

The effectiveness & efficiency of e-aedes framework based on GIS

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Abstract

An effective and efficient management of information can be achieved through the use of information technology. The emergence of dengue virus is associated with uncontrollable breeding of mosquito, and the poor level of cleanliness of the environment. The prevention of mosquito breeding and control have been carried in recent years, which rely on the eradication, the case of Dengue Fever and Dengue Hemorrhagic Fever (DD & DDB) still exist. To hindrance the case of DD & DDB, prevention is the key factor in controlling the spread of the disease and the breeding of mosquito-borne. To prevent the spread of disease and mosquito breeding a quick and appropriate information is needed to locate the areas that have the potential breed of mosquito. The objective of this study is to Collecting knowledge through a literature review and expert understanding of Aedes / Dengue mosquitoes and equipped with a ready, effective and efficient of information. This research uses qualitative and quantitative methodology. This framework is verified through readiness, effectiveness and efficiency. This research shows positive results, particularly for the effectiveness and efficiency.

Keywords: GIS; Early Warning System; E-Aedes; Effective; Efficient.

1. Introduction

In Malaysia, Dengue Fever and Dengue Hemorrhagic Fever (DD & DDB) have become a public health problem every year. Since January 2015, statistics show that 85,746 cases of dengue including 227 involving reported deaths occur in Malaysia. According to the latest data from the Ministry of Health (MOH), throughout the 35th week of 2015, from 30 August to 5 September 2015, 2,230 cases of dengue have been reported the State of Selangor contributed half of the total DD & DDB cases nationwide [9].

To control the spread of disease and reproduction of Aedes mosquitoes, it is necessary to provide information that can provide rapid and precise location identification to areas with potential for Aedes mosquito breeding. Early warning system is a useful technology for controlling the breeding of Aedes mosquitoes [8]. Early warning system (e-Aedes) developed by Wan Azlan (2013), Mohamed Termizi (2015) and Hammadi Zhorif (2016), is one of the online systems that can be used for the prevention and control of Aedes mosquito contagious diseases. This system allows users to get information from the high-risk areas of Aedes mosquitoes and be able to identify early signs of Aedes mosquito breeding at potential sites for Aedes mosquito [7], [11], [16].

The model of contagious and reproductive control systems developed only relied on early Aedes mosquitoes (eAedes) in Aedes mosquito breeding grounds, without providing complete information about the information that can make danger level on the breeding of Aedes mosquitoes and areas that occur in breeding areas through data [1]. Hence, the objective of this research is to identify high risk areas of Aedes mosquito reproduction and evaluate early warning system for e-Aedes. The e-Aedes can determine whether the area is a risky area or non-contagious Aedes mosquitoes through data. This study chooses a qualitative and

quantitative model as a research methodology as it is suitable for use in system development. The process starts with the initial phase of the study to the evaluation phase.

1.1. Factors affecting the spread of Aedes mosquitoes

Thomson and Connor of a journal article in find that the number and rainy season in a region have a close association with the influence of vector flowers. If rain falls, it will be found that stagnant water bodies will become habitat suitable for breeding Aedes [15]. Aedes mosquito reproductive disease is also influenced by the attitude of the community that does not care about the hygiene around. The attitude of the people who do not pay much attention to the dangers of the disease can also cause their families to risk the occurrence of vector virus infection [18].

1.2. Definition of geographic information system (GIS)

GIS is a mapping and geographic information system that serves as a tool of management in the form of computer information that is related to the mapping system and analysis of all events happening on earth [2]. GIS technology integrates data processing from databases and uses typical visualization through geographical analysis of map images.

In Malaysia, GIS is widely used in various fields including domestic security, military, land use analysis, municipalities and epidemic disease distribution [16], [1], [4], [5]. At present, GIS has expanded widely in various fields not only to solve geographical issues but also to health fields around the world.

1.3. GIS-Related early warning system and prevention of aedes and diseases

The Ministry of Health Malaysia (MOH) is working towards expanding the use of latest technologies, especially GIS technology in health information management. DD and DDB disease prevention and transmission activities using GIS in management and prevention were pioneered by the Johor Baharu Municipal Council in 1996 [3]. It uses a database system in analyzing and integrating GIS as well as through map and neighborhood action functions to identify areas in delivering a warning system.

