Social behavior and institutional support on the swamp rice sustainability

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Abstract Social behavior of the community and the institutions that support farming facilities and infrastructure affect the success of farming. The purpose of this study was to describe the behavior and institutional support for the success of rice farming in the tidal swamps of Riau Province. The study was conducted at the rice production center in Siak Regency using a survey method with a structured questionnaire. A total of 203 farmers were purposively selected as random samples in four districts, namely Bunga Raya, Sungai Apit, Sabak Auh and Sungai Mandau. The observation parameters were education, training, age, motivation farming, land tenure and experience in agriculture. The collected data tabulated and analyzed descriptively. The results showed that agriculture in Bunga Raya was more sustainable compared to other sub-districts with index value of social and cultural dimensions (> 50%) and the value of the legal and institutional dimension sustainability index to be 53.9%. The factors that influence the sustainability of the swamp rice farming in Siak Regency were good farmer behavior (age, education, motivation, experienced and landowner status), the existence of supporting institutions peculiarly farming group and BPP that synergize well and government regulations in favor of agricultural development and their sustainability.

1. Introduction
Rice is one of the primary sources of carbohydrates consumed by the people of Indonesia. The need for rice per capita of the Indonesian people is 111.58 kg per capita per year [1]. Therefore, the need for this type of food is 26.91 million t in 2019, and will increase significantly in the following years along with the increase of the total population. On the other hand, the area of potential rice fields is decreasing due to land conversion for housing, industry and related facility needs. It has resulted in the expansion of the planting area to sub-optimal lands, such as tidal land, with various constraints causing lower land productivity compared to the potential soil. Tidal swampland is projected to be a food storage area supporting the existing land area. The swamps in Indonesia covers area of 33,393,570 ha where the tides influence area of 20.1 million ha spread over Kalimantan, Sumatra, Papua and Sulawesi [2].

Agricultural development in tidal land has various constraints, either physical, chemical, soil biology or social and institutional conditions in the region. Subagio [3] states that the swamp development obstacles faced are physical and chemical constraints, namely: the danger of shallow pyrite and nutrient retention, mostly low to very low pH. Arsyad et al. [4] state that the obstacles on developing tidal swamplands in Indonesia are inadequate agricultural supporting infrastructures such as water gates, farm roads and farmers’ weak mastery of supporting technological innovations and limited access of farmers to capital and market institutions. The development of tidal swamps as food barns needs to be done...
appropriately regarding environmental sustainability. The continuous application of appropriate and site-specific technology will increase the realization of food security and the ecological sustainability such as tolerant varieties, land and nutrient management, amelioration with in situ raw materials, pest control and Agricultural Equipment and Machinery Service Unit.

Utilization of tidal swampland to support the program has considerable opportunities because various technological innovations have been available, such as water and soil management technology (micro-water management, land management, amelioration and fertilization), adaptive and productive new varieties, and tools and agricultural machinery. The availability of appropriate technology must be an encouragement by human resources of farmers who are competent in finding, accepting and implementing technological innovations as well as farm institutions and other economies as well as the socio-cultural character that supports tidal swamp farming.

Farmer’s innovation capability, apart from being influenced by technological factors, it is also affected by individual farmer factors, namely age, non-formal education, the land area controlled, the role of information media, the part of companion and the role of farmer group communication [5]. Furthermore, Igirisa [6] states that communication, resources, executive attitudes, organizational structure, population potential, natural resources, economic conditions, technological progress, local culture, and political dynamics are the keys to success. The results showed that farmers in tidal swamplands generally have low abilities. Therefore, socialization and guidance by field officers as well as supporting institutions are needed in the region [7]. The purpose of this study was to describe the behavior and the institutional support for the success of rice farming in the tidal swamps of Riau Province.

2. Materials and methods
The study was conducted at the rice production centers in Siak district from January to March 2019 using survey methods in 4 subdistricts namely Bunga Raya, Sabak Auh, Sungai Apit and Sungai Mandau. This research requires specific criteria so that samples were taken later by the purpose, to solve research problems with 203 respondents, namely: farmers who cultivate rice, informal and formal figures as key-respondents. The number of farmer samples was purposively using the Slovin equation in Ryan [8] with margin error about 7% based on the following equation:

\[ n = \frac{N}{1 + N \cdot a^2} \]

where:
- \( n \) = number of samples
- \( N \) = total population
- \( a \) = percentage of error

Extracting information was carried out using a structured questionnaire guide. The social parameters observed in this study were the level of education, training, age, the motivation of farmers to farm, land ownership status and experience in farming. The collected data were listed and analyzed using descriptive analysis.

