Development of Food Security through Integrated Bio-Cycles Farming System in Manokwari, Papua, Indonesia

Ambar Pertiwiningrum[1], Cahyono Agus[2], Supriadi[3], Arief Fahmi[4], Yudistira Soeherman[5]

[1,5]Faculty of Animal Science, Universitas Gadjah Mada Yogyakarta, Indonesia
[2.4]Faculty of Forestry, Universitas Gadjah Mada Yogyakarta, Indonesia
[3]Ministry of Villages, Development of Disadvantaged Areas and Transmigration, Indonesia

Abstract— *Indonesia's Law No. 18/2012 defines food security as the condition in which all people, in all households, at all times have sufficient food in both quantity and quality to enable them to live healthy, active, productive and sustainable lives, and that the food is safe, diverse, nutritious, equitably distributed and affordable, and does not conflict with religion, beliefs or culture. According to the Food Security and Vulnerability Atlas, Manokwari District in Province of West Papua was categorized as priority 2, strongly priority for improvement. The aim of this program was developing integrated bio-cycles farming system to improve their level of food security. The program was focused in Mansuburi and Wariori village, Masni Sub-district, Manokwari District, West Papua, Indonesia, from August 2015 for multi-years activities. Program was developed in cooperation between Kemendes PDTT (Ministry of Village, Development of Disadvantaged Areas and Transmigration); UGM Yogyakarta and local goverment of Manokwari District.*

The availability of food especially the production of rice, maize, cassava in Manokwari were relatively less developed. Based on the indicators of Normative Consumption per Capita Ratio (NCPR), the ratio of consumption to production in Manokwari was relatively high deficits (> 1.50) due to the limited rice area. Percentage of villages with no access to land and natural fresh water is quite low (<10%)., because of large area and high presipitation in Papua. The poverty was high (25-35%) causes a low access to food. About 30-40% of households have no access to clean water directly. Land conversion from forest area to Sawit estate area around Wariori river caused annual flooding that destroyed 60 ha of agricultural land during rain season since 2014, but the dried effect of El Nino phenomen in 2015 was strongly affecting agricultural production and food security.

Development of master plan for food security 2015-2019 through (i) capacity building of human resources, (ii) natural resource management (iii) business management, would give smart and futuristic perpective program for food security. Facilitating menu 1 (improved seed and fertilizer), menu 2 (infrastructure of check dam, technical irrigation), menu 3 (hand-tractor, handsrayer, cultivator, transplator, composting unit), and menu 4 (rice milling unit, power threser, post-harvest machines) would be very usefull for food security, although delayed in execution. Technical assistance by expert from UGM Yogyakarta improved technical capability in managing natural resource for improvement of food security. The role of 2 assistants that were staying in the village was very important for community empowerment to support food security.

Keywords: community empowerment, Top of Form, food security, integrated farming, master plan, world food program.

I. INTRODUCTION

The population of Indonesia is about 240 million. This is a very large number of people and it is the government's responsibility to ensure their quality of life. However, Indonesia is ranked 107 out of 177 countries in terms of Human Development Index. Food insecurity and poverty are still the major problems in Indonesia, and both are closely related. Food security is defined by the WHO as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" (UNHCR, 2013). Conversely, groups that experience food insecurity consume insufficient and/or poor quality food, and may engage in socially undesirable activities to obtain food. Food insecurity (FI) is a major cause of poor nutritional status in populations globally De vriese (2006). Serious short- and long-term health implications (Foley et., al, 2010) include poor physical, mental, and social health (Strauss and corbin, 1994). FI can be chronic and persistent, generally caused by extreme poverty, or acute, which is transitory and often triggered by violent conflict or forced migration (Hadley, 2007).

