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## **Is Agricultural Institutions Affect the Sustainability of Local *Adan Rice* Farming?**

**Khaerunnisa<sup>1\*</sup>, Ety Wahyuni MS<sup>1</sup>, Didi Rukmana<sup>2</sup>, Saat Egra<sup>3</sup>, Masitah<sup>4</sup>, Fitriani R<sup>5</sup>, Ayu Wulandary<sup>5</sup>**

<sup>1</sup>Department of Agribusiness, Faculty of Agriculture, Universitas Borneo Tarakan, Tarakan, Indonesia

<sup>2</sup>Department of Agriculture Socio-Economics, Faculty of Agriculture, Hasanuddin University, Indonesia

<sup>3</sup>United Graduate School of Agriculture Science, Gifu University, Japan

<sup>4</sup>Department of Agribusiness, Faculty of Agriculture, Universitas Sembilan Belas November Kolaka, Kolaka, Indonesia

<sup>5</sup>Department of Agribusiness, Faculty of Science and Technology, Universitas Muhammadiyah Sidenreng Rappang, Sidrap, Indonesia

\*Correspondence e-mail: [khaerunnisa3892@gmail.com](mailto:khaerunnisa3892@gmail.com)

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### **Abstract**

Krayan's main commodity is *adan rice* which has received a Geographical Indication Certification (GIS). This rice has high economic value and competitiveness because it is cultivated organically. Therefore, local rice commodities need to be cultivated in a sustainable manner. One of the dimensions of local rice sustainability is the institutional dimension. The institutional dimension is important for sustainable agricultural development due to it plays a supporting role in the success of farming. This study aims to analyze the sustainability of local *adan rice* farming on the institutional dimension in Krayan District, Nunukan Regency, Indonesia. This research was completed by using the Multidimensional Scaling Method. The results of the multidimensional scaling index value analysis for the sustainability of local *adan rice* on institutional attributes is 60.19, which means the institutional dimension has an effect on the sustainability of *adan rice* farming. The sensitive attributes that affect the sustainability of local *adan rice* on the institutional dimension are capital loans from financial institutions (banks or other capital assistance institutions), the existence of cooperative institutions, capital assistance from cooperatives, and membership in indigenous forums. This implies that, considering all sensitive attributes of institutional dimension are important aspects to affect the sustainability of local *adan rice* farming.

### **Keywords**

Adan Rice; Institutional; Sustainability; Multidimensional Scaling Analysis

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## **1. Introduction**

The existence and development of agricultural businesses cannot be separated from institutional aspects (Rozikin, 2015; Dianta, 2013; Adenle et al., 2017). The logical consequence of carrying out agricultural development is encouraging institutional innovation with expertise including market knowledge, agribusiness, and rural finance (Adekunle et al., 2012; Limi et al., 2018). Therefore, the institutional aspect is a key requirement for rural agricultural structures to become developed and independent. In order to carry out institutional changes, it is necessary to carry out mapping and analysis of their interrelationships, so it is necessary to identify actors, institutional mechanisms, opportunities, and challenges faced by small farmers (Hounkonnou et al., 2012; Kusnandar et al., 2013). Institutional analysis in

agriculture is aimed to obtain a description of a related agricultural socio-economic phenomenon with the relationship between two or more actors in socio-economic interaction including dynamics applicable and agreed on terms shared by the interactants (Putsenteilo et al., 2020).

Institutional contains the notion of organization which includes roles, rules, and attitudes in the norms and values that develop in a community group where the existence of community life is supported by three pillars of institutions, namely: (1) community institutions (voluntary sector); (2) economic or market institutions (private sector); and (3) public institutions, including government (public sector) (Kustiari et al., 2018; Mujawamariya et al., 2013). Based on their level, institutions can be categorized into four categories, namely: social institutions, groups, organizations or associations, and institutional institutions. Social institutions are certain rules that are adhered to by society in general and are widespread like land lease systems, profit sharing, debt bondage, borrowing between farmers, paying off loans after harvest, and so on. Farmer groups are groups of informal farmers. This farmer organization has written laws, including goals, efforts, membership requirements, and other provisions (Hariance et al., 2021; Nuraini et al., 2016). Farmers institution is an organization that allows farmers to carry out farm agribusiness activities from upstream to downstream, and connect with stakeholders. However, institutional performance affects economic, environmental, and social resources respectively (Amam et al., 2020).

