Sustainability Status of the SoBurbang Agropolitan Area in Bangkalan District Based on Multi-Dimensional Scaling (MDS)

Nor Qomariyah[1*] and *Mardiyah* Hayati[1]

[1]Agribusiness Study Program, Faculty of Agriculture, Trunojoyo University Madura

Abstract. Despite agriculture being the backbone of Indonesia's economy, rural poverty remains a significant challenge due to low productivity, limited market access, and unstable commodity prices. The agropolitan concept, which integrates the agricultural sector with other economic activities such as processing industry and tourism, is proposed as a solution to improve rural welfare. Designated as an Agropolitan Area since 2005, Bangkalan Regency is being developed to support food and horticultural commodities. This study employs Multidimensional Scaling (MDS) and Rapfish software to evaluate the sustainability of the region across environmental, economic, social, technological, infrastructural, and policy dimensions. The SoBurbang Agropolitan Area's development ranges from less than sustainable to quite sustainable, with a sustainability index of 41.45-57.58 percent. Environmental sustainability is hindered by high land conversion rates. Economically, despite market and technological opportunities, capital access remains challenging. Social and policy factors significantly influence sustainability, while technological and infrastructural aspects require further enhancement. This study underscores the need for integrated development strategies to boost the sustainability of agropolitan areas. The validated model, with a high accuracy level, serves as a foundation for future sustainable development strategies.

1 Introduction

Indonesia, an agricultural country with a significant rural population relying on agriculture, faces substantial challenges related to rural poverty. Even though the agricultural sector is the backbone of the economy in many regions, poverty levels in rural areas remain high. According to the Central Statistics Agency (BPS), as of March 2023, the poverty rate was 7.29 percent (11.74 million people) in urban areas, while in rural areas it was 12.22 percent (14.16 million people). Meanwhile in rural areas it is still 12.22 percent or 14.16 million people. These challenges arise due to low productivity, limited market access, and unstable commodity prices in the agricultural sector.

In an effort to overcome this problem, the agropolitan concept has been proposed as one solution. Experts have explored the origins of this concept [1,2] as well as the impact of this approach on the development of agricultural areas and land use that improves the environment. The agropolitan concept aims to develop rural areas holistically by integrating agriculture with other economic activities, creating independent, competitive, and sustainable areas. This approach adds value through processing industries, trade, and tourism.

The agropolitan concept, introduced by Mc. Douglas and Friedman, provides urban services in rural areas, referred to by Friedman as 'cities in the fields [3]. In this way, farmers or village residents do not need to go to the city to get services, both in services related to production and marketing issues and problems related to daily social and cultural needs. By looking at the concept, objectives and understanding of Agropolitan characteristics, the Agropolitan concept can be an effective key in overcoming the country's fundamental problems [4].

Based on the objectives, characteristics and development of Agropolitan policy in Indonesia, since 2005, Bangkalan Regency, including Socah District, Burneh District, and Bangkalan City District, has been designated as the SoBurbang Agropolitan Area, reflecting the objectives and characteristics of agropolitan policy in Indonesia. Then in 2020, BAPPEDA East Java targets again to become an Agropolitan area based on superior food and horticultural commodities. Agropolitan development areas require areas that already have superior agricultural commodities so that their use is more optimal. This area is considered to have great potential in the agricultural sector, especially food crop and horticultural products. The vision for the development of the SoBurBang Agropolitan area, Bangkalan Regency, which is contained in the master plan for the development of the SoBurbang Agropolitan Area, is to create an advanced, independent, quality and sustainable SoBurBang Agropolitan Area to realize community welfare through increased production and added value. The development of agropolitan areas in Bangkalan remains a focus, with initiatives such as the creation of

* Corresponding author: nor.qomariyah@trunojoyo.ac.id

a 5-hectare Bangkalan Farmer's Prosperous Garden (Bang Jani) in Burneh District, aimed at agro-industrial activities.

To ensure the sustainable development of the SoBurbang Agropolitan, an assessment of its current status is necessary. Given the minimal information on the sustainability of the SoBurbang Agropolitan Area across environmental, economic, social, technological & infrastructure, and policy aspects, this research aims to provide a comprehensive assessment of its sustainability. The findings will inform strategies for sustainable agropolitan development in Bangkalan Regency [5].

This research employs the Multidimensional Scaling (MDS) approach, utilizing Rapfish (Rapid Appraisal for Fisheries) software, to analyze data. The Rapfish method, developed by the University of British Columbia, Canada, was initially used to assess the sustainability status of fisheries [6,7]. All the obtained attributes are analyzed multidimensionally to establish two reference points: good and bad [8,9]. Key respondents in this study included representatives from Bappeda Bangkalan Regency, the Department of Agriculture Food Crops Horticulture Plantation, BPP Bangkalan District, and the Chairman of the Farmers and Gardens group Bang Jani. The attributes of each dimension are detailed in Table 1 below.

2 Materials and methods

Table 1. Attributes of sustainability of Soburbang's agropolitan development based on superior food crop and horticultural commodities.

