Abstract. Natural farming system is a reality exists and holistic agricultural system. The purpose of this research was to examine the sustainability index of socio-cultural, economic and environmental dimensions. An indicator based analysis method was employed, adapted from the study of Sustainability Assessment of Farming and the Environment (SAFE) model and the farmer’s sustainability index (FSI) model. The research was conducted on 224 respondents in Morotai Island. This research formulated 13 indicators which were developed and modified based on agricultural sustainability consensus and various researches’ findings and adapted to specific potential condition of local area in preservation of dryland paddy natural farming system. Using the analysis instruments of MDS and Rap-Farm, the analysis presented the feasibility of MDS-Rap-Farm analysis from the perspective of Stress and R-square values, Rap-Farm Ordination, viewing leverage of attributes, validity test with Monte Carlo analysis and prospective analysis methods as the direction of recommendation for sustainability preservation of dryland paddy natural farming system in Morotai Island border area. Therefore, the dryland paddy natural farming system in Morotai Island border area is a reality exists sustainable and holistic which economically dimension, socio-cultural dimension and environmental dimension.

1. Introduction

Natural farming system is a reality exists and holistic agricultural system. The natural farming system principles imply that natural power is able to regulate plant growth [1] [2]. It has natural cycle to supply plants with nutrients and restore land fertility. There are four basic principles of natural farming system [1], namely: 1). No land management. 2). No synthetic chemical fertilizer, pesticide and herbicide. 3). No hybrid seeds. A land developed with natural farming does not respond to hybrid seeds, thus using local seeds is a must. 4). No application of intensive irrigation system. The natural farming system principles may describe the sustainability characteristics of environmental and economic aspects in utilization of biological resources. Sustainable agricultural system has been developed as an alternative in many parts of the world, such as natural farming, biodynamic and organic agricultural systems. Natural farming system is one agricultural system with specification of area of advantage, institutionalization and farmer-specific characteristics. There are no many publications of specific data of the development of natural farming system di Indonesia. The first conference concerning Kyusei Nature Farming in 1989 in Thailand have proposed that natural farming system is the best alternative to the agricultural system in Indonesia [3]. However, farmers in current globalization and technology era find it difficult to apply an agricultural system with the described sustainable principles and the challenge for sustainable agriculture is to utilize...
internal resources better [4]. Sustainable agriculture has been described and explained with various concepts. That sustainable agricultural system is an environmentally friendly system which improves society’s prosperity and quality of life and fulfills their needs [5].

Despite the phenomena that the world is having crisis of natural food source, ecosystem damage, and difficult restoration of potentially polluted soil organic potential, some areas in East Indonesia are full of natural food source wisdom. The inequality of multi-access and distribution of subsidy of green revolution technology causes delayed and under-adoption of the technology. However, it has kept and saved the agricultural lands from externality of green revolution technology. Many kinds of plantation crops, horticultural crops and food crops are developed without inorganic chemical fertilizer. The farmers of Morotai Island Regency continuously exist until now, but with the phenomena of open access to technology information and agricultural globalization and various accesses to absorption of other central programs, they are supposed to get in touch with green revolution technology.

Morotai Island is one of areas with dryland paddy natural farming agricultural system wisdom [6]. With a land size of 2,476 km2 and population of 60,727, Morotai Island Regency has 13,071 farmers distributed to various fields of agriculture [7]. The farmers in Morotai Island Regency are aware, self-reliance and independent from the government’s aid. The pre-study observation result stated that the natural farming system developed by the farmers of Morotai Island is not limited to dryland paddy, but there are also wetland paddy and second crops, plantation crops, horticultural crops, animal husbandry and fishery.

