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## Research Article

# Sustainable Urban Farming Development in Kendari Southeast Sulawesi, Indonesia

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## Abstract

**Background and Objective:** The urban farming program, an activity utilizing unproductive open spaces, vacant and residual land specifically, becomes an alternative activity for urban community whereby this program could improve the quality and quantity of open spaces in urban areas. In accordance with the program's purpose, the study aims to discover and improve the sustainability index of urban farming development expanded in the suburbs of Kendari. **Materials and Methods:** The selected location was in the suburbs of Kendari which have potential as urban agriculture areas, such as Abeli District, Gunung Jati District, Puuwatu District and Baruga District. The determination of variables in each sustainable urban farming dimension was based on the result of FGD and stakeholders. **Results:** The results showed that the average index of sustainable urban farming in Kendari was in a bad category. To achieve the sustainable urban farming, there should be an improvement in some sensitive attributes which can be seen as follows: ecological dimension, economic dimension, social dimension, institutional dimension and technological dimension. **Conclusion:** The development of urban farming in Kendari has not been sustainable yet since each dimension is still less than 50%.

**Key words:** Sustainable, urban farming, urban community, irrigation, agricultural

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**Competing Interest:** The authors have declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

The main problem in urban Agriculture development is the usability of the urban agriculture area. Generally, urban agriculture always undergoes the pressure of development expansion in both social and economic infrastructure. On the other hand, the increasing number of population growth each year has led to the increase of settlements and housing demand as well. The enhancement of social and economic infrastructure development and also high population growth engender the value of land or land rent in urban areas experiencing a significant increase, whereas the increase of land rent value has a potential to convert the agriculture sectors to non-agriculture sectors. Other reasons could also be the trigger, such as low agricultural productivity, low production prices and the increasing needs in service sectors, especially in hotel and restaurant development whereby both service sectors represent the identity of economic development.

The conversion function of agriculture areas could extend the level of cronyism, in this case losing the job. These have been experienced by many people, especially the agricultural community, which leads it to the increasing of urban poverty<sup>1,2</sup>. Therefore, there should be a policy providing areas for urban society to improve their living standard and welfare. The development of agriculture in the city, known as urban farming, could be one of the solutions in reducing the high poverty rate in the city. Apart from this, urban farming is defined as farming business in which the process and distribution are from various food commodities, including vegetable and stockbreeding coming from local or county side of town. In short, urban farming is an activity that includes agriculture, fishery and stock breeding by utilizing unused land or vacant land.

Urban farming is a specific program which increases the improvement of living standard of the poor who are engaged in the urban agriculture sector. The claim is in line with Gill *et al.*<sup>3</sup>, stating that in urban farming development, it is important to enforce the public land use to encourage commercial and productive land while overcoming the social and environmental problems. According to Tadesse *et al.*<sup>4</sup>, that urban agriculture is fateful in order to strengthen the food security in the city. It is believed that the development of urban farming activities could lessen the number of poverty rate in Kendari, while the economic life of the community will also experience a significant increase. Moreover, the activity is also one of the Government's policies implementation which aim to respond the actual issues influencing the community, such as poverty, the environment and agriculture.

In addition, the improvement of the agricultural sector includes the use of natural resources and the development of human resource skills. It is believed that in the future, the improvement of the agricultural sectors by using urban farming method would provide optimal benefits, especially for economic life and people's welfare improvement<sup>5-7</sup>. Further, the issue of improving the community welfare is always associated with the efforts of community to deal with poverty problems. These issues are often perceived as the living conditions of the people in the regions/rural areas<sup>8</sup>. Yet in reality, high levels of urbanization in the city have created groups of poor people due to unemployment matters. As a solution, the urban farming method could be used to support the government in alleviating poverty rates.

Based on this description, study aims to discover and improve the sustainability index of urban farming development expanded and integrated with ecological dimension in Kendari.