The data of Dewan Ketahanan Pangan (National Food Security Council) in 2006 showed that most people have protein-energy malnutrition because they consume less than the recommended daily intake of calories (2000 kcal per capita) and protein (52 grams per capita). A total of 127.9 million people or 60 percent of the Indonesia's total population consume as much as 1322 to 1998 kcal/day. The impact of food insecurity is the malnutrition that can occur at any age. The BPS data in

(2006) showed that more than half of the districts/cities in Indonesia had over 25 percent prevalence of malnutrition among children under five years old. The results of Basic Health Research in 2013 conducted by the Ministry of Health showed that nationally, the prevalence of low weight-less in 2013 was 19.6 percent, composed of 5.7 percent malnutrition and 13.9 percent undernutrition. When compared to the national prevalence rate in 2007 (18.4 percent) and in 2010 (17.9 percent) there had been an increase. The prevalence of malnutrition changed from 5.4 percent in 2007, 4.9 percent in 2010, to 5.7 percent in 2013, while the prevalence of undernutrition rose by 0.9 percent from 2007 to 2013.

For Millennium Development Goals in 2015, the government had set the target of only 15.5 percent nutritional deficiencies. The root of these malnutrition problems is insufficient intake of nutrition among children under 5 years of age. The Indonesian government pays serious attention to the problem of food security and in 2012 had issued a specific regulation regarding food, namely Law No. 18/2012 on food. The law is intended as a legal basis for the implementation of food safety programs which include food planning, food availability, food affordability, food and nutrition consumption, food safety, food labeling and advertising, food supervising, food information systems, food research and development, food institution, community participation, and investigation. Indonesia's food production itself has some issues, namely: (i) the continued conversion of agricultural land to non-agricultural use; (ii) the decrease of the quality and fertility of the land due to environmental degradation; (iii) the more limited and uncertain availability of water for food production due to forest destruction; (iv) the destruction of approximately 30 percent of water infrastructure, where it should be rehabilitated twice in the last 25 years; (v) competition in the utilization of water resources by industrial and residential sectors; (vi) the damage caused by drought and flooding due to the greatly reduced natural protective functions; (vii) the still high proportion of yield loss in the production process, in harvest handling, and in post-harvest processing, which remains an obstacle that decreases the ability to supply the food in high proportion; (viii) climate change; and (ix) the competition between food and biofuel production.

The objectives of the Food Security Master Plan are as follows; (1) Knowing the causes and factors that affect the vulnerability and food insecurity in each predetermined region; (2) Conducting assessment for the region's potentials to develop a resilient food system; (3) Developing a strategy to increase food security in each predetermined region. The completion of the Food Security Master Plan is expected to bring several positive impacts, namely: (1) the existence of a focused policy at regional level on how to handle the vulnerable areas; (2) the management of vulnerable areas in a systematic, sustainable, and measurable way; (3) the changes from vulnerability to food security; (4) the improving conditions of national food security.

Food Security Council and the World Food Programme 2015 has published Food Security and Vulnerability Atlas of Indonesia in 2015. Based on the mapping, 37 percent of children under five years of age were stunted, three quarters of districts had a surplus of cereals, poverty in Indonesia had been reduced but still high, and 34 percent of households do not have access to clean water (WFP[1], 2015). In 2015, the government, through the Food Security Council and supported by the World Food Programme (WFP[2]), published a Food Security and Vulnerability Atlas. The food insecurity in Manokwari District is showed as follows on (tabel 1). Manokwari District was number 2 on priority list, so it could be concluded that the district was vulnerable to food insecurity. This vulnerability was based on the composite food security index. For the first parameter, which was the prevalence of stunting among children under 5 years of age, the percentage of stunted children under five in Manokwari was considered very high: more than 40 percent. It means that for this parameter, Manokwari district was in emergency situation. For the second parameter, which was the ratio of per capita normative consumption towards net cereal production (rice, maize, sweet potato, and cassava), the ratio of consumption to production in Manokwari was a high deficit: more than 1.5. Still in this parameter, concerning the village with inadequate physical access, the condition in Manokwari was good, only less than 10 percent of the villages there had no access to roads or waterways. The definition and measurement used was the proportion of villages that were not accessible by four-wheeled vehicle or water transport. In the third parameter, which was the population living below the poverty line, the percentage of poor people in Manokwari district was bad: about 25 to 35 percent of the population live below the poverty line. The definition and measurement used was the total expenditure per capita monthly (in Rupiah) to meet the minimum level of consumption (food and non-food) needed by an individual to have a decent life. For the forth parameter, which was the households without access to clean water, Manokwari district was still in good condition: about 30 to 40 percent of the villages do not have access to clean water. Clean water was defined as bottled water, refilled water, plumbing, protected spring, protected well, and pumped well – at least 10 meters from the nearest septic tank.