3. Results and discussion
3.1. Level of education
The survey results record that the respondent's education level illustrates the farmer's attitude and ability to accept the various changes. The farmer’s education level is presented in table 1.
Table 1. Average education level of farmers.

| Kecamatan    | Elementary School | Secondary School | High School | Graduate |
|--------------|-------------------|------------------|------------|----------|
| Bunga Raya   | 40 (48.78)        | 30 (36.59)       | 8 (9.76)   | 4 (4.87) |
| Sabak Auh    | 29 (56.86)        | 15 (29.41)       | 5 (9.81)   | 2 (3.92) |
| Sungai Apit  | 19 (59.37)        | 10 (31.25)       | 2 (6.25)   | 1 (3.13) |
| Sungai Mandau| 25 (65.79)        | 11 (28.95)       | 2 (5.26)   | -        |
| **Total**    | **113 (55.67)**   | **66 (32.51)**   | **17 (8.37)** | **7 (3.5)** |

Table 1 shows that the education level of most farmers is elementary school or the equivalent. In total, the number of Elementary School reached 113 people (55.67%). The Secondary School 66 people (32.51%), High School 17 people (8.37%) and Graduate seven people (3.45%). It shows that lowland rice farming activities are not only cultivated by low educated people, but also by people with higher education than elementary school, or even higher. By increasing number of farmers with higher education, it is hoped that the transfer of technology and information will be faster and simple. The farmers will be more responsive to the various new technologies they receive. The results show that one of the factors affecting the adoption rate is the education of the prospective adopters and their family members.

Farmers with higher education have relatively better ways of thinking, so they are better at farming activities. It is in line with what Manyamsari and Mujiburrahmad [9] stated that they were highly educated who are relatively faster in innovation, on the other hand, farmers with low education are kind hard to make an innovation quickly. The farmers would be able to fully use the resources if they had broader knowledge.

3.2. Farming motivation and training/counselling

The motivation of the farmers to plant rice is as the primary income for farmers in Bunga Raya Subdistrict, while in the other three sub-districts it is as an additional income because the primary income of farmers is mostly from gardening. It can present from farming activities carried out for farmers in Bunga Raya Subdistrict more severe and more painstaking. If there is training or outreach related to new programs and technology from the government that are carried out both at their place or outside, they are more enthusiastic in participate, compared to the other three districts.

Farmers in Bunga Raya Sub-district, on the average, attend training two to three times a year, while other farmers averaged only once a year. It is because of the training is sometimes conducted outside the city, whereas the farmers have to need fund it independently. Each group of the farmers only sends a few representatives who are willing to fund their own trips to attend the training.

Many training programs covering several aspects of sustainable agriculture have been carried out such as the Climate Field School, Integrated Crop Management Field School, Integrated Pest Management Field School, Good Agricultural Practices Standard Operating Procedure and the Accelerated Sustainable Agriculture Development Model. The extension program is supposed to be effective in encouraging farmers to implement sustainable agriculture. It is following the study of Jamal et al. [10] and Abdollahzadeh et al. [11] which states that extension support is one of the factors determining the success of implementing an innovation adoption.

Successful extension/training also requires the participation or involvement of farmers because it will influence the adoption of innovation as argued [12, 13, 14]. Bunga Raya Subdistrict farmers are motivated to obtain new technology. This is because they pocket all the necessities of life from rice farming, around 80% of the population has an eye as a rice farmer, plus there is so much encouragement from the local government to the success of existing rice farming. At Bunga Raya sub-district. Farmers also find it easy in terms of the facilities needed for the continuity of their rice farming, so that a high motivation arises from the farmers to further enhancing the rice production they have been doing so far.
3.3. Lifetime of farmer

Age is one of the factors related to work productivity and the speed at which a person adopts an innovation. Lifetime is intimate to workability in carrying out farming activities. Lifetime can be used as a benchmark to see someone's effort at work. The lifetime is still productive if the person can likely work well and optimally. In general, farmers at a working age will have higher physical abilities, have better memory and are more willing to take risks in the adoption of an innovation. It is consistent with the results of Sunaryo's research [15] that states one of the indicators in determining work productivity in business development is the age level.

Relatively young farmers are harder working, nimble, easy to accept innovations, responsive to the surrounding environment when compared to older workers, for more details about the age of the respondent farmers presented in Table 2.

