Development of Disaster E-Logistics Model Based on Geographical Information System

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Abstract

Natural disasters often occur in almost all areas that have the potential to experience disasters. However, problems arise when the process of distributing aid is hampered by manual and incidental logistics management, so the process of distributing logistical assistance to disaster victims is not effective. E-logistics is a system for distributing goods from source to destination. In the context of this paper, the source is a place where logistical assistance is collected and the destination is where the victims of natural disasters are located. Meanwhile, geographic information system is a system that provides regional information in spatial form. The research method used a qualitative approach by

observing the site of natural disasters and interviews with parties related to natural disaster management. The purpose of this research is to assist the government in distributing aid to victims of natural disasters by integrating e-logistic systems and geographic information systems. The results of this study are an integrated e-logistics model and geographic information system for victims of natural disasters

Keywords
Mobile Banking; Customer Satisfaction, Support

1. Introduction
The location of Indonesia at the meeting of the plate's active tectonics, active mountain trails, and regions tropical climate, so that makes some of it the area is prone to natural disasters. Amount disaster victims are classified as very high compared to other countries. Data the last one shows an improvement, either in terms of type of disaster, amount of loss, and number of casualties (Siregar, 2018)
So far, the process of distributing aid to natural disaster posts from government, agencies and the surrounding community are often less evenly distributed, meanwhile still many other victims who have not received assistance. The cause is not evenly distributed assistance, among others, is limited information on the location of the victim and does not have a system data collection on the needs of the victims which will make it easier for officer's natural disasters, agencies and communities to find out the location and needs of victims at each natural disaster post(Mahdia,2013)
E-Logistics is a detailed information system and complex operation implementation. In the context of natural disasters, logistics is the management of the flow of goods between points of origin and points of consumption to meet the needs of victims of natural disasters. Resources managed in logistics can include tangible goods such as materials, equipment and supplies, as well as food and other consumer goods(Inayatulloh,2021)
Geographical information system is a map-based information system to make it easier for decision makers to manage resources or information in an area (Inayatulloh,2021)
The purpose of this research is to help the government distribute aid to victims of natural disasters by integrating an e-logistics system with a geographical information system. The result of this research is a conceptual integration model between e-logistics and GIS to support the logistics management of aid for victims of natural disasters

2. Research Methodology
Observations of disaster victim handlers, especially in relation to logistics delivery, are the initiation of research aimed at identifying the problem. After finding the research problem, it is continued with the identification of solutions that have been carried out in order to develop existing solutions with solutions with information technology. After the proposed information technology concept was determined as an alternative solution, research activities were continued

by designing information technology needs to support the decisions taken. The final step is to design a GIS and e-logistics integration model as a solution for distribution of logistical assistance for victims of natural disasters

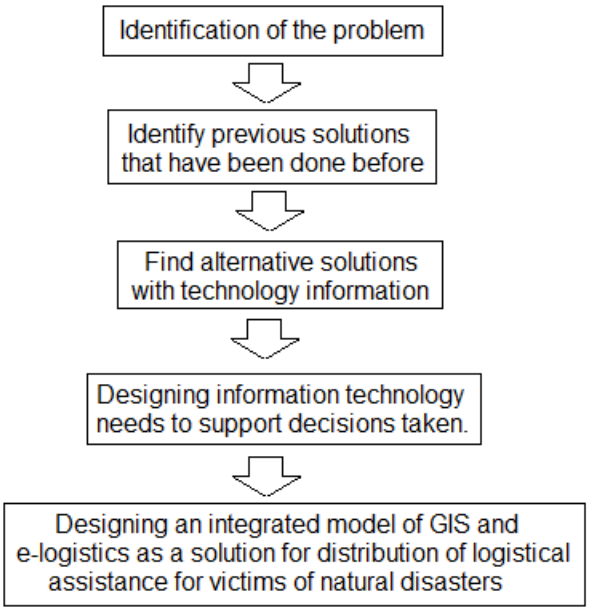

Figure 1. Research Method

3. Literature Review

a. Geographical Information System

Geographical Information System is a computerized information system that allows capturing, sampling, manipulating, recovering, analyzing, and presenting geographic reference data, as a facility to prepare, represent, and interpret facts relating to the earth's surface(Dennis, 2016)