TABLE 1
THE STATUS OF FOOD INSECURITY IN THE STUDIED AREA BASED ON FSVA ATLAS 2015

District (*Kabupaten*)	Cases					Key Issues of Food Insecurity in the District Based on FSVA
	P1	P2	P3	P4	P5	
Manokwari	> 40 %	> 1.5 %	< 10 %	30 – 40 %	25 - 35 %	P1, P2, P5

P1: Prevalence of stunting among children under 5 years of age.
P2: Ratio of per capita normative consumption towards net cereal production.
P3: Population living below poverty line.
P4: Households without access to clean water.
P5: Poor families

II. METHODS

2.1 Data Collection

The primary and secondary data is used to attain the purposes of the study. The primary data collection uses two techniques (figure 1), namely: 1) observation: data collection by directly observing the object, 2) interview: the collection of data by requesting information through a structured questionnaire. The secondary data is collected by using recording techniques; it is conducted by writing down the data that is already exist and belongs to the agencies or institutions involved in this research. The secondary data are obtained from several publications, among others from the National Statistics Center (BPS), Regional Planning Agency (Bappeda), and other agencies concerned. The primary data is taken with interviews, questionnaires, and focus group discussion (FGD). This data is the main focus of the analysis, while the secondary data is used to complete the analysis of the primary data. The primary data is obtained from direct observation and interviews with respondents based on a structured questionnaire. Respondents are divided into two groups: the respondents from local community and the respondents from the government agencies. The respondents from local community are asked for information about; (a) community characteristics, including sources of livelihood and income, economic activities, food and economic assets, conditions of the area/village associated with food needs; (b) evaluation of the government's food program, programs that have been undertaken and the follow-up, community participation in the program, relevance of the program to the needs of the community, aspiration for future program to overcome food insecurity.

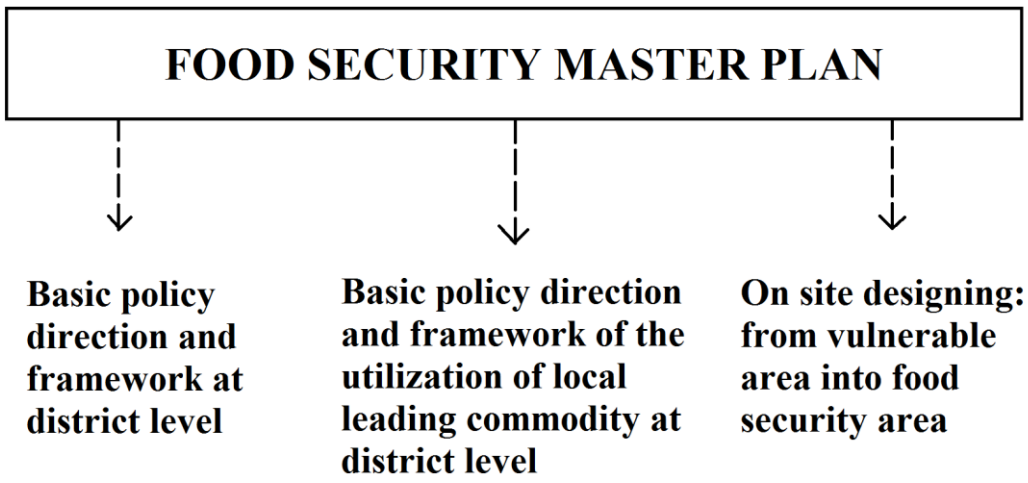

FIGURE 1. THE OUTPUTS OF FOOD SECURITY MASTER PLAN

The respondents from government agencies will be asked for data on the implementation of the government's food programs. The collection of data and information from them is conducted with interviews using variable list and keywords. Meanwhile, a semi-structured questionnaire is used to gather the data from community leaders in groups, while a structured question list is used for the interviews with the households.

