Design and Development of a Geospatial-Based Information Systems for Disaster Management of Adolescent Reproductive Health in Nusa Tenggara Barat Province In 2020

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Abstract. Indonesia is an archipelago country that is very vulnerable to natural disasters, the government has made many efforts to prepare the community to face these risks, either directly or indirectly, although many efforts have been made, there are still many casualties that have occurred so that efforts are needed to prepare a more massive and integrated by involving various related sectors, thus preparedness and mitigation efforts can reach a wider community and facilitate the integration process with various fields by utilizing renewable geospatial technology. With a wide reach, there will be more benefits to the community, especially vulnerable groups, one of which is the youth group, which are vulnerable to experiencing reproductive health problems. The purpose of this study was to design and build a Geospatial Based Adolescent Reproductive Health Disaster Alert Information System in Mataram, West Nusa Tenggara (NTB). To obtain system requirements, data collection had been carried out through in-depth interviews with several stakeholders, followed by the design and development of information systems. The method of designing and developing an information system that was used was the prototyping method where the system was designed and developed in accordance with the identification of system requirements result. Based on the results of this disaster preparedness information system laboratory trial, all components of the information system can be run properly. It is hoped that this system can be tested directly at the field level and can be further developed, especially feature that support community involvement in the use of applications to improve disaster preparedness and mitigation.

1. Introduction

Geographically, Indonesia is composed of a series of islands that are rich in active volcanoes, moreover, that Indonesia is surrounded by three tectonic plates, namely, the Pacific plate, the Eurasian Plate, and the Indo-Australian plate, those geographical factors make Indonesia very vulnerable to natural disasters. Apart from the two factors above, another factor that adds to Indonesia's vulnerability is the location of Indonesia which is under the equator so that Indonesia is known has two seasons that are rainy season which can increase the risk of flooding, and a dry season which can increase the risk of drought and forest fires, plus when the seasons change which can cause the risk of a tornado (Sutopo Purwo Nugroho, Theophilus Yanuarto, Pinuji, Andri Cipto Utomo, & Satrio, 2018)

Aware of those vulnerabilities, the government has tried various strategies to reduce the risk of casualties due to disasters, such as through the Meteorology and Geophysics Agency (BMKG) and the National Disaster Management Agency (BNPB), among others, making early warnings of disasters, raising public awareness of the importance of preparedness. through education and preparation of educational media, determining evacuation routes and disaster safe evacuation points for the community, as well as collaborating with stakeholders at the grassroots level to carry out simulations of disaster mitigation for the people under their leadership, and many other efforts that have been made. However, from all the efforts, it seems that they have not had a significant impact on reducing the number of victims of the disaster that occurred, as in the case of two major disasters that recently claimed countless lives or physical and material victims, namely the earthquake in West Nusa Tenggara which claimed up to 555 victims (Septia, 2018), and the earthquake and tsunami disaster in Palu and Donggala which claimed even more victims, amounting to 2081 people (Friana, 2018)many efforts have been made by the government, but there are some things that have been missed in all the efforts that have been done, namely, the way they use geospatial technology and the integration between each effort that has been done, these two keywords are not optimally done if seen from the previous description, the two keywords have been done but still fragmented from each other, and no integration. If they are carried out it is expected that the affordability of prevention and mitigation information can be spread more widely and evenly. Research on the utilization of geospatial technology in disasters has been widely done but no one has been adopted as a disaster management system at both national and regional levels. This geospatial technology is very necessary to be adopted and developed to improve the effectiveness of disaster preparedness and mitigation efforts that previously have been done, such as research conducted in China on the utilization of mapping or geospatial technology, which has proven effective to disaster management in China (Ding et al., 2015), as well as conducted in Turkey in developing disaster management information systems with geospatial support has improved disaster management efforts in the that country (Nyimbili & Erden, 2018).

