

Analysis of Agropolitan Area Sustainability of Laying Hens in Limapuluh Kota District

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Abstract—The Government of Lima Puluh Kota has established Mungka subdistrict as Agrocitv area for laying chicken, however its development looks sluggish due to some obstacles. This study aims to examine the sustainability of the area development using multidimensional scaling method, viewed from 5 dimensions of sustainability namely economic, ecology, social culture, infrastructure and technology, and institutional dimension. The analysis was also supported by leverage and Monte Carlo analysis to determine the attributes that influence the sustainability of the region. The analysis shows that the development of agropolitan area of laying chicken does not have non-significant impact on rural development in Lima Puluh Kota. This is indicated through the low ecological dimension, although the economic dimension shows better results. Social and cultural dimensions are good, but the dimensions of infrastructure and technology still lack support for the sustainability of the region. The institutional dimension shows poor results. Attributes that affect the sustainability of the area that must be addressed are the lack of availability of upstream-to-downstream agribusiness facilities and infrastructure such as raw materials, agricultural machinery, marketing and road conditions, which are major obstacles in the process of regional development.

Keywords—agropolitan; sustainability; ecology; economi; social culture; technology

I. INTRODUCTION

Agropolitan can be interpreted as an agricultural city that grows and develops due to the running of the agribusiness system and business and is able to serve, encourage, attract, drive agricultural development activities (agribusiness) in the surrounding area [1]. Agribusiness development in the perspective of agropolitan promises prosperity for farmers, Agribusiness has a very important role in national development, including livestock agribusiness, in addition to increasing food supply also to increase income. However, the policy of agribusiness development in the regions has not given significant changes to the improvement of the welfare of the community, and has even led to a welfare gap between cities and villages. The same thing happened to the poultry industry, especially the laying poultry industry. On the one hand, large industries have grown rapidly for almost 30 years, most of which are located in cities. In contrast, the agricultural sector and small-scale industries almost all have bases in rural areas.

The development of the urban area as growth centers did not provide a deteriorating effect, but instead caused the effect of draining resources from the surrounding area. The failure of development in rural areas in addition to causing a backwash effect, also results in control of capital and markets. If the agricultural sector with agribusiness can act as a leading sector in the economy, then every agribusiness effort will have a forward-linkage and backward-linkage [2]. To narrow the gap between rural and city government has implemented a policy of regional development through the agropolitan concept, based on the potential of the area. The program includes the physical, social, economic and development base is the central area of rural growth, namely agricultural centers [1]. Agropolitan development is one approach to rural development, by placing the agricultural region as a center. Agropolitan is a form of regional development by integrating all elements related to the field of agricultural development. District Limapuluh Kota, West Sumatra is one of the areas which has been pursuing a policy of Agropolitan, which begins with the release of the Decree (SK) government of District Limapuluh Kota No 398 / BLK / 2005 dated June 6, 2005, which sets Payakumbuh subdistrict, Mungka, and Guguak as agropolitan agribusiness laying hens. At the beginning of this Agropolitan policy is applied, laying chicken farm in this area show promising economic development for laying chicken breeders. However, the last few years, egg production decreased and the number of farmers is also gradually decreased or even gone bankrupt and close down. These conditions negatively impact the activity of livelihood as laying chicken breeders. Many factors influence the production decline related to the implementation of government policies in the area that need to be assessed as consideration for developing a more comprehensive model of agropolitan areas and contributing significantly to food security -especially chicken eggs- in the central Sumatra region. This study aims to (1) Determine the sustainability status of laying chicken-based farms in Lima Puluh Kota from five dimensions of continuity, namely: ecological dimensions, economic dimensions, social and cultural dimensions, infrastructure and technology dimensions, and legal and institutional dimensions. (2) To identify the key factors in this system and (3) to formulate development policies to improve the sustainability of the laying hens system. By knowing the status of the territory of the five dimensions of sustainability, will make it easier to carry out

improvements to the sensitive attributes that affect the improvement of the status of sustainability areas, especially the dimensions of sustainability with a lower status in order to support the development of the area.

