The potency of mungbeans enhancement in Sambas Regency West Kalimantan

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Abstract. Agricultural Development is very important as a motor of national economy. Local Resources need to be empowered to improve the welfare of the farming community. This empowerment impacts the problems and opportunities in the development of mungbeans in West Kalimantan. The Indonesian Ministry of Agriculture makes West Kalimantan Province as one of the priorities for the development of legumes and tuber Agro-industries. The development of legumes such as mungbeans is part of an effort to diversify food. This research was conducted in June to October 2017 in Sambas Regency, West Kalimantan. The methodology used is the PRA (Participatory Rural Appraisal) with 30 respondents farmers owners and traders. The results showed that Sambas Regency has the potency for enhancing mungbeans in West Kalimantan. This is supported by natural resources, land resources and farmer resources. From the results of financial analysis in 4 sub districts in Sambas Regency, it can be seen that the highest net income received by farmers in the Teluk Keramat District is IDR. 17,136,750, - with an R / C value of 3.49 and B / C ratio of 2.49.

1. Introduction
Mungbeans are one of the plant foods sources of vegetable protein. The protein content of mungbeans is 22% which ranks third after soybeans and peanuts [1]. Early maturing mungbeans (55-65 days), withstood drought, relatively few variations in disease types, can be planted on infertile land, and prices are relatively high and stable. Based on data from the Central Statistics Agency (2015), the production of mungbeans in Indonesia has decreased from 341,342 tons year-1 to 271,463 tons year-1 (in 2011 compared to 2015). Various factors cause the decline in mungbeans production, including low soil fertility, land use change, climate factors are not supportive, and improper cultivation practices. Efforts to increase the productivity of mungbeans can be done by improving fertilizer efficiency and the number of plants per planting hole.

Tidal land has considerable potential to be developed into food-based agricultural land to support national food security. Indonesia's tidal land is quite wide around 20.1 million ha and 9.3 million of them have the potential for the development of food crops [2].

The development of mungbeans crop cultivation in West Kalimantan either able to able to increase regional income or increase farmers' income. Mungbean production in West Kalimantan in 2014 amounted to 924 tons increased to 1,102 tons in 2015, with a harvest area of 1462 hectares or 206 hectares wider than the previous year. The opportunity to increase mungbean production is still quite large with the application of mungbean cultivation technology through the Integrated Crop
Management (PTT) approach and the results of the study show that the productivity of mungbeans ranges from 1.54 t/ha - 3.03 t/ha [3].

The enhancement of mungbeans in Sambas Regency reaches 1043 tons with an average production of around 7.58 kw/ha in 2015 [4]. The increase in harvested area is due to the increased enthusiasm of farmers in growing mungbeans because mungbeans have competitive prices with other agricultural products. The obstacle of mungbean cultivation in tidal land is the lack of knowledge of farmers in the cultivation of mungbeans until after harvest. In addition, it is difficult to obtain mungbean seeds that have high quality and productivity, where the mungbean seeds that are used come from hereditary plants and must also be imported from outside of West Kalimantan.

For this reason, it is necessary to have location-specific mungbean cultivation technology on tidal land that can increase the productivity of existing mungbeans so that it can increase farmers’ incomes [5], good soil conditions will create a suitable growth environment for plant growth.

Mungbeans thrive on soil with a pH of 5.5-7.0. Therefore, the condition of the soil at the trial location is quite supportive for the growth of mungbeans. The type of rainfall is included in type C rain (33.30 ≤ Q <60.00) which is rather wet [6]. This is in accordance with the requirements for growing mungbeans that require rainfall of 50-200 mm/month. Daily temperature at the study site ranged from 25˚C - 28˚C and quite in accordance with the requirements for growing mungbeans that is at a daily temperature of 25˚C - 27˚C with RH 50% - 80% [7]. Sambas Regency is a tropical area with an average monthly rainfall of 187,348 mm [and an average number of rainy days 11 days/month. The highest rainfall occurs in September to January and the lowest rainfall between June and August.

