Problems Analysis on Increasing Rice Production Through Food Estate Program in Bulungan Regency, North Kalimantan

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Abstract. To increase rice production in the Province of North Kalimantan, the provincial government has launched a Food Estate Program. The program is also a central government program in relation to government policies on food security. One of the food estate development areas is the Delta Kayan Food Estate of 50,000 hectares in Bulungan Regency, where about 30,000 hectares area is a tidal land with a very fertile alluvial soil type. This policy study aims to identify and analyze problems of increasing rice production through food estate development in North Kalimantan Province and formulate priority programs as recommendations for policy making in increasing rice production. The study has identified a number of problems of increasing rice production, such as land tenure, land suitability, water system, infrastructure, accessibility of production factors, institutional, and capacity of human resources. The Analytic Hierarchy Process was applied to develop priority programs, resulting in the three most important programs being water management, improving access to production factors, and improving the capacity of human resources. Action plans related to priority programs have also been identified.

1. Introduction

Food security systems in Indonesia are mainly based on rice, corn, soybean, and meat, in which rice is as its pivotal commodity. Food self-sufficiency at national and provincial levels is considered to be the precondition to food security at the household and individual levels. Food security is also one of the determinants of economic stability so that the fulfillment of food sufficiency becomes a development framework that can encourage the development of other sectors. In fact, nowadays Indonesia still imports all of these foods each year. To fulfill the national rice consumption/demand that increased considerably (around 130 kg/capita/year), the government policy is to increase rice production, to reduce rice consumption by 1.5%/year, to accelerate food diversification consumption and/or to support rice import policy [1].

Facing the dynamics and complex problems of food security, in increasing rice production the Indonesian government has made a broader perspective and comprehensive approach, namely seven pillars of agricultural revitalization, i.e. land consolidation, high seeds productivity, infrastructure, skilled labor, financial capital, institutional development, technology improvement, and downstream industry development. The basic purpose of agricultural revitalization is to enhance food/rice production up to surplus of 10 million tons of rice in 2015, to achieve and sustain rice self-

sufficiency, to strengthen food security and nutrition security, to increase competitiveness and added value, and to improve farmer income as well as to conserve environment and climate change adaptation [2]. To that end, the government has also undertaken various breakthrough for expansion of food land, one of them through the development of food estate. To date, there are 4 programs in 4 regions that are nationally notified as food estate development areas, those are Development of 1 Million Hectares Peatland (PLG) in Central Kalimantan, Merauke Integrated Food and Energy Estate (MIFEE) in Merauke Regency - Papua, Delta Kayan Food Estate in Bulungan Regency - North Kalimantan, and Jungkat Agri Complex in Kuburaya Regency - West Kalimantan. However, the food estate programs seem not run as expected due to various complex constraints. Even the PLG was stopped because the technology used was rejected by environmental activists, both at national and international level [3]. In other food estate locations, land conflicts, social conflicts, availability of agribusiness infrastructure, technological issues as well as political issues can potentially hinder success [4][5].

Delta Kayan Food Estate (DeKaFE) in Bulungan Regency was launched by the provincial government in 2011 as part of a central government program in relation to government policies on food security. Traditionally, Bulungan Regency is one of the food base areas in North Kalimantan Province. Quite a lot of people's foods needs are supplied from here. The main commodities of food crops are rice, soybean, and maize. The area is also well recognized for its plantation sub-sector which produces coffee, palm oil, pepper, cocoa, coconut, and rubber. The DeKaFE was planned to cover an area of about 50,000 hectares, from which most or around 30,000 hectares are fertile ground with alluvial soil types. Despite the high spirit and hope of developing the food estate, the program has not shown encouraging results after six years of its commencement.

This policy study aims to identify and analyze problems of increasing rice production through food estate development in North Kalimantan Province and formulate priority programs as recommendations for policy making in increasing rice production with special emphasis on Delta Kayan Food Estate, Bulungan Regency.

2. Research approach

The paper is based on fieldwork undertaken in the province of North Kalimantan and across Bulungan Regency during 2016. Field visits were made to Delta Kayan Food Estates in Tanjung Buka, Bulungan Regency.

