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Strategic planning of food diversification to improve food security in West Java using soft-system methodology

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Abstract. Indonesia is an agrarian country with a diversity in natural resources. However, rice still constitutes the majority of food consumption in Indonesia with an average amount of 119.3 kg/capita/year, which is 57% higher from average world rice consumption. Availability of rice in Indonesia is still far below the demand, and therefore this issue has urged implementation of food diversification. West Java is one of provinces in Indonesia whose population growth higher than availability of food resources. This research aimed to contribute to the improvement of food security in West Java by proposing strategies capable to alter people's mind-set to consume non-rice food sources, using soft-system methodology. Results showed that there food security is potentially achieved by continuous socialization of government policy, a number of continuous activities promoting people to eat diverse foods such as Festival of Non-Rice-Based Local Foods, revitalization of local food sources, and provision of information on nutrient available in non-rice food sources, improvement in welfare of local-food farmers, and a design of optimum food distribution system
Keywords: CATWOE, food security, soft system methodology

1. Introduction

Indonesia is an agrarian country gifted with a huge amount of natural resources which are necessarily capable to meet national needs for foods. However, demand for foods of Indonesian people is dominated by rice. According to [1], Food and Agriculture Organization (FAO) predicted that rice consumer will rise to 4.6 billion in 2025, majority of which is concentrated in Asia, leading to necessity in an increased rice supply. Moreover, Indonesia's population is projected to reach 350 millions in 2035 with rice consumption of 139 kg per capita per year, requiring a total amount of 50 million tons of rice. [2] reported that average rice consumption of Indonesian people year around is 119.3 kg/capita, which is 57% higher than average world consumption. An increased number of population will definitely require an increased amount of rice, however agricultural land area continuously declines due to conversion to residence, office, etc. This issue, as discussed in Regional Assembly of Food Security Council (Sireg DKP) of West Region (Sumatra-Java wide) held in IICC Bogor West Java on 24-26 June 2015, becomes one of underlying reasons to start considering non-rice food sources.

Indonesia has a range of non-rice carbohydrate sources which are potential to serve as staple foods, such as maize, sago, potato, and cassava. The consumption of non-rice food sources should be enacted in order to meet food security. Pursuant to The Law Number 18 Year 2012, food security is a state of fulfilment in food consumption on national and individual levels which is sufficient in quantity and quality, diverse, nutritional, equal and affordable, and not contrary to community religions, beliefs, and cultures to live healthily, actively, productively, and sustainably.

Indonesia is believed to be capable to meet all criteria contained in the above Law, however Indonesian society, particularly West Java society, is not familiar in consumption of diverse foods, particularly in terms of staple food. Therefore, this research was conducted to propose appropriate strategies in implementing food diversification in West Java which leads to improvement in food security, eventually. To solve the problem, this research was completed using Soft System Methodology (SSM) because according to [3], SSM is a human activity system modeling approach, able to solve real world problems and can provide potential solutions.

2. Methods

This research was completed using Soft-system methodology (SSM). SSM consisting of six stages was used in this study. The first stage was identification of actual condition in society. The second stage was description of actual problems using a rich picture diagram. In the third stage, root definition and CATWOE analysis were performed. Subsequently, a conceptual model was designed in the fourth stage. The fifth stage was a comparison between conceptual model and actual model. Lastly, improvement strategies were proposed in the sixth step. The data used in this study was obtained based on observations in the field during 2017-2018 and based on some secondary data.

3. Result and Discussion

3.1. Stage 1. Identification of actual conditions in society

Based on field observations performed, the food source frequently consumed by Indonesian people, specifically West Java, is rice. Indonesian people have not been willing to replace consumption of rice with other carbohydrate sources. This results in a low food security status as according to [4], food diversification is one of quantitative indicators which determines household food security.

Basically, Indonesia has a range of non-rice staple foods which can be optimally utilized by Indonesian people, specifically in West Java. Without food diversification, Regional Food Security Council reported that Desirable Dietary Pattern (DDP) index of West Java population in 2015 was 81. Despite an increase by 1.7 from 2014, a DDP index of 100 has not been reached. This fact is related to low consumption of non-rice food groups. According to [5], West Java is a province with the highest number of food-insecure population (15,554,636 people) and extremely food-insecure population (7,919,360 population). According to [6], per adult-equivalent calorie intake is one of household food security indicators, and West Java is the third province with the highest number of households showing per adult-equivalent calorie intake under the reference, 10% of total households.

3.2. Stage 2. Design of Rich Picture Diagram

Based on actual conditions observed, identification of problems was depicted in a Rich Picture Diagram. This diagram gave complete description on low consumption of non-rice food sources in West Java. The rich picture diagram is given in Figure 1.