Table 2. Age conditions of respondents in Siak Regency, 2018.

| Sub District  | <25 years (number of people) | 25-40 years (number of people) | 41-55 years (number of people) | >55 years (number of people) |
|---------------|-----------------------------|-------------------------------|-------------------------------|-----------------------------|
| Bunga Raya    | 11 (13.42)                  | 24 (29.27)                    | 36 (43.90)                    | 11 (13.41)                  |
| Sabak Auh     | 8 (15.69)                   | 15 (29.41)                    | 22 (43.13)                    | 6 (11.75)                   |
| Sungai Apit   | 4 (12.50)                   | 7 (21.87)                     | 17 (53.13)                    | 4 (12.50)                   |
| Sungai Mandau | 3 (7.89)                    | 10 (26.32)                    | 21 (55.26)                    | 4 (10.53)                   |
| Total         | 26 (12.80)                  | 56 (27.59)                    | 96 (47.29)                    | 25 (12.32)                  |

Table 2 provides information that the average age of the most respondent farmers for all districts is in the age group 41 to 55 years (49.35%), meaning that they included in the productive age. According to the age condition, the Siak Regency farmers are farmers who still have good physical abilities so that they are still able to accept agricultural technology innovations properly than they will be more effective in conducting farming and participating in group activities.

Farmers who are in their productive age are usually more active in socializing and are more dynamic. Younger farmers usually more enthusiasm for curiosity and faster adoption of useful innovations. This makes it possible to increase the scale of production according to scientific or technological developments. It also reflects that lowland rice farming activities in Siak Regency are already in demand by young workers.

3.4. Farming experience

Experience in carrying out rice farming activities is one of the factors that influence farmer actions. The relatively long experience can help farmers in reducing the risk of failure and in increasing their agricultural yield. The experience of farmers in lowland rice farming (table 3).

Table 3. Experience in farming.

| Subdistrict  | <10 years (number of people) | 10-15 years (number of people) | >15-20 years (number of people) | >20 years (number of people) |
|--------------|------------------------------|--------------------------------|---------------------------------|-----------------------------|
| Bunga Raya   | 11 (13.42)                   | 24 (29.26)                     | 36 (43.90)                      | 11 (13.42)                  |
| Sabak Auh    | 9 (17.65)                    | 19 (37.25)                     | 18 (35.30)                      | 5 (9.80)                    |
| Sungai Apit  | 6 (18.75)                    | 12 (37.50)                     | 11 (34.37)                      | 3 (9.38)                    |
| Sungai Mandau| 8 (21.05)                    | 15 (39.48)                     | 12 (31.58)                      | 3 (7.89)                    |
| Total        | 34 (16.75)                   | 70 (34.48)                     | 77 (37.93)                      | 22 (10.84)                  |

The experience of farming greatly influences farmers in making decisions to manage their farming better. Table 3 shows that the average of most respondent experience is in the range of 15-20 years (37.93%). Based on farming experience, it presumed that respondent farmers in Bunga Raya Subdistrict extended farming experience so that it affects the management of farming better. It is following the
results of research by Andayani and Sanira [16] which state that experience plays a crucial role in the results of work achieved by farmers. The farmers who are more experienced can achieve higher production.

3.5. Land ownership status
Mudakir [17] states that land tenure status is separate into three parts, namely owner, tenant and profit-sharing. The results showed that the land ownership status in Siak Regency was dominated by the tenants (85%) of the tenants (10%) and the production sharing (5%), except for Sungai Mandau District, all agricultural land belonged to the village, farmers. Before cultivating, farmers usually sign a letter of agreement with the headman and sub-district official, in the contents that farmers are only permitted to plant rice, secondary crops, vegetables or horticultural crops and other seasonal crops.

Farmers in Sungai Mandau subdistrict are not allowed to plant crops and build permanent houses. They are only allowed to make semi-permanent houses, not allowed to sell and buy the land and cannot be switch without the village / sub-district officials approval. If it is happening, the person concerned will be subject to sanctions following the existing regulations, namely that he is no longer allowed to cultivate the land, because he has violated an agreement previously made. In contrast to their area, farmers are free to determine the steps that will be taken for the soil they manage, while the landowner leases, the pawn has regulations agreed with the landowner.

The results showed that land tenure status influenced the average income received by lowland rice farmers. The highest average revenue income was for farmers with lease tenure status. It is by using the production facilities, especially pesticides that are used on average above the recommendation to protect the plants regardless of the environmental damage that can be caused by the use of pesticides.