The research was carried out by using qualitative research approaches to understand the underlying policy settings, the factors shaping the implementation of the policy and its outcomes, and finally the problems of increasing the rice production. Semi-structured interviews with key provincial and district officials, company officials, and university researchers were undertaken to define the existing situation. Then repeated visits were made to Bulungan Regency to interview representatives of affected groups which were selected with purposive sampling approach, and provided them with the opportunity to identify key problems and to articulate their concerns. The findings were triangulated with an analysis of key texts, including laws, scientific and technical publications, newspaper articles, and agency reports. Focus Group Discussion with key provincial and district officials, company key persons, and university researchers was carried out to consolidate the identified key problems and to formulate the recommendations for alleviating the problems, including its priority setting. Analytic Hierarch Process [6] was employed in the priority setting on alleviating the problems.

3. Results and discussion

3.1. Delta Kayan Food Estate in Bulungan Regency

Food estate is a concept in the development of food production which is done in an integrated manner covering agriculture, plantation, even farms is in a very wide land area. Food estate program is a breakthrough production mode that is attempted to be implemented in order to pursue the fulfillment

of national need of food which then expected can realize food security in Indonesia. Increasing productivity and intensity of planting and expanding production base through new land clearing is a solution offered by the food estate program. The result of food estate development can be a supply of national food security and if excess can be exported.

Delta Kayan Food Estate (DeKaFE) was launched in 2011 with the following development goals:

1) Realizing the food estate area as the center of fast-growing economic activity in the northern part of the North Kalimantan province;
2) Developing key sectors to increase added value and strengthen economic structure;
3) Mobilizing the dynamics of growth through the centers of activities that can spur the development of residential centers/villages that are in the area of its influence;
4) Fulfilling basic needs and quality of population resources, especially in remote areas that are still low; and
5) Strengthening the realization of environmentally sound spatial planning.

In Delta Kayan master plan, the food estate is defined as 'an expanse of paddy field with modern irrigation, industrial management, housing, road, and farming infrastructure that forms a well-arranged system'. The program was designed to involve government, private sectors (investors), and the community. The government will facilitate the basic infrastructure, while investors for their part would invest their capital in the intensive application of machinery, fertilizers, technology, and irrigation to 'unused' or 'uncultivated' land. They would develop infrastructure, providing development knowledge, technologies and management. It was expected that the program proceed rapidly to help the nation meet its food production targets while also providing direct and indirect benefits to regional economies.

The Regent of Bulungan Regency has allocated an area of 50,000 hectares for DeKaFE in Tanjung Palas, North Tanjung Palas, Central Tanjung Palas, and Tanjung Selor, from which 10,000 hectares was reserved for transmigration land, 8,000 hectares for food estate managed by private companies (corporate farming), and the remaining 32,000 hectares was the area that has been cultivated by the local community. The main characteristics of the land are mostly a tidal lowland with A and B type overflow, very fertile alluvial soil type, and having sufficient water supply from Kayan watershed. Figure 1 shows the orientation map of DeKaFE location.

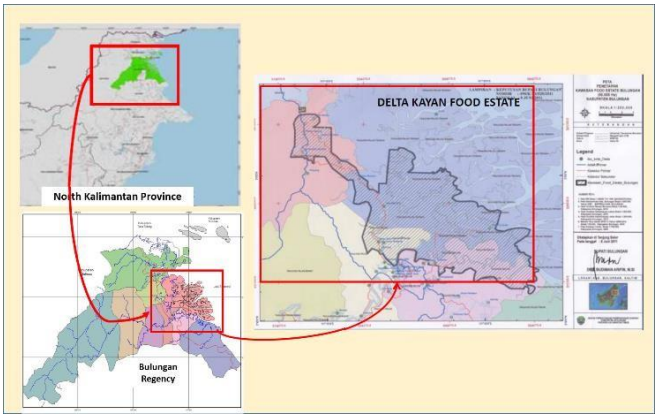

Figure 1. Orientation map of Delta Kayan Food Estate

3.2. The factors shaping the performance of food estate

Based on systems thinking perspective, the food estate can be depicted into three components: input, process, and output. The input consists of six aspects: (a) agroecology (land, water, and climate); (b) infrastructure, including transportation, irrigation system, and financial capital; (c) production factors (availability and distribution); (d) human resources (manpower), (e) technology,