Besides rice and corn, mungbeans are one of the food commodities in Indonesia. The need for this commodity is increasing from year to year because it has many functions, either as a main food ingredient and animal feed, or as a raw material for large to small scale industries or households. The average annual need for mungbeans reaches 2.2 million, but domestic production of mungbeans has not been able to meet demand well. Mungbean production in the country is only able to meet the needs of around 30% and at least 70% must be imported. In 2013, the production of mungbeans in the country only reached 779,992 tons or 33.9% of the total needs which reached 2.2 million tons, so that the shortage was around 1.4 million tons. While in 2014 the production of mungbeans reached 921,336 tons. On the other hand, opportunities for increasing mungbean production in the country are still wide open, both through increasing productivity and expanding the planting area. Mungbean production at the farm level can still be increased through technological innovation, productivity improvement strategies and planting areas.

The purpose of the assessment is to determine the enhancement potency and marketing of mungbeans in West Kalimantan.

2. Materials and methods
The assessment was carried out in Sambas Regency, West Kalimantan. The methodology used was the PRA (Participatory Rural Appraisal) with 30 respondents farmers owners and traders of mungbeans in Sambas Regency. The list of questions is arranged based on key words related to mungbean agribusiness. The data collection was conducted from June to October 2017. After the data was collected, tabulation was then performed which was then analysed descriptively.

3. Results and discussion
3.1. Characteristics of respondents
Characteristics of Respondents in this study are farmers who are accustomed to cultivating mungbeans with a total of 30 respondents. The identities of all respondent farmers covering their age group, education level, experience and land ownership are presented in figures 1, 2, 3, and 4 as follows:
Figure 1 shows that the age of the respondents in the productive category, namely in the range of 41-50 years by 47% and 30-40 years 3%, the rest more than 50 years by 50%. The number of productive ages is expected by farmers to be able to accept the technological innovations offered, so that their production can be increased. Education of respondents at the Senior High School (SHS) in secondary level is 24%, Junior High School is 13%, while those with Primary School (PS) education are still quite high at 63% (figure 2). The level of education has an influence in receiving information technology that is introduced. The behaviour of farmers as managers of their farms will be influenced by internal and external factors which include social factors including the level of education, farming experience and the number of family members [8].

Figure 3. The distribution of respondent based on land tenure areas

There are around 47% of farmers own land of 0.5 - 1 ha, while the remaining 37% with land area <0.5 ha and only about 16% have land of 1.5-2 ha. In conducting the cultivation of mungbean plants, land is the main thing in farming, based on the theory, the greater the area of land, the greater the productivity produced [9]. Land is one of the factors of production, where the production of agricultural products has a significant contribution to farming because the amount of production from farming is greatly influenced by the breadth of land used [10].
For experience, this shows that the longer the experience gained in farming, the better the understanding in the cultivation of mungbeans. The experience of farming has an important role in increasing the competence of farmers. Farmers who have high experience will usually be more mature in dealing with various problems in farming [11]. Experience is education that a person gets in the routine of daily life, such as the events or the reality he experiences.

3.2. Biophysical condition of study area
Sambas Regency is the northernmost area of West Kalimantan Province or between 2 ° 08' North Latitude and 0 ° 33' North Latitude and 108 ° 39' East Longitude and 110 ° 04' East Longitude. Administratively, the geographical location of Sambas Regency is: North: Sarawak (East Malaysia) and South Natuna Sea: Singkawang City and Bengkayang Timur Regency: Bengkayang Regency, and Sarawak. West: Natuna Sea