2.2 Data Analysis

The results of the data collection are analyzed from the perspective of the needs for policy direction and program intervention to make the changes from vulnerability to food security. While doing this, the conditions and typology of the agroecosystem,

the existing socio-economic conditions, and the variations of local food resources in each area are also taken into account. This research was designed by qualitative approach and using descriptive analysis method in generating research phenomenon to know some aspects of a research topic (Donald and Schlinders, 1998). Data analysis by Tadjoer (2004) was designed with the following steps, namely: 1) data collection; 2) data reduction; 3) data display; 4) verification and affirmation of conclusions.

III. RESULT AND DISCUSSION

3.1 Food Productivity in Manokwari District

The quantity of various agricultural products continues to rise. Rice as a strategic and political commodity has experienced an increase in production. The average area harvested in the last 5 years was 4,432 ha with the harvest reached 16,399 tons of dry-mill unhusked rice (*gabah kering giling*). The amount of the dry-mill unhusked rice is equal to 13,119 tons of rice. With the population of 187,591 inhabitants and the assumption that the rice consumption per capita per year is 118 kg, it can be said that the need for rice in Manokwari district is 22,135 tons per year. Thus, there is still a shortage of rice supply as much as 9,016 tons. The increasing productivity of land is expected to reduce the food deficit so Manokwari can become an area with resilient food system. In addition to paddy, Manokwari regency also has the potential to develop other cereal and horticulture production. The superior commodities are corn, soybeans, green beans, peanuts, cassava, and sweet potatoes. The superior local food diversification is a good source of food for local communities. However, the productivity of the crops in Manokwari's vulnerable areas is still very low compared to national average: rice (3 tons/year/ha), sweet potatoes (1 ton/season), cassava (1 ton/season) and maize (1.5 tons/season/ha). The prices of those commodities are as follows: rice: Rp. 10,000/kg, ubi: Rp. 4,000/kg, cassava: Rp. 4,000/kg, maize: Rp. 7,000/kg, sago: Rp. 20,000/pack, banana: Rp. 5,000/bunch, fish: Rp. 20,000 – Rp. 30,000/stack, chicken: Rp. 50,000 – Rp. 65,000/whole chicken, beef: Rp. 90,000 – Rp. 100,000/kg, other meats (deer, pork, etc.): Rp. 75.000, eggs: Rp. 2,000/egg.

As for business analysis to produce rice in Manokwari, every 1 ha of land needs: 50 kg of seed, 150 kg of urea (fertilizer) that costs Rp. 95.000/50kg, 50kg Ponskha (fertilizer) that costs Rp. 120,000/50 kg, 50kg KCl (fertilizer) that costs Rp. 150,000/50kg, and chemical pesticides (Detan, Antrakol, Demolis, Kolakron, Dutbran, Prefaton, Bambu Hijau, Grentonik, Gramason, Round Up, Top Kill, Supremo). The labor needed to prepare the soil: 14 persons with wage of Rp. 100,000/day; tractor rent: Rp. 1,000,000/ha; the labor for planting: 16 persons with wage of Rp. 900,000/ha; the cost of care: Rp. 300,000, and the harvesting costs can be paid with the harvested crop. The production per hectare (in the form of dried unhulled rice harvest/*gabah kering panen*) is 3 tons/year at the price of Rp. 8,000/kg, while the production per hectare in the form of rice is 1.8 ton/year. The ownership of paddy land is 1 hectare per person, and there is no cooperation pattern between farmers and landowners. There is also no straw utilization since the farmers simply burn them. The paddy cultivated is a local variety named Cigilis, which is ready for harvest about 3 months after the seeds are planted. The average number of tractors per village is 8 units, managed by the group, rented with operating costs, salaries for the operators, and donations for the group. They use a threshing machine in the harvesting process, and they have to deal with planthoppers or sometimes snails as constraints or problems in paddy cultivating.

