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# Environmental Based Prevention Model on The Dengue Haemorhagic Fever Dissemination in The DKI Jakarta Province

Arif Sumantri

**Abstract**

Dengue Haemorhagic Fever (DHF) is one of the national problem which not yet overcome till in this time. The root cause the increasing of cases amount of DBD in Indonesia for example because; high resident mobility and densit, good progressively interregional transportation, and also the existence of new settlement. Other factor which influence the happening of KLB is deviation of rain pattern, season factor, society behavioral of irrigate traditionally, lack of society participation in eradication of mosquito den (PSN), lack of knowledge of society concerning symptom of DBD and delay bring to service of health. Other cause is the lack of coordination pass by quickly sector, spread over mosquito vektor of Aedes aegypti in all fatherland, existence of four virus serotype which is rotating during the year and also delay of prevention of KLB.Pursuant to global average value of AHP priority from target alternative in stakeholder level, principal and factor from highest to lowest is Law enforcement (P) equal to 0.48, Monitoring and Enableness of society (N) equal to 0.227, Development of crop conducting anti mosquito (M) equal to 0.152, Socializing culture of PHBS (O) equal to 0.104, and Precaution (L) equal to 0.043, with index inconsistency equal to 0.055. Supporting preventive program of DBD at optimis-moderat scenario hence recommended by society participation entangling followed by the efforts socialization, campaign, movement cymbal and counselling to society, make-up of role of housewife with improvement of knowledge concerning preventive efforts of DBD through cadres of PKK, officer of PSN and officer of other volunteer, development of crop conducting anti mosquito and gift of reward for everybody which is movement activity of development of crop conducting anti mosquito for the prevention of DBD.

**Keywords:** Dengue haemorhagic fever, dynamic system model

First DHF cases occurred in Surabaya in 1968, the number of patients who reported at that time was 58 patients, 24 (41.3%) of them died. In the 1968, 15.340 people was attacked by DHF on the dengue outbreak in the 156 regions on 23 provinces then 549 (3.6%) of them died. Although the mortality rate of DHF tended to decrease, from 41.3% (1968) to 3.2% (1988), but it spreads more widely. Until 2002, all provinces have reported cases of dengue. Until March 2004, has 12 provinces that declared as the outbreak area (KLB). This situation is closely related to the increased mobility of people and in line with the fluent of transportation that was much better at that period.

Many factors must be considered accurately and relatively in the effort to prevent another infection from the insects, especially in the provinces of DKI Jakarta, there are natural resources, artificial resources, environment and supporting components to the success of prevention. Even the natural resources, artificial resources and other environment also has a derivative (derivatives) that many components too. Therefore, in making the eradication of dengue prevention models should be approached with the concept of thinking about the system which is comprehensive (holistic) and integral (intertwined). The system was expected to solve problems involving inter-related problems and always growing and changing, which had previously been difficult to resolve one by one.

The purpose of this research is to Build Environment-Based Prevention Model of Disease Spread of Dengue Fever in Jakarta. Novelty value of this research is to provide new thinking concept that prevention of the spread of dengue to be followed by environmental management based on the potential economic, ecological and social as a guide to increase community participation, especially in realizing PHBS

## METHODOLOGY RESEARCH

### Location and time

Research location are all areas of DKI Jakarta Province. The research will be held on November 2006 until June 2007.

## Design of the research

The method of this research is a systems approach because of problems in environment-based prevention against the spread of Dengue Haemorhagic Fever (DHF) in DKI Jakarta involving multiple parties (stakeholders) and the components in the system is very complex including the aspects of environmental, economic, social, technological, legal and institutional.

## Data collection method

The data to be collected in this study includes primary data and secondary data. The primary data was obtained by interviews, questionnaires and focus group Discussion (FGD), while the secondary data was obtained by survey/visit relevant institutions.

## Sampling Method

Sampling technique in order to dig up information and knowledge (the acquisition of expert opinion) deliberately set (purposive sampling). Basic calculations in Determination of experts to serve as respondents using the following criteria:

a. The presence of the respondent and the respondent's willingness to serve
b. Having a reputation, status/position and has demonstrated its credibility as an expert/expert in the field under study.
c. Already have experience in their fields.