No	Attribute	Category		Criteria
		Bad	Good	
A.	**Environment**			
1	Level of damage to cultivated land Food crop commodities andhorticulture	0	4	0=<3 percent (low), 1=3-5 percent (low), 2=5 10 percent (medium), 3=10-30 percent (fairly high), 4=>30 percent (very high)
2	The level of influence of climate on Productivity of food and horticultural crop commodities	0	4	0=no influence, 1=low influence 2=quite influential, 3=high influence 4=very high influence
3	Levels of Use of Chemical Fertilizers and Chemical Pesticides in the Cultivation of Food and Horticultural Crop Commodities	0	4	0=none (organic fertilizer), 1=<10 percent (low) 2=10-30 percent (medium), 3=30-50 percent (fairly high) 4=>50 percent (very high)
4	Level of land use change in the area Soburbang Agropolitan	0	4	0=no land use change, 1=<5 percent (low) 2=5-10 percent (medium), 3=10-30 percent (fair high), 4=>30 percent (very high), 4=>80 percent (high)
5	Land conservation activities in Agropolitan area Soburbang	4	0	0=<3 percent (low), 1=3-5 percent (low), 2=5-10 percent (medium), 3=10-30 percent (fairly high)
6	Level of suitability land for Mangosteen Plant	0	4	0=<10 percent (low), 1=10-30 percent (low) 2=30-50 percent (medium), 3=50-80 percent (quite high) 4=>80 percent (very high)
B.	**Economic Dimension**			
1	Availability of commodity and horticultural supplies for agro-industry	3	0	0=not available/none, 1=available in small/small quantities, 2=quite available, 3=abundant
2	Availabilityagro-industry market/horticultural processed MSMEs	3	0	0=not available, 1=available but difficult to access, 2=available and fairly easy to access, 3=available and very open
3	The influence of the use of current technology on the added value of Agroindustry products	3	0	0=no influence, 1=there is influence but small, 2=moderate influence 3=very influential
4	Access to capital for food crop entrepreneurs and	3	0	0 = no/not yet, 1 = available but somewhat complicated, 2 = available and quite easy to obtain available with various model schemes
5	Economic impact for public	3	0	0 = no/no impact yet, 1= there is an impact but very minimal, 2= there is an impact and it is quite extensive 3= there is an impact on all communities Around
C.	**Social Dimension**			

1	Population growth rate in the Agropolitan area and its surroundings	0	4	0=low<1 percent, 1=less 1-2 percent, 2=medium 2-5 percent 3=high 5-10 percent 4=very high
2	Conflicts that occur in land use in the Soburbang agropolitan area	0	4	0=none 0 percent, 1=low 1-3 percent, 2=medium 3-5 percent, 3=high 5-10 percent, 4=very high >10 percent
3	Local labor absorption rate	4	0	0=low 0-3 percent, 1=low 3-5 percent, 2=fair 5-10 percent, 3=high 10-30 percent, 4=Very high >30 percent
4	Level of influence of agropolitan area development on access Education andhealth	4	0	0=low 0-3 percent, 1=low 3-5 percent, 2=fair 5-10 percent, 3=high 10-30 percent, 4=Very high >30 percent
5	The level of community participation towards Area Development Agropolitan	4	0	0=low 0-3 percent, 1=low 3-5 percent, 2=fair 5-10 percent, 3=high 10-30 percent, 4=Very high >30 percent
6	Level of influence of agropolitan area development on social culture (order life)	0	4	0=no influence, 1=low influence<5 percent, 2=medium influence 5-10 percent, 3=high influence10-30 percent, 4=very high influence
D.	**Technology and Infrastructure Dimensions**			
1	Condition of road infrastructure and other means	4	0	0=poor (>50 percent damaged), 1=poor (30-50 percent damaged) 2=fair (10-30 percent damaged) 3=fairly good (5 10 percent damaged) 4=good (<5 percent damaged)
2	Level Technologist applications in development Agropolitan	4	0	0=poor (no application), 1=poor (1-5 percent application), 2=medium (5-10 percent application), 3=fair (10-30 percent application) 4=good (<30 percent application)
3	Technology availability appropriate (TTG) production (processing) for agro-industry/MSMEs based Food crops andhorticulture			0=poor (no TTG), 1=poor (1-5 percent TTG) 2=moderate (5-10 percent TTG) 3=fairly good (10-30 percent TTG) 4=good (<30 percent TTG)
4	Ease of public access area on production technology	3	0	0=poor (no access), 1=difficult to access), 2=medium (fairly easy to access), 3=good (very Easy to access)
E.	**Policy Dimensions**			
1	Realization target (roadmap) for the development of agropolitan areas	4	0	0=poor (achievement <5 percent), 1=poor (achievement 5-10 percent), 2=medium (achievement 10-30 percent), 3=good (achievement 30-50 percent) 4=very good (achievement >50 percent)
2	Availability of a legal umbrella in the management and development of agropolitan areas	3	0	0=poor (no PH), 1=poor (present but not effective), 2=moderate (present and quite effective), 3=good (present and very effective)
3	Availability of strategic policies at district/provincial and central levels	3	0	0=poor (no policy), 1=poor (exist but not effective), 2=medium (exist and quite effective) 3=good (exist and very effective)
4	Price setting policy for food and horticultural crop commodities that supports the development of agro-industry/UMKM-based areas	3	0	0=poor (no policy), 1=poor (exist but not effective), 2=medium (exist and quite effective) 3=good (exist and very effective)
5	Availability and existence of institutions at the farmer level (Poktan)	3	0	0=poor (no institution), 1=poor (exist but not effective), 2=medium (exist and quite effective) 3=good (exist and very effective)
6	Availability of institutions and supporting facilities based on agropolitan areas Agro-industry at District/Provincial Level	3	0	0=poor (no institution), 1=poor (exist but not effective), 2=medium (exist and quite effective) 3=good (exist and very effective)

The sustainability status of the SoBurbang Agropolitan Area, assessed using the Rapfish method, ranges between 0-100. The sustainability status intervals for the SoBurbang Agropolitan Area are divided into four categories: 0-25 (Not Sustainable), 26-50 (Less Sustainable), 51-75 (Quite Sustainable), and 76-100 (Sustainable) [10]. MDS sustainability categories are presented in Table 2.