II. RESEARCH METHOD

A. Area Studied and Data Collected

The study was conducted in the District of Limapuluh Kota. Determination of the research location was chosen purposively as many as 3 (three) sub-districts from 13 sub-districts in Limapuluh Kota District, namely: Payakumbuh, Mungka, and Guguak Districts. Conducted over 6 months (March 2018-September 2018).



Fig. 1. Research location of agropolitan area of Laying Hens Farming in Subdistrict Mungka, Payakumbuh and Guguak, Lima Puluh Kota District, West Sumatra Province.

The data collected were both primary and secondary data. Primary data were collected through surveys, interviews. Secondary data were collected from the results of previous research, reports related to service agencies and the data from the Central Bureau of Statistics. Respondents were selected purposively, which was adjusted to environmental conditions and the number of respondents who could represent and understand the problems under study. Respondent done two ways: 1) Respondents of farmers or communities for socio-economic survey at the location was done using random sampling method. The socio-economic data is used to analyze farmer behavior and determine the status and development of the agropolitan area. 2) Expert respondents selected deliberately (purposive sampling). Selected respondents have expertise in accordance with the field under study

B. Analysis Method

The analysis of the sustainability of the development agropolitan area based on laying hens in Lima Puluh Kota District is carried out using the Multi-dimensional Scaling

(MDS) approach. This approach is called Rap-bangkagaslur means rapid appraisal agropolitan development of laying hens which is adaptation of the Rap-fish method commonly used to assess the sustainability status of capture fisheries [3]. Sustainability analysis is stated in the Sustainability Index Agropolitan Development. The analysis is carried out through several stages, namely: (a) determining the attributes of the level of development of laying hens-based areas that include five dimensions (b) the assessment of each attribute on an ordinal scale based on the criteria of the level of development of each dimension; and (c) the preparation of the index and sustainability status of the area based on laying hens farms [4]. (d) sensitivity analysis performed to see which factors contribute most to sustainability Agropolitan, with indicators of changes in root mean square (RMS) on the X axis ordination. The larger the RMS value change, the more sensitive of these attributes in the development of the area. (e) To evaluate the effect of the error in predicting values agropolitan development ordinated use Monte Carlo analysis. MDS analysis is intended to assess the level of development of the region based on the ideal measures which include: the economic, ecological, social and cultural, technology/ infrastructure, and legal/institutional [5,6]. Sustainability index values are given a score of 0% (bad) and 100% (good). If the system studied has a sustainability index value greater than or equal to 50% ($> 50\%$), the system is said to be sustainable (sustained) and unsustainable if the index value is less than 50% ($< 50\%$). Comparison of sustainability between dimensions is done and visualized in the form of a kite diagram. The goodness of fit in MDS is reflected in the magnitude of the S-Stress (S) value and the coefficient of determination (R^2). A low S value indicates goodness of fit, while a high S value indicates the opposite. A good model if the value of $S < 0.25$ and the value of $R^2 > 80\%$ or close to one [7]. Index and sustainability status are grouped into 4 categories, as shown in Table 1.

TABLE I. SUSTAINABLE CATEGORIES BASED ON INDEX SUSTAINABILITY

Index Value	Category	Sustainability status
0.00 - 25.00	Bad	Not sustainable
25.01-50.00	Less	Less sustainable
50.01-75.00	Quite	Quite sustainable
75.01-100.00	sufficiently	Sustainable

The Prospective analysis was carried out in order to produce a sustainable area development scenario based on laying hens for the future by determining the dominant factors that influence system performance. The influence between factors was given a score by the expert using prospective analysis assessment guidelines, namely: 0 (no influence); 1 (small effect); 2 (moderate effect); and 3 (very strong effect). The best possibilities in the future can be determined based on the results of determining the key elements of the future from several factors that greatly influence the development of the area [8].