## MATERIALS AND METHODS

The location of this study was conducted in three villages in Kendari, namely Gunung Jati Village, Tondonggeu Village, Baruga Village and Watulondo Village from July-December, 2018. The selection of research location was based on the consideration of whether or not those villages still have vacant land for urban farming development. The research was conducted in two years with several phases, as presented in Fig. 1. Meanwhile, the data sources, parameters/variables, analysis models and outputs are described in Table 1.

**Data collecting method:** The data collecting method used in the study was a field survey, interview and focus group discussion, as explained as follows:

- The survey method was used to analyze the environmental condition and urban farming activities carried out by the community in Kendari
- The interview method was conducted using questionnaires. This method aims to discover community's problems and needs in implementing urban farming
- Focus group discussion (FGD) was used to discover stakeholders needs, the problems, hopes and opinions related to the problem of urban farming implementation, as well as getting agreements in deciding the key indicators of implementation model of sustainable urban farming in supporting food security in Kendari

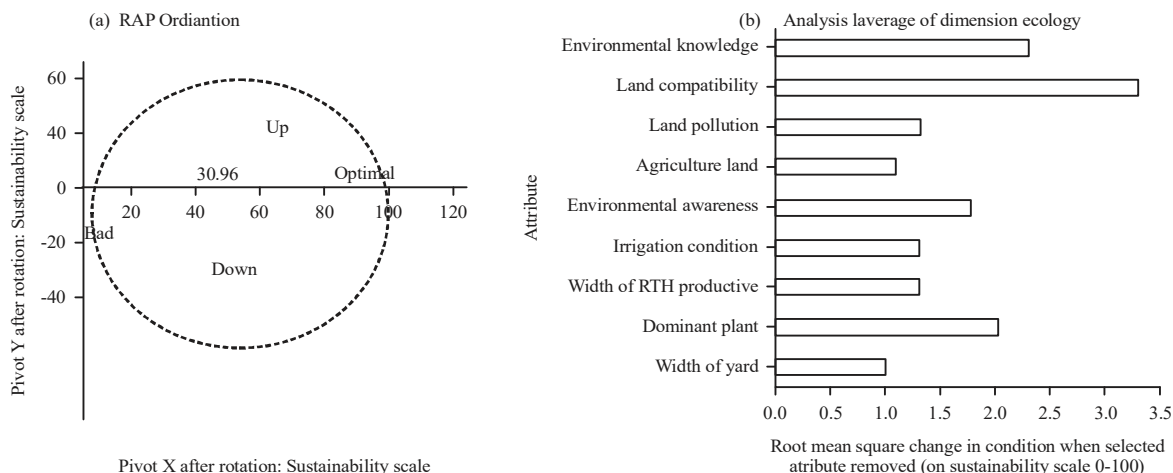


Fig. 1(a-b): (a) Sustainability index and (b) Influencing sustainability of urban farming development in Kendari Sensitive attributes of ecological dimension

Table 1: Objectives, data sources, parameters/variables, analysis models and outputs

Objectives	Data sources	Parameters/variables	Analysis models	Output
Mapping the potential and problems in urban farming implementation	Respondents/stakeholders	Supporting capacity in agricultural land	Spatial analysis	Maps and potential in urban farming application
	Field survey	The condition of farmers' social economy production cost, production prices	Descriptive	
Determine the index and status of the sustainability of the current urban farming implementation	Respondents/stakeholders	Dimension of sustainable development (social, economy, institution, environment and technology)	Descriptive	Indicators of farm sustainability Sustainability index value Current status of farm sustainability Current attributes
	Field survey	Sustainability indicators of each dimension	Matrix and tabulation	
	Literature study	values ranking of each attribute on each dimension	Ranking	
		Relative position of each indicator on the bad-good status	RAPFHIS MDS Leverage	

**Population and sample:** The population in the study was the community owning agricultural land and has the potential to implement sustainable urban farming. Meanwhile, purposive sampling has been used to determine the respondent of this study. The focus group discussion (FGD) participants consisted of various stakeholders of Kendari government, such as agricultural department, environmental department, Development Planning Agency at Sub-National Level, village Community Empowerment Agency, Land Agency, subdistrict head and urban village head.