Experts who will be an alternative choice to be made respondents as many as 28 people, including: employee health office, Bappeda, Sudinkes in DKI Jakarta Province, NGOs related to environmental issue, community leaders and lecturers. So who elected can experts representing each element: Bureaucracy, Academia (college), community and NGOs.

## Data Analysis

### Analytical Hierarchy Process (AHP)

*Analytical Hierarchy Process* (AHP) is an effort to simplify a complex issue that is not structured, but strategic and dynamic in pieces and arrange in a hierarchy.

### Interpretative Structure Modelling (ISM) Analysis

Interpretive Structural Modelling Technique (Interpretative Structural Modeling) is used to formulate policy alternatives in the future. Stages of the preparation of the ISM there are two sub-elements of hierarchy and classification.

### Systems Approach

This research uses the concept of systems approach that combines prevention, environmental valuation and analysis system using Powersim constructor.

### Validation

1) Absolute Mean Error (AME) is the deviation (difference) between the average value (mean) results of a simulation of the actual value.
2) Absolute Variation Error (AVE) is a distortion value of variation (variance) of the actual simulation. Limits of acceptable deviation is between 1-10%.

## RESULTS AND DISCUSSION

Results and discussion consists of the identification of environment-based prevention based on factors that play a role in the spread of dengue disease, are important factors structuring potential and can be used to determine the environment-based prevention against the spread of dengue disease scenarios and formulate policy recommendations are needed for prevention efforts based environment on the spread of dengue in DKI Jakarta Province

### Factors that Contribute to the Spread of Dengue

Priorities of the factors and objectives the prevention and spread of dengue-based environment from the most important to the unimportant in sequence as follows:

1. *Law enforcement (P). 0.480*

   In achieving weight law enforcement priority for the human factor amounted to 0.52, where the value of this weight is the highest in achieving the main goal. Enforcement of regulations to provide supplement in achieving clean and healthy lifestyle. According to Fikri (2005) and Soeroso (2003) application of Law Enforcement will condition the public to utilize and manage the environment in the prevention of the spread of dengue.

2. *Monitoring and community empowerment (N); 0227*

   According Mubasyir (2003), that the community can encourage the success of a dengue eradication programs, through three ways: 1) provide information, 2) provide political support and 3) to contribute resources. Empowerment is done by utilizing the potential contained in the community, so that will have involvement in monitoring the spread of dengue.

3. *Development of anti-mosquito plant cultivation (M); 0152*

   Utilization of anti mosquito plants worth conducting because the B/C ratio is greater than 1. The average value of the business benefits of four anti-mosquito plants in one hectare area until the harvest obtained by Rp. 705 980. Average value of B/C ratio of 1.19 indicates that every USD. 1.00 costs incurred will be obtained profit of Rp. 1,19.

4. *Popularizing PHBS culture (O); 0104*

   Efforts to establish independence of the community in environmental management through environmental sanitation of the neighborhood vector settlement would be more effective if it had materialized into a culture of clean and healthy lifestyle.

5. *Precautions (L); 0043*

   Efforts to prevent the spread of dengue is the most effective is the eradication of mosquito breeding places and followed with an active role in the community clean and healthy lifestyle programs. Improved quality of environmental sanitation to prevent someone to avoid dengue so minimize the cost of treatment and care.

**Important factors that Potential in Preventing Spread of Dengue fever, Based on Structural Modeling (ISM)**

There are 3 elements involved in the development model the spread of dengue prevention and environment based either directly or indirectly, which are converted again into 20 sub element like based on table 1.

Tabel.1 Priority Element in the development and spread of disease prevention model of DHF based environment.

| Sub element |
|---|
| **Element Principle** |
| 1. Management of water supply |
| 2. Vector Data |
| 3. Eradication of mosquito breeding |
| 4. Wastewater management/solid |
| **Element Objectives** |
| 5. To increase the participation of the management of environmental sanitation |
| 6. To independently monitor the mosquito's larva in the community |
| 7. To foster the cultural attitudes as well PHBS |
| 8. To grow the capabilities in an effort to live healthy independent |
| 9. To Establish a community responsibility in environmental management |
| 10. To grow the awareness about the importance of environmental management |
| 11. To form the motivation to act against the presence of promotive and preventive larva |
| 12. To provide a social commitment and the legal consequences in environmental management. |
| 13. To make the legal order of environmentally sound |
| **Element Factor** |
| 14. The quality of environmental sanitation |
| 15. Global climate change |
| 16. The participation of community to prevent with the potential of environmental management |
| 17. Management of water reservoirs |
| 18. The ability to independently realize the culture of healthy living |
| 19. Monitors the effectiveness of larvae and the incidence of cases |
| 20. Knowledge attitudes and behavior on early prevention of mosquito breeding |

