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ANALYSIS OF SUSTAINABLE DEVELOPMENT URBAN FARMING (A CASE STUDY IN MAKASSAR SOUTH SULAWESI)

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Urban farming system creates a balance of environmental and urban ecosystems as well as being part of the concept of Eco City. This study aimed to analyze the level of sustainability of the development of urban agriculture in Makassar in five dimensions (ecological, economic, social, technological and institutional), and identify sensitive determinant of sustainability attributes of each dimension. This study using by Multi-Dimensional Scaling Rapid Appraisal Urban Farming Makassar and the results in the form of index and status of sustainability. Leverage and Monte Carlo analysis is used to determine the attributes that are sensitive influence on the sustainability index and status. The results showed in the multidimensional development of urban farming in Makassar including unsustainable with criteria of sustainability index 47, 23%. Index values and status partially sustainability of each dimension respectively ecological and technological dimensions of 42.66% and 44.69% are less sustainable. While the economic, social, and institutional respectively 50.69%, 51.29%, and 51.04% are quite sustainable. Of the 55 attributes that were analyzed contained 31 sensitive attributes affect the sustainability of the development of urban agriculture in Makassar. The value of the correlation coefficient (R2) between 0.94 to 0.95 and the value of Stress (S) between 0.13 to 1.54 indicates analysis Rap-Makassar-Urfarm appropriate or valid to use in evaluating the sustainability of the development of urban farming in Makassar.

Introduction

Cities are dynamic region continues to experience accelerated growth and development is accompanied by various effects, so that the necessary thinking to meet the principles of sustainable development. Sustainable city development paradigm known as Eco City, the urban development refers to the alignment of environmental, environmentally sound and minimize the negative impact of physical development (Elliott, 2006). Various forms of handling the problem of the urban environment has been conceptualized and implemented with varying success. One of the strategy is the development of the concept of Green City. Green City is an environmentally friendly and sustainable city in all aspects of life, to support the life of the city and other elements such as plants, animals, soil, water, and air. These aspects are intertwined in the lives of urban ecosystems that provide comfort functions, safety, and beauty (Arifin, *et al.* (2007),

In implementable concept of Green City can be realized in the form of agricultural activities are based in the urban and agricultural system known as

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urban farming. This activity is a form of revitalization of the agricultural sector, which put back the importance of the agricultural sector and contextual proportionally in favor of urban development in a sustainable balance. Urban farming is defined as an activity or activities undertaken in the field of agriculture in cities and suburbs in the perspective of environmental balance and the beauty of the city, as well as socio-economic interests of urban communities (Smith *et al.* 1996; FAO, 1999). So that a phenomenon of urban agriculture in the cities of the world as a contributing factor in creating a balance urban environment and reduce the impact of socio-economic development of the city (Lovell, 2010; Aubry, *et al.,* 2010). In the developed countries, urban agriculture is associated with a movement back to nature, the promotion of organic farming, city beautification efforts, environmental education tool for the citizens, hobby/pleasure and as a livelihood (Purwanto, 2010). According to Susanto (2003) implementation of urban farming development must be based on four pillars of sustainability, namely: (1) economically feasible, (2) Appropriate technologically, (3) envornmentally sound and sustainnable, (4) socially and culturally acceptable.

Makassar as a metropolitan city and a strategic development center in East Indonesia region causing more expansive space utilization and spread, so that the spaces have natural ecological functions on the wane. It can be seen from the decline of green open space, both quantitatively and qualitatively. Central Statistics Agency data of Makassar (2014), shows the condition of green open space existing Makassar city is only 9.2%, equivalent to an area of 379.7 ha and continue to decline. While the Law of the Republic of Indonesia No. 26 of 2007, mandates that the provision of green open space at least 30% of the area of the city.

Urban farmingis an important role in supporting the sustainability of ecological functions in urban ecosystems. However, development is a problem with a complex system involving various components, elements or elements in it are integrated with each other. Sustainability is strongly influenced by the behavior of the components of the system that is in it. Urban farming systems development strategy, particularly in Makassar, can be done through an approach of handling the chain of results is the dimensions of sustainable development, and the handling chain of cause or causal chain based on socio-cultural approach which changes human behavior and policy support (Karyanto, 2011). This study focused on the handling strategy results chain that analyze the index and the status of sustainability as well as a key determinant factors of sustainable development of urban agriculture in Makassar in the dimensions of the ecological, economic, social, technological and institutional. Information obtained from this study can form the basis of scenarios and policy in the development of urban agriculture systems.