North Kalimantan has a very potential Border Area, including the Krayan District which is one of the areas in Nunukan Regency and directly adjacent to Sabah Malaysia. The main commodity of Krayan is *adan organic rice* which is an important source of income for some local residents. The bargaining position of *adan rice* sold to Malaysia is still very weak because the marketing pattern is carried out individually and traditionally, even though it has Certificate Geographical Indications (GIS) obtained in early 2012. Refining *adan rice* is considered very important, as well as improving cultivation technology to increase its productivity so that the existence of this commodity is sustainable and has value added. In 2021, the productivity of *adan rice* is 4.8 tons/ha or increased by around 24% and the R/C value is 4.81 with an average paddy field area of 3,466 ha (Rizal, 2015).

*Adan rice* has become a leading and excellent commodity in Krayan with local seeds that have been cultivated by the community of “Dayak Lundayeh” for a long time. In reality, the cultivation of *adan rice* farming in the Krayan area is managed by local wisdom from upstream to downstream. The local wisdom that the “Dayak Lundayeh” tribe has maintained is an organic farming culture (Andrian, n.d. 2017; Rizal & Widowati, 2016). Organic farming is an agricultural cultivation system that relies on natural ingredients without using synthetic chemicals that have an impact on sustainability (Rachma & Umam, 2021). The sustainability of organic agriculture is associated with farmers’ experience, quality of the information provided, and management of risks (Alotaibi et al., 2021).

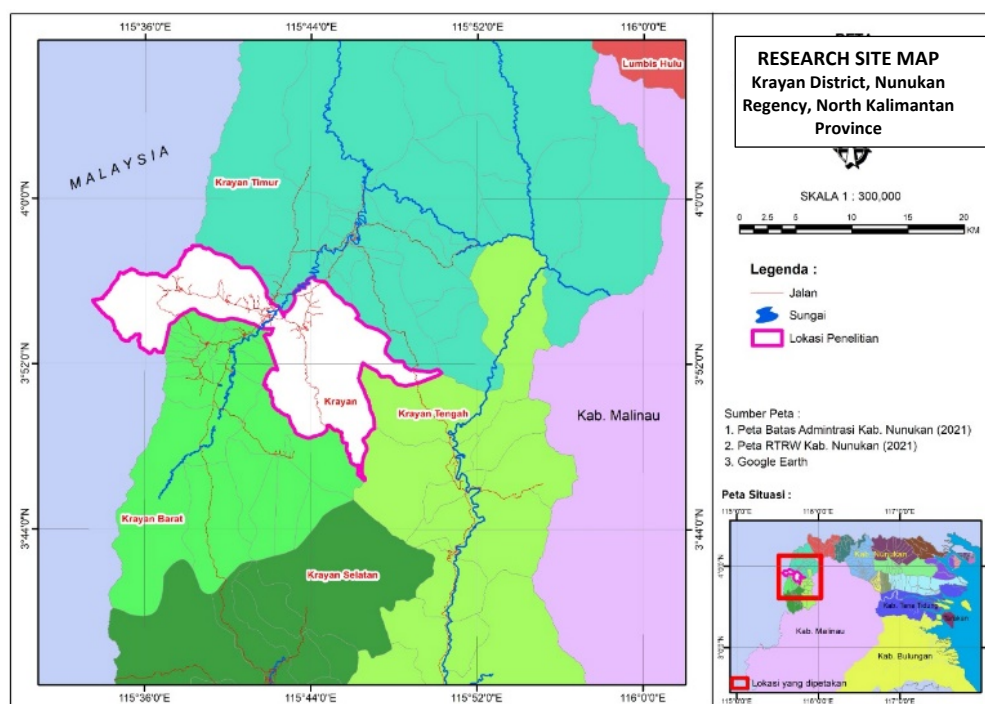
The institutional condition of existing *adan rice* farmers is more characteristic of culture and most of them are only oriented towards meeting the needs of the family, not fully directed to take advantage of economic opportunities through the use of accessibility to various technological information, capital, and markets needed for the development of *adan rice*. On the other hand, agricultural institutions in Krayan such as cooperatives have not been able to

fully accommodate the interests of farmers as a forum for technical development in advancing their farming business. Therefore, agricultural institutions must be established according to their functions so that they can support the sustainability of *adan rice* farming and in developing the local farmer's economy.