Based on Figure 1, the value of the power driver with the highest principles sub element 5 or increase the participation of environmental sanitation management while having the lowest power driver is 20 or knowledge attitude and behavior on early prevention of mosquito breeding. Diagram the hierarchy of the ISM in the structure contained in Table 1.

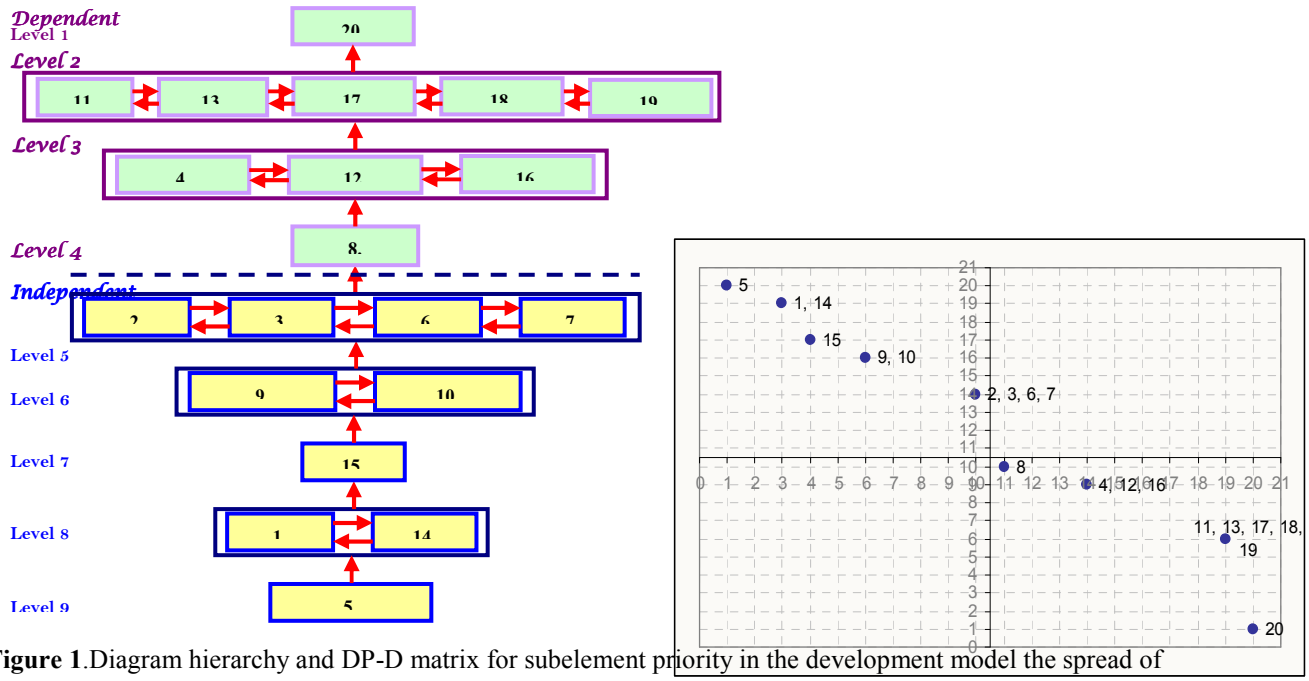


**Figure 1**.Diagram hierarchy and DP-D matrix for subelement priority in the development model the spread of dengue prevention and environment-based

The results of this analysis illustrates the opinion of experts that principle in the development model the spread of dengue prevention and neighborhood-based participation of management starts by improving environmental sanitation, management of water supply, sanitation, environmental quality, global climate change, establish the responsibility of society in environmental management, raise awareness about the importance of environmental management. This was followed by a data vector, the eradication of mosquito breeding, self-monitoring of mosquito larva in the community and foster a culture of clean and healthy lifestyle healthy attitude which in this case the need to attract people to be able to participant in the management of environmental sanitation in order to jointly manage the environment better, should also management of clean water to reduce the breeding places of mosquitoes, maintain the quality of environmental sanitation, to understand global climate change as a contributing factor in enhancing mosquito breeding, forming communities to jointly have the existing environment and the responsibility to manage it, but it also needs to grow awareness of the importance of environmental management.

