Food Estate Program in Central Kalimantan Province as An Integrated and Sustainable Solution for Food Security in Indonesia

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Abstract. The pandemic of COVID-19 has a significant potential impact on the world, especially related to the food shortages. President of Indonesia, Mr. Joko Widodo instruct his boards to create a program in order to face potential food crisis due to Covid-19 pandemic. The goal of this project is to build an integrated food agriculture area as we called Food Estate. The province of Central Kalimantan could be one option to become the national food barn because it has a potential area to be developed in alluvial area on ex-Peatland Development (PLG) land. This program is collaboration between several institutions in Indonesia included private sector in order to create Integrated Food Estate Program. There are several studies conducted by some institution related to the land use analysis and suitability of Ex-PLG area. Previous study from Master Plan of Ex-PLG area in 2008, Quick Strategic Study by the Ministry of Environmental and Forestry, and delineation data from the Ministry of Public Work and Housing result an area covering around 165,000 ha that suitable for agriculture development. Regardless of its promising program, potential threats and challenges must be considered. This paper will focus on explaining the effectiveness of the program in order to achieve food security in Indonesia.

Keyword: food security, integrated, sustainable, solution

1. Introduction
The global pandemic COVID-19 has a significant and potential impact on the world economy, especially related to the food shortages and crises in the world in the medium and long term, as has been reminded by the FAO. The major food producing countries in the world take steps to safe domestic food reserves to ensure the national food stocks. Meanwhile, according to the data from Statistics Indonesia data, in 2019 Indonesia imported 444,508.8 tons of rice. Import policy is an action to secure food stock, which can be overcome or avoided when there is sufficient food to meet national needs. Therefore, in order to anticipate scarcity and crises, The Indonesian government continues to take strategic and tactical steps to increase the productivity of food plants in order to ensure the availability of national food stocks so that national food security can be maintained.

President of Indonesia, Mr. Joko Widodo instruct his boards to create a program in order to face potential food crisis due to Covid-19 pandemic. The goal of this project is to build an integrated food agriculture area as we called Food Estate. One of the steps that will be taken is the development of potential land for food agriculture development. For this purpose, the province of Central Kalimantan...
could be one option to become the national of food centers because it has a huge potential area to be developed.

For those reasons, the Government of Indonesia through some ministries and other sectors take several steps to redevelop the ex-PLG area in Central Kalimantan Province as we known as Food Estate Program. This paper will focus on explaining the effectiveness and suitability of the Food Estate Program in order to achieve food security in Indonesia.

2. Profile and History of Ex-PLG Development
Ex-PLG area is located in four districts in Central Kalimantan Province with: Kapuas, Pulang Pisau, Barito Selatan, & Kota Palangka Raya. The area is divided into five Blocks from A to E with total area is about 1,462,000 ha which is depicted by Picture 1. The area of ex-PLG is bounded by Barito River, Kapuas River, Sebangau River, Java Sea, and Palangka Raya – Bontuk Road.

This area consist of several schemes of irrigation area which has been built since 1970 through P4S project and up until now the irrigation system is still utilized for agriculture and aquaculture. To support all agriculture and aquaculture activities for security program, water management improvement and revitalization of channel and complimentary structure is essential. Current water channel must be rehabilitated and developed to maintain and improve water management system.

The Ex-PLG area is a river delta landscapedominated by peat. Peat of more than 0.5m depth covers about 920,000 ha of the Ex-PLG area of which about 450,000 ha has a depth of more than 3 meters (Figure 2). This deep peat is legally designated for protection under Presidential Decree 32/1990. The remaining 532,000 hectares consists mainly of mineral soils. Traditional settlements are mostly found along the riverbanks and levees, which are suitable for agriculture based on local watermanagement and agricultural practices.