**Sustainability index of urban farming in kendari:** The indicators of sustainable urban farming in Kendari could be used as the indicators of sustainable development, as stated by Rustiadi and Paliudju<sup>9</sup>. He said that the indicators of sustainable development could be categorized into 5 dimensions, namely; (1) Ecological dimension, (2) Economic dimension, (3) Social dimension, (4) Community dimension and (5) Technological dimension. Leverage and Monte Carlo analysis is used to determine the attributes that are sensitive influence on the sustainability index and status.

## RESULTS AND DISCUSSION

**Sustainability of ecological dimension:** The index analysis and sustainability status of urban farming development for ecological dimension in Kendari used eight attributes which might influence the ecological dimension sustainability. The attributes consist of (1) yard, (2) dominant plants, (3) Open Space Green (OSG) productivity, (4) irrigation condition, (5) environmental awareness, (6) conversion of agricultural land, (7) pollution of areas, (8) an appropriate land and (9) environmental knowledge. This is in accordance with the statement Muscalu *et al.*<sup>10</sup>, that sustainable development deals with the concept of quality of life in complexity, economically, socially and environmentally, promoting the idea of balance between economic development, social equity, efficiency and environmental conservation. The result of sustainability analysis of resource management area can be seen in Fig. 1a whereby the sustainability index value in ecological dimension reached 30.09% or in the less-sustainable category. Based on the result of leverage analysis in ecological dimension of nine analyzed attributes (Fig. 1b), there are four sensitive attributes

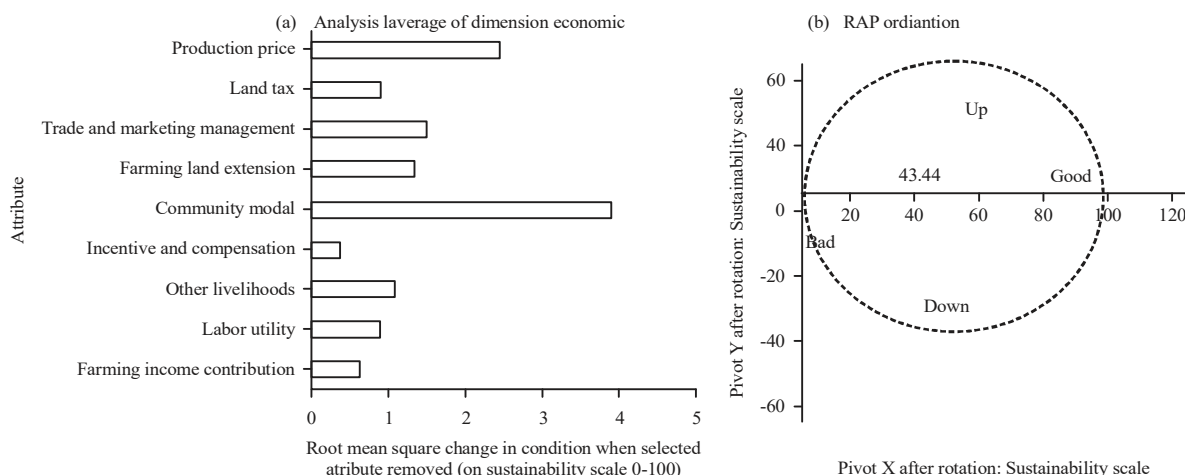


Fig.2(a-b): (a) Sustainability index and (b) Sensitive attribute of economic dimension affecting the sustainability of urban farming development in Kendari

influencing the urban farming development in Kendari, namely; (1) conversion of agricultural area, (2) irrigation condition, (3) environmental awareness, (4) types of plants.

The four sensitive attributes affecting ecological sustainability also have a close relationship with the rest attributes. Further, the conversion of agricultural land is a phenomenon in an urban area which has high population growth rates in which it leads to high demands for shelter. The conversion of agricultural areas into settlement areas, specifically the need for housing development, construction of social facilities and infrastructure (roads and offices), could reduce land productivity due to forced eviction.