3 Results and discussions

The sustainability status of the development of the SoBurbang Agropolitan Area in Bangkalan Regency is divided into five dimensions, namely the sustainability of the environmental, economic, social, technological & infrastructure and policy dimensions. These five dimensions are divided into several attributes which will later be used as determinants of the sustainability of the development of agropolitan areas in a region. The development of sustainable Agropolitan areas is a driver of rural development in the context of sustainable development, which is a development concept that has

now become mainstream world development in general and including Indonesia [13].

Table 2. MDS sustainability analysis index interval.

No.	Index Interval	Sustainability Status	Explanation
1	0-25	Not Sustainable	In a very poor condition and does not support long-term sustainability.
2	26-50	Less Sustainable	The system or activity has some aspects that support sustainability, but many still require improvement.
3	51-75	Quite sustainable	The system or activity demonstrates several positive aspects of sustainability, although there is room for further improvement.
4	76-100	Sustainable (Continuous)	The system or activity is in excellent condition and optimally supports long-term sustainability.

Source: [11], [12].

Table 3 presents the results of the sustainability analysis for the development of the SoBurbang Agropolitan Area based on five key dimensions: environment, economy, social, technology & infrastructure, and policy. The sustainability index in the table is measured in percentages, indicating the extent to which sustainability has been achieved in each aspect. In addition, the table includes the Monte Carlo values to validate the analysis results, R^2 values to assess the model's accuracy, and stress values that reflect the degree of uncertainty within the model.

The results indicate that, based on the data in the table, the sustainability categories are assessed by classifying the index results into "Less Sustainable" and "Moderately Sustainable" categories. The social and policy dimensions fall under the "Moderately Sustainable" category, with sustainability index scores of 53.06 percent and 57.57 percent, respectively. Meanwhile, the environmental, economic, and technology & infrastructure dimensions are categorized as "Less Sustainable," with sustainability index scores ranging from 41.44 percent to 49.84 percent.

The results show that the sustainability of the development of the Soburbang Agropolitan Area, Bangkalan Regency in all dimensions, namely environmental, economic, social, technological & infrastructure and policy dimensions are all categorized as less than sustainable and quite sustainable with sustainability index values ranging from 41.45-57.58 percent. These results are acceptable considering that the validation test results show that the difference between the Monte Carlo value and the sustainability index (ordination value) is around 0.01-0.43 percent or less than 1 percent. [14] states that the difference between the Monte Carlo value and the ordination value is a maximum of 5 percent. This value shows that the influence of error, or the impact of scoring errors is relatively very small. Thus, the Rapfish model developed is declared adequate as an estimate of the sustainability index value. The output R^2 value obtained ranges from 92.03-94.48 percent, which shows that this value is quite high, namely greater than 80 percent. The Squared Correlation (R^2) value of more than 80 percent indicates that the sustainability index estimation model is good and accurate to use. The output in the form of stress values from the five aspects studied was obtained ranging from 16.95-17.7 percent, which shows that the non-conformity criteria are in the quite appropriate category. The stress value that can be tolerated is less than 20 percent. Based on the three output/analysis results validation criteria, it can be concluded that the resulting model is valid and adequate to use as an estimator. The difference between the Monte Carlo value and the sustainability value for all aspects of the study is <5 percent. Likewise, the R^2 values all reach >80 percent, and the stress values are <20 percent. However, the stress value for technology and infrastructure is relatively high at 18 percent, indicating potential uncertainty that must be considered in further decision-making.

Table 3. Sustainability analysis results of the soburbang agropolitan area based on five dimensions.

Aspects/Dimensions	Index Sustainability (percent)	Monte Value Carlo (percent)	R^2 value	Mark Stress (percent)	Sustainability Category
Environment	49,846	50,284	0.945	15,295	Less Continuous
Economy	46,707	46,698	0.938	17,720	Less Continuous
Social	53,058	53,130	0.940	16,491	Quite Sustainable
Technology & Infrastructure	41,449	41,068	0.920	18,420	Less Continuous
Policy	57,577	57,346	0.938	16,949	Quite Sustainable

Source: Processed data, 2023.

3.1 Environmental sustainability

Environmental sustainability is a description of the level of management sustainability related to environmental (ecological) aspects in the development of the Bangkalan Agropolitan Area. The environmental

dimension consists of; 6 (six) study attributes, including; a) environmental conditions, b) level of land damage, c) level of climate influence on productivity, d) level of use of chemical fertilizers, e) level of land conversion in the Bangkalan agropolitan area, f) land conservation activities in the Bangkalan agropolitan area. The ecological sustainability ordination graph is shown in Figure 1.