3. Food Estate Program Business Process
In 2020, the Government of Indonesia has a strategic program for food security purpose as mentioned earlier as Food Estate Program. The main purpose of this project is to redevelop Ex-PLG area so that it can be Indonesia’s food stock region. Food Estate program not only focus on paddy crop but also other potential food crop such as cassava. This project involve various stakeholders from central government until local government in order create an Integrated Food Estate Program. This program is also involve private sector as an investor. The business process of The Food Estate Program is shown in Figure 2. Each of institution has its own task on duty. Several action plan in this program include water management improvement through rehabilitation of irrigation infrastructure, support for farming machinery and equipment (include seeds, fertilizer, and pesticide) off taker mechanism, land provision, and economic policy which will be executed by several institution.

4. Land Use Analysis
Analyzing land use is essential when we want to develop or create intervention to certain area because it will determine the success of the program technically and non-technically and to ensure that negative impact can be reduced.

There are some principles that we have to consider when developing lowland area for irrigation purpose:
- a. The area is not located in deep peatland area but located in development zone
- b. The area is not located in protection zone
- c. Focus on alluvial soil
- d. Intensification of functional land and focus on functioning potential land

The Ex-PLG area has four kinds of management zone (Macrozoning) as shown by Figure 3.
- a. **Protection Zone - 773,500 ha** - Defined by combining the deep peat (>3m) and areas with high biodiversity value. The first priority in this zone is to conserve the remaining forest and peatlands
by strong action against illegal logging and fires, and, where deforestation has taken place, through rehabilitation.

**Figure 1.** PLG Project area covers 1,462,000 hectares in the eastern part of Central Kalimantan
b. **Limited Use Buffer Zone - 353,500ha** - This zone is effectively a buffer between the protection zone and the agricultural development areas defined by the hydrological boundary. This land surrounding peat domes with a peat depth of less than three meters needs to be managed with limited drainage. The zone also includes the strip of mineral soil near to the rivers where mostly Dayak tribe communities live. Interventions in Buffer Zones can only be done if they do not conflict with the functions of the protection areas and the regional hydrology. Large-scale developments requiring drainage such as oil palm plantations and transmigration are not recommended for this zone.

c. **Development Zone - 295,500 ha** - This zone constitutes areas that are hydrologically independent of the peat domes and that have no biodiversity value. The zone has no significant peat deposits and is dominated by mineral soils, so development for large-scale agriculture, plantations, animal husbandry and fisheries can be the priority policy goal.

d. **Coastal Zone - 40,000ha** - This zone is comprised of mangrove forests and other coastal land cover in the southern part of the EMRP area. Mangrove forests in good conditions and those that are regenerating have been proposed for conservation. Highly degraded areas could be reconsidered for semi-intensive aquaculture.

From macrozoning system, we can conclude that there are 295,000 hectares of Ex-PLG area that can be developed. In addition, the study from Quick Environmental Strategic Study by The Ministry of Environment and Forestry of The Government of Indonesia (KLHK) 2020 results the Area of Interest (AOI) for around 770,000 ha land in Ex-PLG Area that suitable for food agriculture (Figure 2).

In 2020, Ministry of Public Works and Housing (PUPR) conducted delineation for irrigation system in Ex-PLG area. There are three types of delineation which is made by the Ministry of Public Works and Housing: delineation for proper irrigation system (functional area), delineation for irrigation system that need to be rehabilitated (functional area), and delineation for remained functional area. The result of delineation is shown in Figure 4 - Figure 6. The calculation area for delineation is presented in Table 1. From that table, we can conclude that there are around 165,000 ha area in Ex-PLG area that can be developed for irrigation area. The criteria of properness is regulated by PUPR standard [3,4].

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**Figure 2. Integrated Food Estate Program Scheme**
From the data explained above, if we overlay all the data and map: macrozoning map, Quick Environmental Strategic Study by KLHK, map delineation from PUPR and peat depth map, we have almost 165,000 ha in Ex-PLG area that can be developed and suitable for agriculture purposes.

