DETERMINATION OF TOURISM DEVELOPMENT IN MAJALENGKA REGENCY WITH GEOGRAPHIC INFORMATION SYSTEM APPROACH

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ABSTRACT

In the tourism sector, Majalengka District receives special attention due to the construction of BIJB Airport. Based on the survey results in Majalengka Major Tourism Master Plan 2016, visitors assess the most unfavorable is accessibility and facilities as much as 76.2% and 9.5%. Yet on the other hand the most favored thing is the beauty of nature as much as 50%. After conducting interviews with disparbud, it is still difficult to assess the area and tourism object. In addition to the manual of the presentation of tourism information, the office also wants to have an information system of business opportunities, which is expected to provide an overview to be taken in developing a tourism business.

DSS supported with GIS appear as solution offerings. In this research using Analytic Hierarchy Process method to determine the priority of regional development as well as the recommendation of tourism business and Simple Multi Attribute Rating Technique in determining evaluation of tourism object. The system built using GIS approach, because with GIS result of DSS output will be processed into spatial and non spatial form which is displayed in the form of map and presentation of information more informative.

Black box testing results and beta testing has been done, it can be concluded that the built system can be accepted by users. Function well and assist the development of tourism in determining and evaluating the development of tourism as well as providing ease of recommendation of tourism business in Majalengka Regency.

Keywords : Tourism Majalengka, Decision Support System, *Analytic Hierarchy Process, Simple Multi Attribute Rating Technique,* Geographic Information System.

1. INTRODUCTION

Tourism and Culture Office of Majalengka Regency is a state institution that has duty to build, preserve and maintain and provide information all related to culture and tourism**.** In the tourism sector, Majalengka Regency gets special attention because it will build an international airport in Kertajati Sub-district, and the Cisumdawu and Cipali highway passing through Majalengka Regency. With the prospect of development in Majalengka then it will automatically become a stopover and destination for domestic and foreign tourists.

Based on the results of the primary survey of 2016 as stipulated in Majalengka Major Tourism Master Plan in 2016, visitors assess the most disliked things in Majalengka Regency is accessibility and facilities as much as 76.2% and 9.5%. Yet on the other hand the most popular thing from the survey results is the beauty of nature as much as 50%. This shows the strength of the natural potential of Majalengka Regency as a tourism resource. This shows the strength of the natural potential of Majalengka Regency as a tourism resource. After conducting an interview with Mr. Andik as Head of Tourism Development, he still has difficulties in conducting assessment of tourism development area and wants to have a system to determine priority of mining area and evaluation of tourism object which must be managed first so that tourism development in Majalengka can be evenly distributed. In addition to his manual of tourism information presentation, he also wants to have an information system of tourism business opportunities, which is expected to provide recommendation of tourism business potential to attract potential investors to invest in Majalengka regency.

Decision Support Systems supported by Geographic Information Systems appear as solution offerings. In addition can be used as a means of support in decision making. the system also provides spatial and non spatial information. By using Analytical Hierarchy Process (AHP) method, the process to find priority area to be developed and business recommendation in a region can be handled properly, because AHP method is a method used to solve complex and unstructured problem into subjective qualitative problem to element -element at each level with the scoring pattern. The utuk evaluation of attractions using the method of Simple Multi Attribute Rating Technique (SMART) because the SMART method is a technique based on the theory that each alternative consists of a number of criteria that have values and each criterion has a

weight that describes how important compared to other criteria. To facilitate the presentation of information from the results of decision support, the system built will use the approach of Geographic Information System (GIS), because with the GIS result of the SPK output will be processed into spatial and non spatial forms are displayed in the form of a map that later the presentation of information will be more informative , and later expected to help Head of Tourism Development in helping determine the development of tourism.

Based on the background previously described above, then on this occasion the author tries to take the topic "DETERMINATION OF TOURISM DEVELOPMENT IN MAJALENGKA REGENCY WITH GEOGRAPHICAL INFORMATION SYSTEM APPROACH".

The purpose of this research is to design and make Tourism Development Determination System in Majalengka District with Approach of Information System Georgrafis to determine the priority of development and evaluation area of tourism object and also distribution of tourism fasilits and give description of recommendation of tourism business in Majalengka Regency. The purpose of this research is as follows:

1. Providing ease of the agency in determining the priority of development and evaluation area of tourism object.
2. Providing ease of the agency in providing recommendations for tourism business potential for people who want to start a business in the field of tourism.