The dryland paddy natural farming system developed in Morotai Island Regency has become the main attention of local government and relevant institutions, that are preparing to launch certified local varieties. It is currently in purification stage, but with the “green revolution package” technology (using chemical fertilizers). Based on interviews with extension agents during initial observation, the productivity is up to 2.5 ton/ha, which means that local seeds do not respond to chemical fertilizer in improvement of productivity. The productivity data from 2013 to 2015 that wetland paddy and dryland paddy only produce 3 and 2 Ton/ha [7]. The data released dryland paddy in Morotai Island is 1,334 ha and the production is 2,853 tons, thus the productivity is 2.14 ton/ha [8]. On the other hand, according to research results, the average productivity of dryland paddy farmers in Morotai Island is up to 3.5 and 4.5 ton/ha [9] [10]. This conforms to the research conducted, the organic agriculture undertaken by the farmers with local input gives maximum outcome, which means that if the expectation is to improve the productivity of organic and natural agricultural systems, it should use local inputs instead of hybrid inputs [11]. This is as found in 2012 that conventional dryland seeds brought into Morotai Island as an aid from the government to a number of dryland paddy farmers fail to grow since the farmers do not apply conventional seedling technique [10].

A holistic and integrated agricultural system naturally optimizes the health and productivity of agro-ecosystem so as to produce adequate, qualified and sustainable food and fiber by avoiding using seeds/seedlings from GMO (genetically modified organism) and avoiding using synthetic pesticide. Weeds, pests and diseases are controlled mechanically, biologically and with plant rotation while avoiding using plant growth regulator and synthetic chemical fertilizer [12]. Sustainable agriculture is an agricultural system which is economically, ecologically and friendly sustainable, with social equality, culturally appropriate and an integrated system approach [13]. In line with the main principle of the Sustainable Development Goals Indonesia (SDGs), one basic change to achieve is the “no one leaves behind” principle [14] which, in case of wider interpretation in the development process of sustainable agriculture, means that no single farmer will be left behind in achieving equality, better quality of life and realizing more sustainable land. Therefore, without exception, natural farming system farmers have the right to fair, qualified life and to keeping their agricultural land sustainable and able to provide natural
source of food. It is relatively complicated to measure the sustainability of various agricultural systems, particularly natural farming. However, the sustainability indicators of each agricultural system in different area will result in different finding of indicators, which will automatically become a novelty of each researcher. Therefore, this research may formulate whether dryland paddy natural farming system is sustainable from the perspective of socio-cultural, economic and environmental aspects.

2. Methods

The research location was at Morotai Island Regency, between 2°00’ North Latitude and 2°40’ North Latitude and between 128°15’ East Longitude and 129°08’ East Longitude. Morotai Island was a border area of North Maluku Province. The research location was determined purposively because of the highest number of dryland paddy farmers and it is still naturally preserved. The data stated that there are 1000 dryland paddy farmers [8]. The samples were taken randomly using Slovin’s formula, resulting in 286 respondents. The data were analyzed for validity, reliability and normality and contain outlier, leaving 224 respondents remaining. The data were valid, reliable and normal, tested using Monte Carlo with analysis instrument MDS. Therefore, the data used were actually valid data of dryland paddy farmers sampled randomly from 5 subdistricts of Morotai Island Regency.

Morotai Island Regency shares borders with Pacific Ocean in the north, Halmahera Sea in the east, Halmahera Sea in the west and Morotai Strait in the south. Morotai Island Regency consists of 5 subdistricts, namely Morotai Selatan, Morotai Timur, Morotai Utara, Morotai Jaya and Morotai Selatan Barat [15]. A sustainability index analysis was conducted to find out the sustainability index of socio-cultural, economic and environmental dimensions, of which formula of concept is adapted from the farmer’s sustainability index (FSI) approach developed [16] [17] [18] [19]. The research formulated 13 indicators, which were developed and modified based on agricultural sustainability consensus and various researches’ findings and adapted to specific potential condition of local area in preservation of dry land paddy natural farming system. Therefore, the following sustainability indicators were formulated:

1. Farmer’s household food sufficiency (Kecukupan pangan rumah tangga Petani - KPR)
2. Self-input availability (Ketersediaan input sendiri - KIS)
3. Farmer’s source of income (Sumber pendapatan petani - SPP)
4. Source of food production per farmer’s household (Sumber produksi pangan per rumah tangga tani - SPT)
5. Productivity (PRO)
6. Crop security (Keamanan Hasil Tanaman - KHT)
7. Mutual aid cultural personality (Kepribadian kebudayaan gotong royong - KGR)
8. Joint harvest and profit sharing wisdom (Kearifan panen bersama dan bagi hasil - KBR)
9. Equity in fulfilling border community’s need for food (Keadilan pemenuhan kebutuhan pangan masyarakat kawasan perbatasan - KPK)
10. Type of fertilizer/pesticide not used per unit of planted land (Jenis pupuk/pestisida yang tidak digunakan per unit lahan yang ditanami - PPH)
11. Type of irrigation not used per unit of planted land (Jenis Pengairan yang tidak digunakan per unit lahan yang ditanami - PRN)
12. Soil fertility (Kesuburan tanah - KST)
13. Groundwater quality (Kualitas air tanah - KAT)

The indicators were classified into three dimensions, namely economic, socio-cultural and environmental dimensions. The 13 indicators under the 3 dimensions were reflected with 41 attributes. The analysis was conducted with help of analysis instrument MDS using Rap-Farm, presenting the feasibility of MDS-Rap-Farm analysis from the perspective of Stress and R-square values, Rap-Farm Ordination, viewing leverage of attributes, validity test with Monte Carlo analysis and prospective analysis methods as the direction of
recommendation for sustainability preservation of dryland paddy natural farming system in Morotai Island border area [20] [21]. The criteria of index value were presented in table 1.

| Index Value | Criteria    |
|-------------|-------------|
| 80.01 - 100 | Highly Sustainable |
| 60.01 - 80  | Sustainable   |
| 40.01 - 60  | Not Sustainable |
| < 40        | Highly Not Sustainable |

3. Results and Discussion

The results of MDS analysis of dryland paddy natural agricultural system in Morotai Island border area using Rap-Farm presenting the feasibility of MDS-Rap-Farm analysis from the perspective of Stress and R-square values for the three dimensions used are presented in table 2.

| Dimension       | Stress (S) | R-Square (R) |
|-----------------|------------|--------------|
| Economy         | 0.234      | 0.956        |
| Environment     | 0.244      | 0.955        |
| Social and Culture | 0.240    | 0.915        |

Table 2 explains that the reference values serving as the base to determine the Goodness-of-fit in MDS are Stress value of less than 0.25 and R-square value of higher than 0.80. Based on Table 1, we find that the Stress value of the three dimensions is less than 0.25. On the other hand, the R-Square value of each dimension is also higher than 0.80. Therefore, we may state that this MDS analysis meets the Goodness-of-fit criteria, so that it is worthy of further discussion/analysis.

3.1. Economic Dimension

Various concepts of sustainability consensus and various results of sustainability researches in the agricultural globalization era find it difficult to find significant and holistic sustainability. The significant and holistic sustainability of an agricultural system is highly determined by the economic dimension. Significant and holistic sustainability has economic dimension, which means that it is economic in maximizing internal input, economic in minimizing external input and the productivity fulfills the need of current and next generations. As defined, sustainable agriculture means low external input [22]. Is sustainable dryland paddy natural farming system in the economic dimension? The results of MDS analysis for the status of sustainability index of economic dimension explain that natural farming system is sustainable. This may be observed in figure 1.
Figure 1. Sustainability index of economic dimension of dryland paddy natural farming system (Source: processed data, 2019)