III. RESULT AND DISCUSSION

A. Sustainability Index and Status of Laying Hens Farming Systems

Sustainability Index and Status Rap-Bangkagaslur results of the analysis showed that the Limapuluh Kota district the average value of sustainability index laying hens system at 63.00, so that the sustainability status categorized quite sustainable.

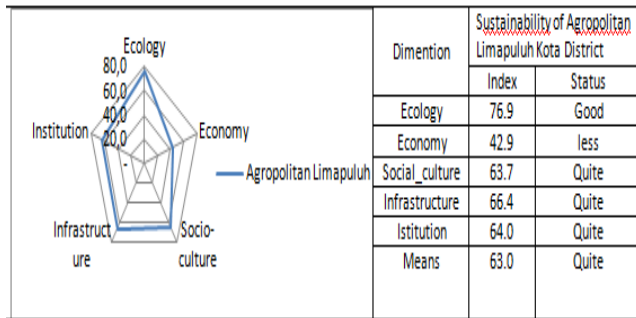


Fig. 2. Kite diagram of agropolitan sustainability index.

The value of sustainability index is generated based on an assessment of the 45 attributes that are included in the five dimensions of sustainability, among other things: ecological dimension (10 attributes), the economic dimension (9 attributes), the social and culture dimension (9 attributes), the dimensions of the infrastructure (7 attributes), and legal-institutional dimensions (10 attributes).

B. Key Factors that Influence the Sustainability of Laying Hens Agropolitan in District Limapuluh Kota

The results of the leverage analysis are shown in Table 2. As a result of the leverage analysis on the ecological dimension, there are 3 attributes, which are sensitive affecting to the sustainability of the agropolitan laying hens farms system. These three sensitive attributes are closely related to the maintenance management of laying hens. This shows that the management of laying hens maintenance applied so far is still in bad category from an ecological perspective. In the economic dimension, there are 3 factors that influence the sustainability of the laying hens system, there are egg prices last 5 years, the ownership (beneficiary of ownership) and the level of subsidies on inputs these three sensitive attributes are related to another. The results of leverage analysis show the socio-cultural dimensions of nine attributes that were analyzed contained 3 sensitive attributes affect the laying hens farm system are frequency of conflicts related to laying hens business, number of households farm and the level of consumer dependence. The sustainability status of the technology-infrastructure dimension is generated based on the assessment of 7 attributes of sustainability. There are 4 sensitive attributes affecting, there are deployment of health posts, availability of facilities and infrastructure for agribusiness, feed technology and use of vitamins and probiotics for laying hens.

TABLE II. KEY FACTORS THAT INFLUENCE THE SUSTAINABILITY OF LAYING HENS AGROPOLITAN IN DISTRICT LIMAPULUH KOTA

Dimension	Attribute influence	RMS Value
Ecological	utilization of laying hens farm waste for organic fertilizer	2.10
	availability of feed	3.10
	utilization of agricultural waste for animal feed	2.20
Economy	the price of eggs for the last 5 years	13.00
	ownership (beneficiary of ownership)	4.90
	the level of subsidies to inputs	4.30
Social Culture	- frequency of conflicts related to laying hens business	4.40
	- the number of households in laying hens farms	4.10
	- The level of consumer dependence.	3.60
Technology and Infra-structure	deployment of health posts	4.60
	availability of agribusiness facilities and infrastructure	3.10
	feed technology	2.70
	use of vitamins and probiotics for layng hens.	2.20
Institution	- the intensity of breeding business activities that violates the law	3.50
	- institutional input of laying hens business	3.20
	- cooperative development	3.10
	- institutional output of laying hens business	2.80
	- agricultural extension agency -microfinance institution (bank/credit)	2.70

Below is a picture of determining the attributes that affect the sustainability of laying hens agropoltan region from the ecological perspective. Analogous in this way is to determine the attributes that affect the other 4 dimensions, so as to obtain as many as 17 attributes that affect the sustainability of agropolitan laying hens in the District Limapuluh Kota.

