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Geographic Information System for Mapping the Potency of Batik Industry Centre

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Abstract

Background: As one of batik producer city in Indonesia, Pekalongan city needs medium and infrastructure that able to provide the information needed by either the local government or the society. The need about information of Batik city center in Pekalongan will provide the information about the batik center for the local government in the potency, obstacle and the needs of Small and Medium Batik Enterprises Centre to improve the Batik Production.
Objective: The research is aimed at mapping the potency of batik center in Pekalongan city by implementing Geographic Information System Technology. The information about batik center in Pekalongan city needs to be maintained. The maintenance in information field is needed upon the batik center in Pekalongan.
Methods: The method used in mapping the batik potency in Pekalongan city is the Geographic Information System (GIS) by providing the information based on a spatial data. Whereas the waterfall system development is used in developing the GIS.
Results: The research resulted the application in mapping the batik center with GIS based that provide reference to the related parties about information and planning as well as investment in batik business.
Conclusion: The system is able to provide the information needed by users, such as business mapping, the mapping about the amount of business in one area, the batik potency in each district that is figured for mapping location.

I. INTRODUCTION

Pekalongan is one of the national batik industrial centers and batik is one of the leading export commodities owned with the main objectives of the United States, Malaysia, Singapore and Germany [1] [2] [3].Export realization Pekalongan city in 2014 for the category of textiles and batik products reached US$ 1,500,490.00. From the above data shows that the commodity for Pekalongan batik is one of the outstanding products and potential areas to be developed [2].

Until now the efforts of Pekalongan City Government to develop the potential of Batik Pekalongan by establishing centers of batik industry and wholesale market which is where batik shopping and ATBM weaving crafts. The strategic location of Pekalongan, which is on the north coast, precisely in the middle of Semarang-Tegal, greatly assisted the development of the wholesale center. Within a period of 1.5 years, Pekalongan city has 3 wholesale centers which are located along the Pantura line, SETONO with 225 stores, Gamer 350 stores and Mega Wholesale MM which has 180 stores. In addition to wholesalers who are the center of batik trade in Pekalongan City, the entrepreneurs also have places of sale/shop batik spread throughout Pekalongan City. The rapid development of this wholesale center cannot be separated from the role of batik entrepreneurs and the City Government of Pekalongan.

As an outstanding product of Pekalongan City, it is necessary to develop good planning and management efforts in order to become a regional income [4] [5]. It requires adequate information that can be used by decision-makers including spatial information. Geographic Information System (GIS), Remote Sensing and Global Positioning System (GPS) are three very useful spatial technologies. Most GIS applications have not been utilized for mapping potential areas but rather on applications for geographic conditions of a region [6].

The development of internet technology supports the development of geographic information system application. Web-based Geographic Information System applications are now being developed towards distributed applications, where users are not tied to a specific computer to obtain spatial data information.

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Geographic information system is a spatial data processing applications using a computerized system to combine the graphics data with the object attribute data using the digital base map. GIS is currently growing rapidly and widely implemented in all fields such as education, health, geography, weather, population, piping networks and others. Basically GIS displays and delivers the desired data acceleration by users where the former only uses manual methods but currently uses the digital method (Computerized) [7] [8].Geographic information system technology has been used by the government to study the territory included to determine the potencies of each regency/city [9]. In the development of Geographic information system, it is designed in a more easily used, thus the technology has reached regencies/cities in Indonesia. Geographic information system may be applied for composing the spatial-based model includes the composing of the potency management model in each regency/city [10] [11] [12]. The first definition of the term GIS as a decision support system was made by Cowen [13].

Geographic information system as a spatial-based digital information system has evolved into a decision support system. Geographic Information System technology has been widely used by the government for regional study including to know the potentials owned by districts/cities. In the development of Geographic information system technology is designed to be easier to use, so this technology has reached the districts/cities in Indonesia. Geographic information system can be applied for spatial-based modeling, including modeling of potential district/municipal management.

Geographic information system technology can be used for scientific investigation, resource management, development planning, cartography and route planning [10] [14] [6].For example, GIS can help planners to quickly calculate emergency response times during natural disasters [13], or GIS can be used to find wetlands that require pollution protection [10]. A GIS is a system, consisting of hardware, software, data, procedures and a proper organizational context which compiles, stores, manipulates, analyses, models and visualizes, spatial data, to solve planning and management problems [5] [15] [16].