Other names for geographic information systems are spatial information systems, spatial data analysis systems, and natural resources information systems. In addition, geographic information system is also defined as a system that manages geographic data by relying on computers (Hermawan,2009)

Processing and storage of data in geographic information systems make use of computer components consisting of hardware and software. Geographical information material is in the form of geographic data, while the management is human resources (Sumantri, 2019).

With the development of technology, geographic information systems make use of computers that can store, manage, process and analyze geographic and non-geographic data. In addition, geographic information systems are used to provide integrated information and graphics. The information obtained is then used for everyday purposes in human life(Sumantri,2019)

Geographical information systems can be combined with other systems depending on their needs, namely government, non-government, groups or individuals. Geographical information system data processing can be done conventionally and computerized(Hermawan, 2009)

Geographical information systems are used for various fields of applied science such as technical investigations, natural resource management, asset management, environmental studies, regional planning, and cartography and disaster emergencies(Hermawan, 2009)

b. E-Logistic

Logistics is the science that manages goods, services, raw materials with various variations from the source location to the destination with the aim of maximizing the use of capital resources. Logistics also includes integration of information, transportation, inventory, warehousing, reverse logistics and packaging.

Based on the above definition, the logistics mission is "to get the right goods, at the right time, with the right amount, right conditions, at an affordable cost, while still contributing profit to the logistics service provider". Whereas e-logistics is the use of information technology to support the logistics process(Inayatulloh, 2021)

c. Potensial natural disaster

Natural disasters are natural phenomena that no human being is able to predict when they occur, even though humans are socialization of potential disasters and geographic information systems with all their knowledge trying to read these natural phenomena. The incidence of natural disasters, humans are only able to minimize them and take action Pre-disaster risk reduction. Disaster risk reduction is carried out by considering sustainable aspects and the participation of all related parties, namely the role of the community in disaster mitigation. This effort is carried out with a strong commitment and prioritizes actions that must be prioritized. The priority that must be made is to study Geographical Information Systems (GIS). The focus of GIS is on disaster response and determining the potential for disaster by estimating the map. GIS can support all phases of the disaster management cycle. This is the need for socialization of GIS and potential disasters(Supriyono, 2018)

d. Model in research

Several methods are used by researchers to explain the results of qualitative research in the form of a conceptual model, which means an effort to realize the research findings in a conceptual model. Several studies using models as outputs are the CSF SME model (Inayatulloh, 2020), the halal food block chain model(Inayatulloh, 2020),TAM SMEs model(Inayatulloh,2020), the DSS model(Inayatulloh, 2019), the e-learning model(Inayatulloh, 2021) and others

4. Result and Discussion

The resulting model is divided into parts, namely e-logistics combined with GIS. Figure 1 describes the e-logistic system that interprets information on aid from within the country and abroad as well as assistance from individuals and institutions. After the aid has been collected from various sources, the aid items are then distributed to the national level government. Relief items are gradually distributed to the provincial level, mayor level up to the location of natural disasters.

However, these stages are temporary in nature where if the distribution process can be sent directly to the location of a natural disaster, these stages can be carried out. The e-logistics system integrates aid information at every point from the point of collection from various sources to the location of natural disasters. The e-logistics system will function to manage information including coordination and validation of data on physical assistance at each point to the location of the disaster where the government is the main actor who will manage the system

Meanwhile figure 2 describes a GIS that divides the system into several layers of information. The first layer is spatial information on areas that have the potential for natural disasters. This information is obtained based on geographic location and historical data of natural disasters. The second layer is the location for the collection of relief items for victims of natural disasters at the district level to the national level and the last layer is the initial layer for the collection of aid for victims of natural disasters. The entire layer is incorporated into a geographical information system.