Based on figure 1, it is found that the sustainability index of dryland paddy natural farming system with economic dimension is 73.36. This index value is within the range criteria of 60.01 – 80.00, which means that this dimension is sustainable. The status of natural farming system is of sustainable category from the perspective of economic dimension. Economic dimension has 5 indicators and 14 attributes to reflect it. The five indicators are: 1. Farmer’s household food sufficiency, 2. Self-input availability, 3. Farmer’s source of income, 4. Source of food production per farmer’s household, and 5. Productivity. The household food sufficiency indicator is based on farmers’ response that dryland rice is basically sufficient not for its amount, but because they follow various consumption patterns. This means that the need for rice is fulfilled with other types of food such as banana, sweet potato, cassava, taro, sago, etc. This way, preserving natural farming system is not based on the intention to pursue the need for rice only, but there is identical satisfaction value by developing rice as one out of the various types of food. That the farmers do not rely on rice as the only staple food results in a tradition value which makes the farmers view food qualitatively and quantitatively based on the availability of various types of food. They do not pursue the highest amount of production of one type of food while neglecting the amount of other types of food. The tradition of product quality dominates the farmers’ orientation more in fulfillment of their food sufficiency. This explains that the dryland paddy natural farming system actually does not contain plantation system, so that they do not know about profit and loss in preservation of the natural farming system, that the dryland system developed in Halmahera and Morotai do not follow plantation method. Therefore, there is no profit and loss in undertaking dryland paddy natural farming [23].

The value tradition formed from farmers’ orientation emphasizes more on quality per type and quantity of various types in fulfillment of the need for food sufficiency and forms a tradition pattern in supplying self-input. The economic tradition includes both economic in maximizing internal input and economic in minimizing external input. This may be proven with the farmers’ description that, in fulfilling the need for input, they emphasize on how to make it available from the harvest from their own land. For example, when a farmer fails to make seed/seedling input by himself, the other farmers may help him by lending their seeds/seedlings (misibau). The farmers are skilled in producing qualified local variety seeds. Their skill in observing qualified seeds/seedlings from growth to harvest are honed from generation to generation.
A question arises whether farmers do not gain real income from their farming, how could natural farming system be sustainable with economic dimension? It is because, theoretically, one of the economic indicators is to generate profitable income. In fact, however, natural farming system is always preserved from the time of the farmers’ ancestor until now and not commercialized. This means that the sustainability criteria in securing the sustainability of system from farmers of ancient time until now are not sold for cash. Bearing natural characteristic means that farmers do not necessarily spend money to maintain their agricultural land as capital intensive input. The farmers do not lack of food and do not show any symptoms of starving, and they qualitatively produce natural food products which current generation would obtain, globally or nationally, at a high price unaffordable for people with low income. On the other hand, farmers of natural farming have other needs beside food, like the need for clothing and shelter as well as for education and decent life in the globalization era which is full of needs of high value.

To fulfill the other needs beside rice, the farmers of dryland paddy natural farming have other sources of income to fulfill their needs from previous generations until now. The other sources of income are from annual plants and seasonal plants beside dryland paddy. They develop annual plants such as nutmeg, coconut, clove, cocoa and seasonal plants such as second crops, vegetables, spices and fruits. In addition, they also have income from animal husbandry and fishery. This way, natural farming system directly produces dryland rice and indirectly produces various sources of food and source of real income. Therefore, the productivity of natural farming system which is claimed low ergonomically and economically is not a constraint in sustainable preservation.