The most fundamental difference lies in the way it is managed. User information systems typically incorporate several data such as maps, transparencies for overlaying (overlay), aerial photos, statistical reports and field survey reports. All of the data is compiled and analyzed manually without computer tools. While automated Geographic information system has been using the computer as a data processing system through the process of digitization. The data source can be either digital satellite imagery or digital aerial photography and aerial photographs were digitized. Other data can be digitized base map [15].

Based on the condition of the distribution of batik trade centers in Pekalongan City, it is proper for the Pekalongan City government to have a spatial based information system that can provide potential information in the region. With spatial information, the Pekalongan city government will be able to determine the steps to determine decisions related to the development of batik industry in order to further increase local revenue [2] [11].

II. METHODS

The research method used to make the model of batik center mapping in Pekalongan City, in general, is divided into four phases (See Fig. 1). The first phase of the research phase is to examine the institutional condition of Pekalongan city government in managing the potential of the region especially Batik. What is analyzed in the institutional review phase of the district consists of two main issues: first is the policy product produced by the local government regarding the potential of the region and the second is to look at the role and function of the district offices related to the potential of the region in implementing the program- the program. The second phase is to look at the environmental characteristics of the city of Pekalongan to find out the problems and potentials. The potential characteristics of the observed areas include the physical, cultural and social characteristics of the Pekalongan community as a producer of batik. Afterwards, the third stage is to compile the results of an institutional review and environmental characteristics of Pekalongan city with the result of a study of a literature study on the basic theory of planning and development of regional potency. Then, the fourth stage is to compile the database based on the result of comparison done in stage three. A database that has been prepared subsequently used as a material for the preparation of a geographical information system model of digital batik-based mapping according to the scenario that has been prepared. Lastly, the fifth stage is to test the geographic information system model that has been prepared in step three that is together with the expert of the spatial information system and the potential users in the regency/city area.

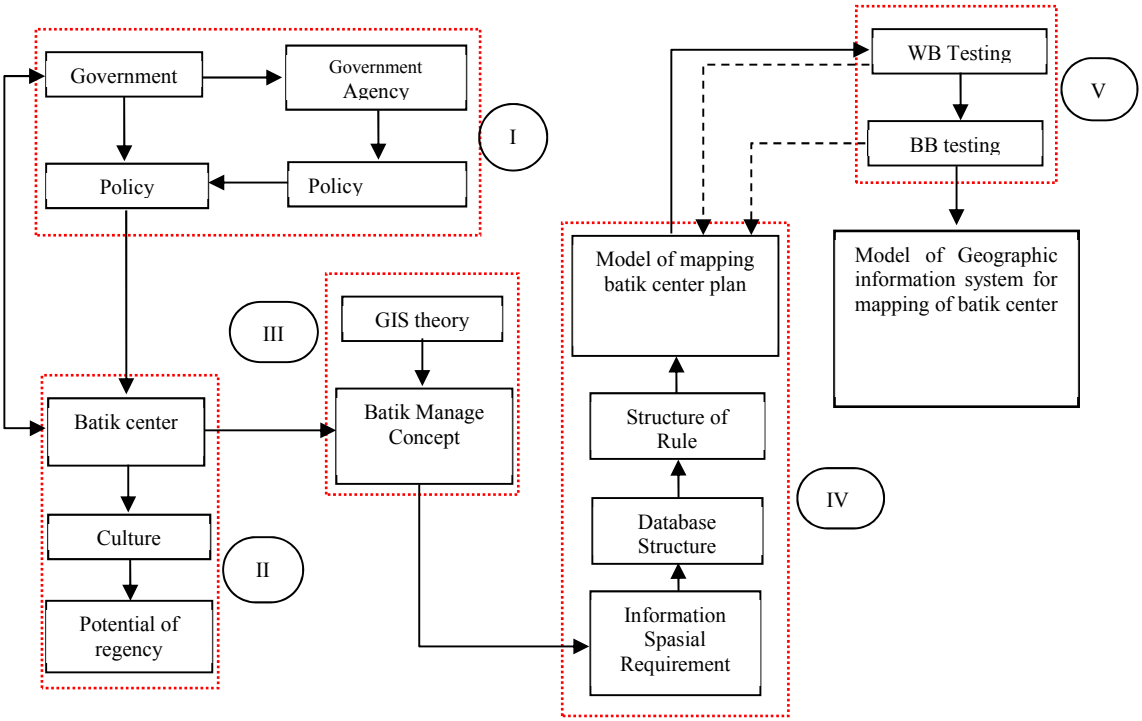

Fig. 1 Research methodology

TABLE 1
CLASSIFICATION OF DATA

Class	Value	Data
Class based on batik business per district	1	0 – 10
	2	11 – 20
	3	21 – 30
	4	31 – 40
	5	>40
Class based on the business type	1	ATBM
	2	Batik Tulis (Written)
	3	Print Batik
	4	Garment
Class based on the business group per village	1	0 – 100 million
	2	100 – 500 million
	3	500 – 1 billion
	4	> 1 billion
Class based on the number of batik shops	1	0 – 5
	2	6 – 10
	3	11 – 15
	4	16 – 20
	5	21 - 25
	6	>25