Disaster Management in Indonesia itself has referred to the international disaster cluster approach, where there are 8 disaster management clusters, one of which is a health cluster. The health cluster itself divides the tasks into 6 sub-clusters and 2 teams, namely (1) health services, (2) disease control and environmental health, (3) nutrition services, (4) reproductive health, (5) mental health, (6) management of the dead victim, while the 2 teams are logistics teams, and data and information teams. More details on reproductive health sub-cluster are divided into 7 components, 5 components of that are components of reproductive health in adults, 1 component handles logistics and the last one component handles adolescent reproductive health (Kementerian Kesehatan RI, 2017).

In this study, the scope of research will be narrowed again on the components of adolescent reproductive health. Adolescent reproductive health such as the miniature reproductive health component in general because it has similar components to reproductive health components in general, will make it easier for disaster management teams to duplicate the system in a broader scope in reproductive health management in catastrophic situations. In addition, youth health management and services in the field are often ruled out while youth are a great asset to the future of the nation.

2. Method

Development of disaster preparedness information system of geospatial-based reproductive health sub-cluster using system development life cycle (SDLC) approach with prototyping method, where prototyping is the development of a system through a series of repetitions to include the necessary changes until the system meets the desired criteria (Everett & McLeod, 2006).. The development of SIGAB KESPRO system is more likely using a throwaway prototype development system, where all the needs needed by the system are identified first and then do the coding starting from the beginning (Stephens, 2015)

3. Result

1. Analysis of requirements

This system requirements analysis was obtained from in-depth interviews with several stakeholders. Overall, there is a gap between what is expected and how was the reality of reproductive health disaster management at the field level

Table 1 System requirement of analysis

	Current conditions and needs
Input	The internet network has reached remote areas in NTB Province, the availability of ordinate data and the proper functioning of the existing early warning system, the availability of enough health workers, and the support of stakeholders. However, there is no disaster information system that utilizes the availability of those facilities and policies
Process	Recording and reporting system was running manually, as well as the process of mapping targets and health service facilities, and the slow process of distribution of logistics and health services
Output	The data and many others information is not documented well, logistics distributions and health services are unequal

2. Application Design

1. Database Design

Figure 1. Context Diagram

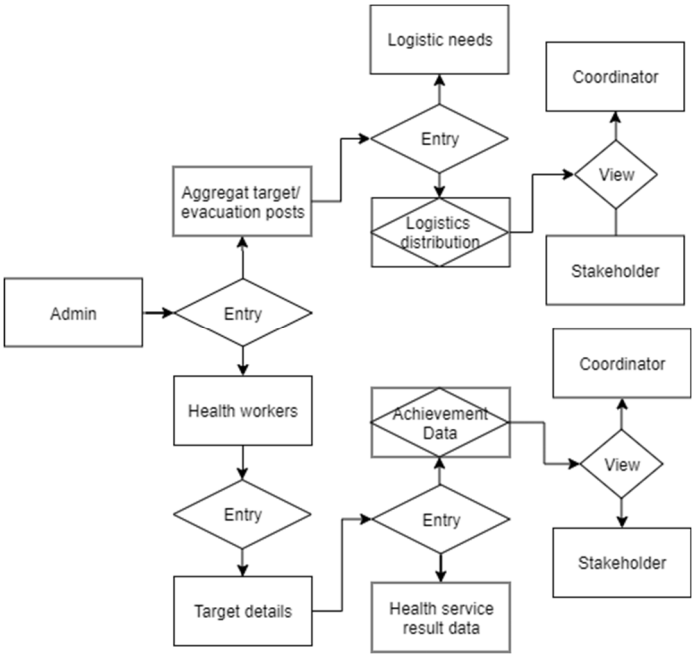

Figure 2. Entity Relational Diagram

From picture 1 and 2 above, namely the context diagram and entity relationship diagram (ERD) in general, it shows the 3 mechanisms that occur in this SIGAB KESPRO Remaja information system, namely the process of identifying targets, distribution of logistics, and reproductive health services to adolescent targets. where these three mechanisms will be further elaborated more clearly in the elaboration of the SOP as follows:

a. SOP Target Management

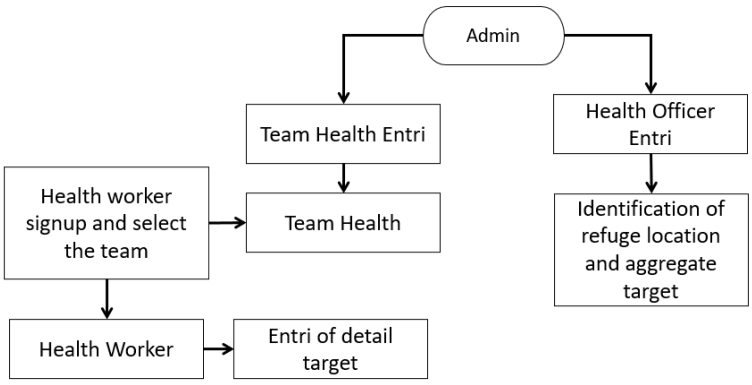

Figure 3. SOP Target Management

In this SOP target management is done by the health officer who directly goes to the field for identifying the location of the refuge and target in it, and then input the target data into the system. While the process of identifying detailed targets is carried out by health workers, where this process of identifying the details of these targets is indirectly carried out by health workers when providing services to the targets.

b. SOP Logistic Distribution

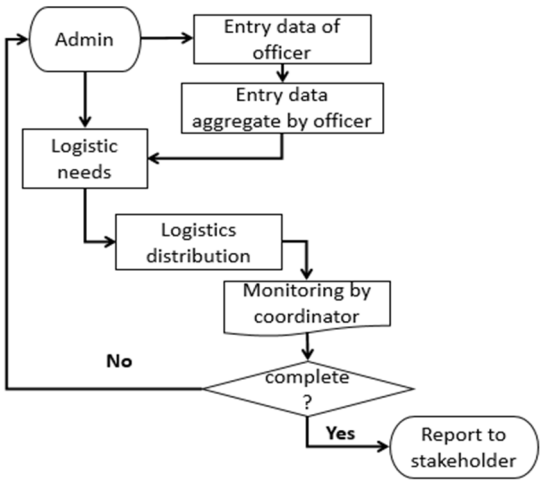

Figure 4. SOP Logistic Distribution

Logistics distribution will be arranged after the target management SOP runs, especially the identification of target aggregates by health officers. Because the target distribution database refers to the results of the target aggregate identification. In this process, the logistical distribution activities are monitored by the adolescent reproductive health coordinator, if there is a shortage of logistics or unequal distribution, the coordinator will confirm to the admin to identify the distribution of targets and the direction of logistics distribution that has been carried out through the SIGAB KESPRO Adolescent information system so that the distribution can be more evenly distributed.

c. SOP Reproductive Health Service for Adolescents

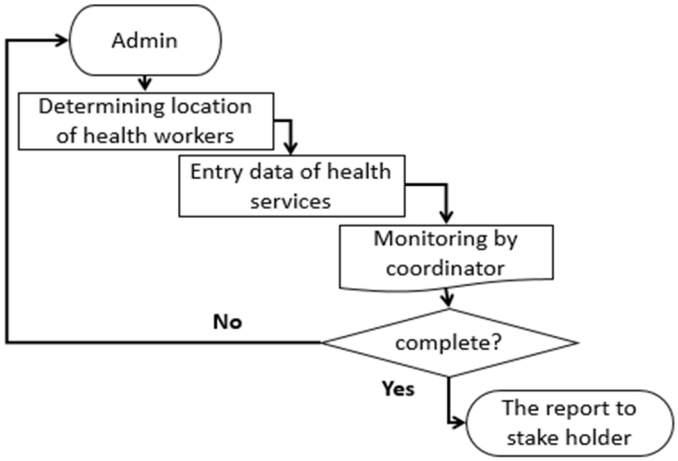

Figure 5. SOP Reproductive Health Service for Adolescents

In the SOP for adolescent reproductive health services, like SOP logistical distribution process, it will also be possible after the aggregate target identification process has been carried out because the distribution of teams and health personnel is based on the results of the identification of refuge locations and victims or targets.