The undoubted quality of *adan rice* is expected to be sustainable. The sustainability of these commodities can be seen from the institutional dimension. Support for facilities and services in institutions can motivate farmers to implement and simultaneously develop useful and sustainable agricultural systems. The research aims to analyze the sustainability of local *adan rice* farming on the institutional dimension in Krayan District, Nunukan Regency, Indonesia.

**2. Materials and Methods**

The research was conducted in Krayan District, Nunukan Regency, North Kalimantan Province from March to October 2022. The research site was determined using a purposive sampling method according to the criteria for determining the research location that produces *adan rice* (Sugiyono, 2017; Etikan, 2016). Respondents were determined using the simple random sampling method (Iqbal Jeelani et al., 2014) with 30% of the total farmer population in the region.



**Figure 1.** Research Site Map

Data collection methods in this study consist of field observations, documentation to obtain secondary data, and interviews to obtain the required qualitative and quantitative data. Agricultural institutional sustainability of *adan rice* were analyzed using Multidimensional Scaling (MDS) which is a statistical technique by carrying out multidimensional transformations into simpler dimensions (Paradis, 2022; Peterfreund & Gavish, 2021) using the Rapfish analysis technique (Rapid Appraisal for Fisheries) developed by the Fisheries Center, University of British Columbia. Rapfish is an alternative approach to evaluating or determining sustainability status (Ario et al., 2021; Burbi et al., 2016; Haridhi et al., 2018;

Yasir Haya & Fujii, 2020). Then used the Rap-FARM (Rapid Appraisal of the Status of Farming), approach that adopted from Rapfish, to assess agricultural sustainability. Determining the index and status of sustainability can be started by determining the attributes and scores for each dimension based on the reality conditions of the data in fieldwork, initial observations and interviews, and references based on literature and judgment from researchers based on scientific assumptions (Paradis, 2022). The sustainability index interval for each dimension can follow the following categories (Table 1).

**Table 1.** Sustainability Status Category

Number	Index	Category
1	0-25.00	Not Sustainable
2	25.01-50.00	Less Sustainable
3	50.01-75.00	Quite Sustainable
4	75.01-100	Sustainable

Analysis with the Rapfish program on Microsoft excel will also perform a sensitive analysis (leverage analysis), Monte Carlo, stress values (S), and coefficient of determination ( $R^2$ ). Sensitive analysis (leverage analysis) to obtain attributes that are sensitive to the sustainability status and see the order of priority based on changes in the RMS (Root Mean Square) value on the x-axis. The greater the RMS value, the more sensitive/larger the role of this attribute is towards improving the sustainability status of *adan rice* farming and the interventions or improvements that need to be made. Monte Carlo analysis was performed to estimate the level of random error in the model generated through the MDS analysis of all dimensions at the 95% confidence level. The results of the MDS and Monte Carlo sustainability index analysis are then compared, if the difference between the two values is small or less than 25%, it can be concluded that 1) The analysis process is carried out repeatedly stable, 2) Errors in inputting data and data missing items can be avoided, 3) Errors in scoring each attribute are relatively small, and 4) The modified Rapfish method used is good enough to evaluate sustainability in the research conducted or the results are close to the actual situation and the data analyzed has been well mapped (Mastuti et al., 2018).

The stress value and the coefficient of determination determine whether additional attributes are necessary and reflect the accuracy of the dimensions being studied with the actual conditions in the field. The model or results of the analysis can be concluded to be quite good if it produces a stress value of less than 0.25 and an  $R^2$  value close to 1. Attributes and scores for the institutional dimension have been determined in Table 2.

**Table 2.** Dimensions, Attributes and Assessment Criteria for Sustainability of *Adan Rice* Farming

Dimension	Attributes	Assessment Terms
Institutional	Farmer group membership	a. (0) No b. (1) Inactive c. (2) Active
	Rules in farmer groups	a. (0) No b. (1) There are but not binding to be obeyed c. (2) There are and binding to be obeyed
	Membership in indigenous peoples' forums	a. (0) No b. (1) Inactive c. (2) Active
	Rules in customary community forums relating to farming	a. (0) No b. (1) There are but not binding to be obeyed c. (2) There are and binding to be obeyed
	The existence of cooperative institutions	a. (0) No b. (1) Inactive c. (2) Active
	Capital assistance from cooperatives	a. (0) No b. (1) Sometimes c. (2) Always
	Capital loans from financial institutions (banks or other capital assistance institutions)	a. (0) No b. (1) Sometimes c. (2) Always
	Extension activities/training from agricultural extension workers	a. (0) No b. (1) Sometimes c. (2) Always

### 3. Results and Discussions

#### 3.1. Characteristics of *Adan Rice* Farmers

##### *Characteristics by Age*

Table 3 clearly shows that the age of productive farmers is 60 (83.5%) of *adan rice* farmers are between 20-60 years old. This shows that most of the farmers physically have good strength and a high spirit of work so they are believed to be able to optimize and manage local *adan rice* farming properly. This statement is in line with Arvianti et al., (2019) who explained that farmers who are still in productive aged between 20-60 years, have better skills in managing farming than non-productive farmers aged > 60 years.