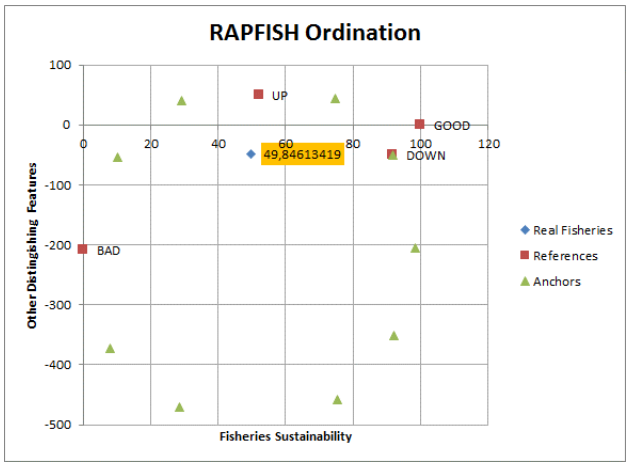

Fig. 1. Environmental sustainability coordination graph.

The results of the analysis for environmental (ecological) dimension sustainability obtained an ordination value of 49.84 percent or categorized as less than sustainable. This can happen because there is no well-integrated environmental management concept. The goodness of fit test results also show that the sustainability index estimation model can be used, where the Squared Correlation (R^2) value is 0.945 or close to 1. This value illustrates that more than 94.5 percent of the model can be explained well. The remaining 5.5 percent is explained by other attributes [8].

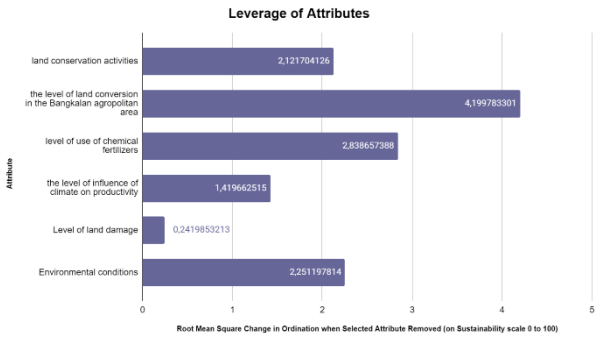

Fig. 2. Graph of leverage of environmental sustainability attributes.

Based on the attributes that have been determined, the attributes that leverage environmental dimension sustainability are shown in Figure 2, where the attribute that most influences the sustainability of the environmental dimension is the level of land conversion in the Bangkalan agropolitan area with an RMS value of 4.20 percent. The RMS value shows the magnitude of the role of each attribute in the sensitivity of sustainability status.

The rate of land conversion is a key factor in ensuring sustainability in the development of the SoBurbang agropolitan area. Large-scale land conversion has occurred in Bangkalan Regency due to regional development following the construction of the Suramadu Bridge, as Bangkalan serves as the primary access point from Madura to Surabaya. Moreover, agricultural land has been converted to non-agricultural use to accommodate the increasing demand for housing and the development of shopping centers [15]. To maintain the sustainability of the agropolitan program, it is essential to prevent further land conversion and promote the opening of new agricultural land, ensuring the continuity of agricultural production in the agropolitan area. Sufficient land availability remains a critical criterion for the successful development of agropolitan areas [16,17]. To maintain the environmental dimension, sustainable agricultural practices that minimize negative impacts on ecosystems and natural resources could potentially be implemented [18].

3.2 Economic sustainability

Economic sustainability is a description of the level of sustainability of economic aspects in the development of the Soburbang agropolitan area. The economic dimension consists of; 5 (five) study attributes, including; a) availability of raw material supplies for agro-industry, b) market availability for agro-industry/UMKM products, c) Utilization of Technology, d) access to capital for farmers, and e) Economic impact on society. The economic sustainability ordination graph is presented in Figure 3 below.

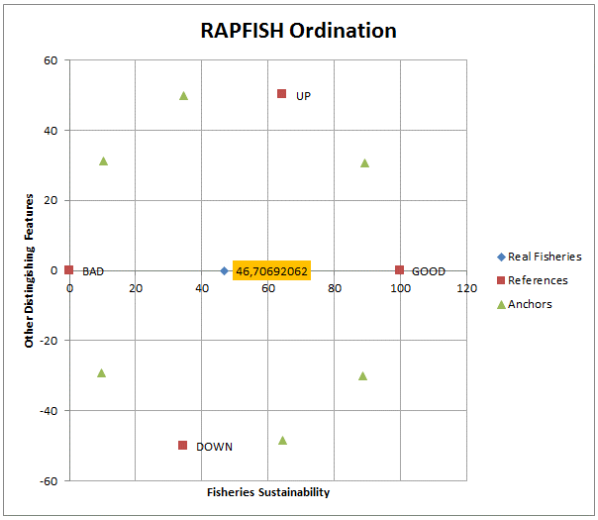

Fig. 3. Economic sustainability ordination chart..

The results of the analysis for economic sustainability obtained an coordination value of 46.70 percent or categorized as less sustainable. This shows that the economic dimension has not shown sustainability regarding the development of the Soburbang agropolitan area. This can happen because

there is no concept of comprehensive economic development, and so far it is still farming in nature. Meanwhile, agricultural product processing activities with agro-industry development have not yet been implemented.