There is also a reviewer involved in the reclassification and measurement analysis, maps and neighbourhood actions contained in GIS have been used to identify suitable locations for landfill sites. GIS plays a role in collecting, storing, analysing and displaying information according to data goals and objectives to deliver an early warning [12].

According to Aziz Shafie [1] study, control and prevention of DD & DDB epidemic occurs when a case occurs, space information on the spread of Aedes mosquito disease and breeding is important to consider in the prevention activities. The information obtained was analyzed to increase the success of DD & DDB disease prevention activities before a case event was more severe. Studies emphasize the importance of early warning systems to take steps to prevent the cause of DD & DDB disease from continuing.

The system developed by Wan Azlan [15] is a Management Information System based on an analysis of the effectiveness of information system services. The selected case study is the Aedes Early Warning System (e-Aedes). The system aims to support the effectiveness of information systems used and thus facilitates and smoothens the management process at the Disease Control Division (BKP), Ministry of Health Malaysia. This system is a provides early warning to local residents if the census finds that the area is at risk of contagious Aedes mosquitoes.

Early warning system of Aedes mosquitoes (e-Aedes) was developed for disseminating early information on transmission of Aedes mosquito infections and is a way to reduce and prevent the Aedes mosquito.

2. Methodology

This research uses combination of qualitative and quantitative approaches. Various research instruments such as document highlights, interviews, questionnaires, observations and discussions are used for data collection process. Evaluation of the prototype of the e-Aedes framework is conducted to measure the readiness, effectiveness and efficiency aspects of e-Aedes framework based on GIS.

Research Approach

The approach of this study is divided into four (4) phase's namely theoretical studies, empirical studies, the verification and validation of research.

2.1. Theoretical research

Theoretical researches is needed to identify factors that contribute to the usability of the e-Aedes system from a development perspective. Theoretical research is important because it provides an understanding of the field of study and becomes a research guide. An understanding of the field of study is derived from sources of published documents and unpublished documents. Theoretical research are literary studies to determine the background of the research, research problems, research objectives and scope of the research, the preliminary framework of the research and the conceptual framework.

The conceptual framework of the e-Aedes involves three major components comprising Aedes mosquito breeding factors, early warning system criteria and GIS criteria. Based on these three components, the effectiveness and efficiency factors become a measure in the development of the study framework, as shown in Figure 1.

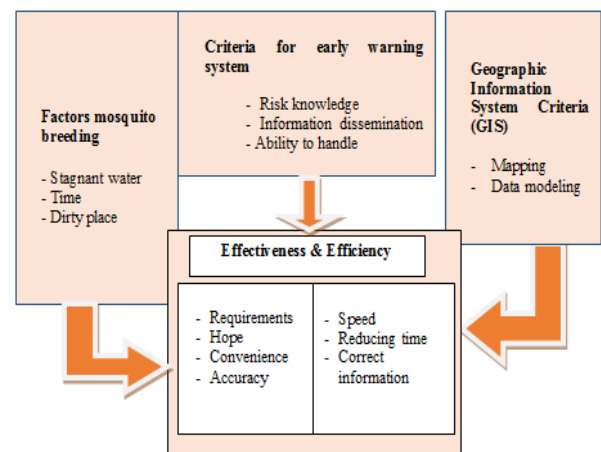


Fig. 1: Conceptual Framework of the Aedes Early Warning System (E-Aedes).

2.2. Empirical research

Empirical research is the data collection phase in setting early research instruments. This empirical evidence is required so that actual data can be collected based on the actual situation. This phase consists of the initial instrument model of e Aedes. Early research instruments were used to identify all the information needs of the e-Aedes and also assess the level of effectiveness and knowledge of the people against Aedes mosquitoes. There are two stages to develop the instruments. The first stage is interview. This interview is conducted to determine the level of expert knowledge of the Aedes early warning system (e-Aedes). Interviews were conducted with field experts and had information on Aedes mosquito research.

The second stage is the evaluation of the efficiency and effectiveness of e-Aedes framework. The questionnaire was distributed to residents in designated areas according to the scope of the study to measure effectiveness after using the e-Aedes framework based GIS. The questionnaires used were closed questionnaires using Likert scale. Respondents can choose an answer based on their understanding of the question asked. Data collected then analyzed [13].