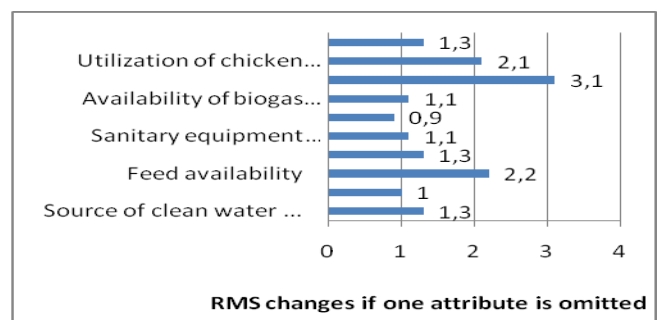


Fig. 3. Analysis leverage of the ecological dimensions of the laying hens system in District Limapuluh Kota.

Analogous in this way, the determination of the attributes (factors) that affect the four other dimensions. Thus obtained were 19 attributes that affect the sustainability of laying hens in the district Agropolitan Limapuluh Kota, as shown in Table 2.

C. Statistical Analysis of Sustainability Index Values

MDS analysis stress value has a value of 0.001 <0:25 where the smaller the stress value the better output MDS analysis. The coefficient of determination (R²) in this study is 0.958. This is indicated by the amount of value close to one. Based on these two statistical parameters, it was concluded that all the attributes used in each dimension were able to describe the sustainability of the laying hens cultivation system. The results of Monte Carlo analysis (Table 4.) show a small difference in values between the sustainability index values of MDS and Monte Carlo at a 95 percent confidence interval. The small difference in values shows: (1) errors in making each attribute score are relatively small, (2) variation in scoring due to relatively small differences in opinion, (3) stable repetitive MDS analysis process, and (4) data entry errors and lost data can be avoided.

TABLE III. RESULTS OF MONTECARLO ANALYSIS AT 95% CONFIDENCE INTERVAL.

	Limapuluh Kota District		Difference
	MDS	Monte Carlo	
Ecological	76.9	76.0	0.9
Economy	42.9	41.9	1.1
Social Culture	63.7	62.7	1.0
Infrastructure	66.4	65.4	1.0
Institution	64.0	63.1	0.9

D. Development Scenario for Sustainable Agropolitan Laying Hens Farming in Kabupaten Lima Puluh Kota

The concept of sustainable development that harmonizes environmental, economic and social interests is a concept of

development that has been accepted by all countries in the world. This concept aims to create a balance between economic growth (economic dimension), environmental preservation (ecological dimension), equity (socio-cultural dimension). Some opinions add the dimensions of technology-infrastructure (development and application of technology to better infrastructure), legal-institutional (compliance with the law and institutional functioning) for the implementation of sustainable development. The application of the concept of sustainable development in the real system requires strong commitment of the main actors of the system (stakeholders) to ensure the success of development.

Prospective analysis is able to explore the possibilities of the future based on predetermined goals. The step of determining index and sustainability status aims to provide an overview circumstances of the actual laying hen farm system (existing condition). Prospective analysis aims to prepare strategic actions in the future by determining key factors that play an important role in the various possibilities that will occur in the future. These possible variations in the future, are formulated in the form of a sustainable development scenario for laying hens.

Based on Table 2, sensitive attributes were assessed and grouped into 4 sections placed in 4 quadrants are based on the level of influence and dependence of attributes on the system. Based on the assessment of 19 sensitive attributes, 8 key factors have been identified that have a strong influence on the system.