and (f) institutional development. These six components are the basic requirements to shape the performance of the food estate program. The process consists of two components: (a) corporate farming and (b) community farming. These components are integrated within each other. Both input and process will produce outputs in terms of (a) food (in this case rice) production; (b) distribution; and (c) people welfare. The key success factor of estate food program will be determined by harmony, synergy, and integrated

cooperation between the stakeholders involved, i.e. central government, local government, private sectors, and community. Figure 2 shows the factors shaping the performance of food estate.

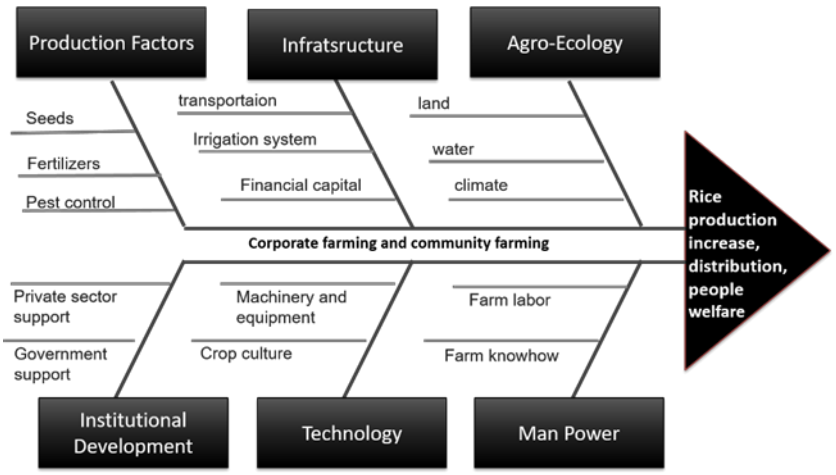

Figure 2. The factors shaping the performance of food estate

Tidal lowland development needs a proper planning, management, and utilization of land as well as proper technology application, especially water management aspect [7]. This soil has a good potential for agricultural development through proper management. The availability of sulfuric acid layer is a natural condition [8]. Macro and micro-water management is a critical determinant of successful tidal lowland management. Operation and maintenance of macro water system (covering primary, secondary and tertiary network and the water gates) should ensure the land is protected from flooding during wet season and high tide, and also from drought at dry season, while the micro-water system can reduce soil acidity and iron content which is a major constraint on tidal lowland.

There are four reasons why Delta Kayan Food Estate is considered to have a good prospect. First, it is part of central government program so that supports from central government assured. The second, Delta Kayan is a fertile area with enough water resources. By setting good irrigation infrastructure, it can be assumed that the farm must be running good. Natural potential also supports. Delta Kayan region has a fairly high rainfall that can dissolve acid content in the soil. The water of Kayan River is also proved to contain no compounds that could harm the plant. The third, the human resources are considered sufficient. The potential comes from the transmigrants. In Bulungan, 50 percent of transmigrants are locals, i.e. residents from surrounding areas who live in three or four families in one house. Other 50 percent are those coming from outside Bulungan, for example from West Java and East Java. The transmigrants from East Java already had good farming experiences, so they can transmit the technology to the local transmigrants. The fourth, the DeKaFE program has successfully attracted a private sector to invest.

3.3. Performances and problems encountered

Systematic steps have been taken by local governments to realize the intended food estate. Over the past five years, the Bulungan Regent has implemented programs and activities in the development of the DeKaFE area, at the beginning focused on Tanjung Buka, Central Tanjung Palas. Among other efforts are the implementation of transmigration for 9 settlement units (SP1-SP9), involving

10,466 inhabitants as the workforce for food estate, developing new paddy fields, and encouraging the agricultural mechanization through the provision of hand tractors to the farmers/transmigrants through farmers groups. There was also the construction of farm roads, construction of primary canals, secondary canals, and irrigation water gates, and construction of bridges between settlement units. During 2013-2016, there

were a total of 2,416 hectares of new paddy field and 35,750 m primary irrigation canals with 78 unit water gates. Yet, the DeKaFE area can only be accessed from Tanjung Selor, the capital of North Kalimantan Province, and other community activities center through river by using small boats.