The cattle ranch is still run in traditional way with the ownership of cattle per household is 7 to 20. The cattle are fed with grass and allowed to graze freely on at least 10 hectares pasture fields that belongs to the village of Wariori. The field consists of uncultivated land, village land and oil palm plantation. Cows are not confined in cages because people of the village cannot afford to make them, and why bother to gather the forage grass and carry it to the cages while there is still extensive field that provides ample grass to feed their livestock. The average cattle price is 6 to 7 million rupiah. The constraints for cattle production in this village are the maintenance management that is still conducted in traditional way, and the people's low awareness.

3.2 Mansaburi Village

Mansaburi village is located on the shoreline of Pacific Ocean, 3 km from the capital of Masni district, which is the nearest market for agricultural products. Less than 5 percent of Mansaburi village has slope area, and its height is between 0-2 meters above sea level. The type of its soil includes clay, sandy clay and alluvial. The thickness of the topsoil is 10-20 cm. Mansaburi village has a quite good fertility rate. It can be seen in the use of land that mostly take advantage from the soil's fertility for farms and plantations. Another type of the soil is red-yellow podzolic latosol and litosol, while the types of the rocks are sedimentary rock and metamort. Quaternary age sediments only appear in a few places, while Resen (Qa) sediments only fills the valleys where today a big river and its tributaries flow. The climatic conditions in Mansaburi are

generally erratic, showing that the wet weather is more dominant than the dry months. This is in accordance with rain frequency and intensity that is rather high. The village is in the category of zone 5 with average annual precipitation ranges between 3000-4000 mm.

The land use in Mansaburi village are as follows; (1) 10 ha of primary forest area; (2) 6 ha of settlement and yard; (3) 2 ha of common facilities; (4) 65 ha of oil palm plantations; (5) 2 ha of shrubs area; (6) 3 ha of grazing area for livestock. Mansaburi's land where it is possible to grow crops is usually around the houses, which covers 0.25 hectares including a part of it to build a house. Mansaburi people do not use the land for agriculture but for crops, fruits, and vegetables. In Red Kali village, there is no farmland; only yard area around the houses alone. Their regular yard area is planted with cassava and maize (0.8 ha), vegetables and fruits (with 1.5 ha of banana plantation). Mansaburi people have natural food sources such as taro that is taken from nature. The fields were later turned into palm plantations. The commodities of Mansaburi village include sweet potato, cassava, corn, taro and horticultural plants such as spinach and squash in a very small area. The types of commodities that are widely grown are bananas (1.5 ha), coconut (0.8 ha) and cocoa (0.5 ha). However, its food processing is still undeveloped and very simple, for example: the abundant amount of coconuts is processed into copra and the extract can be made into coconut sugar. Also, cacao seeds can be dried to make raw material for chocolate, and in addition, bananas are also processed into chips or simply fried. While working as farmers, Mansaburi people also look for a way to diversify their farm. The livestock and poultry options are chickens, pigs, cows, and duck. The forage and fodder (*Hijauan Makanan Ternak*) were obtained from yards and fields. Free-range chickens are sold for their eggs and meat. Chickens, pigs, cows, and ducks are usually sold directly to the market. The plantations that are most widely developed in Mansaburi village are bananas and coconuts. Both are primary commodities that serve as a variation of local food. In addition, people also grow mango, citrus, areca nut, rambutan and durian as additional crop.