Likewise, one of the obstacles in urban farming development in Kendari is the condition of irrigation. It is known that the need for clean water as a fulfillment of life necessities in urban areas is immensely high. In fact, it also uses for the irrigation of urban farming development system in Kendari. It could be said that people's awareness of the environment also has declined.

The change of land function from agriculture to another function could be a sign of a reduction in people's environmental awareness. In other words, the urban farming system in Kendari might be no longer used as its function. In this case, instead of developing type of plants oriented with urban farming productivity, they prefer to develop ornamental plants and protective plants (mango and woods) in their yard. Thus, there should be an improvement and well management on four sensitive attributes in order to increase the index values of this dimension in the future.

**Sustainability of economic dimension:** The index analysis and sustainability status of economic dimension in urban farming development in Kendari used nine attributes, namely; (1) Contribution of farm income (2) Labour absorption, (3) Other sources of income, (4) Incentives, (5) The asset of farmer group, (6) Expansion of farming area, (7) Trade and marketing system, (8) Land tax, (9) Production price. Based on the leverage analysis result of the ecological dimension of nine analyzed attributes (Fig. 2a). There are five sensitive attributes influencing the urban farming development in Kendari, namely; (1) Incentives/compensation, (2) Contribution of farm income to total income, (3) Labour absorption, (4) The increasing of income from other sources, (5) High tax for land. Those 5 sensitive attributes that affect economic sustainability have been related one and another.

The analysis result of the sustainability of urban farming development in Kendari could be seen in Fig. 2b, with the sustainability index value for economic dimension reached 43.44% or in the less sustainable category.

The farm profit or income could be identified by discovering the difference between input and output of the production. The farm inputs can be seen by multiplying the output of production with the selling price. The farm profit depends on-farm production and farm product prices. The farm production is highly depended on the availability of facilities and production inputs. Thus, these sensitive attributes should have well management and recognition in order to increase the index values of this dimension in the

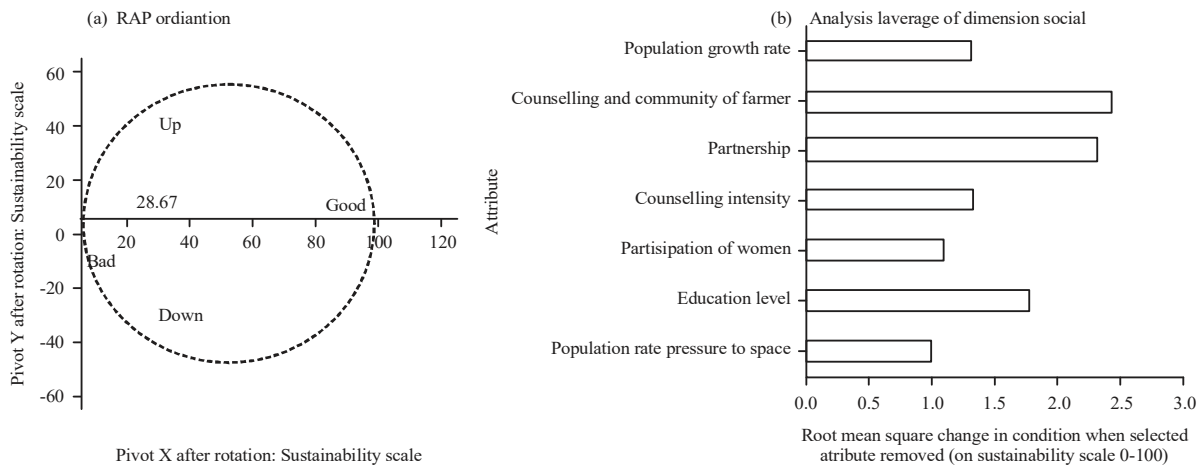


Fig. 3(a-b): Sustainability index, (a) Affecting the sustainability of urban farming development in Kendari and (b) Sensitive attributes of social dimension

future. Therefore, this in turn could elevate the economic sustainability. It is in line with the statement of Lindahl *et al.*<sup>11</sup> that the urban farming development is an opportunity to increase the livelihood of farmers.