Investors' interest in the food estate program has been proved by the inclusion of four investors in 2011. They processed development permits to invest in the DeKaFE through corporate farming, and the Regent has allocated 6,903 hectares for the four investors. However, as of late 2014, only one of them actually planted rice. In the implementation of corporate farming, farmers or transmigrants do not only act as workers but also act as business owners, i.e. by integrating the land they own into the land managed by the investor.

In 2015 McCarthy and Obidzinski [5] reported that despite the capital intensive and technologically advanced investment, the company operating corporate farming in DeKaFE only achieved productivity of around 2.5-3 ton per hectare. This was well below the average productivity achieved by rice farmers in Java which can achieve productivity of about 4.5-7 ton per hectare. The key problems remained was the intrusion of salt water from the coast, the high cost and difficulty of accessing inputs due to the poor infrastructure, and pest attacks. At the other hand, the neighboring transmigrants settled around the food estate also had to struggle in growing food crops. In this tidal zone, with sulfuric acid and peat soils, drainage needs to be engineered carefully to avoid salt water intrusion. In other areas, overly effective drainage had exposed the soil to the air, oxidizing the pyrites without providing the means to effectively drain the emergent sulfuric acid. All the issues mentioned above have discouraged some parties involved in DeKaFE.

In more detail fashion, the followings are a diverse set of issues that have been identified as problems faced in DeKaFE:

1) The absence of special institution that handles the development of food estate in an integrated manner; the development and problem-solving mechanisms by related agencies were less effective due to partial and sectoral approach.
2) Quite high interests of private parties to the development of DeKaFE, but there is still remaining problems related with "clean and clear status" of the land reserved for them; in several sites there were still some overlapping land tenures.
3) Efforts to increase food production are still focused on rice, but land suitability maps for rice crops are not yet available
4) In the face of salt water intrusion, acid sulfuric soils, and extensive dry periods, the high yielding rice varieties did not thrive as well as their potentials. This is considered as the main reason of low yield of rice production.
5) The absence of effective irrigation in many places. Therefore, paddy rice field is rain fed and vulnerable to production failures due to floods, drought and unreliable rainfall.
6) Lack of agricultural infrastructure, especially for the distribution of agricultural production factors to the farms as well as for distribution of agricultural products from farms to the markets.
7) Widespread pest infestations without significant measures to overcome them, especially due to limited availability of chemicals, and also due to low purchasing power of the farmers.
8) In community (household) farming, most of the farmers cannot afford fertilizers as well as chemicals for plant protection. In an in-depth interview with them, it was revealed the farmers obtained an average yield of 1.2 - 1.5 tons per hectare, even quite a lot less than that.
9) Lack of skilled labor, especially to deal with a specific management and care needs of farming

in lowland tidal area, and also to operate and carry out maintenance of agricultural machinery.

10) After the tractors for tillage sank in the swampy land, the labor required to replace them was not readily available. The estate offered wages forty percent below the market rate found in neighboring oil palm plantations, so that the estate had trouble attracting workers. Community farms even were worse due to their inability to hire farm workers except for their family members.

3.4. Alternatives problem solving

Problems that have been identified were arranged into a problem tree with reference to the factors shaping the performance of food estate, and alternative solution for each of the problem was also formulated, resulting in the hierarchy of problems and solutions demonstrated in figure 3. Priority setting of alternative solutions was made based on the urgency level of problem encountered related to DeKaFE objectives. It was determined with consolidated pairwise comparison at each level of the hierarchy made during focus group discussion, then the resulted local priorities (weights) were synthesized to obtain the overall (global) priority of each alternative solution. The result is presented in table 1.