## Needs Analysis

Needs analysis is the first step in a systems approach, and determine the feasibility of a system built. In this phase, an inventory needs of all actors (stakeholders) involved, as inputs in the model.

## Problem Formulation

Conflicts of interest between the stakeholders, an issue that requires a solution for the system to work constructively in order to achieve the goal. The basic problems, systematically described as follows:

1. Participation of environmental sanitation management
2. Management of water supply
3. The quality of environmental sanitation
4. Global climate change
5. Establish a community responsibility in environmental management

6. Growing awareness about the importance of environmental management

**Identification Systems**

In the build environment-based prevention system against the spread of dengue, there are several components that are illustrated in the diagram feedback (causal loop) between two or more variables that form a closed chain.

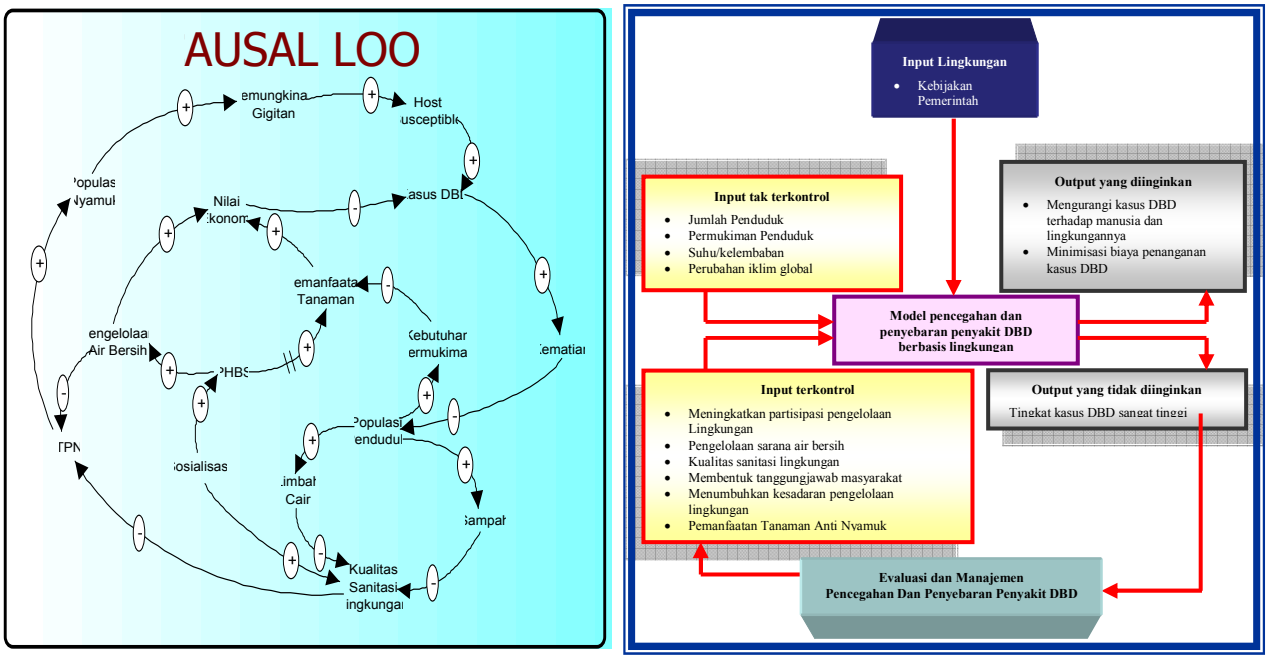


**Figure 2**. Causal diagrams (causal loop) and the Black Box model of the spread of dengue prevention and environment-based

**Simulation Model**

Models of prevention and spread of dengue-based environment composed of three sub-models that interact with each other. The three sub-models are sub models of environmental, social and sub-sub models economic model. Models of prevention and spread of dengue-based environment designed based on a causal diagram.