3.6. The sustainability of the socio-cultural dimension
The results showed that the sustainability status of the social and cultural dimensions for the three Districts (Bunga Raya, Sabak Auh and Sungai Mandau was sustainable (> 50%), except for Sungai Apit Subdistrict, the status of the sustainability was less sustainable (<50%). It is due to several things, namely: 1) The management of paddy rice farming in Sungai Apit District has not provided support for the development of the social and cultural dimensions, while in Bunga Raya, Sabak Auh and Sungai Mandau Districts, the management of paddy rice farming has been able to provide support towards the development of social and cultural dimensions.

The sustainability of lowland rice farming in Sungai Apit District optimistic, it is necessary to pay attention to the development of the socio-cultural dimension and to improve it. 2) the ethnic group that dominates the Apit River area is the Malay ethnic group, which based on their habits is to work as fishermen and gardeners so that generally they only plant without any culture to maintain. Ethnic Malay farmers are commonly satisfied when they can meet their daily needs, so they do not motivate to get more income by engaging in the intensive farming culture, including being creative to find additional income from farming areas as is done by farming communities in other sub-districts.

3.7. Institutional parameter
The institutional parameters observed in this study were the availability of formal regulations, the existence of farmer groups, the traditional institutions, coordination between stakeholders, the Agricultural Extension Center, logistics agency, Microfinance Institutions and Agricultural Equipment and Machinery Service Unit.

The existing formal regulations of agricultural area development action plan in Siak Regency was setting out in 2017 to 2021. The Siak Regency Government has prepared the eternal rice field as a development location of rice plants. Efforts to prevent the conversion of agricultural land functions, especially rice land, were carried out in 2014 by the Siak Regency Government with the issuance of the Siak Regency Regional Regulation Number 2 of 2014 concerning the Protection of Sustainable Food Agricultural Land.
The follow-up to this regional regulation is the insurance of the Siak Regency Regulation Number X of 2015, which contains the area of Siak Regency’s protected rice fields, furthermore so that the public understands the purpose of this regulation, the Siak Regency Government through the Agricultural Extension Center will socialize this regulation through a meeting held implemented in farmer groups. It was during this meeting with farmer groups that government programs related to agriculture and the latest agricultural technology presented. At the field level, there are quite a lot of supporting institutions in Siak Regency such as Farmer Groups, Farmers Group Association, Village Unit Cooperatives, seed breeder groups, pest control team groups, Agricultural Equipment and Machinery Service Unit.

This institution plays an active role in advancing rice farming in Siak Regency, including the existence of Agricultural Extension Center and other stakeholders who always guide the field of agriculture, especially rice. Of the four sub-districts that are centers of rice development, not all districts have complete and active institutions. Whether farmer groups are dynamic or not can be seen from the presence of group meetings, both formal and non-formal.

Farmers who actively participate in group meetings have a better level of knowledge and higher application of technology, so they get higher yields. The results of this study are in line with the results of research by Wangke et al. [18] which states that the level of application of lowland rice farming technology has a significant relationship with the participation or presence of farmers in agricultural extension activities. Farmers who are active in participating in extension activities tend to be higher in the application of farming technology.

Participation in the form of attendance is carried out for various reasons, including increasing information and knowledge, solving problems, exchanging experiences, maintaining harmony, obtaining technical guidance which is crucial not only to productivity, the income also that agricultural and rural life and more sustainable. The participation in the form of presence greatly influences farmers in adopting a technology, involvement in farming institutions and attendance in training contribute positively to the adoption of sustainable agricultural practices [19 - 23]. Farmers in Siak Regency besides developing modern agricultural technology, they still maintain old customs or traditions in running their farming. The cultural tradition that is still hereditary out until now is happening to the field praying when they are about to enter the planting season.

The tradition of happening to the fields is due to ask for a blessing from the Lord of the Universe, for better results and release from avoiding disease pests, so that rice production increased. The tradition of going down the paddy fields is an annual tradition for the community of rice farmers in Siak Regency with the hope that each year the yield of rice barns can be better than the previous year.

Other routine traditions that they do are praying together by reading the Prophet's, prayers before the first harvest are carried out and continued with eating together. Harvesting is prohibited on Fridays, prohibited from harvest when a neighbor dies, fighting, saying dirty words and doing alms on the earth is not allowed expression of gratitude towards Allah SWT and nature.