Users are divided into two types of users, namely government and external users. The government has a role to manage aid for victims of natural disasters and external users are aid providers and external institutions that will oversee the process of distributing aid from donors to victims of natural disasters.

The process starts from the donor registering to the system and proceeds to the verification stage by the system administrator. The next stage is for donors to input aid data for victims of natural disasters which will be directly verified and validated by the system. Donors can view disaster area information and can choose the area to be given assistance. The government will provide recommendations to donors on the areas most in need of assistance. Like donors, external institutions also register to the system which will be verified by the system administrator. One of the

verification processes includes verification of legality from external institutions because external institutions as one of the external users can see in real time aid from donors and distribution of aid to victims of natural disasters managed by the government.

The government gives authority and responsibility to people or parties who have been assigned to each section. Each person in charge involved in the system such as the part that manages data from institutions and individual providing assistance from within the country and abroad will update the data to the system. The same thing is done by the person in charge in each section to the information, coordination and validation of assistance in natural disaster areas. The validation process is carried out by the person in charge to ensure that the material flow that reaches the area under their responsibility is the same as the data or information they received from the previous process or section. External agencies can monitor in real time the incoming assistance and outgoing assistance at each part or layer in the system

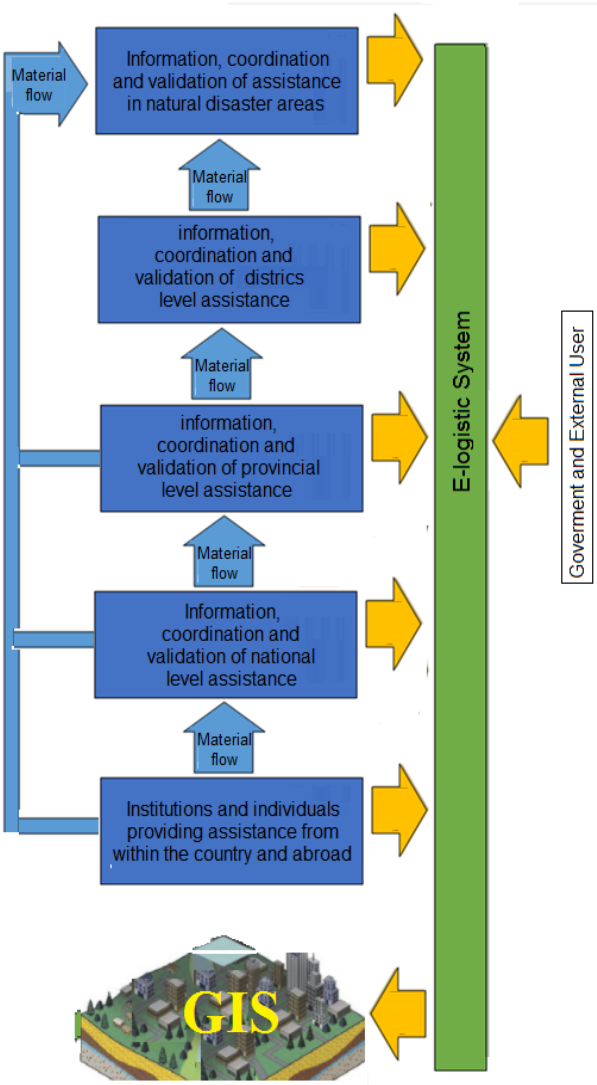

Figure 2 Information Flow and Material Flow in Information System for Natural Disaster Victim