The purpose of this research were: (1) to analyze the index and the status of the dimensions of ecological sustainability, economic, social, technological and institutional capacities in the development of urban agriculture in the city of

Makassar. (2) to identify the factors or attributes that sensitive determinant of the sustainability of each dimension.

Research Methods

The research was conducted in the city of Makassar, South Sulawesi Province in May to September 2015. Makassar is a regional development center located in Eastern Indonesia, with the rapid development acceleration.

The type of data that is used to describe the status and sustainability index. The secondary data were obtained from the Central Bureau of Statistics, the study of literature and the document of the relevant agencies with research. The primary data obtained from interviews of urban agriculture experts and stakeholders. Experts and stakeholders purposively selected in four categories, as follows: (1) policy-makers but are not directly affected: the Parliament, the Government (the Parks Department, Office of Food Security, Department of Agriculture, the Regional Environmental Agency). (2) influence in the policy but did not directly affected: public figures, political figures. (3) does not affect the policies and directly affected: the user community, urban agriculture practitioners, employers plants/seeds, plant lovers. (4) contribute to the policy and are not directly affected: agriculture experts and observers, NGOs, environmental organizations and the agricultural profession.

Analysis of the sustainability of the development of urban agriculture in Makassar using ordination techniques Multi-Dimensional Scaling (MDS) called Rap-Makassar-Urfarm (Rapid Appraisal for Makassar Urban Farming), is a statistical analysis of multidimensional transformation sustainability (Fauzi and Anna, 2005). This method is a modification of the approach RAPFISH (Rapid Appraisal for Fisheries) developed by Fisheries Centre, University of British Columbia, Canada (Kavanagh, 2001; Kavanagh & Pitcher, 2004; Fauzi and Anna, 2005). Results of this analysis is expressed in scale and status of sustainability indices in each dimension and multidimensional.

The research covers 55 attributes of the five dimensions of sustainability, namely: 13 ecological dimension attributes, 10 attributes the economic dimension, 13 the social dimension attribute, 9 the technological dimension attributes, and 10 institutional dimension attributes. The attributes of each dimension given ordinal scale score of 0-3, and interpreted from bad conditions (at least sustainable) up to good condition (very sustained). Scores definitive analyzed is the mode value, to determine the points that reflect sustainability position relative to the good and bad points (Kavanagh, 2001; Sampeliling *et al.* 2012). Index values and sustainability status grouped four categories, namely: 0-25% bad category (unsustainable), from 25.01 to 50% (less sustainable), from 50.01 to 75% (quite sustainable) and 75.01-100% either category (highly sustainable) (Kavanagh and Pitcher, 2004). Accuracy of measurement of each dimension and attribute in MDS is reflected in the value of Stress (S) and coefficient of determination (R2). Model

(good fit) indicated by the value S is smaller than 0.25 (S <0.25) and the value of R2 close to 1 or 100%, which means that selected attributes can currently explain close to 100% of the existing models (Pitcher and Preikshot, 2001; Kavanagh and Pitcher, 2004).

Furthermore, Leverage analysis is used to determine the sensitivity of the attributes that affect the sustainability and is measured through changes in the Root Mean Square (RMS) on the X axis ordinated greater RMS value changes, the greater or sensitive role that attribute to increased sustainability status. Monte Carlo analysis is used assuming the influence of an error in the process of analysis at 95% confidence interval. Results of analysis expressed in terms of index value Monte Carlo, and then compared with an index value of MDS results.

Research Results

Multi Dimensional Sustainability

Based on the analysis of MDS Rap-Makassar-Urfarm known that the index of sustainability of urban agriculture development in multi-dimensional Makassar is 47.23%, where the index value is in the interval 25.01 - 50% with less sustainable status. Index and ecological dimensions of sustainability status, economic, social, technological and institutional shown in Table 1 and illustrated in the diagram sustainability index kite (Kite diagram) in Figure 1.