The results of the leverage analysis show that the level of technology utilization (RMS=4.01 percent) is the biggest lever of economic sustainability in the development of the SoBurbang agropolitan area. [8] stated that the RMS value shows the magnitude of the role of each attribute in the sensitivity of sustainability status. Mastering technology is a priority in developing agropolitan areas. Through the use of modern technology and efficient farming practices, crop yields can be increased significantly. For example, the use of advanced agricultural tools and machinery, efficient irrigation systems, and better cultivation techniques can increase agricultural productivity. Increasing agricultural production and productivity is one of the main focuses in agropolitan development. Because agropolitan development aims to increase agricultural productivity through the application of modern technology and efficient agricultural practices. With higher productivity, farmers can produce more food products and earngreater income and increased welfare of farmers.

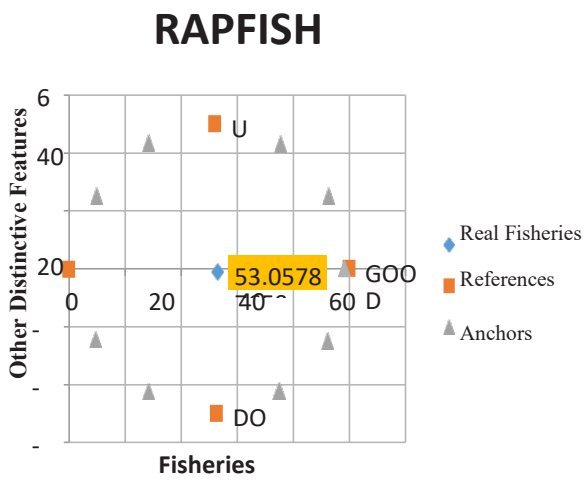

Fig. 4. Graph of leverage of attributes for economic sustainability.

3.3 Social sustainability

The social dimension in the sustainability analysis of the Suburbang agropolitan area is very important to ensure that the development carried out is not only profitable from an economic and environmental perspective, but also improves the quality of life and social welfare of the local community. Social Sustainability is an indicator of the sustainability of a development activity, including agropolitan, which is stated in the triangular framework of the concept of sustainable development [19].

Sustainability The social dimension consists of 6 (six) study attributes, including; a) Population growth rate in the agropolitan area and its surroundings, b) Land use conflicts in the agropolitan area, c) Level of local labor absorption, d) Level of influence of the development of the agropolitan area on access to education and health, e) Level of community participation in the development of the agropolitan area, f) The level of influence of the development of agropolitan areas on social culture (living order). The social sustainability ordination graph is presented in Figure 5 below.

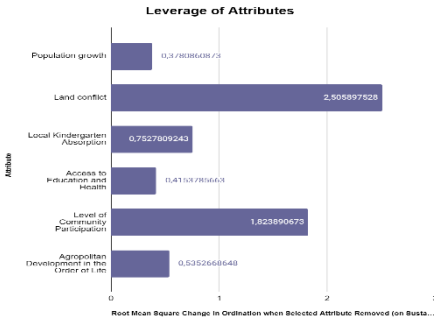

Fig. 5. Social Dimension Sustainability Ordination Chart.

The results of the analysis for social sustainability obtained an ordination value of 53.06 percent or categorized as quite sustainable. This shows that the social dimension has not shown sustainability regarding the development of the Soburbang agropolitan area. This can happen, because there is no concept of developing comprehensive social aspects, and so far it is still voluntary, such as the lack of concepts of comprehensive community empowerment starting from seed farmers, cultivators, collectors, processors and marketing (marketing).

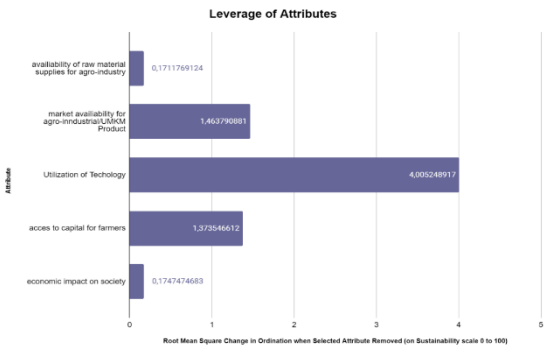

Fig. 6. Chart of leverage of social sustainability attributes.

The results of the leverage analysis show that land conflict is the biggest leverage attribute in the sustainability of the SoBurbang Agropolitan area because it has the highest RMS value, namely 2.51 percent. This finding is in line with Tamami's 2015 research [20] which stated that the implementation of the development of the SoBurbang agropolitan area was hampered, one of which was due to land problems with the community, causing suboptimal land use and land degradation. When land is contested, land maintenance and conservation are often neglected. This will worsen the condition of the land and agriculture will not develop. The cause of agrarian conflict can occur because of claims to land owned by village communities [21]. Land conflicts not only impact the availability of

land for farming, but also have significant social impacts on farmers and rural communities [12]. Overlapping policies and unclear land rights often cause conflict between local communities and other parties, such as large companies or the government. The conflict resolution strategy or policy that can be implemented to mitigate this issue involves conducting mediation and negotiation with representatives of the local community. Mediation helps reduce tensions and facilitates mutually acceptable solutions, enabling the land to be utilized more optimally.