3.3 Wariori Village

Wariori is one of the villages in Masni District with the population of 1,298 inhabitants. The village has great agricultural potential since it has vast tracts of land. The commodities that are cultivated on this land are rice (that has a productivity of 12 tons/ha/year from an area of 300 ha), and corn (that has the productivity of 1.8 tons/ha/year from an area of 10 ha). Based on that data, it can be seen that the total rice production is 3,600 tons/year, and maize production is 18 tons/year. Some other plants that are also cultivated are: cassava with total area of 10 ha, sweet potato with a total area of 5 ha, and coconut with total area of 15 ha. Commodities such as rice, maize, and cassava are usually self-consumed and partly sold to wholesaler. There is no further food-processing in Wariori village other than making corn into milled corn. Aside from these commodities, another natural resource in the village comes from livestock and poultry. The existing potential are: 1,335 chickens, 145 pigs, 4 goats, and 404 cows. Fishery potential is not yet developed and only a few people grow fish in the ponds for food. Fish farming can be a good source of protein that can be developed in Wariori river with floating fish cages, if people can solve the flooding problems.

3.4 Design of a Region with Integrated Resilient Food System

The increased capacity is needed to ensure the improvement of labor's skills that is environmentally sustainable through; (a) The development of human resources through a mental revolution with independent human resource development and the improvement of management, technical, and financial capacity through training, mentoring, and empowering the actors in the field; (b) The mentoring by "TROOPS OF FOOD SECURITY" coordinated professionally by Unit Coordinator and Sector Coordinator, involving a combined team of students, scholars, agents of influence, volunteers, army, facilitators, community leaders, teachers, environmental student group, and field workers, all in intensive, integrated, and sustainable way for the empowerment of natural and human resources; (c) The development of "PRODUCTIVE ECONOMY & BUSINESS", which is the development of integrated agricultural enterprises as the source of food and family income through productive-conservative programs and creative industries based on local resources that are featured, integrated, and comprehensive, from "upstream" to "downstream"; (d) The organization of "HEALTHY MANAGEMENT & ORGANIZATION" to strengthen community and institution empowerment through management and rehabilitation of natural resources based on local wisdom and region with integrated resilient food system, involving marginalized local communities, women's groups, youth groups and junior high school students, to facilitate the village and school's plant nursery, neighborhood trainers, etc.

The development of resilient food system with refinement and application of integrated farming concept such as;(a) The innovation of "INTEGRATED AGRICULTURE" through application of IBFS concept (Integrated Bio-cycles Farming System) which consists of the management of the plant (Integrated Crop Management), soil moisture (Integrated Moisture Management), nutrients (Integrated Nutrient Management), pest and disease (Integrated Pest Management), from "upstream"