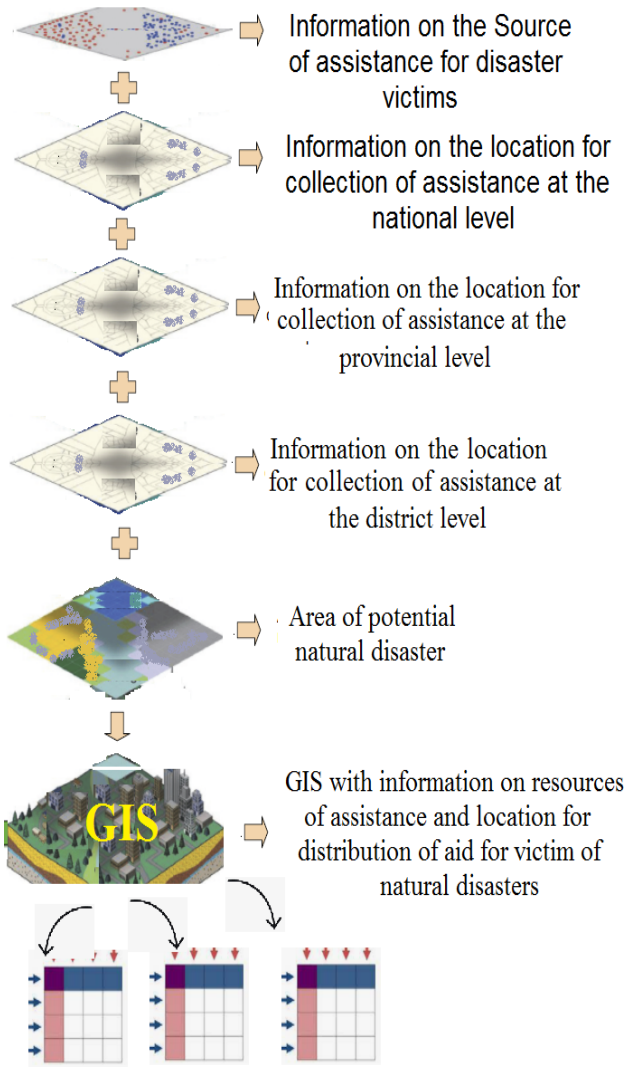

Figure 3. Integration several layer in GIS for natural disaster victim

Figure 3 describes integration several layer GIS and e-logistics. Vector data is a common type of data found in GIS. The first layer is source of assistance disaster victim. Information on sources of aid for disaster victims is information about individual and institutional donors who will provide assistance to victims of natural disasters
The second layer is Information on the location for collection of assistance at the national level. This layer provides location information to receive and distribute aid from donors to victims of natural disasters. At the national level, location information is more devoted to assistance from abroad or areas far from the location of natural disasters. Information on the third layer and fourth layer is devoted to areas close to natural disaster locations
The fifth layer is information about areas that have the potential or frequent occurrence of disasters. The five layers above are combined into spatial data which will become the GIS data model

EVALUATION MODEL

Based on discussions with experts who have competencies related to logistics systems, there are several suggestions given by them as follows:

1. The model needs to be equipped with information technology that supports the construction of this system. It is necessary to explain the infrastructure of the internet communication network because natural disasters can cause the disconnection of the existing communication network.
2. The model needs to be equipped with a system that supports the flow of materials because difficulties in sending aid to natural disaster locations often occur when sending aid to victims of natural disasters.

3. The model needs to be added to the transparency of aid from donors to victims of natural disasters because relying solely on reports of incoming and outgoing funds does not guarantee that there will be no misuse of funds by irresponsible people

5. Conclusion

The integration between GIS and e-logistics is a solution to increase the efficiency and effectiveness of aid distribution for victims of natural disasters. GIS that provides spatial data on potential natural disasters will facilitate efforts to determine the location of distribution of relief items for victims of natural disasters, especially locations that are difficult to reach due to road constraints or other means of transportation. The e-logistics system helps the government manage data and information on assistance through a system that integrates all stakeholders related to the logistics of natural disaster victims

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Biography

Inayatulloh is a candidate doctor at Bina Nusanatara University's Doctor of Computer Science. Since 2000, Inayatulloh has been a lecturer at several universities and colleges in Indonesia such as Bina Nusnantara University, Indonusa University, State Islamic University, Archipelago Economics College and is currently a lecturer at Bina

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