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Development of Small Urban Center, using Analytical Hierarchy Process

KEYWORDS

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ABSTRACT *The present research work is emphasizing the power of Analytical Hierarchy Process (AHP) which will cause to find priority of small urban center or "agropolitan" unit. Analytical Hierarchy Process (AHP) playing a major role in developing effective information systems for regional development to realize the scientific management of agropoitan. The objective of this study is to identify criteria and alternative of agropolitan and select locations in Prakasam district in Andhra Pradesh state for constructing and development of an agropolitan area. The result of this study shows that, the Eastern part of the district is a very suitable area for agropolitan in Prakasam district and Ongole region is best priority which is indicated by most potential area of primary commodity. In the other point of view, the agropolitan with agricultural business activities could generate all potencies in Ongole and the surrounding area that can improve the life situation of local people. Finally, development of agropolitan area leads to improve linkage between rural and urban to increasing prosperous rural society.*

Introduction

The area of small urban center or agropolitan consist of agriculture town and surrounding area of central agro product countryside which the boundaries are not determined by the government administration boundaries but determines by concentrating existing economical scale. In the other words, agropolitan area is an area with agricultural activities which has urban facilities in it (Rustiadi and Hadi, 2006).

To develop an area, the first step to do is to determine the location of the area itself. There are some phases should be taken in determining location area as a requirement which has to be fulfilled. These are as follows:

1. Find the area location target.
2. Find the availability and the quality of human resources in the area/location.
3. Discover how far supporting condition of nature such as: inclination or topography, height of area above sea level, weather condition level and soil factor.
4. Observe the weakness and strength of the society around areas such as society's understanding in forest conservation, ability in economics, technical ability, and ability in area management.

OBJECTIVE OF THE STUDY

The specific objectives of the thesis are:

- Finding the high suitability location of agropolitan in Prakasam district.
- Preparation of action plan for development of agropolitan project in the study area.

Methodology

AHP is a multi-criteria decision method that uses hierarchical structures to represent a problem and then develop priority for alternatives based on the judgment of the expert (Saaty, 1980). Saaty (1980) described that weighing activities in multi-criteria decision making can be effectively dealt with hierarchical structuring and pairwise comparisons. Pairwise comparisons are based on forming judgments between two particular elements rather than attempting to prioritize an entire list of elements.

The method is formulated as in Figure 1.1, below, describe combines Analytical Hierarchy Process (AHP) and Geography Information System (GIS) to achieve the goal of this research. The precursor stage is preparation/collecting all data to support the process of this study. The data must support all criteria that establish to GIS and AHP process, with these data the interview model to implement an AHP stage with experts can be composed.

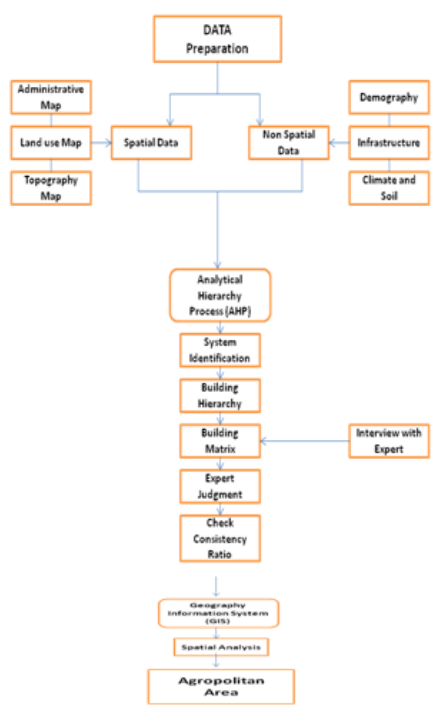

Figure 1.1 AHP Methodology of Agropolitan Priority

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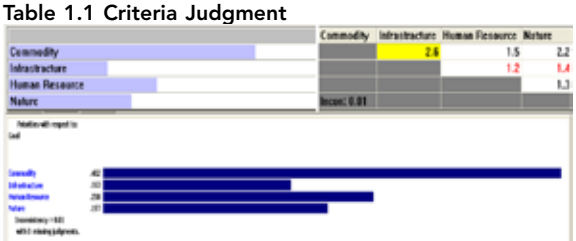
RESULTS AND DISCUSSIONS