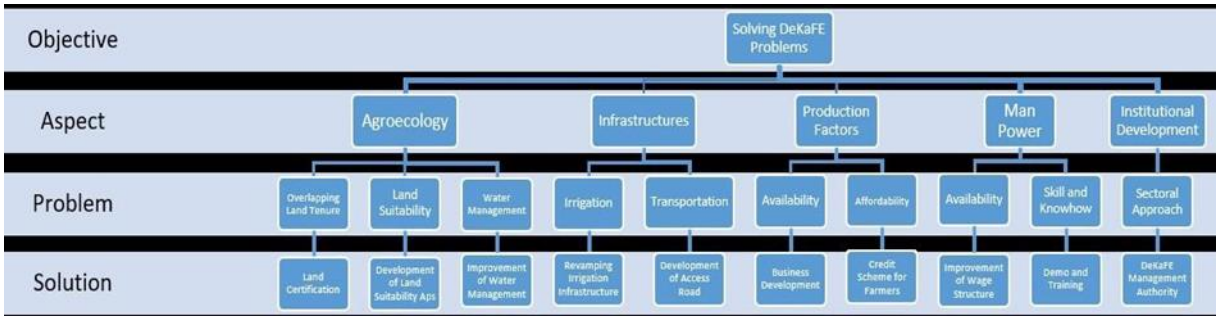

Figure 3. Hierarchy of problems and solutions identified from the DeKaFE

Table 1. Alternative solutions of DeKaFE problems and its priority setting

DeKaFE Problem Solving										
Aspect	Agroecology			Infrastructure		Production Factors		Man Power		Institutional Development
	0.409			**0.249**		**0.164**		**0.117**		**0.061**
Problem	Land Tenure	Land Suitability	Water Mngmnt	Irrigation	Trans-portation	Avail-ability	Afford-ability	Avail-ability	Skill	Sectoral Approach
	0.211	**0.109**	**0.680**	**0.500**	**0.500**	**0.600**	**0.400**	**0.350**	**0.650**	**1.000**
Solution	Certification	Suitability Mapping	Improving Water Mngmnt	Revamping Irrigation Infrastructure	Roads Development	Business Development	Credit Scheme	Wage Structure	Demo & Training	DeKaFe Management Authority
	0.086	**0.045**	**0.278**	**0.125**	**0.125**	**0.098**	**0.066**	**0.041**	**0.076**	**0.061**
Priority	4	8	1	2	2	3	6	9	5	7

From the result shown in table 1 it is discerned that the highest priority of problem solving in DeKaFE is the improvement of water management. Saragih et. al. [9] has emphasized that water management is one of the important factors for land management in the tidal land area. Rice cultivation in tidal land requires specific water management, particularly in relation to reducing high waterlogging in the wet season and anticipating the lack of water in the dry season. Macro and micro-water management is a critical determinant of successful tidal land management which will have an impact on the optimum utilization and conservation of land resources. In this case, water management is not only to reduce or

to add surface water availability, but also to reduce soil acidity due to pyrites layer oxidation, to minimize salinity hazards and flooding risks, as well as to reduce toxic chemical compounds as a result of pyrite layer oxidation. To establish the above conditions, water management operation is geared toward aspects of water table retention that is always located above pyrites layer and land leaching through a controlled drainage systems.

Revamping irrigation infrastructures is also very important to be undertaken seriously. Better irrigation infrastructure will support a better water management. At the same level of priority is the provision of good access to the DeKaFE area through development of access roads from and to the neighboring community activity centers. Development of DeKaFE will deal with a lot of people and materials mobility. With good and easy access, the business on production factors may also flourish. In turn, farmers will be able to obtain the necessary production factors more easily. This is closely related to the third priority in handling the problems, i.e. the provision of production factors. Production factors such as seeds, fertilizers, and chemicals are all things that must be available on farm, including rice farming because in addition to being a technical factor in determining the yield, it will also bring social and economic effects. In addition, the access roads will also help the marketing of agricultural products that can increase farmers' income.