In addition to the above stages, specifically in modeling the mapping of batik centers by using Geographic Information System, several steps of development methodology are done such as formulating the problem, adjusting the existing data and selecting the operations that need to be taken to answer the problem [9][12]. The steps that need to be executed is the identification of basic data, processing of basic data into data that can determine the centers of batik, and the process of results analysis.

III. RESULTS

The steps in creating the potency map model of batik centre in Pekalongan City were explained as follows.

A. Data Identification

The raw data used in composing the Potential Map of Batik Centre in Pekalongan City are as follows: The map of Pekalongan city out of the Pekalongan region that taken from Pekalongan city government, scale 1: 17,000 produced by the office of Regional Planning and Development of Pekalongan city. The District map is a vector-type map (polygon) to map the business condition and the amount of batik business in each district. The village map is a vector map (polygon) contained the mapping data and the potential of batik business in each village. The type of Batik business map is a vector map (point) that contains points of batik business locations and other businesses that support the potential of batik in each village. Batik shop maps is a vector map (point) that describes

the locations of shops selling batik in Pekalongan city, the shops displayed are the large ones due to the numbers of batik shop in Pekalongan city. By the raw data provided, they were processed into data that can be used to determine the potency condition of such area. Clasification of data is show in Table 1.

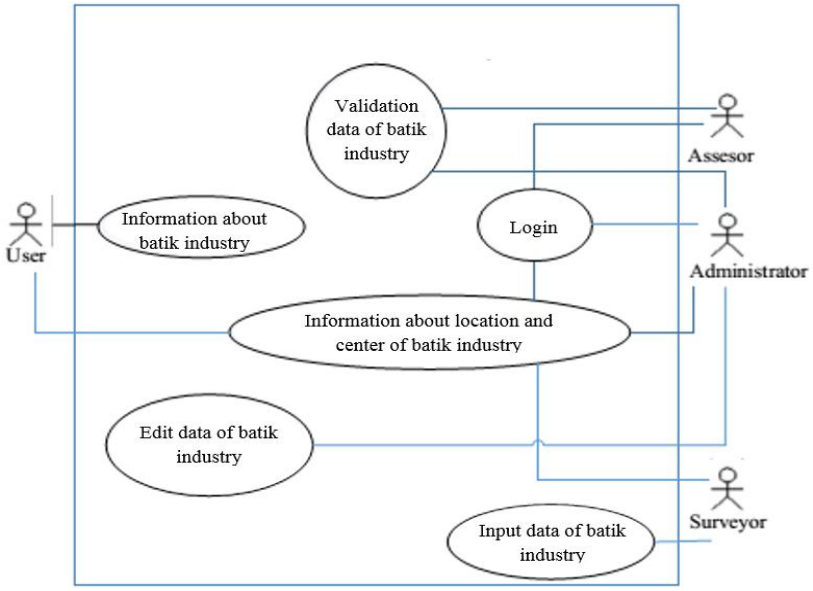

Fig. 2 The use case diagram of proposed information systems

Fig 3. The ERD of proposed information systems

B. System Design And Coding

To describe the interaction between users and GIS using Use-Case Diagram. Use-Case diagrams are diagrams that describe the interactions that occur between the system and the activities carried out by the user (as an actor) as shown in Fig. 2, while an explanation of the activities that can be performed by users. Contextually describing outside entities in the system environment and interacting with the system and the main information flowing between entities and systems can be seen in Fig. 2.

Entity Relationship Diagrams (ERD) are used to help database designers identify the data and structural needs that will be described and used in a database physically. The ERD design of the system developed can be seen in Fig. 3.

C. Interface Design

The user interface is a set of ways that users use to interact with machines, computer devices, certain computer programs, or other tools. The user interface provides input facilities, allowing users to control the system; and

output, allowing the system to inform user feedback [17].