It is to ensure whether there is any attribute identified in preserving dryland paddy natural farming system which needs to be concerned about to maintain it or if serious effort is needed to improve economically. This is based on which attribute needs to be conducted so that here will be no drama of getting replaced by agricultural globalization technology. It is to view sensitivity analysis (leverage) of each parameter of economic dimension with the 14 attributes, namely: 1. The productivity of dryland paddy is deemed relatively high in case local variety manyan is used, 2. The productivity of dryland paddy differs for each type of local variety, 3. The productivity of dryland paddy in the last 5 years ranges between 2-4 ton/hectare, 4. The food production of dryland paddy farmers’ household is derived from various types of crops they plan such as cassava, sweet potato, banana, taro, etc., 5. The dryland paddy natural farming is not the only source of food production of farmers’ household, 6. Farmers’ income is derived from plantation crops like cocoa, nutmeg, clove, coconut, etc., 7. Farmers’ income is from other crops farming, such as corn, banana, cassava, sweet potato, sago, etc., 8. Farmers’ income is not from the product of dryland paddy natural farming system, 9. Paddy cultivation stages are performed by manpower in the family, 10. Farmers have various types of local seeds such as manyan, goro-goro, siaang, bule, etc., 11. Farmers use seeds derived from their own harvest, 12. The availability of other sources of food such as cassava, sweet potato, banana, sago, etc. adds to the need for food beside rice, 13. The habit of consuming various types of food available fulfills their daily need for food, 14. Farmers consider it sufficient with their natural rice from their own harvest. The number of parameters reflects the indicators of economic dimension to determine which parameter influences the sustainability the most? This may be observed in detail in figure 4.
Based on figure 2 above, we may observe that the 14 attributes highly determine or influence the sustainability of dryland paddy natural farming system by descending order of value to be achieved. The one with the highest value should be maintained and preserved, while the one with the lowest value should be improved with skill and expertise so as to preserve it holistically. The four highest orders of the result of sensitivity analysis of sustainability index of economic dimension are: I. Dryland paddy natural farming system is not the only source of food production of farmers’ household, II. Farmers’ income is derived from other food crops farming, such as corn, banana, cassava, sweet potato, etc., III. Paddy cultivation stages are performed by manpower in the family, IV. Farmers use local seeds derived from their harvest. These prove that the productivity of dryland paddy is low and significantly deemed to fulfill their need for rice which is only derived from their own harvest since they do not only produce rice as the source of food. Their sources of income are from selling their other crops.

Dryland paddy natural farming system is not commercialized, but remains preserved and significantly proven as economically sustainable, which is also influenced by farmers’ habit in maximizing their own inputs of seeds, manpower and agricultural land. However, they should always improve their source of food production per farmer’s household, which is not derived only from dryland paddy, but from other crops which may be taken as source of food. Farmers’ income is derived from other food crops farming, such as corn, banana, sweet, cassava, potato, sago, etc. In line with previous indicators, the natural farming system may still be used for other food crops. We may conclude that in the effort to improve the sustainability status of economic dimension, it is necessary to pay attention to and consider the three indicators. This is shown by the leverage value of the attributes which is higher than that of the other attributes. This change to the indicator of leverage factor will easily lead to raising or lowering the sustainability index value of economic dimension. The attributes need to be improved well so that the sustainability index value of economic dimension will enhance in the future.

3.2. Environmental Dimension

The results of MDS analysis for the sustainability status of environmental dimension may be observed in Figure 3.
Based on figure 3, it is found that the sustainability index of environmental dimension is 74.55. This index value ranges from 60.01 – 80.00, which means that this dimension is sustainable. It may be explained that the status of natural farming system is of sustainable category from the perspective of environmental dimension. Field facts show environmentally friendly agricultural practices, as may be viewed from the agricultural system principles developed until now from generation to generation, but need to be proven scientifically with a research. The analysis results show that natural farming system is an ecological agricultural system which is truly environmentally friendly. From the parameters observed, the very influential one is that the land is near river, so that the farmers describe that the groundwater in their farm land within the last 5 years is still good, which also influences the land fertility. This also influences the farmers’ behavior not to use fertilizer of any kind since the land is considered quite fertile to ensure the availability of nutrients for plant’s life cycle. In detail, we may observe which parameter reflects a high achievement in the result of sensitivity analysis. The sensitivity (leverage) of each attribute of environmental dimension is presented in figure 4.