3.8. Law and institutions

The result was showed that the value of the legal and institutional dimension sustainability index for Bunga Raya District to be 53.9%. It means that the legal and institutional dimensions of lowland rice management in Bunga Raya are sustainable. Role of law and institutions in the lowland rice farming management in Bunga Raya District us starting to be good. The awareness of the importance of obeying the rules is inseparable from the human character of the implementer.

The formation of a course character involves ethnicity, social environment, the length of time exposed to the rules and the perceived positive value of running these rules. Bunga Raya sustainability, due to the location of the Bunga Raya sub-district which is bordered by the district capital and access, so that it allows regulations made in the form of regional regulation (Perda, Perbub, Perbup) or others to be conveyed more quickly to farmers with intensity higher. Repetitive delivery both, by officers and among farmers causes the exposure to be understood faster, and the positive value causes farmers to comply with existing regulations. The existence of binding rules, the best institutional implementation and the benefits obtained cause farmers to tend to take advantage of existing institutions.
The index value for the sustainability of the legal and institutional dimensions of the District (Sabak Auh, Sungai Apit and Sungai Mandau) was 46.0%. This condition illustrates that the legal and institutional dimensions have not been optimal. It should be a serious concern because law and institutions have keys role in sustainable natural resource management. The institutional aspect does not only regulate of lowland rice resources but also the respect of these parties who have an interest in the rice field ecosystem. The results showed that the attributes that most influenced the sustainability of the legal and institutional dimensions for all districts were the role of agricultural extension and the existence of wented institutions.

Rice production and productivity increased due to the intervention of agricultural extension workers. Agricultural extension agents provide guidance and solutions to problems faced by farmers. Agricultural extension agents also spread innovation and technology to farmers in developing and increasing their production, productivity and farm income. The Agricultural Extension Center (BPP) is an extension institution that still exists at the sub-district level. The results of the research show that some traditions or habits that are maintained by farmers, especially by farmers in Bunga Raya District, are praying down the fields when entering the planting season, praying together before the first harvest, prohibiting harvesting on Fridays and harvesting when a neighbor die. It is due to fight, forbidden to say dirty and due alms on the earth as an expression of gratitude to Allah SWT.

The role of farmer groups in increasing production and sustainability of lowland rice farming in Bunga Raya District is quite large. One of the ways the group helps its members is by collaborating with the production facility providers. This collaboration intends to help members get cheaper fertilizer and also to make it easier for farmers to market their crops. The role of the group is un-success when farmers face problems if there are problems farmers will be able to jointly solve the problems they face, such as in terms of fulfilling agricultural production facilities, technical production and marketing of products.

Wangke et al. [18] stated that the coaching and activities of farmers using a group approach is one of the conditions for facilitating agricultural development. Developing farmer groups means building their willingness and confidence to be actively involved in rice development, besides that they can move in a methodical, efficient and organized manner.

3.9. Land productivity
Siak Regency is one of the rice productions centers in Riau Province and has the highest productivity (5.47 t ha⁻¹) with intervals of 4.68 to 6.60 t ha⁻¹ [24]. The land productivity data for each subdistrict presented in table 4.

| Subdistrict         | Productivity (t ha⁻¹) |
|---------------------|-----------------------|
| Bunga Raya          | 6.60                  |
| Sabak Auh           | 4.99                  |
| Sungai Apit         | 4.68                  |
| Sungai Mandau       | 4.89                  |
| Source: [24]        |                       |

Table 4 provides data that the highest rice productivity is in Bunga Raya subdistrict (6.60 t ha⁻¹) and the lowest is Sungai Apit District (4.68 t ha⁻¹). Compared with the average of rice productivity in Riau Province (4.01 t ha⁻¹), the rice productivity at these four sub-districts is better [25]. The high productivity of rice in Siak Regency compared to other districts in Riau Province is partly due to relatively fertile soil conditions and more advanced cultivation technology applied by farmers. Farmers mostly use superior varieties, crop management such as fertilizing, irrigating and controlling plant-disturbing organisms is almost under technical guidelines, especially for Bunga Raya District.

4. Conclusions
Agriculture in Bunga Raya is supportable compared to other sub-districts. The factors that influence the sustainability of the swamp rice farming in Siak Regency are good farmer behavior (age, education,
motivation, experienced and landowner status), the existence of supporting institutions peculiarly farming group and the Agricultural Extension Center (BPP that synergize well and government regulations in favor of agricultural development and their sustainability.

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