2.3. Verification of instrument of research

The validation of this research model instrument is based on data obtained from theoretical and empirical studies. Verification phase of this research instrument involved activities to identify effectiveness and efficiency factors based on the analysis of the theoretical and empirical studies. The use of content analysis methods is one of the most suitable qualitative methods as it allows the study to classify and identify theoretical and empirical studies previously acquired in several key categories [10] This section involves expert assessment and data collection. An expert interview technique is used to obtain information content requirements for the model framework (e-Aedes). An interview session conducted to obtain information and validation e-Aedes based GIS system model content. Informal and formal interviews are used to obtain the information needed. Informal interviews and open interviews are techniques that can be used effectively in investigations [12].

2.4. Validation of framework

The validation of the proposed study framework is based on an early instrument of e-Aedes framework based on GIS. Apart from verifying the research framework, this section will also evaluate the resulting research framework. The assessment of the research framework involves interviews with individuals (experts) identified as having relevance and expertise and experience in the domain of the relevant issues. Evaluation was carried out on the aspects of effectiveness, efficiency and relevance of factors in the

development of a research framework involving the built prototype.

3. Research findings and assessment

This chapter discusses the findings of this research, based on interview obtained from expert interviews. Discussion and evaluation of the results of the study on effectiveness and efficiency are based on data. In this interview, the selected expert involved three (3) people in the area of Aedes mosquitoes, dengue fever and community (active). The three selected experts are able to confirm the initial instrument of research in this research based on their respective expertise. Based on these three components, the effectiveness and efficiency factors become a measure in the development of the study framework of the e-Aedes involves three major components comprising Aedes mosquito breeding factors, early warning system criteria and GIS criteria. As shown in Figure 1. After the improvement through an initial interview with this expert, the specialist is required to confirm the result of the interview. As a result, experts believe there are some unnecessary items on the Aedes mosquito breeding factors, early warning system criteria and geographical information system criterion (GIS). As shown in Figure 2.

Done steps, verification of questionnaire for analyze to assess the readiness, effectiveness and efficiency of e-Aedes framework based on GIS, this research develops a questionnaire for the survey respondents. The questionnaire was conducted in the final study, which to assess the efficiency and effectiveness of the GIS-based e-Aedes system. The questionnaire was distributed to residents in designated areas according to the scope of the study to measure the effectiveness and efficiency level of e-Aedes framework based on GIS.

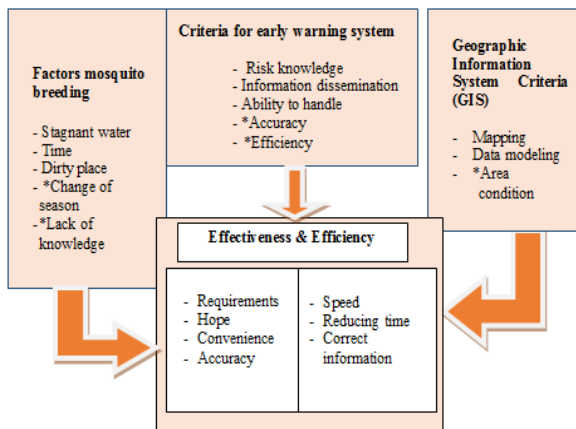


Fig. 2: Certified by Expert.

- Framework Assessment

A question ere that are distributed to 30 respondents is made to evaluate the level of acceptance of the framework. From the descriptive analysis, the percentage of respondents based on gender and the level of education was analyzed. The level of education is to evaluate the understanding of the respondents regarding Aedes and GIS studies.

- Descriptive Analysis

Descriptive analysis will turn the raw data of the questionnaire to a form that is easy to understand. Reliability tests which are performed from each part of the query shows Alpha Cronbach's value exceeds 0.5 in each section. At Alpha Cronbach's estimation, Alpha Cronbach's is 0.7, in the evaluation part of the effectiveness, Alpha Cronbach's value is 0.8, and the latter is Alpha Cronbach's rating on efficiency rating of 0.9.

a) Respondent Demographic Information

The distribution of male respondents is 56.7% compared to 43.3% of female.

b) The readiness e-Aedes framework based on GIS

Figure 3 shows positive median all for graphic. Where A1 - A5 refers to interviews with experts, which are then obtained median

results from the picture below. Indicated that the respondent is ready to uses e-Aedes framework based on GIS.