to “downstream” through 5A (Agro-production, Agro-technology, Agro-industrial, Agro-business, Agro-tourism) in the integrated and sustainable empowerment of natural resources for the improvement of land productivity in conservative way, based on society; (b) To facilitate "AGRO-PRODUCTION" through management of community land along with innovations in integrated featured agriculture to synergize the sectors of agriculture, livestock, forestry, veterinary, agricultural technology, in an integrated and comprehensive manner from “upstream” to “downstream”; (c) To facilitate "AGRIBUSINESS" through business management so the business doer can participate in modern way, not getting stuck in traditional system which is the subsystem. It also makes business-doer more prosperous, keeping them from being manipulated by other economic sectors; (d) To facilitate “AGRO-TECHNOLOGY” through efficient technology and suitable biotechnology to create a new revolution in the fulfillment of many people’s lives; (e) To facilitate "AGRO-TOURISM" through educational tours so that every living being can enjoy and contribute in fulfilling the needs of life and environmental improvement; (f) To facilitate ”AGRO-CONSUMPTION” through diversification of food and local food processing; (g) To facilitate “AGRO-DISTRIBUTION” through storage, distribution, and trading systems; (h) To facilitate “FOOD PRODUCTION’S MEANS AND FACILITIES“ by increasing the quantity and quality of the means and infrastructure of integrated food production, such as tractors, harvesters, fertilizer processing unit, etc; (i) To facilitate “FOOD INFRASTRUCTURE” in the form of ponds, dams, irrigation canals, farm roads, new fields, green cottage, nursery farm, productive-conservative land, green meeting rooms, etc; (j) The revitalization of "SELF-ENERGY" through rehabilitation of biomass-biogas energy by making use of waste in the form of animal manure, agricultural waste, and other waste in biogas installations with various types of dome, pipe, and material; (k) The development of "GREEN FERTILIZER" through composting and the use of organic matter as a source of nutrients to improve productivity and land rehabilitation; (l) The development of “FOOD SAVINGS & FELLOWSHIP" through the cultivation of animals and plants to fund education, scholarships for children and green trainers by planting fast growing plants and raising animals to pay students' school fees; (m) DEVELOPMENT OF FOOD SCIENCE RESOURCE to support the activities to develop a region with Resilient Food System by facilitating the collection, application, and dissemination of knowledge related to development, production, consumption and distribution in that region; (n) Survey, inventory, data analysis, mapping and information systems in the database of natural resources in integrated FOOD INFORMATION SYSTEMS; (o) Researches that are applicative-collaborative, innovative-inventive, as well as multi-, inter-, and intra-disciplinary with the theme “RESEARCH & SOCIAL SERVICES IN FOOD SECTOR” concerning local natural resources, conducted by reliable researchers from universities and research organizations supported by undergraduate and postgraduate students; (p) The development of "FOOD PUBLICATION & COMMUNICATIONS” through training, in-house and field training, workshops, focus group discussions, teleconferences, seminars, seminar publications, national-international journals, the improvement of vulnerable and marginal people’s skill, as well as dissemination of the results of programs and research; (q) The development of strategic information systems and integrated information dissemination concerning land resources, biodiversity, and environment, through online technology system of “google drive”, web, electronic media, virtual media, printed media, leaflets, booklets, social media, books, newsletters, writing competitions about green knowledge, etc; (r) Knowledge Management development done sustainably by conducting the transfer of information, knowledge, and experience to be equally implemented and developed during the program.

KISS ME (coordination, integration, synchronization, synergism, Monitoring and Evaluation) will be conducted through; (a) Routine coordination and consolidation Meetings between the implementation team and all stakeholders involved; (b) Integrating activities and policies based on the database; (c) Synchronization of planning and field implementation based on the latest database; (d) Synergism between internal and external program to have greater leverage in achieving the optimal results of performance; (e) Monitoring the implementation of activities in the field by internal and external team (in actual or virtual way). The monitoring activities are carried out by observing carefully the circumstances or conditions, including the conduct or activities of the program. The aim is to make all input data or information obtained in the observation as the basis for making decisions needed for further action. The purpose of this monitoring is to observe/determine the development and progress, to identify the problems and the anticipation/attempted solution; (f) Evaluation by internal and external team (in actual or virtual way). The evaluation of the program aims to see the success rate of activity management through the study of management and the output of its implementation, as well as the problems faced. All of the information will be used to evaluate the performance of the next program and activities. The form of the evaluation is the assessment of management and the output of its implementation, as well as the problems faced; (g) Written and oral report; (h) Progress and activity’s follow-up for continuous quality improvement

The performance indicators are measured with the input, the process, and the output of the implementation of the program which include: time management, financial planning, program input, program implementation, implementation process, the

achievement of program targets, the precision in planning and execution, program product, and so on. Food Security Master plan for Manokwari District described by (table 2).