**Sustainability of the social dimension:** The index analysis and the sustainability status of the social dimension in urban farming development in Kendari from seven attributes, it only gave a sustainability index around 28.67% (Fig. 3a). Those seven attributes could be seen as follows; (1) The rate of population growth, (2) Counseling and agricultural institution, (3) The collaboration of stakeholders with related sectors, (4) Intensity of agricultural counseling, (5) The level of mother's participation, (6) Level of education and mother's skill and (7) Population pressure on space.

Based on Fig. 3b, it appears that one of the sensitive factors of social dimension affecting urban farming development in Kendari was the population pressure on areas whereby the increasing number of population growth could affect the settlement and housing demand. The increasing number of population growth in Kendari was caused by several factors, including high birth rates and migration from village to Kendari as a consequence as the capital of Southeast Sulawesi. Another factor was the low level of mother's participation in the yard utilization for urban farming development in Kendari. Commonly, the yard is only used for ornamental plants. This condition, definitely, could be happened since the agricultural counselor and institution did not do their role in urban farming development system. By seeing those phenomena, it could be predicted that there

would be food security reduction inasmuch island resources were no longer used for urban farming development which supports food security in Kendari.

**Sustainability of institutional dimension:** The index analysis and sustainability status of institutional dimension in urban farming development in Kendari used 11 attributes to conduct a sustainability analysis with an index at approximately 32.21% (Fig. 4a). Institutional aspect in urban farming development is an important variable in promoting urban farming development<sup>12</sup>. These 11 attributes are predicted as the most influential attributes on the sustainability of Institutional dimension. These attributes consist of (1) Market guarantees by the government, (2) Authority to control and protect agricultural areas, (3) Strengthening farmer institution, (4) An advocate for protected agricultural land, (5) Mother's agricultural organization, (6) Urban farming policy, (7) Agriculture counseling, (8) The existence of social institution, (9) The intensity of farmer group meetings, (10) Counseling institution and (11) Strengthening farmer institution.

Based on the data in Fig. 4b, the five sensitive factors of institutional dimension affecting on urban farming development could be elaborated as follows; firstly, farmer institution is weak in improving urban farming development. Secondly, none of the government policy supports the development of urban farming system. Thirdly, mother's participation did not get well management in urban farming development. Lastly, none of market guarantees by the government for urban farming production. Those

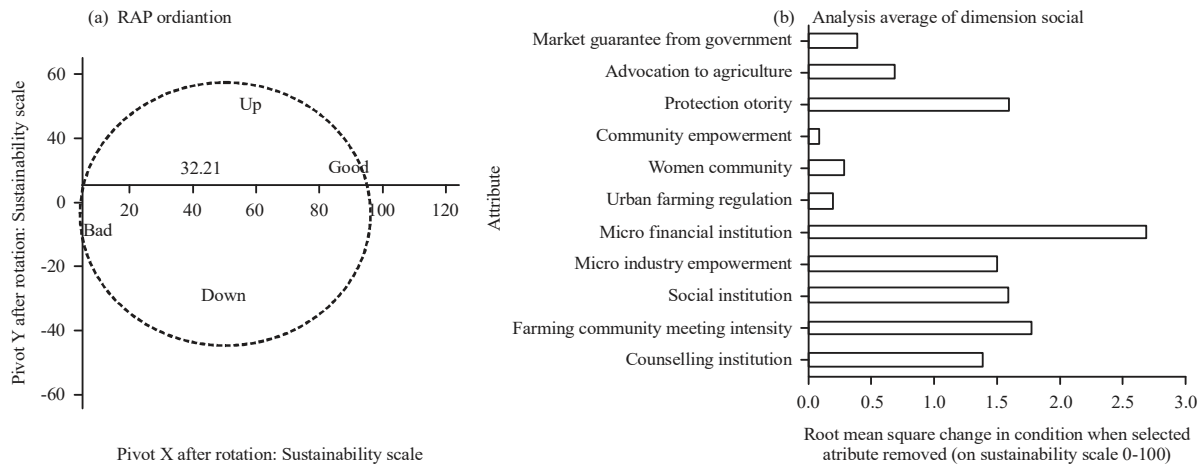


Fig. 4(a-b): Sustainability index, (a) Affecting the sustainability of urban farming development in Kendari and (b) Sensitive attributes of institutional dimension

5 sensitive factors could affect the sustainability in urban farming development. Therefore, improving food security through urban farming development engenders those five sensitive attributes as a major concern.