TABLE 1: VALUES SUSTAINABILITY INDEX MDS ANALYSIS, MONTE CARLO ANALYSIS AT THE 95% CONFIDENCE INTERVAL, STRESS VALUE (S) AND COEFFICIENT OF DETERMINATION (R^2)

Sustainability dimension	*Sustainable Index*			*Value*		
	MDs	*Monte Carlo*	*Between*	*Stress (S)*	R^2	*Status of Sustainable*
Ecology	42,66	40,31	2,35	0,137	0,953	Less Sustainable
Economics	50,69	50,47	0,21	0,149	0,947	enough Sustainable
Social	51,29	51,12	0,17	0,139	0,952	enough Sustainable
Technology	44,69	44,26	0,43	0,154	0,944	Less Sustainable
Institutional	51.04	51.25	0,21	0,149	0,947	enough Sustainable

Sustainability Ecological Dimension

Ecological dimensions of sustainability analysis conducted on 13 attributes of sustainability, namely: the rate of land conversion, land area of the yard, the level of land use, types of fruit trees dominant, dominant vegetable crops, environmental regulation aesthetic value, the value of the ecological function of urban farming, organic waste treatment , the use of fertilizers and pesticides, irrigation conditions, climatic conditions, the potential for flooding, and vast green open space productive.

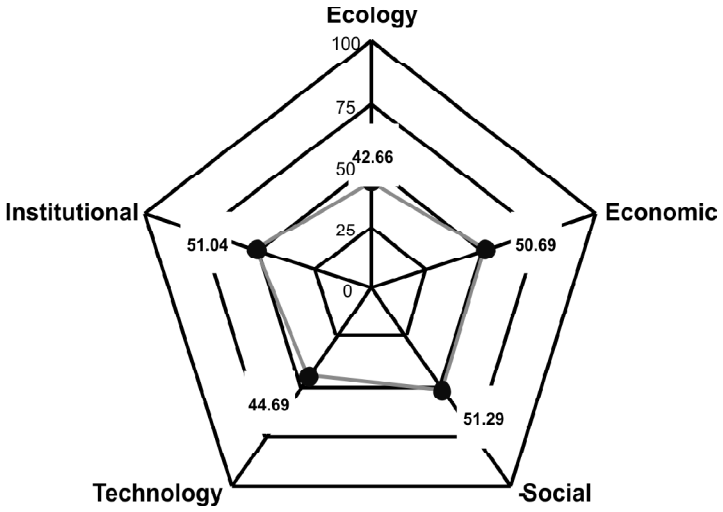

Figure 1: Kite Diagram ofIndex Sustainability Value of Urban Farming in Makassar City, South Sulawesi, 2015.

Based on the analysis of MDS Rap-Makassar-Urfarm, it is known that the ecological dimensions of sustainability index value of 42.66% and are at intervals index of 25.01 - 50% (less sustainable status). Furthermore, Leverage analysis results indicate that there are four attributes that are sensitive to the value of the ecological dimensions of sustainability indices, namely: (1) the condition of irrigation, (2) the use of fertilizers and pesticides, (3) the processing of organic waste, and (4) the dominant plant species (Figure 2).

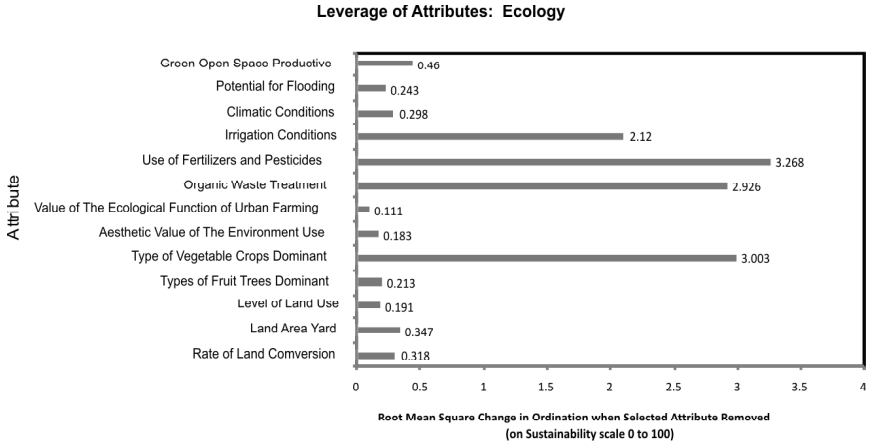

Figure 2: Analysis of Leverage/Sensitivity for Dimension Ecology Sustainability

Sustainability Economic Dimension

The economic dimension of sustainability analysis conducted on ten attributes of sustainability, namely: the need for production facilities, production facilities, incentives, productivity, revenue contribution of urban farming, urban farming venture capital, business feasibility of urban farming, leading commodities, contributes of urban farming tofood needs/family nutrition, improvement of the poor economy.