2. RESEARCH CONTENTS

2.1 Decision Support System

Decision support system is an interactive computer-based system, which helps decision makers to use data and models to solve unstructured problems. Decision support systems integrate the intellectual resources of individuals with computer capabilities to improve the quality of decisions [1].

Decision support system consists of three important components, namely data management subsystem, model management subsystem and user interface.

2.1.1 AHP Method

The Analytic Hierarchy Process (AHP) method was developed by Thomas L. Saaty in the 70s when at Warston school [2]. AHP method is one of the methods that can be used in the decision-making system by taking into account the factors - perceptions, preferences, experiences and intuition. AHP combines personal judgments and values into a logical way.

2.1.2 SMART Method

SMART (Simple Multi Attribute Rating Technique) is a multipurpose decision-making method developed by Edward in 1977. This multiatributive decision-making technique is used to support decision makers in choosing between alternatives. Each decision maker must choose an alternative that fits the stated objectives.

2.2 Geographic Information System

Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyze, organize and display all types of geographic data. Acronym GIS is sometimes used as a term for geographical information science or geospatial information studies which is the study science or work related to Geographic Information System. In a simple sense the geographic information system we can conclude as a combination of cartography, statistical analysis and technology database system (database) [3].

2.2.1 Spatial Data

Spatial data has a sense as a data that refers to the position, object, and relationships among them in the space of the earth. Spatial data is an item of information, in which there is information about the earth including the earth's surface, below the surface of the earth, waters, marine and sub-atmospheres (Rajabidfard and Williamson, 2000a) [3].

2.3 System Analysis to be Built

System architecture has front end and back end side. Front end is located on the side of visitors who access the website, for example, visitors can see the distribution of tourist attractions supporting sasil and potential tourism business in Majalengka District. Meanwhile, on the back end of the system is the part that acts as the management of data processing such as spatial data of the administrative area of Majalengka Regency, whether it is a subdistrict, village or in the form of data analysis of development and analytical areas of tourism business potential. For spatial data processing on a system using Google Map API with Google Fusion Table for the process of making its layer. General analysis of the system can be seen in Figure 1 below.

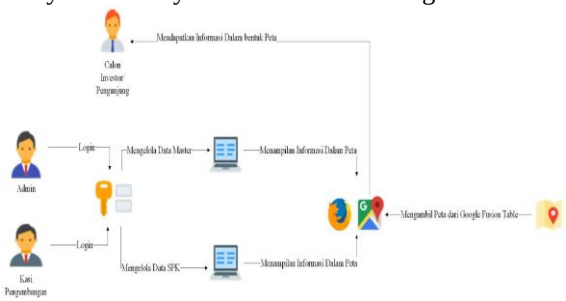


Figure 1. General System Analysis

2.4 Analysis of AHP Methods

The working principle of AHP is to simplify a complex, unstructured, and objective complexity. Basically the steps in the AHP method include::

a. Arrange the hierarchy of the problems faced (decomposition)..

This stage is the making of the hierarchy of problems.

b. Criteria Rating

This stage means making an assessment of the relative importance of two elements at a certain level in relation to one level above it.

c. *Synthesis of priority*

From each pairwise comparison matrix then look for eigen vector to get local priority with the following steps:

1. Create a pairwise comparison chart based on criteria assessment.
2. Summing the value of the comparison for each criterion.
3. Create a normalized table by dividing each element by the result of the sum of each column in the previous stages.
4. Looking for the average of each criteria to get Priority.

d. *Logical consistency*

An important characteristic of the AHP process. This is achieved by glorifying all the eigen vectors obtained from different levels of the hierarchy and then obtaining a weighted composite vector resulting in a decision sequence. Here is a step to calculate the consistency ratio (CR) of the matrix:

1. Multiplying the comparison matrix value with the result of Local Priority divided by the average line so that the λ value is obtained**.**
2. Calculate the value of **λ max**
3. Calculate the **CI** value
4. Calculating **CR.** If the CR result is less than 0.1, then the result can be said to be consistent. If inconsistent, the comparison matrix must be repeated to create.