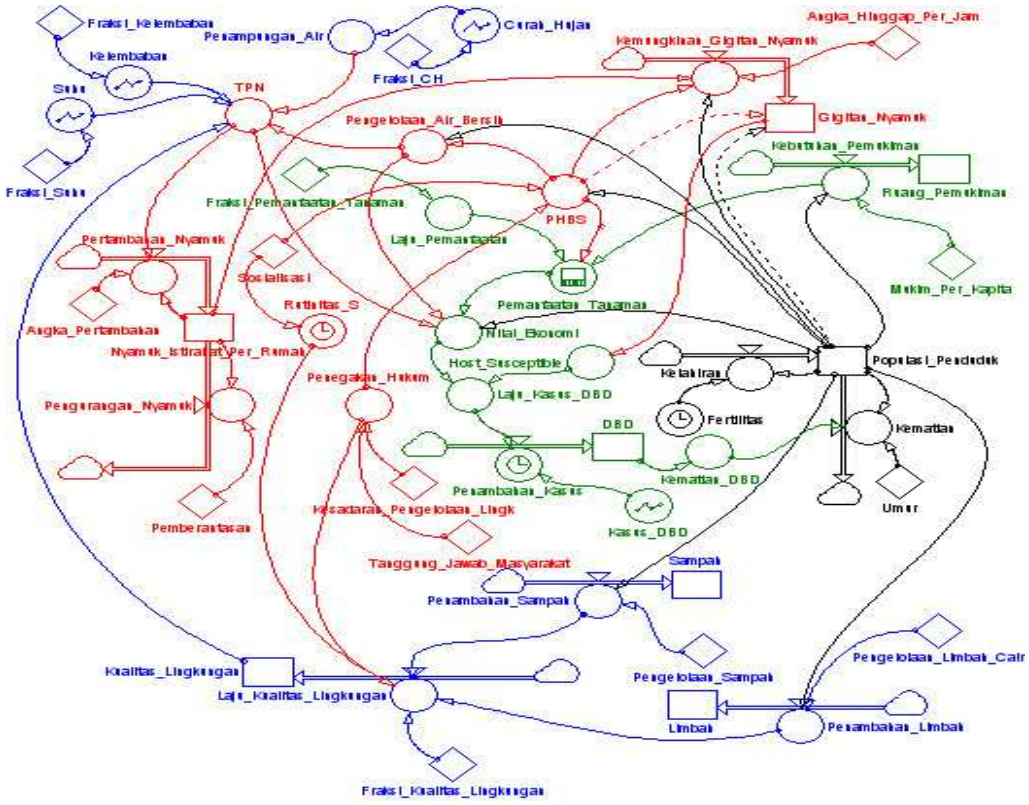


**Figure 3**. Stock Flow Diagram (SFD) model neighborhood-based prevention against the spread of dengue in DKI Jakarta Province

To link scenarios into the model, made interpretation of the conditions factor into the model variables. In this case made some changes in certain variables in the model, so that the relevant scenarios can be simulated.

**Simulation Scenario**

Scenario simulations are made to the scenario above, to determine the behavior of the individual. Studies conducted on five variables that are considered to determine the policy direction of prevention and spread of dengue is environmental quality, economic value in the prevention of dengue, DHF incidence, mortality due to DHF, and the number of people who do clean and healthy lifestyle.

Model-based dengue prevention of the spread of the disease environment that has been formulated to be used with Many diagnostic assumptions that would limit the applicability of the model. The assumptions are:

1. The rate of birth rate assumed to be constant with no change fraction fertilization.
2. To death other than dengue cases are considered on the basis of life expectancy per person assuming the average is 65 years old.
3. For the amount of solid waste is taken based on the study of society Department of Environment and Hygiene (2006) that the average solid waste per person per day amounted to 2.5 liters, while for liquid waste that is not managed as much as 10 liters per day.

**Moderate Pessimists Scenario**

Application of moderate-pessimistic scenario it will have implications in the form of: 1) the increasing number of deaths due to dengue cases, 2) increasing the number of mosquito breeding places, 3) the low value of economic benefits received by the public and, 4) the higher the possibility of a mosquito bite on human.

