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Literature study on the theory of GIS-based multi evaluation criteria

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Abstract. Multi-criteria evaluation method is a method that can be used in making decisions by making complex issues into simple. GIS (Geographic Information System) is a tool that has a positive impact in the scientific decision-making process of planning for program development activities. Decision-making by integrating the multi-criteria evaluation with GIS has significant potential for the complexity of making a decision. The study of literature of this article focuses on the discussion of multi-criteria evaluation based on GIS. The purpose of writing this article is to organize and classify articles decisions using GIS-based MCDA. Based on the results of the study, determining the location of the housing using GIS-based multicriteria evaluation became the topic most widely presented. GIS-based multicriteria evaluation gave the result of decisions capable of precise, fast and effective.

1. Introduction

Multi-criteria evaluation method is a method that can be used in making decisions by making complex issues into simple [1,2], Multi-criteria evaluation is considered good because it can compare the criteria established by several alternatives in making decisions [3] so its application into a framework that is very effective in making decisions [1,2], Multi-criteria evaluation method has been widely used in making a decision, either in determining the spatial arrangement [4,5], Determines the heating system in a high-rise building [3], Determine the area of agricultural area delineation [6], Identify the tread linear infrastructure corridors, such as the cost of toll roads, rail, pipeline transmission [7], Determining the location of landfills [8] Designing cellular manufacturing system [9].

GIS (Geographic Information System) is a tool that has a positive impact in the scientific decision-making process of planning for program development activities[10], GIS is a system that is able to build, manipulate and display information georeferenced [2,4,11], GIS is a software that is widely used in the determination of spatial decision by analyzing spatial data [12], The main task is to perform GIS spatial data analysis [13], GIS is not a new invention, geographic data processing has long been done by the various fields of science, which distinguishes it from the old processing only uses digital data [7].

Decision-making by integrating the multi-criteria evaluation with GIS has significant potential for the complexity of making a decision [8], GIS and multi-criteria evaluation has the unique ability to be complementary. GIS MCDA can manipulate data and provide decision-making criteria [14], Decision-making methods using MCDA and GIS can provide many clear advantages and can be used as a spatial decision-making tools [15-17], The framework uses MCDA and GIS methods present a number of opportunities for potential land suitability assessment efforts, including easier access to the data, algorithms and computational resources [18].



The study of literature of this article focuses on the discussion of multi-criteria evaluation based on GIS. The purpose of writing this article is to organize and classify articles decisions using GIS-based MCDA. Articles that become reference material taken from 2007 to 2017. This article is organized into four sections: introduction, methods, discussion and debate.

2. Method

The method used in this article is a literature review of various articles that are relevant to the GIS-based multi-criteria evaluation. Articles were collected from 2007 to 2017. The articles were obtained compiled and classified based on topics studied by making the results of the study prepared columns as table 1.

Table 1. Summary review article journal.

Article Title	Object Of Research	Year	Instrument	Result
Integration of GIS and multicriteria analysis Descision For Urban aquaculture development in Bangladesh	Bangladesh Chittagong city	2007	- Observation - Topographic Map 1: 10.000	Zoning approach can provide important information BAGGI prospective developers / investors to identify suitable zones to meet certain objectives in the long term
Multi Criteria for regional function based on Geographic Information System	Garut	2009	- Observation sheet - thematic maps	Multi-criteria evaluation functions transform the area using GIS can be used for spatial planning
Suitable Deliniation of cropland area using a GIS-based multi-criteria evaluation approach in the Dao National Park Region, Vietman	Protected areas in Vietnam	2016	- GPS - thematic maps	Spasil analysis gives an overview to identify the suitability of land that can be optimally diamnfaatkan
etc				

Literature study methods used to construct the concept of multi-criteria evaluation based on GIS. The steps in this literature study are: 1) a search of relevant articles with multi-criteria evaluation based on GIS. The search starts from September to November. The articles collected through search engines from various sources such as google scholar, science direct, IEEE, Taylor and Francis, 2) articles that have been collected are then selected and screened according to the topics relevant to the evaluation of multiple criteria based on GIS. Articles unrelated issued.

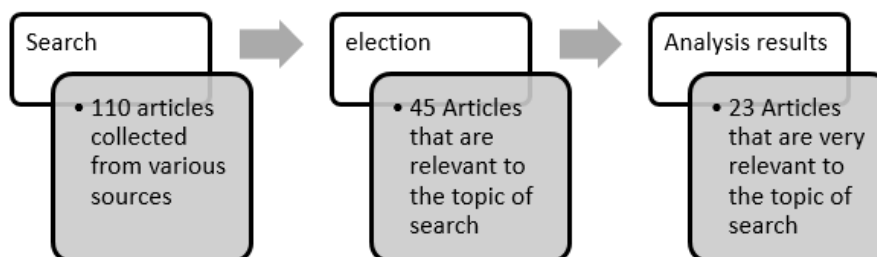


Figure 1. Selection process articles.

3. Results and discussion

GIS-based multicriteria evaluation approach has been used with many things in making decisions [13]. Most articles focus on: 1) the assessment criteria in decision-making, 2) the GIS component, 3) spatial analysts.

3.1. Multicriteria evaluation component

Planning and decision-making need to consider many factors such as size, access / traffic, utility, forms, security, safety, cost, location, level of noise, drainage and plant life [11], Factors in determining each different zoning [12] in accordance with the management of the natural resources available in each region [19], Determination and systemic analysis of all the factors affecting the level of regional determination [20], Evaluation of multiple criteria can be used to determine the key factors in determining a decision [2].