### Table 1. Functional Area in Ex-PLG Area

| No. | Location | Potential Area (ha) | Functional Area (ha) | Potential Area Remained (ha) |
|-----|----------|---------------------|----------------------|-----------------------------|
|     |          |                     | Proper Irrigation    | Rehabilitation of Irrigation| Total                  |
|     |          |                     | Area                  | Area                        |
| 1   | Block A  | 43,503              | 4,873                 | 17,257                      | 22,130                 |
|     |          |                     |                      |                             | 21,373                 |
| 2   | Block B  | 11,543              | -                    | 3,580                       | 3,580                  |
|     |          |                     |                      |                             | 7,963                  |
| 3   | Block C  | 33,724              | 3,567                 | 16,354                      | 19,921                 |
|     |          |                     |                      |                             | 13,803                 |
| 4   | Block D  | 76,092              | 19,873               | 19,974                      | 39,847                 |
|     |          |                     |                      |                             | 36,245                 |
| Total|          | **164,862**         | 28,313               | 57,165                      | 85,478                 |

![Figure 3. Macrozoning of Ex-PLG Area](image-url)
Figure 4. Irrigation (Functional) Area with Proper Condition (Green Area)

Figure 5. Irrigation (Functional) Area That Must be Rehabilitated (Red Area)

Figure 6. Remained Functional Area That Has not Been Developed (Purple Area)

Figure 7. Remained Functional Area That has not Been Developed (Purple Area)
| No | Name  | Area (ha) | Tidal Zone | Non-Tidal Zone | Land Character | Peatland soil depth (cm) |
|----|-------|-----------|------------|---------------|----------------|-------------------------|
|    |       |           | Type A (ha) | Type B (ha) | Type C (ha) | Type D (ha) | Shallow (ha) | Deep (ha) |                     |                     |
| 1  | Block A | 227,100   | 34,430     | 28,032       | 42,788       | 14,916       | 32,951       | 11,637     | Alluvial Clay       | 0 - 50              |
| 2  | Block B | 161,480   | 2,102      | 2,452        | 3,328        | 4,554        | 3,854        | 1,226      | Alluvial Clay       | 0 - 75              |
| 3  | Block C | 568,635   | 9,694      | 13,265       | 11,224       | 10,714       | 3,571        | 2,551      | Alluvial Clay       | 0 - 50              |
| 4  | Block D | 162,278   | 39,183     | 31,387       | 27,489       | 17,094       | 9,096        | 6,497      | Alluvial Clay       | 0 - 35              |
| 5  | Block E | 342,507   |            |              |             |             |             |            | Protection Zone    |                     |

**Figure 8.** Quick Environmental Strategic Study by The Ministry of Environment and Forestry of The Government of Indonesia

5. **Food Estate Program Action Plan Analysis**

5.1 **Rehabilitation and Development of Irrigation System**

One of important activities in Food Estate Program is rehabilitation and development of Irrigation system including improvement of institutional aspect. This responsibility is given to Ministry of Public
Work and Housing (PUPR). The result of the inventory survey that is done by PUPR in ex-PLG Area conclude that from Block A to D there are several common issues in the area:

a. There must be review design from current design because it is made for several years ago (7-15 years)

b. Irrigation system is not well functioning due to sedimentation is most area and some hydraulic structure is not fully built so that flood prevention function cannot be achieved

c. Lack of inspection road and connecting bridge

d. Lack of guidance and coordination from related institution

e. There is land use change because production cost of agriculture is higher than selling cost

f. Initial survey for irrigation infrastructure, agriculture field, and accessibility in Kapuas District (Dadahup, Palingkau Lama, and AnjirSerapat) and PulangPisau District (Tahai and Belanti II) has been done. In Dadahup area, land productivity is about 1.7-2.9 ton/ha meanwhile in Belanti II land productivity is around 2-4 ton/ha. The main problem in Dadahup is the nonoptimal water management because the channel is full of sediment so that the water cannot flow. This causes leaching process is not effective.

In general, food crop productivity can be improved through rehabilitation and improvement of irrigation system (including primary, secondary, tertiary, and quarter channel) and implementation of modern farming.