If the CR score is consistent, then prioritizing ranking can be done in the following way:

a. Change the value of the sub criteria for each alternative into the form of a local priority value.
b. To obtain an alternative appraisal result by summing the multiplication of all local priority sub criteria with local priority for each line of criteria and doing all the alternatives.
c. From the results obtained, then done ranking from the largest number to the smallest.

2.4.1 Data Analysis Method AHP

In the development of tourism, in Riparkab Tourism Majalengka District 2016 is divided into 6 development areas, can be seen in table 1.

Table 1. Regional Data

No	Regional Name	Subdistrict
1.	Recreation and Artificial	Kertajati, Jatitujuh
2.	History, Culture and Religion	Bantarujeg, Talaga, Cikijing, Banjaran
3.	Agro tourism	Kecamatan Lemahsugih, Malausma, Cingambul
4.	Art of Creative Culture	Jatiwangi, Ligung, Palasah, Sumberjaya, Leuwimunding, Kasokandel, Dawuan
5.	Sports, Adventure & Edu-Recreation	Maja, Cigasong, Majalengka, Panyingkiran, Kadipaten
6.	Conservation Education	Argapura, Sukahaji, Sindang, Sindangwangi, Rajagaluh

2.4.2 AHP Method Analysis Area Determination

1. Arrange the hierarchy of the problems faced (decomposition).

Determination of priority of development area which refers to Regulation of Minister of Culture and Tourism Number PM.37 / UM.001 / MKP / 07. The criteria used are

1. Availability of Tourist Destination (KDW).
2. Tourism Facilities (FP).
3. Accessibility (AKS).
4. Community Involvement (KM).
5. Market Potential (PP).
6. Strategic Position (PS).

The hierarchical structure in determining the priority of regional development can be seen in Figure 2

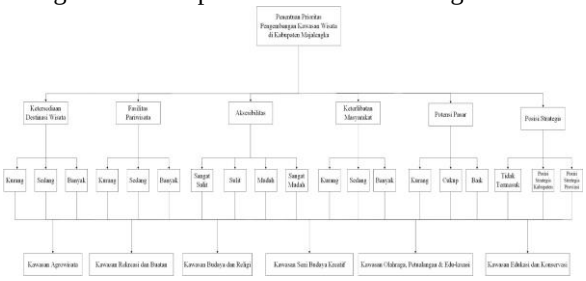


Figure 2. Hierarchy of Regional Development

2. Criteria Rating

Here is a comparison of weights between criteria.

Table 2. Weight Between Criteria

Comparison matrix between criteria						
	KDW	FP	AKS	KM	PP	PS
KDW	1	3	3	5	5	7
FP		1	3	5	5	7
AKS			1	5	5	7
KM				1	2	3
PP					1	3
PS						1

3. *Synthesis of priority*

The matrix is normalized among the criteria can be seen in Table 3.

Table 3. Matrix of Inter-Criteria Normalization

Matrix normlaisasi comparison between criteria							Priority Value
KDW	0.45	0.62	0.40	0.30	0.25	0.25	0.38
FP	0.15	0.21	0.40	0.30	0.25	0.25	0.26
AKS	0.15	0.07	0.13	0.30	0.34	0.25	0.21
KM	0.09	0.04	0.03	0.06	0.10	0.11	0.07
PP	0.09	0.04	0.03	0.03	0.05	0.11	0.06
PS	0.06	0.03	0.02	0.02	0.02	0.04	0.03
Σ Kolom	1	1	1	1	1	1	1

4. *Logical Consistency*

Results from Logical Consistency can be seen in Table 4.

Table 4. Result *Logical Consistency*

	Antar Kriteria	Sub KDW	Sub FP	Sub AKS	Sub KM	Sub PP	Sub PS
λ maks	6.61	3.07	3.07	4.12	3.04	3.07	3.07
CI	0.12	0.03	0.03	0.04	0.02	0.03	0.03
CR	0.09	0.06	0.06	0.04	0.03	0.06	0.06
Konsisten	YA	YA	YA	YA	YA	YA	YA

The alternate data of the incoming area is subsequently converted to local priority in order to find alternative assessment results seen in Table 5.