3. *Application Interface Design*

SIGAB KESPRO Remaja consists of two application designs, namely web-based application interface designs and android-based applications interface designs.

a. Web-based application interface design

The login page on the SIGAB KESPRO Remaja application is designed to use an email address as the login account, this aims to reduce forgetting of the username and password.

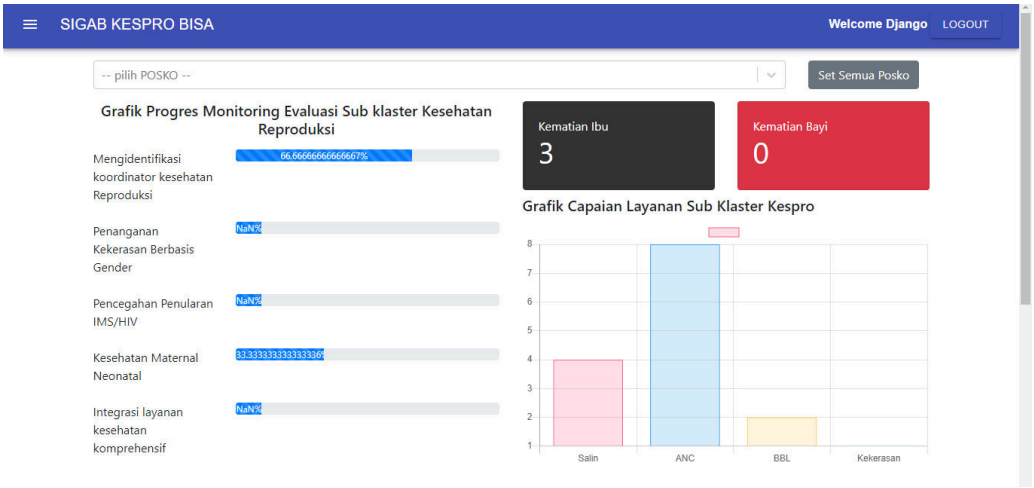

Figure 6a. *Tampilan Indikator di Dashboard*

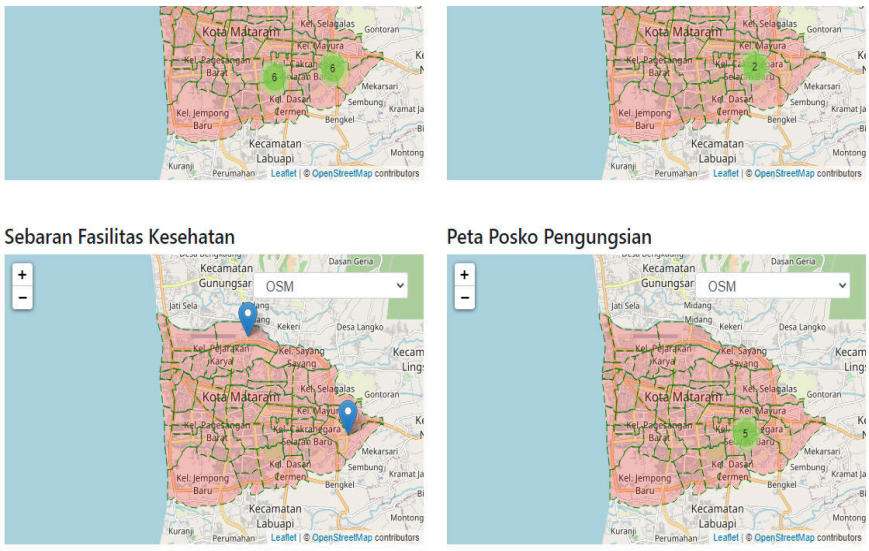

Figure 6b. *Tampilan Peta Dinamis Dashboard*

The dashboard displays several important indicators and maps dynamically in accordance with progress in the field. Display of indicators to describe the achievements of health services being carried out while the map provides information on the location of both target locations and health workers.