3.4 Technology and infrastructure sustainability

Sustainability of technology and infrastructure is a depiction of the level of sustainability related to technological and infrastructure aspects in the development of the Soburbang agropolitan area. The attributes that are estimated to have an influence on the level of sustainability in the infrastructure and technology dimensions consist of four attributes, namely a) Condition of road infrastructure and other facilities, b) Level of application of technology in agropolitan development, c) Availability of production (processing) technology for agro-industry, d) Convenience regional community access to production technology. The technology and infrastructure sustainability ordination graph is shown in Figure 7.

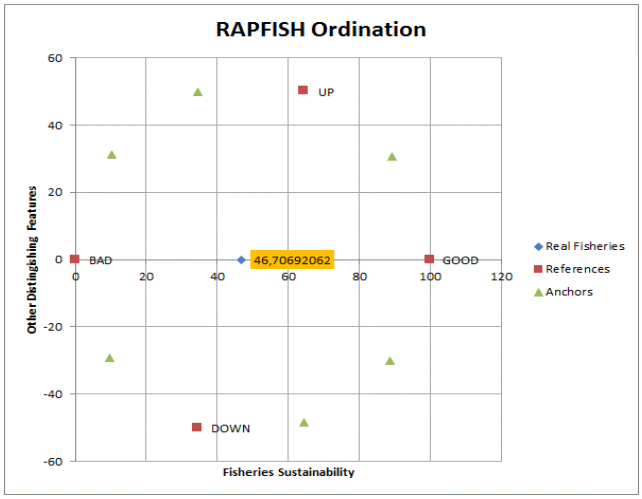

Fig. 7. Technology And Infrastructure Sustainability Ordination Graph.

Based on the results of the MDS analysis, the ordination value or sustainability index for the infrastructure and technology dimensions for the development of the SoBurbang agropolitan area was 46.71 percent. This condition is included in the less sustainable category. This is because there is no concept of industrial development, especially product processing. Currently there are only cultivation activities, and there are no industrial activities processing superior commodities. On the other hand, industrial supporting infrastructure is also not yet available. So that the sustainability of technology and infrastructure in the development of the Soburbang agropolitan area can be achieved, it is important to know the attributes of the levers of sustainability of the technology and infrastructure aspects.

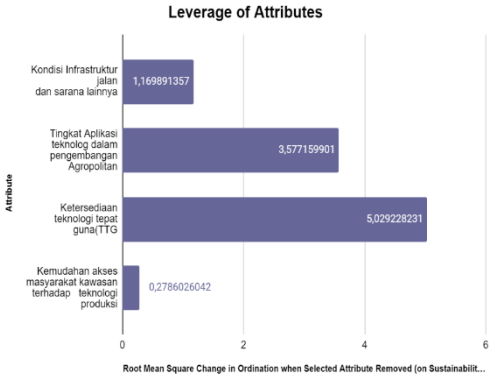

Fig. 8. Graph Of Leverage Of Attributes For Sustainability Of Technology And Infrastructure.

The availability of appropriate technology (TTG) is the attribute that has the greatest influence on the level of sustainability in the infrastructure and technology dimensions in the SoBurbang Agropolitan Area. This is because in this area there is no appropriate technology to increase productivity and added value from existing superior commodities. Meanwhile, the road facilities and infrastructure that still appear to be very minimal are the poor quality connecting road facilities and infrastructure between villages. Infrastructure plays an important role in increasing economic growth, where higher economic growth occurs in regions that have an adequate level of infrastructure availability. Similar research [16] concluded that Indonesia's economic growth was influenced by the availability of infrastructure, including electrification, paved roads and clean water. The results of research [23] show that the overall impact of developing an agropolitan infrastructure model on five agribusiness subsystems implies three aspects of a sustainable development system, namely social aspects, economic aspects and environmental aspects. Potential funding to support the availability of technology and infrastructure in Bangkalan Regency can be sourced from the Special Allocation Fund (DAK) or Village Funds. This has been demonstrated in Magelang Regency, where the use of village funds successfully improved farmers' access to appropriate technology and enhanced infrastructure that supports agricultural activities. The construction of access roads facilitates smoother product distribution, while technology service centers enable farmers to utilize modern tools, increasing efficiency and agricultural yields [24].

3.5 Policy Sustainability

Policy sustainability is a depiction of the level of sustainability related to policy aspects in the development of the Soburbang agropolitan area. The policy dimension consists of 6 (six) study attributes, including; a) Realization of targets (roadmap) for

developing agropolitan areas, b) Availability of a legal umbrella in the management and development of agropolitan areas, c) Availability of strategic policies at the Regency/Provincial and Central levels, d) Incentive and disincentive policies in developing agropolitan areas based on agroindustry made from regional superior commodity raw materials e) Availability of institutions and supporting facilities for agro-industry-based agropolitan areas at the District/Provincial Level. The policy sustainability ordination graph is presented in Figure 9.