3.3. Topography
Most of Sambas Regency is relatively flat (0% - 15%) with an area of 468,196 hectares or 67.59%, and an area with a slope of 15% - 40% is 160,396 hectares or 25.08%, while slope class > 40% covering an area of 46,832 hectares or 7.3%. The height of the area differs based on the sub-district, the height of 0-7 m above sea level is found in the Districts of Sejangkung, Sambas, Tebas, Selakau, Jawai, Paloh and Teluk Keramat. Altitude of 8-25 m above sea level are found in the Districts of Sejangkung, Sambas, Tebas, Selakau, Pemangkat and Teluk Keramat. Altitude of 26-100m above sea level is located in the Districts of Sejangkung, Sambas, Tebas, Selakau, Pemangkat, Teluk Keramat and Paloh. Judging from the type of land, most of Sambas Regency consists of alluvial land which covers an area of 230.63 thousand hectares or around 36.06 percent of the area of 0.64 million hectares and subsequently red and yellow podsoid land around 157.32 thousand hectares or 24.60 percent which is spread out in almost all districts. Sambas Regency Area has 3 (three) Watersheds (DAS) with an area of 516,200 ha or 80.71% of the area of the regency consisting of Paloh Watershed (64,375 ha), Sambas Watershed (245,700 ha) which includes the Sambas River, Sambas Kecil, Kumba Sajingan Besar River and Sebapai watershed (193.125 ha) which includes the Sebapai and Selakau Rivers. Weather Conditions of Sambas Regency In 2015 based on data from the Paloh meteorological station of Sambas Regency, the average air temperature ranged from 22.7 °C to 33.6 °C. The maximum air temperature occurs in May at 33.6 °C, while the minimum temperature occurs in March at 22.7 °C.

3.4. The potency for mungbean enhancement

![Figure 5](https://example.com/figure5.png)

**Figure 5.** harvested area of mungbean plants in Sambas Regency, West Kalimantan (2006-2018)

The types of mungbeans that are mostly cultivated by farmers in Sambas Regency are local varieties that are planted in descending order. Generally, farmers plant mungbeans in tidal paddy fields
at the end of the rainy season around January - February after rice or other crops. In the past 13 years, the harvest area of mungbeans fluctuates from year to year. The largest planting occurred in 2016 with harvest area of about 2,705 ha while the lowest in 2008 with a harvest area of 359 ha.

As for several factors that affect the harvest area of mungbeans, including the low production of mungbeans in Sambas Regency, among others, caused by: 1). Producers produce few mungbean seeds, so farmers use local seeds as they are. 2). Low productivity at the farm level due to less intensive maintenance. 3). Limited production and post-harvest facilities and infrastructure.4.) Lack of capital and procedures for accessing capital which make it difficult for farmers. 5). The application of recommended technology has not been implemented optimally. 6). Competition in the use of land resources with other food commodities.

3.5. Mungbean cultivation techniques in tidal land

In the cultivation of mungbeans, there are several technological components that can be offered to farmers, as shown in Table 1a and 1b below:

**Table 1a. Component of mungbean cultivation technology specific location in the field tides of West Kalimantan**

| Technology Components | Technological Innovation |
|-----------------------|--------------------------|
| **Varieties**         | Vima-1, Perkutut, Murai, Kutilang |
| **Land Cultivation**  | Land tillage is done a week before planting on: (1). Former rice fields; - There is no need for land management - Rice stumps need to be cut and rice straw cleaned - Making drainage channels with a distance of 3-5 m (2). Ex-crop land (corn, soybeans, peanuts); - Piracy as deep as 15-20 cm, smoothed and levelled - Making irrigation channels with a distance of 3-5 m |
| **Planting**          | Tugal system (making hole to plant seeds) |
| **Planting Distance** | (1). In the rainy season; 40 x 15 cm, with a population of around 300-400 thousand plants per hectare. (2). In the dry season; 40 x 10 cm, with a population of around 400-500 thousand plants per hectare. |
| **Seed requirements** | 25-30 kg / ha, planted 2-3 seeds / planting hole with 90% growing power |
| **Stitching**         | Before the age of 7 days after planting (HST) |
| **Fertilization**     | Urea + TSP + KCL with dosage (kg / ha) - Urea = 45 kg / ha - SP36 = 45-90 kg / ha - KCl = 50 kg / ha - Organic material (Pukan) 15-20 tons / ha |
| **Time of fertilization** | - Basic fertilizer is given at the beginning of planting - The first supplementary fertilizer is given on the 14th day - The second supplementary fertilizer is given on 28 days |
| **How to fertilize**  | Basic fertilizer is given when planting in a run on the side of the planting hole along the row of plants |
| **Use of Straw Mulch** | Application of rice straw with a dose of 5 tons of rice straw / ha |
### Table 1b. Component of mungbean cultivation technology specific location in the field tides of West Kalimantan (Continue)