Table 5. Alternative In The Form Of Local Priority

	KDW	FP	AKS	KM	PP	PS	Hasil
A1	0.72	0.72	0.26	0.26	0.19	0.08	0.55
A2	0.08	0.19	0.06	0.26	0.08	0.08	0.12
A3	0.19	0.08	0.06	0.26	0.08	0.19	0.14
A4	0.19	0.72	0.12	0.26	0.72	0.72	0.37
A5	0.19	0.72	0.06	0.26	0.19	0.08	0.31
A6	0.72	0.19	0.12	0.26	0.19	0.19	0.39

Based on the results of the analysis, the calculation is manually the same as the result of calculation using DSS AHP. Results from AHP DSS ranking can be found that the Agro-tourism Area is a priority area to be developed first. The ranking results can be seen in Table 6.

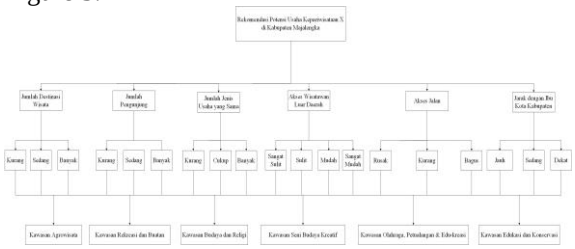
Table 6. Rangking Result

Zone	Result	Rangking
Agro Tourism Development Zone (A1)	0.54	1
Creative Cultural Arts Development Zone (A6)	0.39	2
Artificial Recreation Development Zone (A4)	0.37	3
Historical, Cultural and Religious Development Zone (A5)	0.31	4
Sports Development, Recreation & Edukreasi Zone (A3)	0.14	5
Conservation-Education Development Zone (A2)	0.12	6

2.4.3 AHP Method Business Recommendations

1. Arrange the hierarchy of the problems faced (decomposition).

The criteria in determining the recommendation of tourism business were obtained after the interview with Mr. Andik as Head of Tourism Pengembanan, the six criteria are Number of Tourism Destination (JDW), Number of Visitors (JP), Number of Equal Businesses (JJUS), Foreign Tourist Access (AWLD) , Access Road (AJ), and Distance with District Capital (JIKK). The hierarchical structure in the recommendation of tourism business can be seen in Figure 3.



Figuere 3. Business Recommended Hierarchy

2. Criteria Rating

Here is a comparison of weights between criteria.

Table 7. Weight Between Cirteria

Comparison matrix between criteria						
	JDW	JP	JJUS	AWLD	AJ	JIKK
JDW	1	2	2	5	5	7
JP		1	2	3	3	7
JJUS			1	3	3	7
AWLD				1	3	5
AJ					1	5
JIKK						1

3. *Synthesis of priority*
The matrix is normalized among the criteria can be seen in Table 8.

Table 8. Matrix of Inter-Criteria Normalization

Matrix normlaisasi comparison between criteria							Priority Value
JDW	0.39	0.48	0.34	0.40	0.33	0.22	0.36
JP	0.20	0.24	0.34	0.24	0.20	0.22	0.24
JJUS	0.20	0.12	0.17	0.24	0.20	0.22	0.19
AWLD	0.08	0.05	0.06	0.08	0.20	0.16	0.10
AJ	0.08	0.08	0.06	0.03	0.07	0.16	0.08
JIKK	0.06	0.03	0.02	0.02	0.01	0.03	0.03
Σ Kolom	1	1	1	1	1	1	1

4. *Logical Consistency*
Results from Logical Consistency can be seen in Table 9.

Table 9. Hasil *Logical Consistency*

	Antar Kriteria	Sub JDW	Sub JP	Sub JJUS	Sub AWLD	Sub AJ	Sub JIKK
λ maks	6.35	3.07	3.07	3.07	4.12	3.04	3.04
CI	0.07	0.03	0.03	0.03	0.04	0.02	0.02
CR	0.05	0.06	0.06	0.06	0.04	0.03	0.03
Konsistn	YA	YA	YA	YA	YA	YA	YA

The alternate data of the incoming area is subsequently converted to local priority in order to find alternative assessment results seen in Table 10.