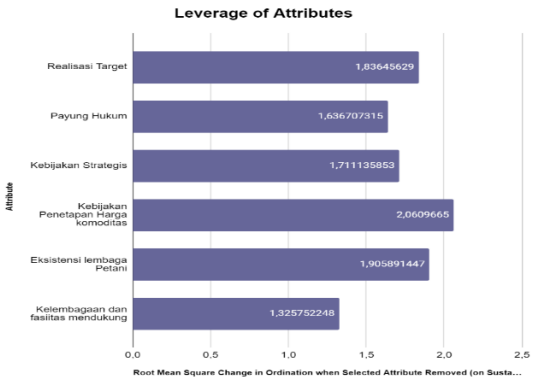

Fig. 9. Sustainability Ordination Graph For Policy Aspects.

The results of the analysis for policy sustainability obtained an coordination value of 57.57 percent or categorized as quite sustainable. This shows that the policy aspect is the strongest aspect in studying the sustainability of the development of the SoBurbang agropolitan area. This shows that the main problem currently being faced is the conception or policy aspect of developing the SoBurbang Agropolitan Area which emphasizes added value to the area through a high added value agro-industrial approach.

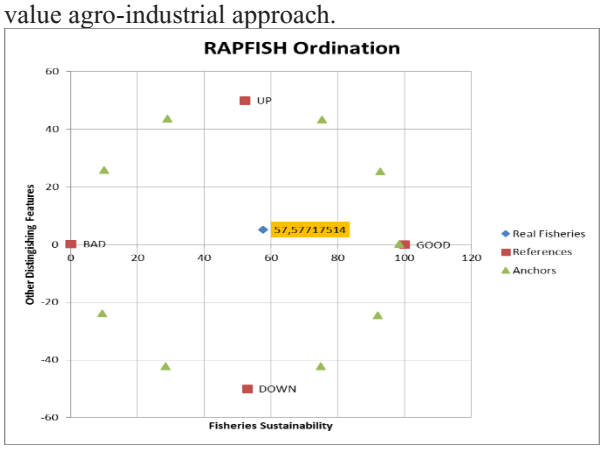

Fig. 10. Graph of leverage of policy sustainability attributes.

The results of the leverage analysis of the policy aspects of the SoBurbang agropolitan area are the policy on setting prices for food and horticultural crop commodities. The policy of setting staple food commodity prices in Bangkalan Regency aims to protect farmers and ensure they earn profits. According to [25], the objectives of price setting include: a) Profit orientation achieving new targets and increasing profits; and b) Sales orientation: increasing sales volume and maintaining or expanding market share. A similar pricing policy has been implemented in India, known as the Minimum Support Price (MSP), where the government guarantees a minimum price for specific agricultural commodities. The MSP establishes a minimum price that must be paid by buyers, including the government and related institutions, for agricultural products such as rice, wheat, corn, and other commodities. The primary objective of this policy is to protect farmers from sharp market price fluctuations and ensure stable income [18].

3.6 Trade off Soburbang Agropolitan Sustainability

The sustainability of the development of the Soburbang agropolitan area, Bangkalan Regency as a whole is categorized as poor and quite sustainable. The sustainability trade off shows that the technology and infrastructure aspects are the aspects that have the lowest level of sustainability, namely 41.45 percent, then the economic aspect with an index value of 46.707 percent, and the environmental aspect with an index value of 49.846 percent, all three are categorized as less sustainable. Meanwhile, the other two aspects, namely the Social and Policy aspects, are categorized as quite sustainable with indexes of 53.06 percent and 57.58 percent respectively. Graphically it is presented in Figure 11 below.

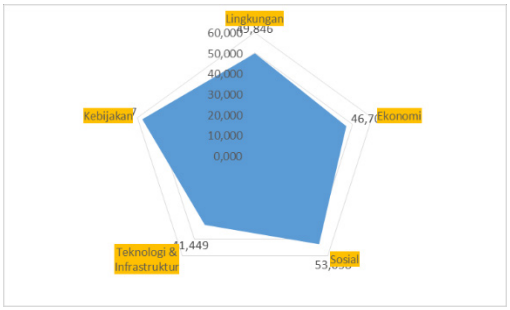

Fig. 11. Trade off Soburbang Agropolitan Sustainability.

The trade off condition for the sustainability of the Soburbang agropolitan area as in the picture above shows that all aspects need serious attention, starting from policy, technology and infrastructure, social, economic and social aspects [5]. Aspects of technology and infrastructure, economics and the environment are aspects that need to receive primary attention in the sustainable development of the Soburbang agropolitan area, because these aspects are categorized as less sustainable. Technology and infrastructure aspects are one of the aspects that need to be the main concern in the sustainable development of the SoBurbang agropolitan area. Therefore, an actionable and practical plan is needed to ensure the sustainability of the SoBurbang agropolitan area in the future across all its dimensions. Specifically: 1) For the dimension with the lowest sustainability, namely technology and infrastructure, efforts can be made by increasing the adoption of modern agricultural technologies and

building infrastructure that supports distribution and market access. 2) In the economic dimension, sustainability can be enhanced through agricultural product diversification and financial support to improve the economic well-being of local farmers. 3) For the environmental dimension, sustainable agricultural practices that minimize negative impacts on ecosystems and natural resources should be implemented. 4) In the social dimension, which is categorized as moderately sustainable, community empowerment through training and skills development can increase local participation in agropolitan programs. 5) Lastly, the policy dimension can be strengthened by establishing a robust policy framework that promotes integration between the government, private sector, and community to support sustainable agropolitan development.