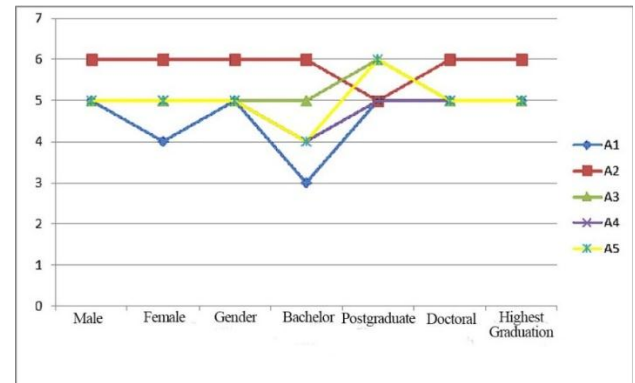


Fig. 3: Median Score of Readiness.

c) Effectiveness Using GIS Based e-Aedes System

Figure 4 shows that based on interviews with experts, it is found that the median value comparisons to the questions raised to the respondents are in accordance with the specified criteria, have all the median positive values for graphic. Indicated that the respondent is effective to uses e-Aedes framework based on GIS.

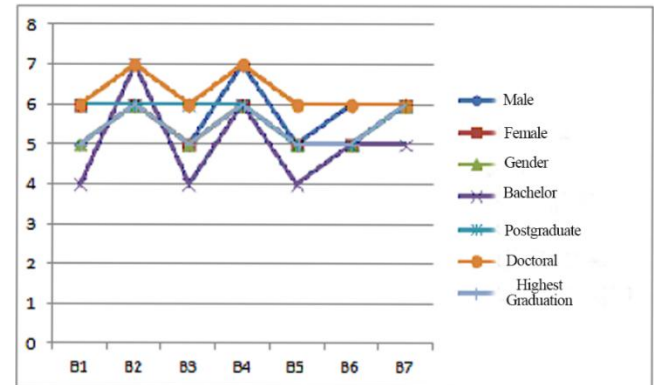


Fig. 4: Median Score of Effectiveness.

d) Efficiency Using GIS Based e-Aedes System

Fig. 5 Shows Positive Median All for Graphic, Indicated That the Respondent Is Efficiency to Uses E-Aedes Framework Based on GIS Except for Postgraduate, There Is Low Value from Other Responden.

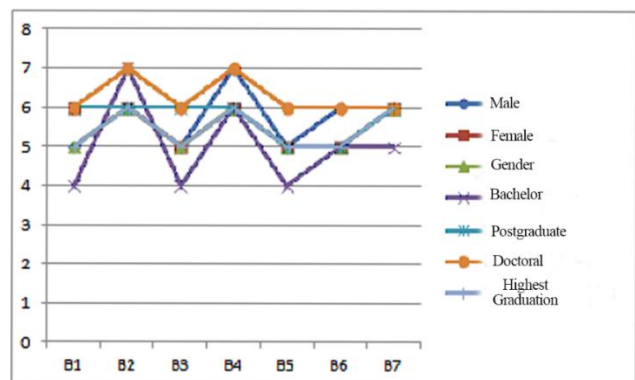


Fig. 5: Median Score of Efficiency.

4. Conclusions

This research shows that the e-Aedes framework based on GIS is effective and efficient. It is hope that the authorize will adapt this framework to reduction eliminate the dengue outbreak. The first objective was achieved based on independent studies, and through a joint workshop with experts based on three (3) areas, namely the

expertise of Aedes mosquitoes, dengue fever and the community (active). This study has ratified the initial instrument of study in this investigation based on expertise for the development of an e-Aedes system framework based on GIS. In the second objective, the framework of the Aedes mosquito early warning system (e-Aedes) was developed based on GIS based on the results of expert experts. Furthermore, in the third objective, the framework assessment is carried out to the respondent to test the order and accuracy of the framework that is built.

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