Figure 3. Sustainability index of environmental dimension of dryland paddy natural farming system (Source: processed data, 2019)

Figure 4. Result of sensitivity analysis (leverage) of each attribute of environmental dimension
Based on figure 4, we may observe that the attribute which highly determines or influences the sustainability of environmental dimension is 1) groundwater quality (KAT) indicator, in which the quality of groundwater in the land where dryland paddy is planted is still good in the last 5 years and the quality of groundwater condition is viewed from how well dryland paddy grows with the natural farming. In natural farming system, water and soil quality is an important factor of plant health and quality, and the water source for the plants can so far fulfills the need for water. The soil used to plant dryland paddy has good nutrient content/soil fertility (KST) in the last 5 years. The natural farming system may, with nutrient content/soil fertility as the determinant of plant sustainability, anticipate the fundamental nutrient element factor. With regard to the indicator of non-utilization of fertilizer/pesticide/herbicide per land unit (PPH), the farmers do not use fertilizer of any kind. The natural farming system in this case does not use fertilizer of any kind, either chemical or organic. It may be concluded that, in effort to improve the sustainability status of environmental dimension, it is necessary to pay attention to and consider the two indicators. Basically, the leverage value of the attributes is higher than that of the other attribute. Any change to this leverage factor will easily lead to raising or lowering the sustainability index value of environmental dimension. The attributes need to be improved so that the sustainability index value of environmental dimension will improve in the future.

3.3. Socio-Cultural Dimension

In any agricultural system, anywhere, it is currently very difficult to find and prove the sustainability of socio-cultural dimension. The agricultural globalization phenomena are closely related to high valued fulfillment of need factors which unconsciously sets aside the socio-cultural dimension as farmers’ friendly, simple and personally good character in their farming activities. The socio-cultural dimension is world farmers’ character ever since they develop agricultural system which is, however, set aside by agricultural globalization. A socio-cultural dimension which describes friendly, simple and personally good agricultural system which is not set aside by agricultural technology globalization, which tends to be capital intensive so that farmers tend to pursue maximum benefit, is expectedly fulfilled. The friendly, simple and personally good characters of the socio-cultural dimension are reflected in farmers’ farming behaviors. Basically, farmers of natural farming system have friendly and personally good socio-cultural character. Can it be scientifically proven that natural farming system is also sustainable from the perspective of socio-cultural aspect? The results of MDS analysis for the sustainability status of socio-cultural dimension may be observed in Figure 5.

![Figure 5. Sustainability index of socio-cultural dimension of dryland paddy natural farming system (Source: processed data, 2019).](image-url)
Figure 5 proves that the sustainability index of socio-cultural dimension is up to 68.55. This index value ranges from 60.01 – 80.00, which means that this dimension is sustainable. This means that the status of natural farming system is of sustainable category from the perspective of socio-cultural dimension. The sensitivity (leverage) of each attribute of the dimension is shown in Figure 6.

![Figure 6. Result of sensitivity analysis (leverage) of each attribute of socio-cultural dimension](image)

Figure 6 shows that the attributes to determine or influence the sustainability of socio-cultural dimension are 1) Equity in fulfilling the need for food (KPK) indicator, in which natural farming system is able to fulfill farmer household’s need for rice and natural farming system serves to be a solution to expensive and unaffordable qualified rice. Dryland paddy natural farming system is able to fulfill people’s need for food and serves to be an alternative for the society when rice’s price elevates. The quality of harvest from dryland paddy natural farming system is good and not inferior to expensive rice. 2) Mutual aid cultural personality (KGR) indicator, consisting of bari system or mutual aid, keeping dryland paddy natural farming system preserved and mutually assisting in performing others’ work and bari system or mutual aid keeps dryland paddy natural farming system preserved. Benefit sharing system in the community is a tradition conducted from generation to generation. Besides, the mutual aid tradition is still commonly performed in the community, so that they help perform others’ work. We may conclude that this attribute shows good contribution to the sustainability status of natural farming system from sociocultural perspective. 3) Joint harvest and profit sharing wisdom (KPB) indicator, which is sharing good deed in strengthening of life as a hereditary wisdom. A farmer who is going to harvest his crops will engage his neighbors, relatives and family who do not have dryland paddy field to participate in the harvest. Such is which is a hereditary wisdom socio-culturally agreed on in joy and simplicity, giving a portion of harvest to those who help harvest to gain the benefit together as an expression of gratitude. The socio-cultural wisdom has unconsciously shaped farmers’ conscience to be responsible for their relatives’
need for food. Each man in the world is responsible for others’ need for food. This is actually reflected in the practice of dryland paddy natural farming system farmers’ socio-cultural principles in Morotai Island border area [24].