| Technology Components | Technological Innovation |
|-----------------------|--------------------------|
| Preservation          | (1). Weeding; 2 times carried out at 2 and 4 weeks of age or spraying non-selective pre-growth herbicides with a 1-2 litre / ha measure applied 3-4 days before planting.  
(2). Irrigation; for light textured (sandy) soil irrigation is carried out twice, namely at the age of 21 and 38 HST, for heavy textured soil (clay) irrigation is done 1 time |
| Pest Control          | PHT concept              |
| Harvest age           | 60 60 - 70 HST (when the pods are black or brown) |

3.6. Enhancement opportunities

| INTERNAL | EXTERNAL |
|----------|----------|
| **Strength (S)** | **WEAKNESS = W)** |
| - The potential of agricultural land in Sambas Regency is quite wide, namely 66,733 ha  
- Technological and HR packages that are skilled in mungbeans cultivation are available in the field.  
- Availability of skilled extension agents in the field  
- Farmers are accustomed to growing mungbeans |
| - Uncertain climate conditions  
- Mungbeans harvest area is still low  
- The difficulty of farmers getting superior varieties  
- Production of mungbeans is still low |

| OPPORTUNITIES=O) | STRATEGY S-O | STRATEGY W-O |
|------------------|--------------|--------------|
| - The selling price is still relatively high  
- Increasing product demand |
| - Increase farmers’ knowledge about mungbeans cultivation  
- Increase the Planting Index by means of intercropping Mungbeans with corn or rice |
| - Using New Superior Varieties like early maturing one  
- Improvement of mungbean cultivation systems with location-specific technological innovations |

| THREAT (T) | STRATEGY S-T | STRATEGY W-T |
|------------|--------------|--------------|
| - Flooding in the rainy season  
- Drought in the dry season  
- Pest attack |
| - Improvement of water governance on the land so that it reduces the impact of flooding in the rainy season  
- Making shallow wells in anticipation of drought  
- Conduct training on pest prevention and intensify education about mungbean pest |
| - Increase farmers’ knowledge and ability as seed growers of mungbeans  
- Improve the quality of mungbean production so that prices can compete. |

*Figure 6. SWOT Analysis on potential development of mungbeans in Sambas Regency*

SWOT analysis is one method of analysis that can be done in decision making theory. Internal factors in the development of mungbeans are strengths and weaknesses. While external factors in the form of opportunities and obstacles. From the results of the assessment of internal and external
environmental strategic factors, the development of mungbeans in Sambas Regency which has been divided into strengths, weaknesses, opportunities and threats are included in each column of the SWOT matrix [12]. Based on these factors then analysed and formulated possible strategies that can be generated as shown in Figure 6. It can be seen that the factors that influence the development of mungbeans in Sambas Regency consist of internal and external factors. Internal factors consist of strengths: The potential of agricultural land in Sambas Regency is quite wide, namely 66,733 ha, the availability of technology and human resources packages that are skilled in mungbean cultivation, the availability of skilled extension agents in the field and farmers are accustomed to cultivating mungbeans.

For weakness (weaknesses): Uncertain climatic conditions, harvested mungbeans are still low, the difficulty of farmers getting superior varieties, mungbean production is still low. SWOT analysis in the development of mungbean cultivation is presented in Figure 6.