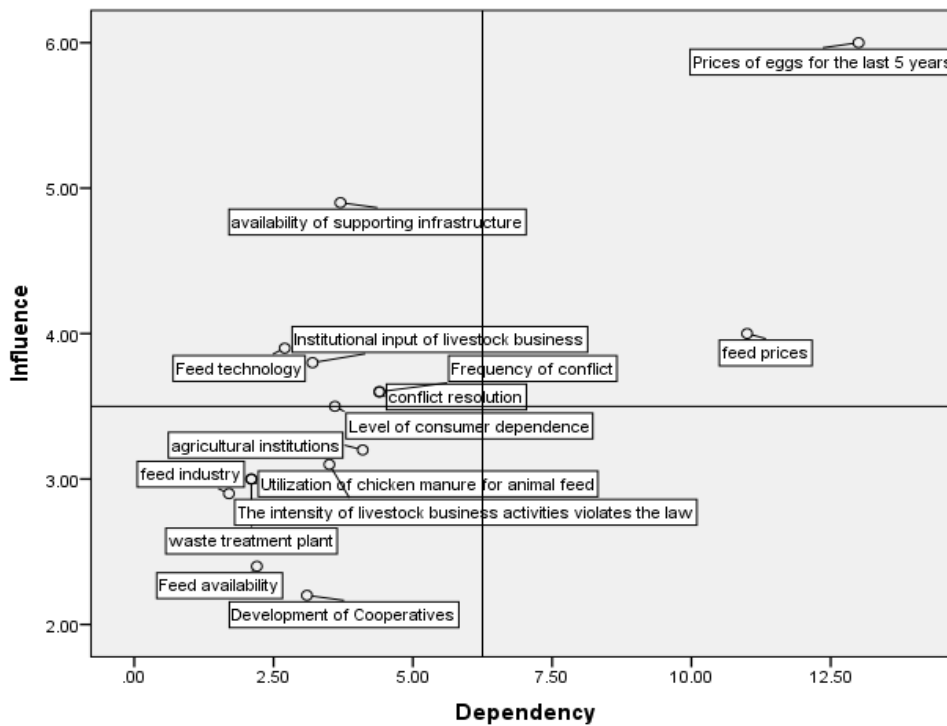


Fig. 4. The level of importance of the factors resulting from the merger of existing conditions and need analysis affecting the farming system in Limapuluh Kota District.

These eight key factors have a low level of dependence but have a major influence on the system, including: (1) feed technology, (2) institutional input livestock business, (3) frequency of conflicts related to laying poultry business, (4) level of consumer dependence, (5) the intensity of illegal farming activities, (6) utilization of agricultural waste for animal feed, (7) availability of feed and (8) cooperative development. In addition, only one other attribute is a key factor that has a strong influence and dependence on the system, namely the price of eggs in the last 5 years.

The combination of important factors from the prospective analysis of existing conditions and need analysis resulted in 18 factors influencing the laying poultry farming system (9 factors derived from existing conditions and 9 factors derived from need analysis). These factors have similarities and can be combined, so the combined factors influence the system to 15 factors, shown in Table 5.

TABLE IV. FACTORS INFLUENCING THE LAYING HENS FARMING SYSTEM AS A RESULT OF COMBINING THE EXISTING CONDITION AND NEED ANALYSIS FACTOR

No	Existing Condition	Need Analysis
1	Feed Technology	Availability of supporting infrastructure
2	Institutional input of laying hens business	Agricultural institutions
3	Frequency of conflicts related to laying poultry business	Conflict resolution
4	The level of consumer dependence	-
5	The intensity of laying hens business activities that violates the law	-
6	Utilization of agricultural waste for animal feed	waste treatment plant
7	Availability of feed	Feed industry
8	Cooperative development	
9	The price of eggs for the last 5 year	Feed prices

IV. CONCLUSION

Based on the existing conditions, the ecological dimension shows sustainability, the economy is less sustainable, while for

the dimensions of socio culture, infrastructure and institutions are quite sustainable. To improve the sustainability status of Agropolitan areas based on laying hens in Limapuluh Kota Regency, a progressive-optimistic scenario strategy is needed by making overall improvements to all sensitive attributes, at least 7 key factor attributes generated in prospective analysis, so that all dimensions are sustainable for regional development based on laying hens farms.

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