We may conclude that, in effort to improve the sustainability status of socio-cultural dimension, it is necessary to pay attention to and consider the indicators. Basically, the leverage value of the attributes is higher than that of the other attribute. Any change to this leverage factor will lead to raising or lowering the sustainability index value of socio-cultural dimension. The attributes need to be well improved so that the sustainability index value of socio-cultural dimension will improve in the future.

The result of combined Rap-Farm ordination method of all dimensions related to the analysis on the dryland paddy natural farming system in the whole results and discussion shows that economic, environmental and socio-cultural dimensions are of sustainable category. The sustainability indexes of the multi-dimensions may be observed in figure 7.

![Figure 7. Result of Rap-Farm ordination of the sustainability index of multi-dimensions of dryland paddy natural farming system](image)

From figure 7, we may conclude that the sustainability analysis result in sustainability index of dryland paddy natural farming system for all attributes used to assess the sustainability is divided into three dimensions: economic, environmental and socio-cultural. The analysis results in index value of economic dimension of 73.36% with sustainable status, that of environmental dimension of 74.55% with sustainable status and that of socio-cultural dimension of 68.55% with sustainable status. According to the analysis and discussion, the sustainability index of all dimensions of dryland paddy natural farming system is 72.15%, with sustainable category or status.

Furthermore, to view the error level of the analysis of Rap-Farm with MDS, a validity test is conducted with Monte Carlo analysis method with confidence level of 95%. The Monte Carlo analysis aims at showing the stability of the sustainability index value of the management of dryland paddy natural farming system, that Monte Carlo analysis is
conducted to examine the stability level of ordination, aiming at observing the perturbation level in all dimensions [25]. The result of Monte Carlo analysis related to dryland paddy natural farming system shows that there is no significant difference between the sustainability index value of the result of multi-dimension analysis (MDS) and of Monte Carlo analysis. This shows that the result of Rap-Farm analysis ordination is stable and has no perturbation, either with each dimension or with combined dimensions, which may explain the sustainability of dryland paddy natural farming system. Meanwhile, the differences between the sustainability index value of Rap-Farm analysis and of Monte Carlo analysis are presented in Table 3.

Table 3. Monte Carlo analysis for the stability of sustainability index value of dryland paddy natural farming system

| Dimension       | MDS (%) | MC (%) | Difference | |\(\text{MC-MDS}\) | % |
|-----------------|---------|--------|------------|-----------------|----------|
| Economic        | 73.36   | 73.42  | 0.06       | 0               |          |
| Environmental   | 74.55   | 74.40  | 0.15       | 0.00             |          |
| Socio-cultural  | 68.55   | 68.28  | 0.27       | 0.27             |          |

Source: Processed primary data, 2019

Table 3 explains the results of Monte Carlo analysis conducted at confidence level of 95%, which is then compared with the results of MDS analysis. In case the comparison result is low, it shows that the impact of scoring error is relatively low, the impact of various scorings on the attribute is relatively low, repeated assessment with MDS becomes stable, and data error or data loss becomes relatively low. Comparing the results of Monte Carlo (MC) analysis and of MDS analysis at confidence level 95% or error level 5% results in higher difference in value of the two analyses (\(\text{MC-MDS}>5\%\)) or lower (\(\text{MC-MDS}<5\%\)). In case the difference in value of the two analyses \(>5\%\), the result of MDS analysis does not sufficiently serve as an estimator of the sustainability index value, and if the difference in value of the two analyses \(<5\%\), the result of MDS analysis sufficiently estimates the sustainability index value [21]. The sustainability index of dryland paddy natural farming system shows that the mean difference of the two analyses is very low (0.176%). Similarly, the difference in value of the two analyses per dimension is \(<5\%\). This shows that MDS analysis model is sufficient to estimate the sustainability index value of dryland paddy natural farming system. This very low difference in value shows that the error in analysis process may be lowered or avoided.