External factors consist of opportunities (opportunities): Selling prices are still relatively high, demand for products is increasing. Threat factors (treats): Flooding in the rainy season, drought in the dry season, pest attack. Strategy for developing mungbeans in Sambas Regency include: Improving water management on land so as to reduce the impact of flooding in the rainy season. Making shallow wells in anticipation of drought and conducting training on pest prevention and intensifying information on pests of mungbean diseases

3.7. Financial analysis of mungbean cultivation in sambas Regency

From the results of research that has been carried out in Sambas Regency, the average production of mungbeans at the farm level ranges from 0.5-1.6 tons / ha, with a selling price of IDR. 15,000 (at farmer level). The low yield of mungbeans at the farmer's level is partly due to less optimal cultivation practices, so to improve the productivity of these plants, proper cultivation techniques are needed.

From the results of farm analysis in 4 districts in Sambas Regency, it can be seen that the highest net income received by farmers in the Teluk Keramat District is IDR. 17,136,750, - with R / C value of 3.49 and B / C ratio of 2.49. R / C ratio is an analytical method to measure business feasibility by using the ratio of revenue and cost [13,14]. Business feasibility analysis is used to measure the rate of business return in implementing a technology. With the result criteria: R / C> 1 means the business has been run efficiently. R / C = 1 means the business is run in a break-even point condition (BEP). R / C ratio <1 business is not profitable and not feasible. In the Mungbean Farming in Sambas Regency R / C ratio> 1, so it can be interpreted that the cultivation of Mungbean plants in the Sambas Regency can be carried out efficiently and profitably.

Table 2. Financial analysis of mungbean cultivation in 4 Sub District, Sambas Regency, West Kalimantan

| No | Description                  | Sub District |
|----|------------------------------|--------------|
| 1  | Production (kg/ha)           | Jawai | 600 | 1,200 | 500 | 1,600 |
| 2  | Price (IDR/kg)               |         | 15,000 | 15,000 | 15,000 | 15,000 |
| 3  | Revenues (IDR)               |         | 9,000,000 | 18,000,000 | 7,500,000 | 24,000,000 |
| 4  | Production cost (IDR)        |         | 4,840,000 | 6,347,750 | 4,560,000 | 6,863,250 |
| 5  | Income (IDR)                 |         | 4,160,000 | 11,652,250 | 2,940,000 | 17,136,750 |
| 6  | R/C Ratio                    |         | 1,86 | 2,84 | 1,60 | 3,49 |
| 7  | B/C Ratio                    |         | 0,86 | 1,84 | 0,64 | 2,49 |
| 8  | BEP                          |         | 8,066 | 5,289 | 9,120 | 4,289 |

Source: Analysis of Primary Data 2018
Mungbean farmers in production centres sell their products not directly to consumers but are sold to collecting traders. Furthermore, traders will sort based on the quality of the mungbeans to be marketed (figure 7). Farmers usually sell their mungbeans in the form of stalks (still with their stems), because selling them is more efficient because they save time and costs in the post-harvest process.

From the marketing pattern, there are two (2) marketing institutions that play a role in which village collectors with their functional activities are directly buying and collecting the production of mungbeans that are scattered in each village, then by carrying out the functions of weighing, loading and unloading, transportation. The intermediary then distributes it to retailers in the Sambas Regency market. The price determination is based on the results of the agreement when the transaction occurs, where both parties see price developments in the market at that time, while the market information for farmers is not very good because the source comes from collecting traders. The price of mungbeans at the farm level was IDR. 15,000.- / kg, where traders collect margin distribution and profit margin which is greater than IDR. 3,000-5,000 / kg and a profit rate of 15-25%. This is in accordance with the activities and costs incurred greater.

4. Conclusions
From the results of the SWOT Analysis, there are several opportunities and constraints in the development of mungbeans in Sambas Regency, but can be overcome by improving the cultivation system and increasing farmers' knowledge by intensifying counselling about mungbean cultivation.

From the results of financial analysis in 4 sub districts in Sambas Regency, it can be seen that the highest net income received by farmers in the Teluk Keramat District is IDR. 17,136,750, - with an R / C value of 3.49 and a B / C ratio of 2.49.

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