The next priority is resolving problems of land tenure. Overlapping land tenure would pose a risk of social conflicts that would disrupt productive activities in the food estate. Therefore, the attempt to achieve "clean and clear" status on the DeKaFE land area is of necessity, one of the approaches is by certifying the land ownership/control.

Increasing the knowledge and ability of farmers to grow crops in tidal land is needed so that the available technology can be implemented properly. This can be done by carrying out periodic training for the farmers or provision of demonstration plots.

Although the other solutions have lower priority than the five solutions described above, the difference of their weights to each other is so small so that they can be considered having equal priority. Affordability of the production factors by farmers will make them more active in doing farming, as this will affect the effectiveness and efficiency of their production process. It has been proved that unavailability and/or unaffordability of production factors has resulted to low yield that in turns will also result in low farm earnings. Increasing affordability of production factors may be achieved by provision of credit schemes that suitable with characteristics of tidal farming. Land suitability mapping will help agricultural practitioners in determining the most suitable treatments to the land. Establishment of DeKaFE management authority is not included in high priority, but it is worth to be considered. Alternatively, synergies and coordination among authorized offices/agencies need to be better realized.

Based on the above-mentioned problems, problem solutions, and priority setting of the alternative solutions, a set of action plans which are considered as recommendations for the policy makers in the province of North Kalimantan was formulated, it is presented in table 2.

Table 2. Recommended action plans for increasing rice production at Delta Kayan Food Estate

Objective	Expected Outcome	Indicator	Action Plans	Inputs	Institutions in Charge
Improvement of water management	Established water management system in lowland tidal area	Acreage of productive irrigated land	1. Development of irrigation infrastructure networks (primary, secondary and tertiary canals, water gates) 2. Development of water management seasonal operational plan at tertiary blocks	1. Rice fields 2. Irrigation infrastructures 3. Experts on water management 4. Development budget	– Office of Public Works and Spatial Planning – Office of Agriculture
Improvement of accessibility of DeKaFE area	Developed access roads with reliable transportation services	1. Length of access road 2. Availability of transportation services	1. Development of farm roads 2. Development of inter-areas access roads 3. Operation of public transportation services	1. Road networks plan 2. Land for farm road and inter-areas access road 3. Man power 4. Development budget	– Office of Public Works and Spatial Planning – Office of Transportation Affairs
Improvement of production factors supply	Accessible production factors by farms	1. Availability of production factors 2. Price of production factors	1. Development of cooperative units 2. Development of village business units based on partnership scheme with private sectors	1. Transportation mode 2. Production factors 3. Business practitioners	– Office of Agriculture – Office of Industry and Trade
Strengthening financial capital institutions	Fulfilment of capital needs for farming	Acreage of planted area	1. Incentives for agricultural sector through credit scheme for farming 2. Farm insurances	1. Expert on financial capital institution 2. Financial capital institutions 3. Financial capital	– Higher Education Institutions – Business Institutions – Office of Agriculture
Improvement of farmers and farm labors skill and knowhow	Qualified and skilled human resources of rice cultivation in lowland tidal areas	1. Number of qualified/ skilled farmers 2. Number of innovation on appropriate technology	1. Extension and training 2. Development of demonstration plots 3. Research on rice cultivation in lowland tidal areas	1. Trainers/Extension Workers 2. Extension /training methods 3. Crop culture technologies 4. Researchers 5. Research Funding	– Higher Education Institutions – Office of Agriculture – Research Institutions
Assurance of “clear and clean” land tenures	“Clear and clean” land tenures	1. Number of operating corporate farming 2. Percentages of certified land	1. Iventarizing and planning of land ownership 2. Exemption of land tenure 3. Land certifications	1. Allocated land 2. Land Surveyors 3. Land maps 4. Certification fund	– National Land Agency – Office of Forestry – Office of Agriculture