D. System Evaluation And Testing

There were two types of testing used in this study, i.e. alpha testing and beta testing. Then, this study used a black bock technique for alpha testing. Testing of the system with black box method using analysis software specifications without reference to the internal working procedures of the system. The purpose of black box testing is to test whether the component matches the predetermined requirements for the component. The Black box techniques only look at the basic aspects of the system and to ensure that inputs are received correctly and produce output correctly as expected [18]. Thus, there were four group of users (administrator, surveyor, assessor, and user) are chosen to conduct the alpha testing with black box technique. In detail, the result of those testing can be seen in Table 2.

TABLE 2
THE RESULT OF ALPHA TESTING

Activity	Group of user	Output	Result
Login	Administrator, surveyor, assessor	Information system display the main page	Accordance with the design
Input data of batik industry	Administrator, surveyor	Table data of batik industry is added with the new data	Accordance with the design
Validation data of batik industry	Administrator, assessor	The short message will be appearing on the screen "validation status has been changed"	Accordance with the design
Information about location and center of batik industry	Administrator, user	Table data of batik based on its category, scale of enterprise, and the location of enterprise table data of supplier	Accordance with the design

As seen in Table 3, the result of alpha testing with black-box technique indicates that the all functions contained in the system being developed have been running properly. In the other words, it can be said that all the functions of the application based on GIS in batik industry has been successfully used and did not experience an error; if there is an error, this is caused by users who do not provide right input [18]. In this study, beta testing is carry out by giving some questionnaire to the twelve potential user. It can be said that this study use "closed beta" in which beta testing is done by a closed group of individuals. List of questionnaires and the answers from twelve of potential users can be seen in Table 3.

TABLE 3
THE RESULT OF BETA TESTING WITH QUESTIONNAIRE TECHNIQUE

Questionnaire	Answer (%)				
	1	2	3	4	5
Do you agree, if I say that the application GIS have a good user interface?	0	0	8.33	25.00	66.67
Do you agree, if I say that this application will make the user easy to get the information about center of batik industry?	0	0	33.33	58.34	8.33
Do you agree, if I say that operationalize of this application is easier to understood?	0	0	16.66	50.00	33.33
Do you agree, if I say that the application can help user to make effective decision about batik industry?	0	0	16.66	66.67	16.67

1: Strongly disagree; 2: Disagree; 3: Neither agree nor disagree; 4: Agree; 5: Strongly agree

The result of the Beta testing can be summarized as follow: (1) The GIS application developed has a good interface and easy to use; (2) user can easily follow the provided instruction; (3) The system is able to provide the information required by user, such as the mapping of the business field, the mapping of the amount of business in one district, the potency of the business type per village and displayed suit to the map location.

E. System Implementation

The display of the geographic information system for mapping the potential of batik can be seen in Fig.4 and Fig.5.