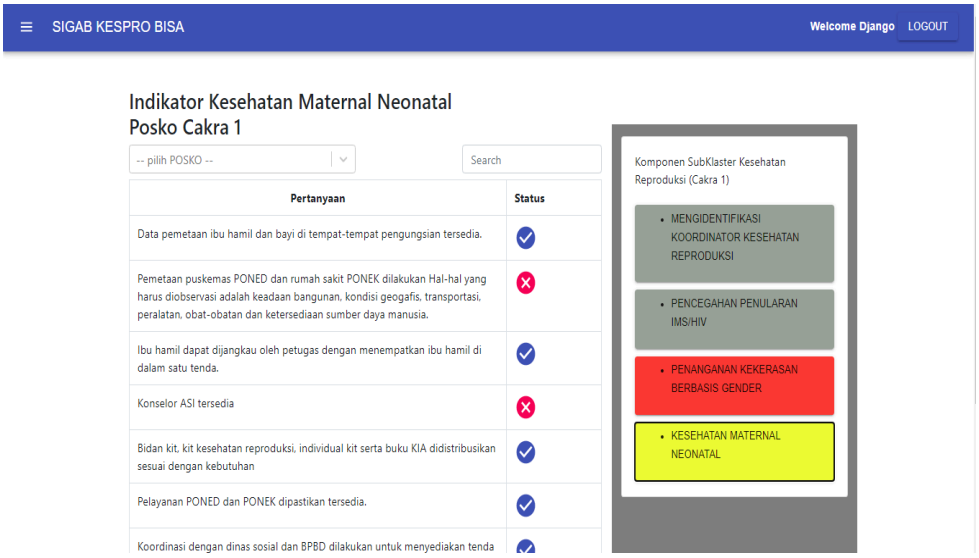

Figure 7. *Halaman monitoring capaian indikator*

Figure 8 shows a detailed monitoring display that is updated in real-time according to the progress of disaster management in the field