EXPERT JUDGMENT

Based on several information stated before and the goal of this research, several steps are taken to achieve the goal. The criteria and alternative are dependent on each other in achieving the goal. The judgment of the expert can be identified by filling the matrix with number according to interviews with the experts. There are four criteria of this research: commodity, infrastructure, human resources and natural factors. After the model is criteria filled in the matrix, we compare the factors at each level of the hierarchy. We do this by judgment each pair of criteria in the model with respect to their parent criteria as to which is more important, preferred, or likely. Some judgments will be objective. The black color of number in these matrixes means the input number and for red color means one decided by the input number itself. Table 1.1 shows a filling matrix and the result of calculation of each criterion that we put in the matrix.

Table 1.1 Criteria Judgment



The results show that commodity factor has a higher score (with weight 0.402) than other factors in determining the agropolitan area. The next important factor is human resources (0.238). Meanwhile the weight of natural factors and infrastructure factor are only 0.197 and 0.163. The inconsistency ratio of expert judgments is 0.01; this ratio can be tolerated because in general the inconsistency ratio should be less than 0.1.

Table 1.2 compares each alternative location in Prakasam District based on with commodity factor. Filling the matrix with judgment from respondent and calculate the number in the matrix, East Prakasam has the highest weight (0.427), followed by West Prakasam (0.115), North Prakasam (0.186), and South Prakasam (0.273). Similar to commodity factor, Table 1.3 shows that infrastructure factor in East Prakasam has the best weight. Also based on human resources factor Table 1.4, East Prakasam has 0.313 weights which are better than the other. And also in natural factor (Table 1.5) East Prakasam has higher weight (0.304) than other districts.

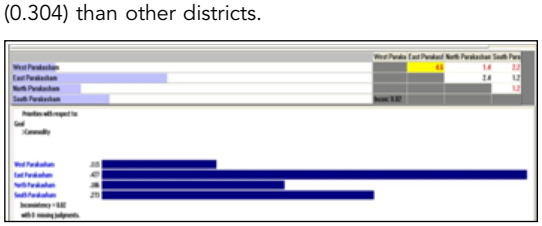


Table 1.2 Commodity Factor

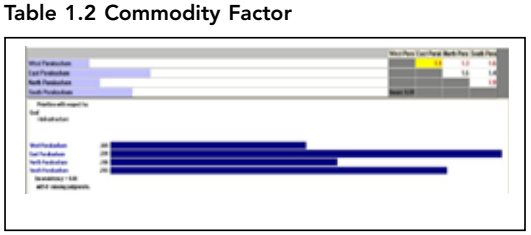


Table 1.3 Infrastructure Factor

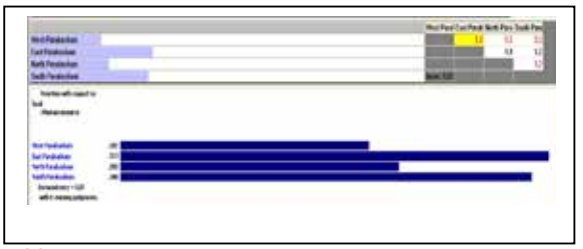


Table 1.4 Human Resources Factor

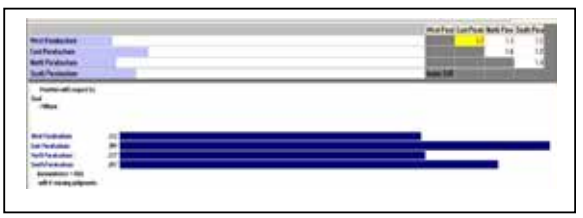


Table 1.5 Natural Factor

After giving an opinion or judgment to each criterion, we go to the next judgment for each alternative location. Because there are 20 respondents who represent the experts, we choose one respondent to show the judgment, and after that we combine all the respondent/ expert to obtain the result. A representative result can be obtained from these 20 respondents. The results of all 20 respondents are given in Table 1.6 to Table 1.9. The result of calculating the entire matrix, East Parakasham has the highest value.