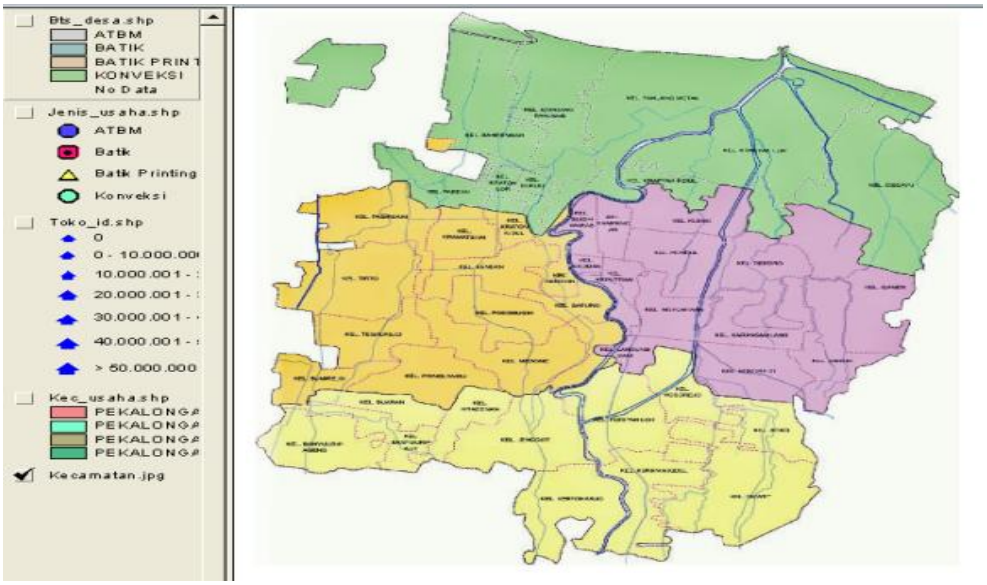

Fig. 4 The interface for inputting data

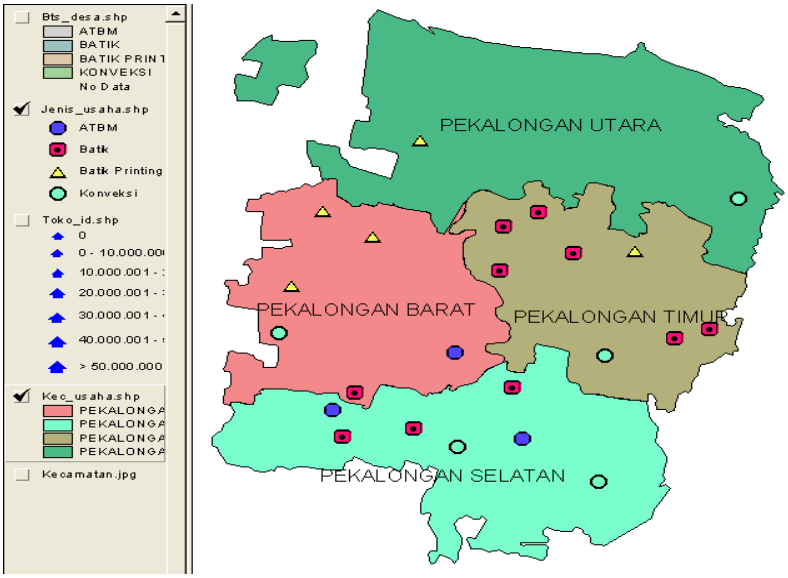

Fig. 5 Interface for information about center of batik industry

The advantages of this can show the data of batik potential location point in Pekalongan region spatially and tabular. Potential batik displayed can include villages, districts, and locations of the batik industry.

IV. Discussion

the current mapping process of the batik potential in Pekalongan has less objective, both in terms of time and quality. This is due to the lack of media that can provide information about the potential that exists in the region of the city of Pekalongan.

This research has developed a system to map geographic informatics the potential of good business that can be a tool in determining areas that could potentially address mathematically and complete with an information system to present the information based on the area they are potentially striving for. After the analysis is carried out through tests of user acceptance obtained that the information of the worthiest areas of the foundation of potential business development of batik Pekalongan Selatan subdistrict. This is according to the mapping data show that there are many batik Small and Mendium enterprises (SMEs) in the region. In addition, the level of revenue of the sector in the majority of sub batik Pekalongan Selatan. Results of the User Acceptence Testing (UAT) showed that the developed system provides comfort for the local governments to map out the batik potential in Pekalongan. Based on the mapping, much easier to see the potentialities that are owned by each region. This mapping can help local governments develop existing potentials to increase local revenue[2] [3][19] [20].

The potential of the batik in Pekalongan Selatan Sub-district for further developed can be seen in various aspects of the company. The modal aspects of the SMEs derive in large part of their own capital and more experienced a capital increase so that the potential to grow by adding capital derived from other sources such as credit banking[20][21]. Aspects of production, most small medium sized enterprises use local crude, most educated labor Junior high and high School, and some are still manually the potential of technology by developing technology and job training can do. The marketing aspects, most small-medium enterprises using only the media marketing stores can thrive. The presentation of the results of this research with the use of GIS technology can facilitate describe the results of the research in the form of data visualization. Use of GIS technology in more detail of information visualization so you need information about SMEs can be very complete.

V. CONCLUSIONS

The GIS application development in mapping the potency of batik has been presented in this paper. Spatial model presented by GIS may directly be applied to understand the mapping of the potency of batik industry centre in Pekalongan city. System Development Life Cycle development methodology used in creating this application adopted Use-Case Diagrams tool, whereas for the database design The Entity Relationship Diagram was used.

The test result with the Alpha test and the beta test were used to test the suitability of the application developed with the needs of users. The Alpha test result using black-box method indicates that all the function in the application of GIS is working well, suit to the design of the application.

The result of the Beta testing can be summarized as follow: (1) The GIS application developed has a good interface and easy to use; (2) user can easily follow the provided instruction; (3) The system is able to provide the information required by user, such as the mapping of the business field, the mapping of the amount of business in one district, the potency of the business type per village and displayed suit to the map location.

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