**Sustainability of technological dimension:** As one might expect, the technological dimension is driving growth on urban farming development. The higher availability of technology, the easier it is for business development, including the development of urban farming system. Moreover, there are various attributes in technological dimension used for improving the development of urban farming system, such as green technology, technology in the application of urban farming cultivation, irrigation technology, agricultural information technology, the use of agricultural production facilities, the process of agricultural production and technology in pests and plant disease prevention (Fig. 5a). In accordance with the result of multi-dimensional scaling analysis, it showed that there were four sensitive factors of technological dimension affecting urban farming development in Kendari. In addition, it also showed that sustainability index only got 28.67% (Fig. 5b) as a result of lack of green technology uses, lack of cultivation technology practice, lack of irrigation technology and lack of the use of production facilities. Due to the weakness of four attributes, it affects the development of urban farming system and insufficiency food in Kendari. Accordingly, to provide adequacy of food in Kendari, the four attributes should be a major concern in urban farming development, so that the other areas do not have to be involved in the matters.

**Sustainability index of urban farming development in kendari:**

The sustainability of urban farming development in Kendari is multi-dimensional, for instance ecology, economy, social, community and technology. Based on analysis result and scoring of urban farming development policies in Kendari, it showed 30.09% for ecology, 43.44% for the economy, 28.67% for social, 32.21% for community and 28.67% for technology. What is more, the analysis result of sustainability level of 43 urban farming attributes consisted of 9 ecological attributes, 9 economic attributes, 7 social attributes, 11 community attributes and 7 technological attributes. Based on the result of MDS analysis Fig. 6, showed that the sustainability index average of urban farming development was still less than 50%. It indicates the sustainability status of urban farming development in Kendari is still less sustainable. This happens because it is not followed by greening after harvest or planting in a sustainable manner by utilizing organic matter from the surrounding community. According to Gaviglio *et al.*<sup>13</sup> reports, that for the present sample of farms, the constraints imposed by the greening have a significant effect on the sustainability of farms, but not on those that needed more improvements. In addition, farming activities as one of the side strategies for fulfill the needs of family life and its people have long live in the city. FAO<sup>14</sup> that there are many who are not from rural backgrounds, but who choose agriculture as one of their livelihood strategies and farming activities can be more easily combined with other jobs.

The results showed that index values and status partially sustainability of each dimension respectively technology and social dimensions of each 28.66% are less sustainable. While

Table 2: Stress (S) values and sustainability status R<sup>2</sup> of urban farming development in Kendari

Parameters	Sustainability dimension				
	Ecology	Economy	Social	Technology	Community
Stress (S)	0.1111625	0.136622	0.147722	0.121181	0.135563
R <sup>2</sup>	0.93886	0.9199234	0.928813	0.929911	0.938823