Table 10. Alternative In The Form Of Local Priority

	KDW	FP	AKS	KM	PP	PS	Hasil
A1	0.08	0.19	0.72	0.06	0.11	0.11	0.23
A2	0.72	0.72	0.72	0.26	0.63	0.26	0.66
A3	0.19	0.72	0.19	0.26	0.63	0.63	0.37
A4	0.19	0.08	0.72	0.56	0.63	0.26	0.34
A5	0.19	0.19	0.72	0.26	0.63	0.11	0.33
A6	0.08	0.19	0.72	0.12	0.63	0.63	0.29

Based on the results of the analysis, the calculation is manually the same as the result of calculation using SPK AHP. The result of the AHP SPK ranking can be found that the recommendation for the accommodation business is in the Conservation-Education Area. The ranking results can be seen in Table 11.

Table 11. Rangking Result

Kawasan	Result	Ranking
Conservation-Education Development Zone (A2)	0.66	1
Sports Development, Recreation & Edukreasi Zone (A3)	0.37	2
Artificial Recreation Development Zone (A4)	0.34	3
Historical, Cultural and Religious Development Zone (A5)	0.33	4
Creative Cultural Arts Development Zone (A6)	0.29	5
Agro Tourism Development Zone (A1)	0.23	6

2.5 SMART Evaluation Analysis Tourism Object

The first step in the SMART method is to determine the number of criteria. In this analysis use 3 criteria. The second step is given the weight of each scale, then done normalization. The third step provides the criteria value for each alternative. The fourth step looks for utility values. The results of the four steps that have been done can be seen in table 12.

Table 12. Results Utility Values and Normalization Weight

No	Criteria	Sub-Criteria (Criteria Value)	Utility Values	Weight
1.	Accessibility	Easy	100	0.7
		Enough	60	
		Difficult	20	
2.	Amenities	Very Good	100	0.25
		Good	70	
		Less	40	
		Very Less	10	
3.	Amenities	Well Gromeed	100	0.05
		Not Well Groomed	50	

Next is to calculate the final result, which gives the criterion value at each altrnative for the calculated final value. In the assumption of this case, the alternative tested is the tourism object data from Disparbud in 2016. The assessment for the alternative can be seen in table 13.

Table 13. Alternatif SMART

No	Name	Accessibility	Amenities	Amenities
1	Kebun Teh Cipasung	Enough	Less	Well Gromeed
2	Curug Muara Jaya	Easy	Very Good	Well Gromeed
3	Bendungan Rentang	Easy	Good	Well Gromeed
4	Pendakian Ciremai	Easy	Very Good	Well Gromeed
5	Cadas Gantung	Difficult	Less	Not Well Gromeed
6	Panorama Lemahputih	Easy	Very Good	Well Gromeed
7	Gunung Cakrabuana	Difficult	Less	Well Gromeed
8	Panorama Cikebo	Easy	Less	Not Well Gromeed
9	Situ Batu	Difficult	Very Less	Not Well Gromeed
10	Rumah Adat Panjalin	Easy	Less	Not Well Gromeed

The last stage of this stage, from the above data is converted to the value of the sub-substitute which has obtained the utility value and its normalization, for the final result itself if the value is greater than 50 then the recommendation is feasible, for greater value equal to 30 recommendations considered, and less than 30 not feasible or tourism object should be developed. The final value search stage can be seen in table 14.