The analysis on the 41 attributes of the three (economic, environmental and socio-cultural) dimensions results in 12 attributes which partially serve as leverage factor in each dimension. As leverage factor, the quality of some of the 13 attributes needs to be improved and that of the remaining needs to be maintained in managing dryland paddy natural farming system in Morotai Island border area, thus future sustainability index value will be better or stay as is with good preservation values. As leverage factor, these factors sensitively serve an important role in raising or lowering the sustainability index value of dryland paddy natural farming system.

The key factors of analysis are determined from the key factors which sensitively influence the performance of system resulted from sustainability analysis. The leverage analysis results in 12 sensitive factors (attributes), which are submitted to experts for assessment and prospective analysis. The further prospective analysis conducted on the 12 attributes is presented in Table 4.
Table 4. Leverage Factor

| Dimension/Leverage Factor | RMS  |
|--------------------------|------|
| Economic Dimension       |      |
| Dryland paddy natural farming is not the only source of food production of farmer household | 1.038 |
| Farmers’ income is derived from other crops farming such as corn, banana, cassava, sweet potato, sago, etc. | 0.933 |
| Plant cultivation stage is performed by manpower in the family | 0.894 |
| Farmers use local seeds from their own harvest | 0.873 |
| Environmental Dimension |      |
| Quality of groundwater in the land where dryland paddy is planted is still good in the last 5 years | 1.488 |
| Land where dryland paddy is planted has good quality of nutrient content/fertility in the last 5 years | 1.348 |
| Quality of groundwater condition from the perspective of how well dryland paddy grows with natural farming | 1.14 |
| Farmers do not use any fertilizer | 1.085 |
| Socio-Cultural Dimension |      |
| Natural farming system is able to fulfill farmer household’s need for rice | 1.469 |
| Bari system or mutual aid keeps dryland paddy natural farming system preserved and lightens others’ work | 1.303 |
| Natural farming system serves as solution to expensive and unaffordable qualified rice | 1.275 |
| Joint harvest and benefit sharing wisdom means sharing good deed in strengthening life as a hereditary wisdom | 1.246 |

Table 4 explains the results of prospective analysis, which is division of attributes into 4 quadrants. In detail, the 4 quadrants are presented in figure 8.

Figure 8. Diagram of the results of prospective analysis of sustainability index of dryland paddy natural farming system
Description of figure 8.

Quadrant II (STAKES) contains factors with strong influence and dependency (leverage variables). Factors in this quadrant considered strong variable. Attributes identified in quadrant II are natural farming system is able to fulfill farmer household’s need for rice, quality of groundwater in the land where dryland paddy is planted is still good in the last 5 years, and bari system or mutual aid keeps dryland paddy natural farming system preserved and lightens others’ work.

Quadrant III (OUTPUT) contains factors with low influence but with high dependency. Attributes identified in quadrant III are land where dryland paddy is planted has good quality of nutrient content/fertility in the last 5 years, natural farming system serves as solution to expensive and unaffordable qualified rice, and joint harvest and benefit sharing wisdom means sharing good deeds and strengthening of life as hereditary wisdom.

Quadrant IV (UNUSED) contains factors with low influence and dependency. Attributes identified in quadrant IV are farmers do not use fertilizer of any kind, plant cultivation stage is performed by manpower in the family, farmers’ income is derived from other crops farming, and dryland paddy natural farming is not the only source of food production of farmer household.

Conclusion
Reality different previous researches find and describe that in case an agricultural system is sustainable from the perspective of economic dimension, on the other hand, it is difficult to find one sustainable from the perspective of socio-cultural dimension and, particularly, of environmental dimension, since agricultural lands are generally contaminated by negative externality of green revolution technology. Therefore, the dryland paddy natural farming system in Morotai Island border area is a reality exists sustainable and holistic which economically dimension, socio-cultural dimension and environmental dimension.

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