b. Android-based Interface Design

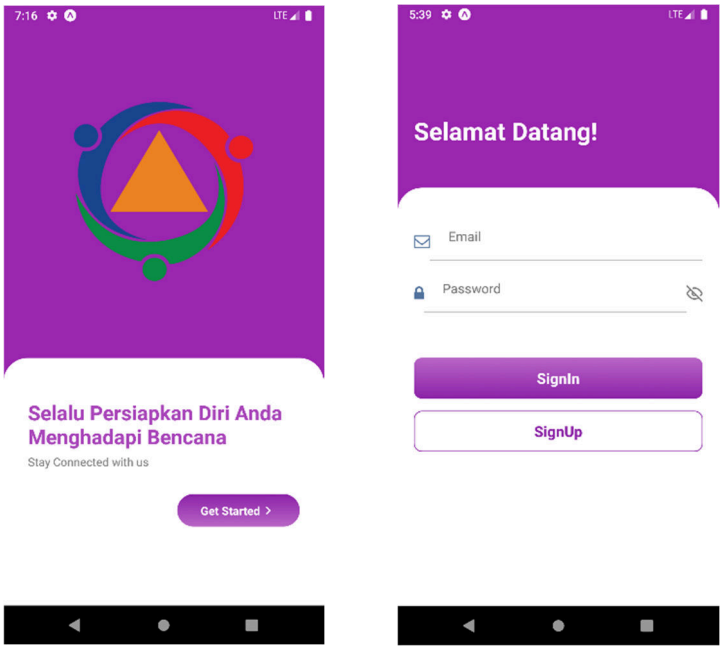

Figure 8. Login page for android application

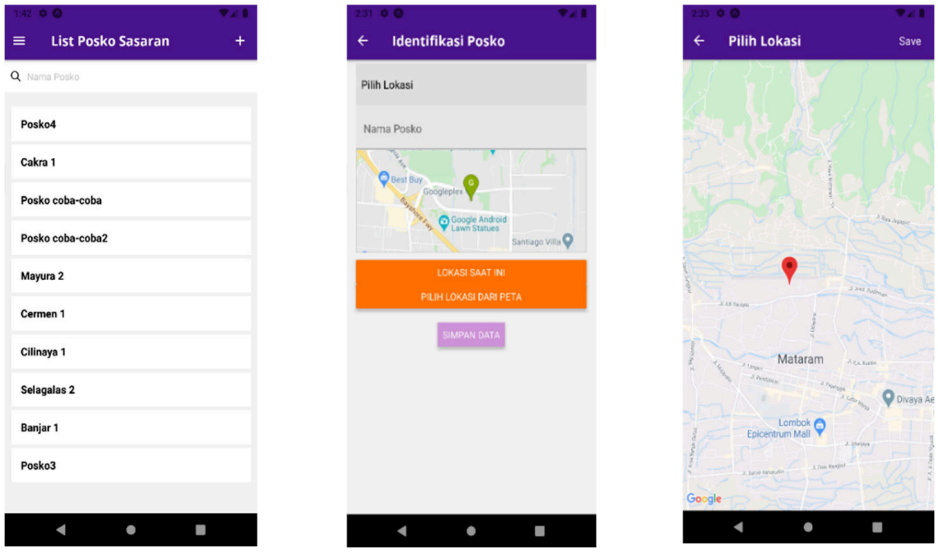

Figure 9. Identification of refuge and target location

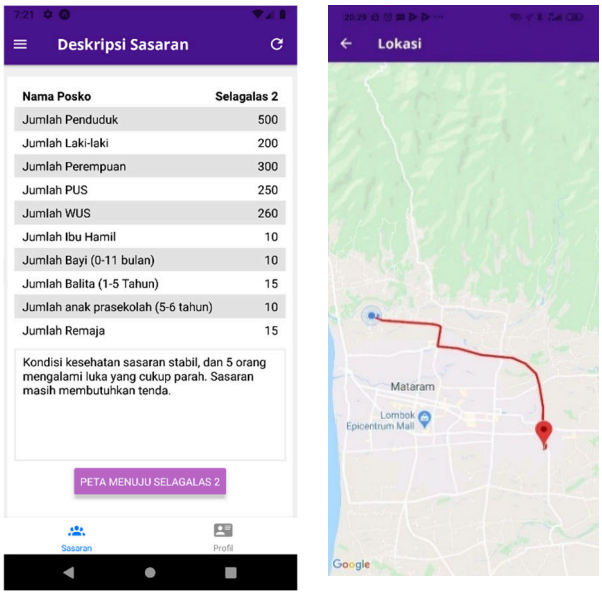

Figure 10. Target descriptions, and direction for refuge and target location

Figure 11 shows the results of the identification of the location of the refuge and the target carried out by the health officer, where the results of this identification will display the number of targets and the ordinate point where the target is located so that health workers can use these points to go to the target location to provide health services as shown in Figure 12.