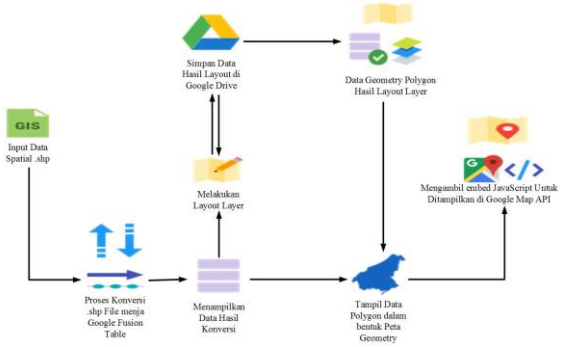
Table 14. SMART calculation results

No	Name	Utilyty Values	Normalization	Final Result	Note
1	Kebun Teh Cipasung	60 40 100	0.7 0.25 0.05	57	Feasible
2	Curug Muara Jaya	100 100 100	0.7 0.25 0.05	100	Feasible
3	Bendungan Rentang	100 70 100	0.7 0.25 0.05	92.5	Feasible
4	Pendakian Ciremai	100 100 100	0.7 0.25 0.05	100	Feasible
5	Cadas Gantung	20 40 50	0.7 0.25 0.05	26,5	Not Feasible
6	Panorama Lemahputih	100 100 100	0.7 0.25 0.05	100	Feasible
7	Gunung Cakrabuana	20 40 100	0.7 0.25 0.05	29	Not Feasible
8	Panorama Cikebo	100 40 50	0.7 0.25 0.05	82.5	Feasible
9	Situ Batu	20 10 50	0.7 0.25 0.05	19	Not Feasible
10	Rumah Adat Panjalin	100 40 50	0.7 0.25 0.05	82.5	Feasible

From the results of the above table analysis can be concluded the object of the ten alternatives are tried many attractions in the area tersbut which should be developed, among others, Cadas Gantung, Gunung Cakrabuana, and Situ Batu..

2.6. Geographic Information System Analysis

GIS analysis is the stage where in making the map. The step of digitization process for polygon starts from converting .shp to google fusion table data, then polygon layouting process can be done. At the last stage is taking javascript for more details can be seen in Figure 2.



Gambar 4. Tahapan Pembuatan GIS

2.7 Spatial Data Analysis

Spatial data on the application to be built covers the area, sub-district, and the region's recommendation in the form of polygon. While the distribution of tourism objects, facilities, evaluation results in the form of points.

Table 15. Spatial DataAnalysis

No	Description	Spatial Daa	Final Result
1.	Sub-District Administration	Polygon	
2.	Recreation and Artificial Area	Polygon	
	Historical, Cultural and Religious Area	Polygon	
	Agro Area	Polygon	
	Creative Cultural Arts Area	Polygon	
	Sports, Adventure & Edu-Recreation Area	Polygon	
	Conservation Education Area	Polygon	
3.	Priority of Area Development	Polygon	
4.	Natural tourism	Point	
	Cultural tourism	Point	
	Artificial/Special torurism	Point	
5.	Accommodation Facilities	Point	
	Eating and Drinking Facilities	Point	
	Travel Tourism Agency Facilities	Point	
6.	Evaluation Result of Tourism Object Not Feasible	Point	
	Evaluation Results Are Considered	Point	
	Evaluation Result of Tourism Object Feasible	Point	
7.	Recommended Accommodation Business	Point	
	Recommended Drinking Eating Business	Point	
	Recommended Travel Business	Point	

2.8 Non Spatial Data Analysis

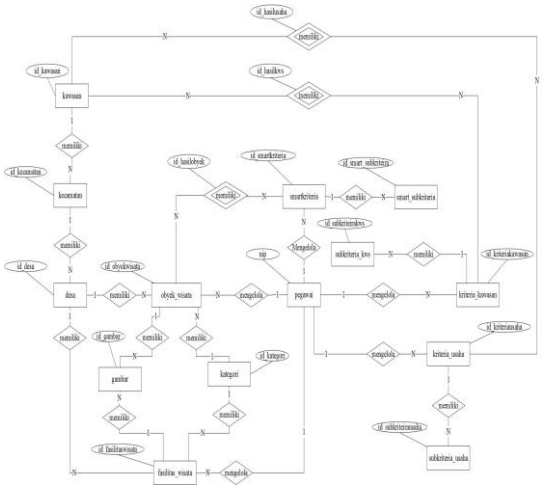
Non spatial data analysis used in this application can be seen in Table 16.

Table 16. Non Spatial Data Analysis

No	Name	Description	Atribut
1	Sub-District	Contains about the existing sub-district data in Majalengka Regency	id_kecamatan, nama_kecamatan
2	Village	Contains about the existing village data in Majalengka Regency	id_desa, nama_desa
3	Tourism Site	Contains about the data of existing tourism site in Majalengka Regency	id_wisata,nama_wisata, kategori, alamat, longitude, latitude, pengelola
4	Tourism Facilities	Contains about the data of existing tourism facilities in Majalengka Regency	id_fasilitas, nama_fasilitas, kategori, alamat, longitude, latitude, pengelola
4	Category	Contains data about tourism categories	Id_kategori, nama_ketegori, icon_kategori
5	Image	Contains images of attractions or facilities	id_gambar, nm_gbr

2.9 *Entity Relationship Diagram* (ERD)

ERD model on the system to be built can be seen in Figure 5 following ERD scheme.