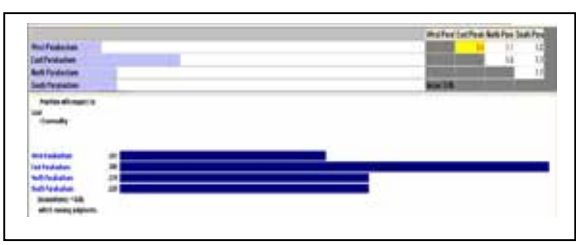


Table 1.6 Total Commodity Factor

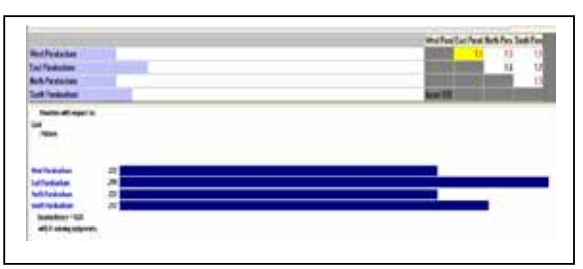


Table 1.7 Total infrastructures Factor

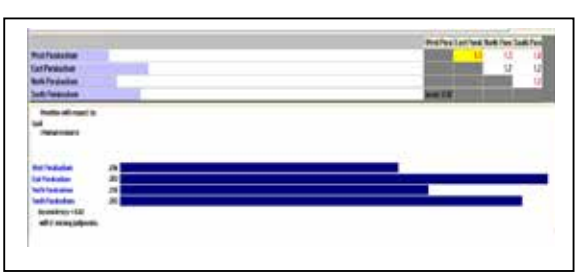


Table 1.8 Total Human Resources Factor

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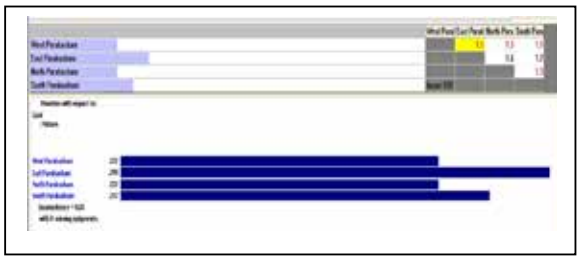

Table 1.9 Total Natural Factors

SYNTHESIZE

Synthesize is a process of weighting and combining priorities throughout the model after judgments are made to yield the final result. Judgments are synthesized (combined) throughout the model using a weighting and adding process to derive the overall weight for the alternatives. The best alternative is the one with the highest priority. This synthesize shows that East Parkasam area is the first priority alternative location which had chosen to determine agropolitan areas in the Parkasam District with weight (0.345), followed by South Parkasam (0.273), North Parkasam (0.206) and West Parkasam (0.177).

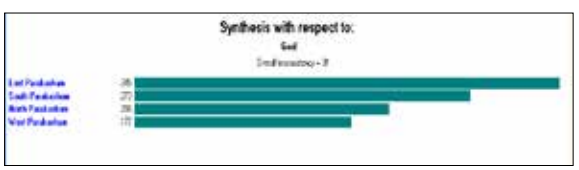

Fig: 1.2 Synthesis Result

HEAD TO HEAD SENSITIVITY

Figure 1.3 displayed how two alternatives compare to one another against the objectives in a decision. One alternative (East Prakasam district) is listed on the left side of the graph and the other alternative is listed on the right. The alternative on the left is fixed, while selecting a different tab on the graph can vary the alternative on the right. Down the middle of the graph are listed the objectives in the decision. The Overall East Prakasam area the highest percentagetage in each criteria compared to other districts.