4 Conclusion

This study aims to evaluate the sustainability of the SoBurbang agropolitan area in Bangkalan Regency. The overall sustainability level of the SoBurbang agropolitan development is categorized as "less sustainable" to "moderately sustainable," with index values ranging between 41.45% and 57.58%. The analysis results indicate that the social and policy dimensions exhibit higher sustainability levels compared to the environmental, economic, and technology & infrastructure dimensions. The success of the social and policy dimensions in achieving better sustainability might be attributed to active community involvement and supportive, strategic policies across various administrative levels. The model employed in this study, with a Squared Correlation (R^2) exceeding 80% and an acceptable stress value, demonstrates that the approach is sufficiently valid for assessing the sustainability of agropolitan areas. To enhance sustainability, a multi-faceted approach is needed: integrated land management policies to curb land conversion, improved financial and market access for farmers, investment in agricultural technology, and robust policy frameworks to support sustainable practices. Evaluating the sustainability of the SoBurbang agropolitan area is very important to ensure the achievement of the Agropolitan goal, namely the welfare of rural communities in Bangkalan, necessitating coordinated efforts across all dimensions of sustainability.

References

1. D. S. Gangwar et al., *Conceptual framework of agro-ecological resource management system for climate-smart agriculture*, Int. J. Environ. Sci. Technol., **14**, 2, 101-112, (2017)
2. R. Parmawati, *Sustainable Management and Rural Agropolitan Development in Sendang Village of Tulungagung, East Java: A Multidimensional Analysis of Sustainability*, Jurnal Kawistara, **9**, 3, 241-256, (2019)
3. J. Friedman, *Agropolitan Development: A Territorial Approach to Fulfillment Basic Needs*, Indonesian Obor Foundation, (1988)
4. I. C. Laode et al., *Agropolitan area development based on MDS analysis*, IOP Conf. Ser.: Earth Environ. Sci., **343**, 1, 012202, (2019)
5. Oryzanti, Parwa, et al., *Economic development of mangosteen agro-industry based on sustainability*, J. Economics and Policy, **12**, 1, 33-53, (2019)
6. T. Hartono et al., *RAPFISH performance indicators for capture fisheries*, Bul. Ekonomi Perikanan, **6**, 1, 65-76, (2005)
7. H. Hardjomidjojo et al., *Measuring sugar industry sustainability*, Manajemen IKM, **11**, 1, 89-96, (2016)
8. T. Pitcher and D. Preikshot, *RAPFISH: A rapid assessment technique for evaluating the sustainability status of fisheries*, Fish. Res., **49**, 3, 255-270, (2001)
9. A. Fauzi and S. Anna, *Sustainability evaluation of Jakarta fisheries*, J. Pesisir dan Lautan, **4**, 3, 43-55, (2002)
10. Z. Hidayah, N. Nuzula, and D. Wiyanto, *Analysis of fisheries resource management sustainability in the Madura Strait*, J. Perikanan Univ. Gadjah Mada, **22**, 2, 101-115, (2020), doi: 10.22146/jfs.53099
11. H. K. Alamsyah et al., *Environmental strategies for activities in Indonesian Archipelagic Sea Lane*, J. Marine Environ., **12**, 2, 9-25, (2022)
12. Y. Erwina, R. Kurnia, and Y. Yonvitner, *Sustainability status of fisheries in Bengkulu Waters*, J. Sos. Econ. To the Sea and Fish., **10**, 1, 21-35, (2016)
13. C. Donohue and E. Biggs, *Monitoring socio-environmental change for sustainable development: Developing a Multidimensional Livelihoods Index (MLI)*, Appl. Geogr., **62**, 391-403, (2015)
14. P. Kavanagh and T. J. Pitcher, *Implementing Excel tools for RAPFISH*, Fish. Cent. Res. Reports, **12**, 2, 75-90, (2004)
15. S. Arifin, *Land Use Changes Post Suramadu Bridge in Bangkalan District*, Thesis, (2017)
16. H. Bahasoan, *Potential development of agropolitan areas in Serang District*, Uniqbu J. Exact Sci., **2**, 2, 1-10, (2021)
17. R. Costanza et al., *Global changes in ecosystem service values*, Global Environ. Change, **26**, 152-158, (2014)
18. K. Diehl et al., *Ecosystem services in European policy assessment*, Ecological Indicators, **61**, 6-17, (2016)
19. R. S. Rivai and I. S. Anugrah, *Sustainable agricultural development in Indonesia*, Agro Econ. Res. Forum, **29**, 1, 13-25, (2011)
20. N. D. Tamami, *Stakeholder mapping for food security in the Soburbang Agropolitan*, Pamator, 8, 2, 133-146, (2015)
21. A. Chen and S. Scott, *Development strategies in*

China's rural cooperatives, J. Agric. Food Systems and Community Dev., **4**, 4, 35-55, (2014)

22. F. E. Ramadani and S. Harianto, *Social conflict over plantation land*, J. of Soc. Conflicts, (2020)
23. R. B. Prasetyo and M. Firdaus, *Infrastructure and regional economic growth*, J. Dev. Econ. and Policy, **2**, 2, 222-236, (2009)
24. L. A. M. Tambajong, *Sustainable Coconut Agropolitan Model in North Sulawesi*, Dissertation, Bogor Institute of Agriculture, (2009)
25. Soemarso, *Accounting: An Introduction*, Jakarta: Aditya Media, (2004)