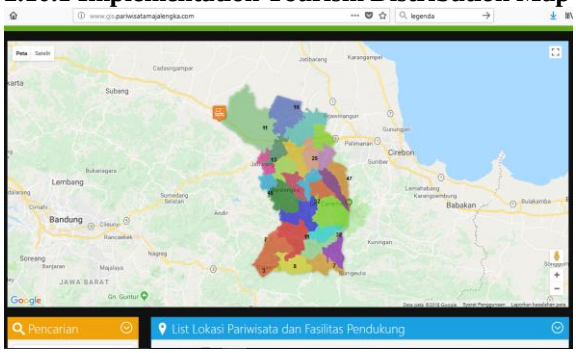


Gambar 5. *Entity Relationship Diagram* (ERD)

2.10 Interface Implementation

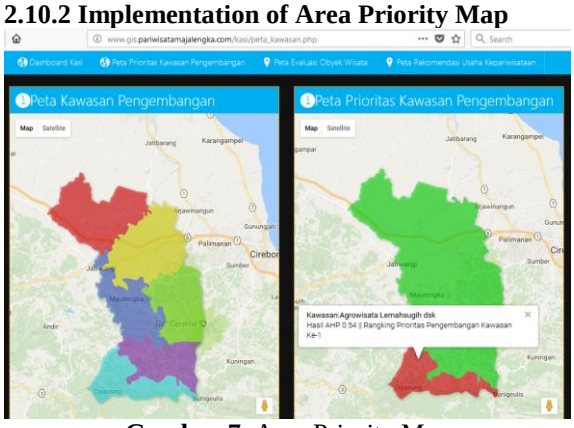
Here is the result of interface implementation.

2.10.1 Implementation Tourism Distribution Map



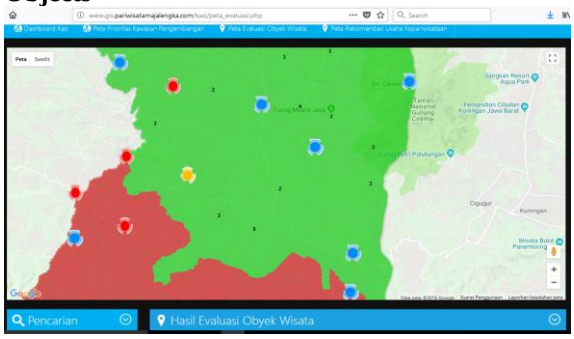
Gambar 6. Map of Tourism Distribution

2.10.2 Implementation of Area Priority Map



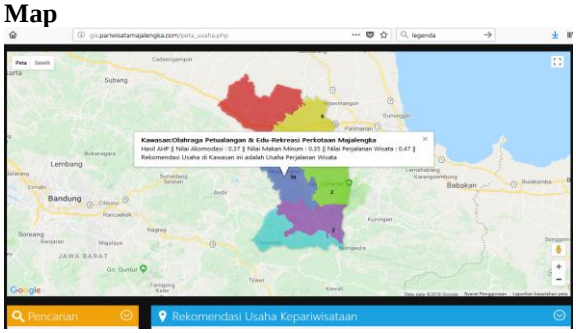
Gambar 7. Area Priority Map

2.10.3 Implementation Evaluation Maps Tourism Objects



Gambar 8. Evaluation Map of Tourism Object

2.10.4 Implementation Business Recommended Map



Gambar 9. Business Recommendation Map

3. CLOSING

In this section will explain the conclusions and suggestions of the research..

3.1 Conclusions

Based on the results of the tests and discussions that have been made then got the following conclusion:

1. This system is quite helpful for the development of tourism conduct assessment, evaluation and decision making in determining the development of tourism.
2. This system assists in the development of the provision of proprietary and community business recommendations to obtain recommendations and information distribution of tourism business in Majalengka Regency.

3.2 Suggestion

Suggestions that can be given to the system of determining tourism development in Majalengka district with geographic information system approach that has been made for further development can be explained as give.

1. This system in the presentation of the mapping can be added several libraries to map visualization more interactive.
2. This system can be developed in mobile version and added some features compatible with mobile apps.

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