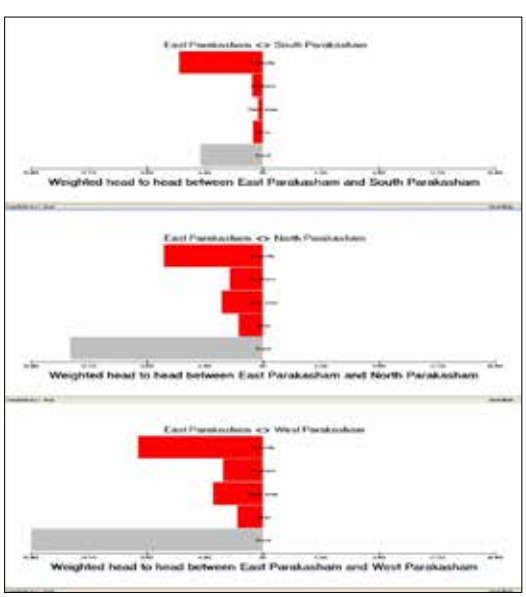

Fig: 1.3 Head to Head Sensitivity

AGROPOLITAN POTENTIAL AREA

With Spatial Analysis of GIS, the weight of all criteria and using model builder, the models are represented as sets of spatial processes, such as overlay and dissolve techniques The criteria calculated scores are done with measure scale 1 (not suitable), 2 (stable), and 3 (very suitable). The result of the GIS process of determining agropolitan area is East Prakasam (very suitable) and South (suitable). According to GIS result, that shows East Prakasam as a very suitable area of agropolitan. Very suitable because this district has all the criteria to construct an agropolitan area. The farmer after they produce raw agriculture commodities in center production, collecting the commodity and send to the center of agropolitan area that consist of the market. This area also is near from business center and transportation infrastructure. Otherwise, the farmer can storage their raw commodity in cold storage.

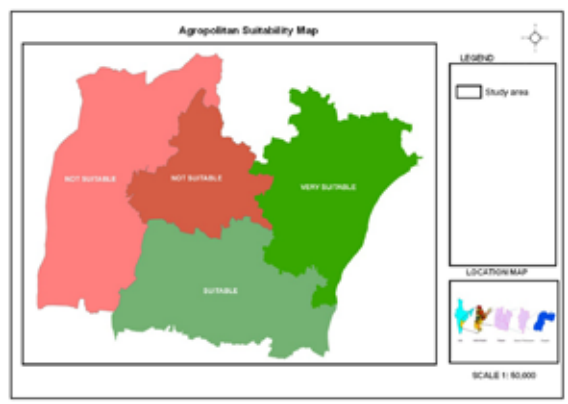

Fig: 1.4 Agropolitan Suitability Map

ONGOLE AS AN AGROPOLITAN REGION

The analysis of land carrying capacity shows the relationship between population, land use and environment. This analysis is used to find the carrying capacity to support agricultural activities. Table 6.10 shows the detail of the analysis, where "A" is the total area that can be used for farming and "r" is the frequency of harvests per hectare per year.

The carrying capacity is calculated as follows:

$$CCR = \frac{A \times r}{H \times h \times F}$$

Where "F" is the land size, "h" is the percentage of population residing, "H" is the total farmer households and CCR is the carrying capacity. In Ongole with 206419 people, assuming the average household comprises of five members, the result of this analysis shows that the average households in Ongole have 0.50 hectares of land. This is smaller than the ideal threshold of 1 hectare, as determined by the carrying capacity. However, the development of an agropolitan can solve this problem by increasing efficiency through pooling of resources.

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Table 1.10 Selection of the Growth Center for Agropolitan

No	Medal	Size of area (KM^2)	TOTAL CROPPED AREA, (AREA, HECTARES)	Total population	Growth Center Types			
					Market Centre	Growth Centre	Growth Pole	Growth Cluster
1	ADDANKI	261.5	13735	74904	3	2	1	0
2	BALLIKURAVA	227.9	12895	49713	3	1	1	0
3	CHIMAKURTHI	289.4	11679	64590	2	2	1	0
4	CHINAGANJAM	172.6	7905	40668	3	1	1	0
5	CHIRALA	106.1	5988	165772	4	2	1	1
6	INKOLLU	146.1	13029	48565	2	1	1	0
7	J.PANGULURU	170	10349	44753	3	1	1	0
8	KARAMCHEDU	163.1	12955	39356	2	1	1	0
9	KONDAPI	215.5	14683	36412	3	1	1	0
10	KORISAPADU	150.8	12915	43844	3	1	1	0
11	KOTHAPATNAM	169	7807	47573	2	1	1	0
12	MADDIPADU	168	13971	49473	3	1	1	0
13	MARTUR	181.9	12486	63954	3	1	1	0
14	MUNDALAMURU	332.1	15500	53132	2	1	1	0
15	N.PADU	258.9	25024	68911	3	2	1	0
16	ONGOLE	206.3	13661	206419	4	2	1	1
17	PARCHUR	224.2	16228	55840	3	1	1	0
18	S.GULURU	208.8	12695	53608	3	2	1	0
19	SA.PADU	212.3	16118	60462	3	2	1	0
20	TANGUTUR	203.8	18376	58871	4	1	1	0
21	THALLUR	196.3	8467	44881	2	1	1	0
22	VETAPALEM	106.1	4923	67990	2	1	1	0
23	YEDDANAPUDI	92.7	11634	29585	2	1	1	0
	Total	4463.4	293023	1459282	64	30	23	2