To support dengue prevention programs in the moderate-pessimistic scenario it is recommended that the following things:

1. Implementation of legislation that contains about environmental sanitation activities involving community participation.
2. Community empowerment in improving knowledge about disease prevention efforts DBD.
3. Distribution of free anti mosquito plants are rolling or else in the whole region on every house in one area that has been determined.

**Moderate Optimistic Scenario**

Application moderate optimistic scenario would have implications in the form of: 1) the low number of deaths due to dengue cases, 2) the reduction in the number of mosquito breeding places, 3) the high value of intangible economic benefits obtained by society and, 4) getting a mosquito bite on a small probability human.

To support dengue prevention programs in the optimistic scenario-moderate then recommended the following:

1. Involving community participation that followed the efforts of socialization, campaigns, launching movements as well as counseling to the public.
2. Enhancing the role of housewife with increased knowledge about disease prevention efforts DBD through PKK cadres, officers PSN or other volunteer officer.
3. Development of anti-mosquito crop cultivation and the reward for those who drive the development of crop cultivation anti mosquito for dengue prevention.

**Validity of Models**

Test results show that the output of the model-based dengue prevention of the spread of the environment, for Absolute Mean Error (AME) deviating 0.045% for the population of actual data and Variation Absolute Error (AVE) deviate by 4.414%, while in cases of DHF for Absolute Mean Error (AME) deviating 0.182% for the population of actual data and Variation Absolute Error (AVE) deviate by 0.355.

## Referral Policy and Management Strategy

**Development Policies in Law Enforcement**

Law enforcement in the implementation of legislation should actually be enforced because it is a key principle in the implementation of the Act strictly and consistently. This can be done if in the process of its formulation, the people who become the object of law involved to strengthen the system of government, and the guarantee of justice and public security.

**Monitoring and Policy in Community Empowerment**

The Policies to monitor the empowerment of communities is required as confirmation of the monitoring effort through legislation or other law. The policy in monitoring and community empowerment is in the management of water supply, environmental sanitation quality and increase the participation of environmental sanitation management.

**Policies in the Development of Anti Mosquito Plant Cultivation**

Seeing the advantages and benefits earned and the negative effects that almost did not exist, then the policy is carried out over the selection of crops cultivated, socializing on a regular basis, land and institutional arrangements in the manufacture of oriented farming groups.

**Spread of Dengue Disease Control Strategy**

In DHF cases there have been several strategies that have been implemented but the optimization of the implementation is still lacking. The Government implemented a regional strategy, in this case is the Ministry of Health, are:

1. Make a vector and disease surveillance systems are effective based on laboratory results.
2. Eradication of vectors are integrated with the community and across sectors
3. Emergency Preparedness and anticipation (outbreaks / epidemics)
4. Clinical diagnosis and proper case management
5. Develop knowledge and skills through training and research officer. Policy implementation can be done in the short-term program, medium term (3 years) and long-term program (5 years)

## CONCLUSIONS AND SUGGESTIONS

**Conclusion**

1. Principles on the prevention and spread of dengue-based environment with the priority order from the largest scale to the smallest environmental sanitation, prevention and control. Based prevention of environmental factors to the spread of dengue from most important to the unimportant in sequence is the environment, humans, vectors and observation cases.
2. Principle elements within the independent sector is the management of water supply, vector data, the eradication of mosquito breeding, and management of liquid waste / solid.
3. Pessimistic conditions in 2009 as many as 27,793 people and in 2030 the increase was significant as many as 81,783 people, this is due to environmental degradation of 45.07% in 2009 to reach 7.23% in 2030.
4. Besides the economic value received by the public even less in the year 2009 the value of benefits earned about Rp. 281 638 per year per person, and in 2030 only received Rp. 194 135 per year per person.

**Suggestion**

Law enforcement community needs to be improved environmental management, by building community awareness and responsibility in environmental management.

Improved monitoring and community empowerment through increased dissemination to the public about dengue and management efforts in preventing the spread on a regular basis, making communal septic tanks by empowering communities to manage liquid waste from households, particularly to prevent the direct discharge of liquid waste into nearby drains and community empowerment in waste management on a smaller level to reduce dependence on government in waste management.

Development of anti mosquito plant cultivation by optimization the use of the compound of the community land for cultivation of anti mosquito.