TABLE 2
FOOD SECURITY MASTER PLAN FOR MANOKWARI DISTRICT

Focus on Issues Based on FSVA (*Food Security and Vulnerabi-lity Assess-ment*)	Region's Agro-ecosystem condition	Resume of Socio-Economic Conditions	Region's Policy Direction	Food Security Master Plan	
				The Choice of Program Interventio n	Supportin g Activities
•Prevalence of children stunting is high. • The level of cereal consumption is low. • Poor family	1. **The main food commo-dities**: the major food source for the community is cultivated rice in the fields. 2. **The availability of land for food production**: Potential vast tracts of land, and part of it have not been managed /utilized. 3. **Pasture and potential grazing land**: Pasture still vastly available, and grazing po-tential is very high 4. **Water potential for cultivation**: natural potential of the river flow is high enough, but not all used for irrigation system 5. **Rainfall**: Very high, around 2008.38 mm / year 6. **Variation of food sources**: the community's staple food is rice, with food sources variation of corn, soybeans, green beans, groundnuts, cassava, and sweet potatoes. **Problems**: • Conversion of forest to oil palm plantations without considering environmental issue. Annual flood damage food land area • The land for food production is limited to the yard **Risk of Disaster**: earthquake and tsunami, because it is located in the vicinity of the fault	1. **Social cohesion**: social life in the observed villages is quite well, there are no obstacles related to social conflicts or conflicts of interest 2. Motivation and work ethic of the community to progress are quite well, but the independence still needs to be improved. 3. **Village organization and farmer's group**: Village governmental institutions function well in serving the community. Farmer's group has been formed long and capable of functioning. 4. **Education**: the lack of education, skills and human resources are the causes of the high unemploy-ment. Trainings for specialized skills are needed to improve the quality of human resources. 5**. The technical ability to cultivate**: People have been using the method of intensive rice cultivation. Livestock is still cultivated by traditional grazing systems. Intensive broiler farms have been cultivated on a small scale (population: hundreds) 6. **Agricultural technology**: people are already quite familiar with the use of modern agricultural equipment such as tractors, manual threshing and milling machine. 7. **Potential commodities**: besides the staple food, there are potential for rubber plantations, coffee and oil palm plantation.	1. To improve the quality of food/nutriti-on intake for children, mothers, and nursing mothers. 2. To improve the quality and quantity of food production facilities and infrastructure 3. To deve-lop and increase the consumption of local food varieties. 4. To increase family access to sources of clean water. 5. To build installation of clean water to meet the needs. 6. To maintain the pattern of local food consumption. 7. To increase the productivity of paddy field. 8. To develop an institutional system that can perform the functions of coordination and synergy across sectors	To improve family's ability in producing and processing nutritious food, based on local food resources To improve agricultural infrastructur e To develop processed products made from local potential	1. To use the houses' backyard to sustain family nutrition 2. To increase the capability of nutritious food processing . 3. Protein production on household scale 1. To developof tertiary irrigation canal. 2. To manage farm road constructi on 1.Facilitati ng the means of production 2. Facilitatin g the certificatio n and marketing

IV. CONCLUSION

There are four main issues concerning vulnerability to food insecurity in Papua region, as follows: the prevalence of stunting children under five, the ratio of per capita normative consumption towards net cereal production, households without access to clean water, and poor families. The toddlers stunting is caused by insufficient nutritional intake by the toddlers themselves and by pregnant women. Several factors are associated with the stunting problems, including the lack of energy and protein, chronic disease that often occurs, insufficient feeding practices and poverty. Those problems also need to be responded to enhance the ability of families in consuming nutritious food.

To cope with this aspect of malnutrition, it is recommended to implement the Program of Family's Capacity Improvement in Producing and Processing Nutritious Food Based on Local Food Resource. This program needs to be supported by a wide range of household-scale productive activities such as backyard farming to produce vegetables for the family, and raising free-range chickens on "mini" scale to produce eggs as a source of supplemental protein for the family. The "mini" scale (5-10 chickens) aims to reduce the burden of maintenance costs to zero. The needs for poultry feed in such volume of business can be provided by the household's food waste and other sources.

To overcome the problems concerning the ratio of per capita normative consumption towards net cereal production and the preservation of local food, local crops should be grown, primarily sweet potatoes and cassava. A strict monitoring should also be conducted to control the conversion of agricultural land to grow food into oil palm fields. To deal with the problems concerning poor families, a program should be implemented: The Improvement of Rural Poor Families' Welfare through Optimization of Integrated Land Resources Intensively. The program is based on the finding that there are still a lot of land resources in the studied locations that have not been utilized optimally. Regarding clean water issues, the efforts to apply appropriate technology should be encouraged to meet the community's needs for clean water and drinking water.

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