Source: Primary data, 2019, R<sup>2</sup>: Coefficient score of determination

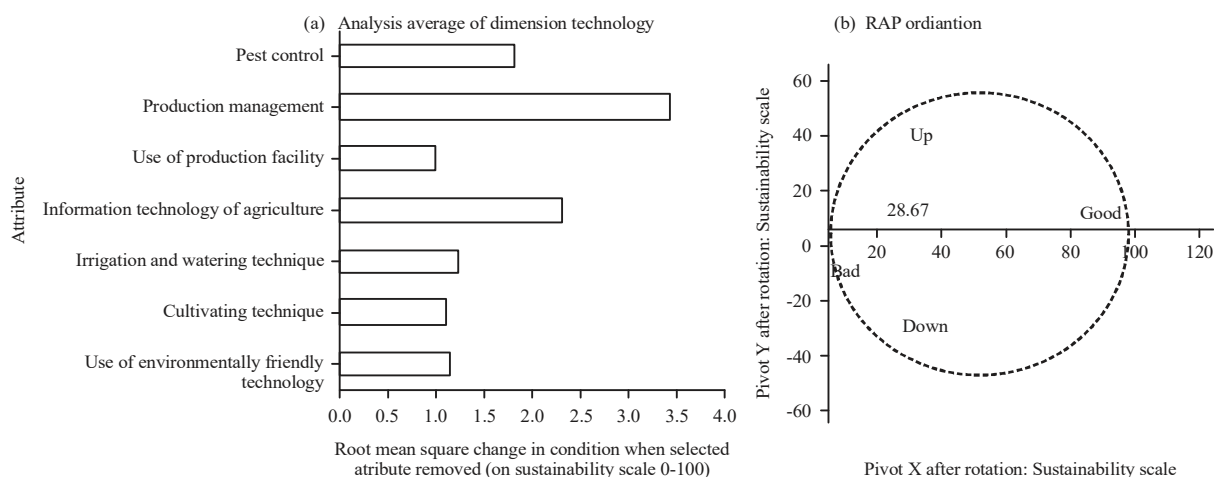


Fig. 5(a-b): (a) Sustainability index and (b) Sensitive attributes of technological dimension affecting the sustainability of urban farming development in Kendari

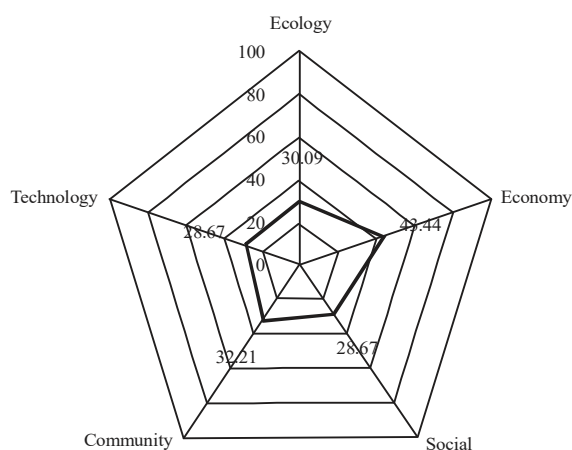


Fig. 6: Kite chart of sustainability index of urban farming in Kendari

the ecology, economic and community respectively 30.09, 43.44 and 32.21% are quite sustainable and it means less sustainable<sup>15</sup>.

The value of stress (S) generated in each dimension has a smaller value than the requirement (<0.25), by assuming that if the value is smaller than 0.25, it would be in good category. In contrast, the coefficient score of determination (R<sup>2</sup>) in each dimension is quite high. After all, both statistical parameters

showed that all the use of attributes in each dimension in the research were sufficient to explain the sustainability of urban farming development system in Kendari (Table 2).

The result showed that value of the correlations coefficient (R<sup>2</sup>) are between 0.91-0.93 and the value of stress (S) are between 0.11-0.14 and it indicates analysis the sustainability of the development of urban farming for each attribute is sufficiently accurate and reliable<sup>15</sup>.

### CONCLUSION

The development of urban farming in Kendari has not been sustainable yet since each dimension (social, economy, ecology, technology and community) is still less than 50%. The analysis showed that sustainability status could be improved from deficient to sufficient category by managing sensitive attributes affecting the sustainability of each dimension.

### SIGNIFICANCE STATEMENT

This study discovered the sustainability index of urban farming development expanded in the suburbs of Kendari. The main problem in urban agriculture development is the usability of the urban agriculture area. Generally, urban agriculture always undergoes the pressure of development



expansion in both social and economic infrastructure. On the other hand, the increasing number of population growth each year has led to the increase of settlements and housing demand as well. This study will help the researcher to uncover the main problem in urban agriculture development. Thus, a new theory that's the development of urban farming in Kendari has not been sustainable yet since each dimension and sustainability status could be improved from deficient to sufficient category by managing sensitive attributes affecting the sustainability of each dimension.

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