Objective	Expected Outcome	Indicator	Action Plans	Inputs	Institutions in Charge
Optimization of land use with appropriate rice varieties	Increased yield and production	1. Acreage of planted area with appropriate rice varieties 2. Yield per hectare 3. Total annual rice production	1. Mapping of land suitability for rice 2. Provision and development of rice varieties suitable for low land tidal areas	1. Farmland 2. Expert on land suitability mapping 3. High yield rice varieties for lowland tidal areas 4. Development budget	– Office of Agriculture – Office of Public Works and Spatial Planning
Establishment of Delta Kayan Food Estate Management Authority	Effective food estate development and management	1. Number of operating corporate farming 2. Acreage of planted area with appropriate rice varieties 3. Total annual rice production	1. Establishment of Delta Kayan Food Estate Management Authority 2. Establishment of mechanisms and working procedures within the organization	1. Government policy 2. Experts on institutional development 3. Experts on management	– Provincial Government – Regency Government

4. Conclusions

Seven pillars of agricultural revitalization to improve food security in Indonesia consist of land consolidation, high seeds productivity, infrastructure, skilled labor, financial capital, institutional development, technology improvement, and downstream industry development. It is materialized through, among others, the development of food estates. Delta Kayan Food Estate in Bulungan Regency, North Kalimantan, was launched in 2011. It covers an area of about 50,000 hectares, most of them are fertile tidal lowland with alluvial soil types. Despite fulfillment of precondition for successful food estate, the high hope, and spirit, as well as efforts that have been made, the program has not shown encouraging results after six years of its commencement. A number of problems have been identified, including the overlapping land tenures, salt water intrusion, acid sulfuric soils, ineffective irrigation infrastructure, insufficient production factors, pest infestation, and lack of access to the neighboring community activity centers. To overcome the problems, it is recommended to improve water management, improve irrigation as well as transportation infrastructures, solve overlapping land tenures through certification, and to improve provision of production factors. Knowledge and capacity of the farmers need to be improved so that available technology can be applied properly. In lack of synergy among authorized agencies, the establishment of Delta Kayan Food Estate Management Authority is also recommended. A set of action plans as recommendations for the policy makers in the province of North Kalimantan has been formulated.

References

[1] Wardis G 2014 Food Security Systems in Indonesia: Challenges and Implications to Food Security in Maluku *Occasional Paper No. 54* (Kagoshima University Research Center for the Pacific Islands)

[2] Suswono 2011 The Indonesian Food Security in the Perspective of Global Economy and National Sovereignty. Paper presented at the International Conference on “The Future of Global Food Security and Safety: Issues and Justification”, IPB International Convention Center, Bogor, 27 October, 2011

[3] Mawardi I 2007 Rehabilitation and revitalization of ex-peatland development projects at Central Kalimantan (in Indonesian) *Jurnal Teknologi Lingkungan* **8**(3): 287-297

[4] Moran S 2011 INDONESIA: MIFEE: The stealthy face of conflict in West Papua. Asian

Human Rights Commission. http://www.farmlandgrab.org/post/view/20801 (assessed on September 25, 2017)

[5] McCarthy J F and K Obidzinski 2015 Responding to food security and land questions: Policy principles and policy choices in Kalimantan, Indonesia. Conference Paper No. 47. Land grabbing, conflict and agrarian-environmental transformations: perspectives from East and Southeast Asia. An international academic conference, 5-6 June 2015, Chiang Mai University

[6] Saaty T L 2008 Decision making with the analytic hierarchy process *International Journal Services Sciences* **1**(1): 83-98.

[7] Imanudin S I, M E Armanto and R H Susanto 2009 Developing Seasonal Operation for Water Table Management in Tidal Lowland Reclamations Areas at South Sumatera, Indonesia *Journal of Tropical Soils* **16**(3): 2011: 233-244.

[8] Husson O, M T Phung and M E F Van Mensvoort 2000 Soil and water indicators for optimal practices when reclaiming acid sulphate soils in the Plain of Reeds, Viet Nam *Agricultural Water Management Journal* **45**: 127-143.

[9] Saragih S I Ar-Riza and M Noer 1996 *Some Alternative Cropping Patterns Support the Optimization of Tidal Land Utilization for Food Crops. Proceedings of Seminar on Swamp and Dry Land Farming System Technology* (in Indonesian) (Banjarbaru: Balittra)