Thus, Ongole qualifies as a research area for an agropolitan Region. Ongole acts as a marketing center, sales center, information center, animal market, outlet for small-middle scale industries and vegetable market. The data from Ongole can thus be used to conduct empirical analysis on the characteristics of an agropolitan region.

AGROPOLITAN POTENTIAL AREA

The result of a GIS process of development of agropolitan area is Prakasam district showed that Ongole Mandal has a most suitability to setup and development of agropolitan project. According to GIS result that showed, Ongole city as a very suitable area of agropolitan. Very suitable because this area has all the criteria to construct an agropolitan area. The farmer after they produce raw agriculture commodities in center production, collecting the commodity and send to the center of agropolitan area that consist of the market. This area also is near from business center and transportation infrastructure. Otherwise, the farmer can storage their raw commodity in cold storage. The agropolitan project in these districts will automatically give multiply effects, for example increasing farmer's income level will generate more social economic activities in rural areas. Also better socioeconomic conditions will a positive impact to another sector such as education, health, political stability, sustainability and the general quality of life. The farmer in these areas can also have more abilities to increase their productivity of many primary agricultural products. Then, agro-industry will be developed in agropolitan areas, which means that the area can produce manufactured products such as packing industries and food process. These products will then be marketed to urban cities, as larger markets in the regions.

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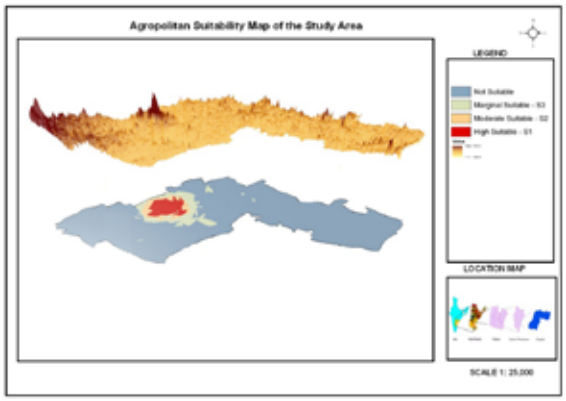

Fig: 6.27 Agropolitan Suitability Map of the Study Area

CONCLUSION AND RECOMMANDATION

1. This thesis has made a significant contribution in combining the GIS, and AHP into a conceptual framework for an agropolitan development. It has also investigated the factors that may determine the effectiveness of an agropolitan. This study contributes to the understanding of agropolitan development in promoting healthier rural-urban linkage patterns, and in being a sustainable alternative for the national development.
2. From the research findings, it is found that the development of agropolitan relies heavily on four factors that respectively include: commodity, human resources, natural factors, and infrastructure with regard to the link with the hinterland and with the region's economic center.
3. Based on the findings, the development program should focus on promoting agglomeration of activities in the agropolitan by establishing secondary and tertiary agricultural-related activities such as food processing, cold storage, distribution center and packaging.
4. In relation to the socio-economic factors, capacity building and provision of urban amenities are very important. An education program should be directed towards giving the rural residents the necessary knowledge needed for application in the local communities.
5. The national policy must also provide a supportive environment for the development of agropolitan regions. Since the relationship between the agropolitan center and its hinterland is largely dictated by the larger economic centers, the central government should pay close attention to the policies related to local government expenditures for rural infrastructure and education, the food price and food import as well as the development of research programs that support the improvement in agricultural technologies.

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