Evaluation of a multiple criteria decision making method based on the analytic hierarchy process (AHP). Multicriteria evaluation methods are considered good because it can compare the criteria established by the alternative criteria. Its application into a framework for making decisions that are effective against a very complex issue [1].

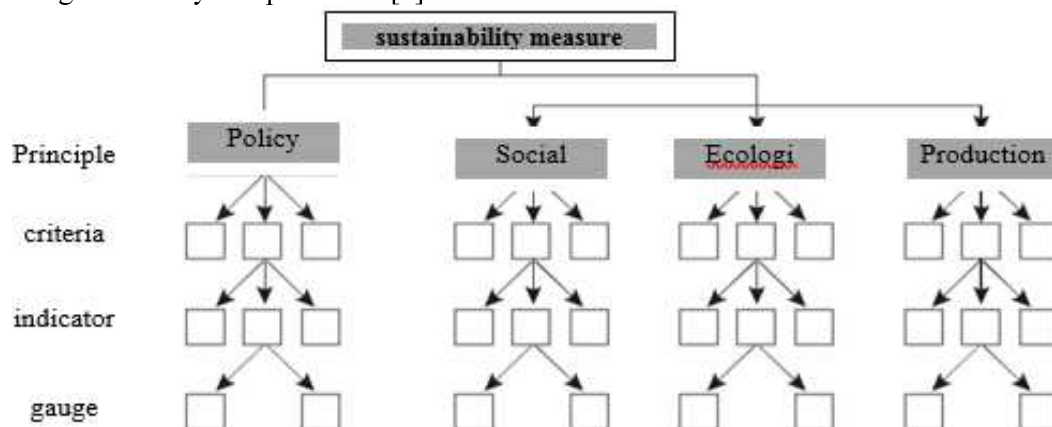


Figure 2. The hierarchy structure multicriteria evaluation.

In a situation involving a variety of criteria, confusion can arise if a logical decision-making process and structured not followed [21]. To get the preferred option, the relative importance of each decision criterion against what has been made must be evaluated and incorporated into the decision-making process. Two multiple criteria evaluation methods are the simplest and can be used in the assessment criteria and indicators are determination of ranking and value determination [1,13].

3.2. Component GIS

Geographic information systems or GIS has the ability to create a model framework for the evaluation of the zoning of a region through multicriteria evaluation approach that is integrated with expert knowledge [22]. Geographic information system, or GIS software is one that is widely used in the determination of spatial decision, by analyzing spatial data (in the form of a map), field data and social data economists [23]. Because of the complexity of the problem in the determination of the conservation areas in spatial decision making must also use a complex method. One method that has been frequently used in the decision-making role in the field of management and resource management is a method of multicriteria Decision Making (MCDM) [10].

GIS serves to create digital maps [4]. As a system, GIS application procedure begins with a data entry form various kinds of data are then processed (involving a wide range of processes and analysis) to produce a wide range of output (output) in the form of maps, tables, statistical data or other data bases.

Monitoring the coverage area of a region utilizing remote sensing technology to provide information on covering the land with the interpretation of existing objects in the image. Remote sensing technology

advances, particularly advances in spatial resolution and temporal resolution can be used to analyze the appearance of earth more detail. The method used in analyzing is to overlay digital images by using GIS [10]. The information obtained is used to indicate areas that have the ability to land the most critical and most sensitive. Classification cover / land use that is more detailed than digital classification results using Maximum Likelihood classification. Land use change caused by human activities, especially in rural areas into residential (housing complex), that such changes are dominated by artificial changes, the changes made by human activity. This is demonstrated by an increase in each of the extent of coverage of land types mixed farms, settlements. industrial and paddy fields. Changes in land caused an estimated runoff during the rainy season.

3.3. Spatial analysis using GIS-based multicriteria evaluation

Spatial analysis gives an overview of identify land suitability that can be used optimally [6]. Spatial analysis using multiple criteria and geographic information system can be used for more effective urban planning, precise, fast and with a relatively low cost [5,24], Multi-criteria evaluation approach based GIS provides a systematic mechanism for small information can contribute to the planning for the development of a region [25].

The method of decision making by integrating multi-criteria evaluation with GIS has significant potential for decision-making complexity that can be applied in the real world. GIS and multicriteria evaluation have the ability to complement each other. GIS can manipulate data and multiple evaluation criteria provides a collection of procedures [8,17]. Operation transformations established in devices that combine GIS maps using simple topology relationships and explicitly take into account the nature and complexity of the problem of planning multiple criteria.

Using multiple criteria decision-making methods and GIS can provide many clear advantages and can be used as a tool to move that involves the community in the decision-making process [15], GIS-based evaluation of multiple criteria are used to process and synthesize a number of considerations and the value of spatial data sets to examine the implications and assessment of policy making [26], GIS is a tool that allows interactive users to combine various human services so that data can be linked to geographical parameters [27], Use of GIS to assess the accessibility to services and community integration patterns show interaction objectively [28].

4. Conclusion

This article presents the results of studies evaluating multiple criteria-based GIS application in various fields. Based on the results of the study found that frequent use of some aspects of GIS-based multicriteria evaluation is determining the location of housing, Determining the location of landfills, determining the location of the farm, the siting of linear motorway, determining the location of the hospital. Based on the results of the study, determining the location of the housing using GIS-based multicriteria evaluation became the topic most widely presented. GIS-based multicriteria evaluation gave the result of decisions capable of precise, fast and effective

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