**Table 3.** Characteristics of *adan rice* farmers by Age

Age	Frequency	Percentage (%)
20-30	9	12.3
31-45	21	29
46-60	30	41
61-75	11	15
76-90	2	3
<b>Total</b>	<b>73</b>	<b>100</b>

### Characteristics by Education Level

**Table 4.** Characteristics of *adan rice* farmers by Education Level

Education Level	Frequency	Percentage(%)
Elementary School	22	30
Junior high School	15	21
High School	27	37
Bachelor degree	9	12
<b>Total</b>	<b>73</b>	<b>100</b>

As clearly depicted in Table 4 that *adan rice* farmers have taken education although there are still 22 (30%) *adan rice* farmers whose education is only at the elementary school level. However, most of *adan rice* farmers education level was high school, 27 (37%). This shows that local *adan rice* farmers have a fairly high awareness of education so they are able to absorb information (Charina et al., 2018; Susanti et al., 2016) in the agricultural sector, although until now they still persist in carrying out the cultivation process in the traditional way because they maintain the rice quality, not the quantity.

### Characteristics by Land Area

**Table 5.** Characteristics of *adan rice* farmers by Land Area

Land Area	Frequency	Percentage(%)
0.5-2.0	19	26
2.1-3.5	23	31.5
3.6-5.0	18	24.7
5.1-6.5	7	9.6
6.6-7.0	6	8.2
<b>Total</b>	<b>73</b>	<b>100</b>

As shown in Table 5 that, the average *adan rice* farmers has a land area of 2.1-3.5 Ha (31.5%). Land area generally affects the acquisition of production and income generated in *adan rice* cultivation. The wider the land used for rice farming, the higher the production and income generated. However, the larger the area of land used in farming, the greater the costs incurred (Saputra & Wardana, 2018; Sari & Munajat, 2019).

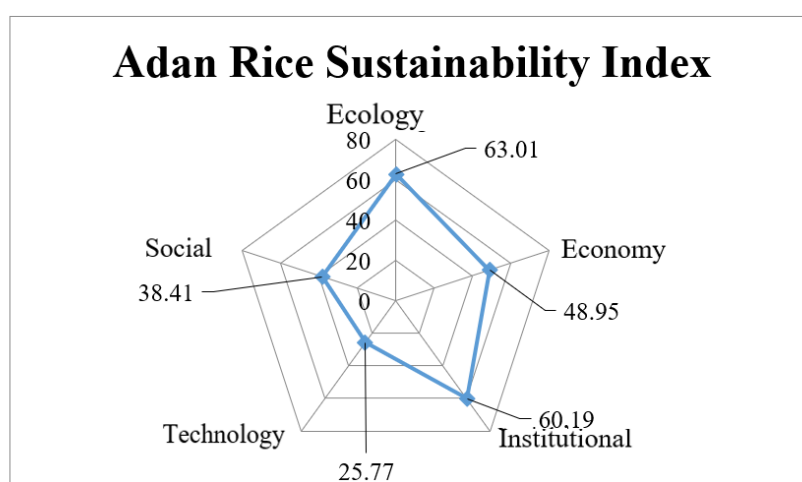
## 3.2 Sustainability Status

The sustainability status of *adan rice* farming based on ecological, economic, social, technological and institutional dimensions can be explained through the index values in Table 6.