3.3. Stage 3. Design of Root Definition

Based on observation results discussed in stage 1 and 2 (rich picture diagram), root definition which describes the arising problems was obtained in stage 3. Root definition was performed at the same time as CATWOE analysis. Results of CATWOE analysis is presented in Table 4.

Root definition:

Availability of resources in West Java can be utilized to achieve food security in West Java, even more in other regions in Indonesia (P) by means of developing and consuming different types of foods which are adequate both in quantity and quality, safe, diverse, equal, and affordable which are not contrary to people's religions, beliefs, and cultures in order to live healthily, actively, and sustainably (Q) for establishment of sustainable food security (R).

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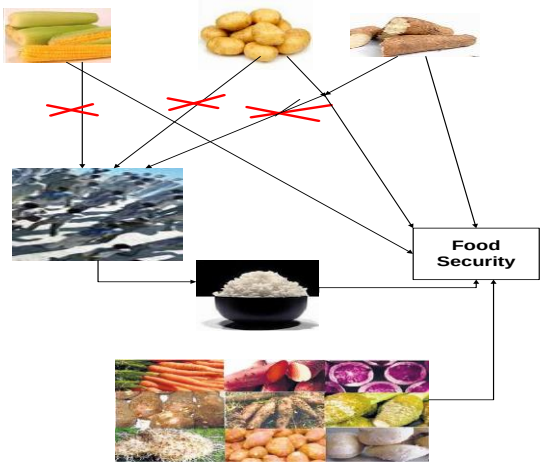

Figure 1. Rich Picture Diagram

Table 1. CATWOE analysis of food security improvement in West Java

C (Customers)	:	Indonesian people, West Java people
A (Actors)	:	Farmers, Government, Indonesia people, West Java people
T (Transformations)	:	Fulfillment of food security, especially in West Java
W (Weltanschauung)	:	Lack of information and lack of motivation in consuming other food sources
O (Owners)	:	Farmers, Government, Indonesia people, West Java people

3.4. Stage 4. Design of a Conceptual Model

Conceptual model in an abstraction of activity system relevant to the real world and related to the arising problems. This was designed based on results of observation in stage 1-3. The conceptual model of this research is presented in Figure 2.

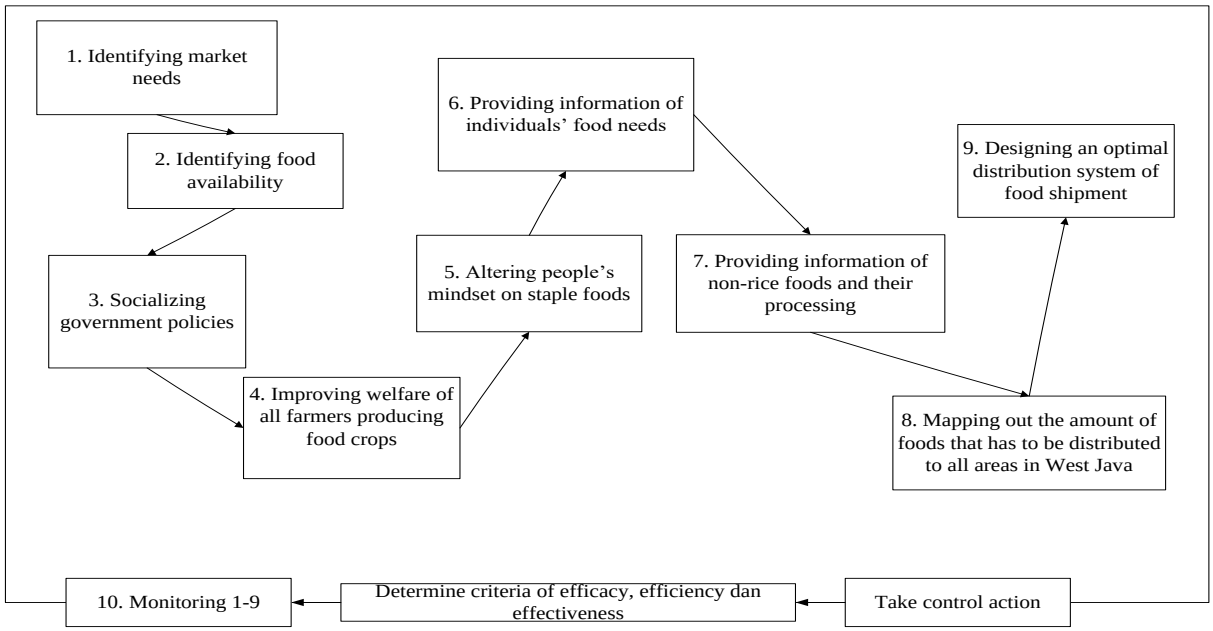

Figure 2. Conceptual Model of food security improvement in West Java

Results of the conceptual model design were valid for fulfilment of 3E criteria (efficacy, efficiency, and effectivity) as follows:

Efficacy (E1) : Food security is achieved through implementing food diversification.
Efficiency (E2) : Efficiency is achieved for capability to meet people's needs for foods.
Effectivity (E3) : Welfare of farmers who process all the food crops and fulfilment of people's need for foods are achieved.