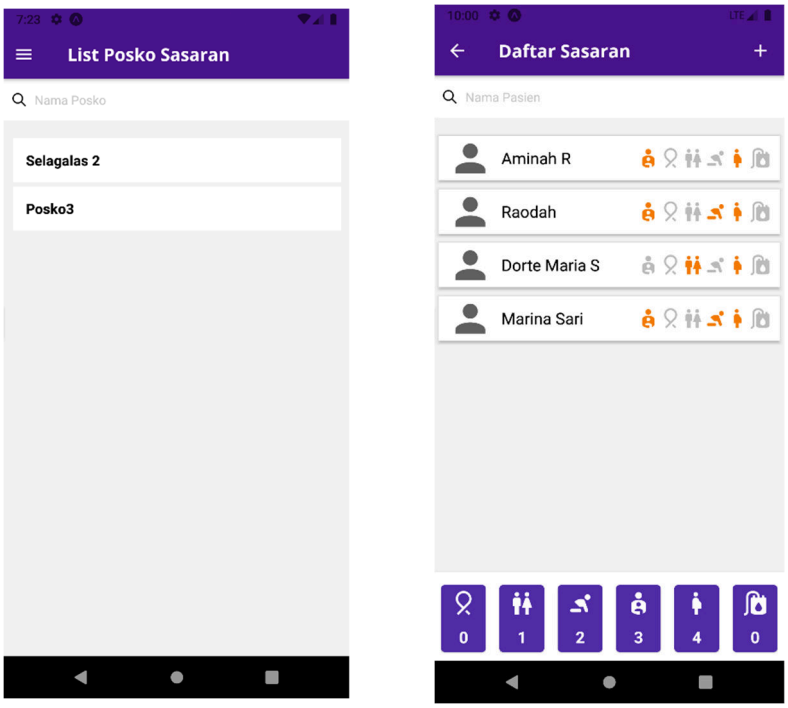

Figure 11. Display of health services result for every refuge location

4. Discussion

SIGAB KESPRO Remaja (Adolescent reproductive health disaster alert) is a form of information system that is built to assist the disaster management process, especially for adolescents in the emergency response phase, many studies have been carried out to prove the usefulness of information systems in assisting management processes as was done by Wahjono (2014) which revealed that information systems can speed up the decision-making process in an organization, a similar thing was also conveyed by Sakurai & Murayama (2019) especially in helping disaster management, through the results of their research which revealed that information systems would be able to increase the effectiveness of disaster management, especially in the phase mitigation and preparedness as well as the emergency response phase

SIGAB KESPRO Remaja is built on a combination of guidelines for the minimum initial service package (PPAM) for reproductive health (2017), guidelines for the minimum initial service package (PPAM) for adolescent reproductive health (2018), and experiences in disaster management during the earthquake in West Nusa Tenggara in 2018, where the disaster management process has been running well, although there are still many deficiencies, especially in the adolescent reproductive health management process, this combination is expected to be able to cover the existing shortcomings. This combination consists of two approaches, namely a theoretical approach and a practical approach to actual events. It is hoped that with this combination of references the resulting system will be easier to apply to actual conditions when natural disasters occur.

SIGAB KESPRO Remaja is based on a geospatial basis, where through a geospatial-based information system it will produce information that has an area point from which the information comes, this will provide many advantages in the disaster management process as conveyed by Milenković & Kekic (2016) Geospatial information system (GIS) in disaster management is used in all phases, including the emergency response phase, in the emergency response phase, GIS makes it very possible to share information through a map so that it will make it easier to identify the existence of areas that need help from health workers, or otherwise provide information to the team rescuers or health workers

about the location of the target area, and can provide information on the location of the closest health facility and many other functions.

Many studies have been conducted that prove the reliability of using geospatial in helping to improve the effectiveness of disaster management, such as research by Ding et al. (2015) which integrates and manages various sources of geospatial information in assisting the disaster management process with significant results in increasing the effectiveness of disaster management in their country. In another study also conducted by Nyimbili & Erden (2018) which examined and analyzed the use of geospatial-based applications to assess earthquake risk, early warning, fast response, and loss estimation due to disasters, from the results of this study, he recommended the use of applications - geospatial based applications in increasing the effectiveness of disaster management.

5. Conclusion And Recommendation

The SIGAB KESPRO Remaja information system can help the team easier to create and collect reports based on the required data. The prototype of SIGAB KESPRO Remaja has components that are very similar to the reproductive health sub-cluster so that this system has the potential to be developed into an application that has a larger scope. It is hoped that the SIGAB KESPRO Remaja information system can be further developed, especially in terms of integration with the ordinate points provided by the BPBD and community involvement in the use of applications as an effort to improve disaster preparedness and mitigation.

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