**Table 6.** Index Value and Sustainability Status

Dimensions	Index Value	Stress	R Square	Status
Ecology	63.01	0.13	0.94	Quite Sustainable
Economy	48.95	0.15	0.94	Less Sustainable
Institutional	60.19	0.14	0.95	Quite Sustainable
Technology	25.77	0.15	0.94	Less Sustainable
Social	38.41	0.13	0.95	Less Sustainable
<b>Multidimension</b>	<b>51.27</b>	<b>0.14</b>	<b>0.95</b>	<b>Quite Sustainable</b>

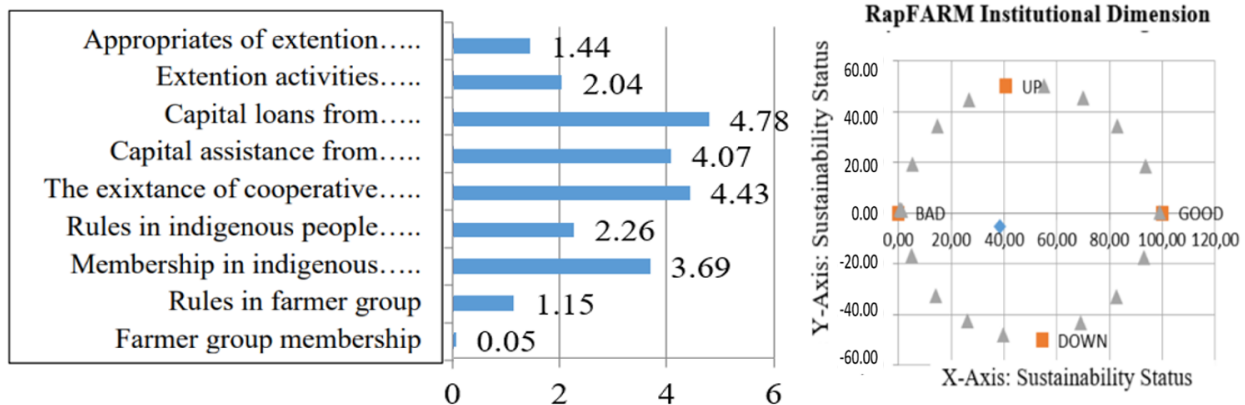
The results of multidimensional index value for the sustainability of *adan rice* farming show a value of 51.27 which is quite sustainable. Two dimensions considered into the moderately sustainable category, namely the ecological and institutional dimensions. In contrast, the less sustainable category includes the economic, social, and technological dimensions. Index values and sustainable status that vary between dimensions indicate that multidimensional sustainable status can be achieved if interventions for the improvement and development of *adan rice* farming are carried out in all dimensions in a holistic or comprehensive manner. The stress value for five dimensions shows a value of less than 0.25 and the coefficient of determination is close to 1, which means that the dimensions and attributes used are sufficient and reflect the accuracy of the dimensions being studied with the actual conditions in the field. The following index values are presented in the fly chart.



**Figure 2.** *Adan Rice* Farming Sustainability Index Fly Chart

### 3.3 Sensitive Attribute for Institutional Dimension

Attributes of the institutional dimension that are thought to affect the sustainability of *adan rice* farming are (1) Farmer group membership, (2) Rules in farmer groups, (3) Membership in indigenous peoples forums, (4) Rules in indigenous peoples forums, (5) The existence of cooperative institutions, (6) Capital loans from cooperative assistance, (7) Capital loans from financial institutions (banks or other capital assistance agencies), (8) Extension activities/training from agricultural extension workers, (9) Appropriates of extension materials for farmers.



**Figure 3.** Leverage Analysis on Institutional Dimensions

The results of the leverage analysis (Figure 3) on the institutional dimension show that the sensitive attributes are (1) Capital loans from financial institutions (banks or other capital assistance institutions) (2) The existence of cooperative institutions, (3) Capital assistance from cooperatives and (4) Membership in indigenous forums. The main lever factor is the attribute of capital loans from financial institutions such as banks or other capital assistance institutions. While other attributes such as the appropriate extension materials, extension activities, customary forum rules, and membership of farmer groups are not sensitive to the institutional dimension. It can be described that capital support in agriculture plays an important role in agricultural sustainability. In this case, the sustainability of local *adan rice* farming is highly dependent on capital attributes. Local farmers with minimal capital ownership need support from financial institutions so that their farming business is not interrupted.

**4. Conclusion**

The results of the multidimensional scaling index value analysis for the sustainability of local *adan rice* on institutional attributes is 60.19, which means the institutional dimension affects the sustainability of *adan rice* farming. The sensitive attributes that affect the sustainability of local *adan rice* on the institutional dimension are capital loans from financial institutions (banks or other capital assistance institutions), the existence of cooperative institutions, capital assistance from cooperatives, and membership in indigenous forums. This implies that, considering all sensitive attributes of institutional dimension are important aspects to affect the sustainability of local *adan rice* farming.

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