The success of lowland irrigation development is determined by several factors:

a. The ability to control the flood due to flood and ebb phenomenon and the influence of upstream charge

b. The ability to manage the water in dry season (prevention of drought) and wet season (prevention of flood)

c. The water quality (leaching process)

d. The availability of complementary structure and water pump (if necessary)

From 2020 until 2021, Ministry of Public Work and Housing (PUPR) will rehabilitate and develop the irrigation system in Ex-PLG Area with scope of work:

a. Preparation of Survey, Investigation, and Design (SID) for Rehabilitation and Development of Irrigation System in Block A, B, C, D.

b. Preparation for Environmental Impact Assessment (EIA) document.

c. Rehabilitation and development of Irrigation covering area 165,000 ha

This rehabilitation and development of irrigation system is priority program in Food Estate. Revitalization of water management can be executed for each block covering area 165.000 ha with detail as follow: Block A covering area ±43,503 hectar, Block B covering area ±11,543 hectar, Block C covering area ±33,724 hectar, and Block D covering area ±76,092 hectar.

This program is essential because in order to improve water management system in irrigation land we have to improve the infrastructure. Economically, it will be efficient to develop in this area because we do not have to built the irrigation system from zero. Therefore, the program by PUPR is a significant action that must be taken seriously and carefully.

5.2 Farm Machinery and Equipment

The Ministry of Agriculture of The Government of Indonesia contribute to this project by supporting this program in terms of land engineering, seeds, fertilizer, farming machinery and equipment, and other related job. These are important because in current condition, the farmer use traditional machinery. Moreover, the use of high quality seeds and fertilizer and also modern technology of machinery can improve the quality and quantity of production. Hence, the contribution of Ministry of Agriculture is vital in pursuing food security.
Agriculture, the key livelihood strategy in the area, is mixed in nature and a farmsystems approach is taken in the Master Plan. Farm systems have similar resource bases, enterprise patterns, household strategies and constraints that allow the development of specific development strategies and interventions that support farmers rather than specific commodities. At present the biophysical conditions place limits on agriculture but improved agricultural techniques, better land and water management infrastructure and practices, and upgradedsupport services could help farmers raise productivity and provide easier access to markets. Across the area, fisheries and to a less extent forestry, provide an important contribution to local incomes, while new opportunities are emerging in the plantation sector, especially oil palm.

5.3 Human Resources
The Ministry of Village, Development of Disadvantaged Regions and Transmigration support this program through migrating people into Ex-PLG Area as “Millennial Farmer” program where the farmer has a modern farming skill. This idea is expected will attract more people to participate in this program.

5.4 Funding and Corporation
The Ministry of State-Owned Enterprises (BUMN) will facilitate the cooperation between the farmer and related stakeholder such as private sector. BUMN has some program to add the value of farm production such “corporate farming” and “corporate farmer”. Other program by BUMN is farming assistance and financing, rice offtaker and distribution of production. The action by BUMN is important because in the reality, agriculture production is not optimal due to the lack of capital, machinery, knowledge and so on. Therefore, the program which is designed by BUMN is expected to increase the value of the crop.

6. Threats and Challenges
Although the Food Estate Program looks promising, we have to carefully consider the possible threat that might occur to this program. Based on past experience, some issues that exist on the peatland development are wildfires, climate change, socio-economic issue and other possible threats. But all of this threats can be mitigated if we make an integrated and sustainable planning and program such as, wildfire mitigation and prevention, capacity building, coordination with related stakeholder, conservation activities, and others.

7. Conclusion and Recommendation
Based on the explanation above, we can conclude several things from this paper:

a. Ex-PLG area is feasible area for Food Estate Program because the area is suitable for agriculture purposes. There are area covering nearly 165,000 ha in Ex-PLG area that suitable for irrigation development. In addition, it will be economically effective if we develop in this area because we already have the irrigation system so that we do not have to build from zero the infrastructure. On the other hand, this program environmentally feasible because the area is located in appropriate zone.

b. The involvement of several institution in Food Estate Program will create this program become more integrated.

c. There are threat and challenges that we have to take into account in this project such as wildfires, climate change, socio-economic issue, and other possible issues. That is why sustainable and integrated planning is essential for this project so that we can avoid the same mistake that happen in the past.

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