After a conceptual model was designed, debating was performed to comparatively analyse the conceptual model versus the real world, as presented in Table 2 in stage 5.

3.5. Stage 5. Comparison between real-world and conceptual model situations

The fifth stage was a comparison between conceptual model and actual model. Based on analysis in stage 1 to 4, debating was carried out to analyse results of the conceptual model design as compared to the real world. The comparison between real-world and conceptual model situations is presented in Table 2. Lastly, improvement strategies were proposed in the sixth step.

Table 2. Comparison between the conceptual model and the real world

Activities in conceptual model	Real Word			Result	Reflection with Objectives
	Requirement	Tool	Step		
Identifying market needs	Finding out the number of population	Statistical data	Finding out data of all people in West Java	Number of population and food needs	Known amount of foods required
Identifying food availability	Finding out types of foods available	Statistical data of plantation	Identification all types of foods	Amount of foods available	Known amount of foods available
Socializing government policies	The socialized policies having to firstly consider supply and demand of non-rice foods	Statistical data of supply and demand	Socializing policies in an optimal means	People understanding objectives ad results of the socialization	Understood objectives of government in achieving food security
Altering people's mindset on staple foods	Finding out an appropriate means to deliver information to people	Delivered information being valid and able to be accepted by people	Continuously and concretely carrying out alteration in people's mindset	People starting to understand non-rice food sources	People willing to change their staple-food consumption
Providing information of individuals' food needs	Finding out the amount of individuals' food requirement	Statistical data	Identification of data of individuals' food needs	The amount of foods required by humans	Known amount of foods required by humans
Providing information of non-rice foods and their processing	Providing knowledge on types of non-rice food alternatives and how to process them	Types of food crops and their processing	Discovery of types of food crops	Providing information types of non-rice food crop alternatives	Being able to provide valid information on types of non-rice food alternatives
Mapping out the amount of foods that has to be distributed to all areas in West Java	Identifying areas in West Java	The number of population in each area	Identification of the number of population in each area	Finding out the amount of foods that has to be met	Being able to find out the amount of foods that has

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					to be met in each area

Table 2. Comparison between the conceptual model and the real world (cont.)

Activities in conceptual model	Real Word			Result	Reflection with Objectives
	Requirement	Tool	Step		
Designing an optimal distribution system of food shipment	Identifying areas and distance between areas in West Java	Finding out an optimal distribution system	Identification of distribution facilities and time	Identifying the amount of foods that has to be distributed	Being able to find out the amount of foods that has to be distributed to each area

3.6. Stage 6. Action Recommendation

Based on the debating performed, a number of strategies proposed to achieve food security as follows

a. Socializing government policies to strengthen position of non-rice staple foods in each area by a number of means such as
   - Designing an education curriculum being able to deliver information on food security
   - Providing concrete examples of non-rice food consumption
   - Organizing activities such as one-day no rice
b. Providing consultation to farmers on processing of food crops in order to gain higher profit.
c. Carrying out massive movements to alter mindset of people on staple foods by a number of means such as
   - Promoting people to consume non-rice food sources along with providing information of significant added-value margins
   - Continuously organizing Festival of Non-Rice-Based Local Foods which attracts people in all areas
d. Re-introducing people to local food sources growing in Indonesia which are safe and meeting requirement for food security consumption
e. Providing socialization to people on nutrients contained in non-rice food sources
f. Mapping out the amount of foods that has to be provided as well as mapping out an optimal distribution system.

Result of this study will the results of this study can be used to improve food security in West Java and are needed for future environmental changes

4. Conclusion and Recommendation

This research aimed to propose appropriate strategies for implementation of food diversification in order to maintain food security in West Java using soft-system methodology. Results showed that food diversification is implemented through a number of means, i.e. continuous organization of a number of activities to alter people's mind-set on consumption of staple foods, such as Non-rice Local Food Festival, revitalization of local food sources and provision of information on required nutrients available in non-rice food sources, socialization of government policies through a design of educational curriculum which is able to deliver information on food security, improvement of farmers welfare through provision of consultation on processing of food crops in order to grain higher profit and design of an optimal distribution system. Achievement of the proposed strategies will assist Indonesia with improvement in food security.

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