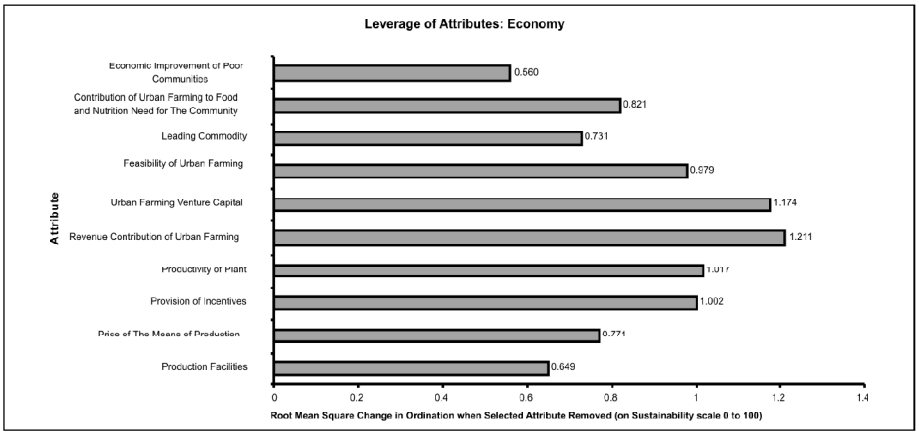

Figure 3: Analysis of Leverage/Sensitivity for Dimensions Economic Sustainability

Based on the analysis of MDS Rap-Makassar-Urfarm, it is known that the economic dimension of sustainability index value of 50.69% and are at intervals index of 50.01 - 75% (sustained enough status). Furthermore, Leverage analysis results showed that there were seven attributes that are sensitive to the value of the economic dimension of sustainability indices, namely: (1) the contribution of urban farming income, (2) urban farming venture capital, (3) productivity, (4) incentives, (5) feasibility of urban farming, (6) the contribution of urban farming to the needs of households and (7) the price of the means of production (Figure 3).

Sustainability Social Dimensions

In the social dimension, analyzed thirteen attributes of sustainability, namely: knowledge of urban farming, formal education level of society, land ownership/ yard, environmentally friendly behavior, participation of household and teenage mothers, the existence of government services, public perception about urban farming, motivation in the development of urban farming, public attitudes in the development of urban farming, community development intensity in the agricultural activities of the city, population pressure on land, the development of urban farming, and community participation in the development of urban farming.

MDS analysis results Rap-Makassar-Urfarm shows that the value of the social dimension of sustainability index is 51.29% and the index interval 50.01 - 75% (sustained enough status). Furthermore, Leverage analysis results indicate that there are ten attributes that are sensitive to the value of the social dimension of sustainability indices, namely: (1) the purpose of the development of urban agriculture, (2) the level of formal education community, (3) the status of land ownership, (4) behavior in vision environment, (5) the existence of public services, (6) public perception of urban farming, (7) the motivation of people in the development of urban farming, (8) the intensity of community development, (9) the pressure of population on the land, and (10) the role of society in the development of urban farming (Figure 4).

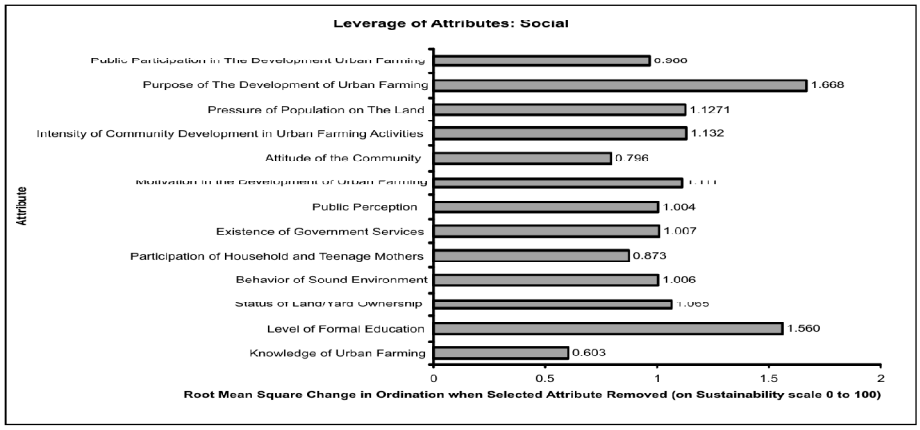

Figure 4: Analysis of Leverage/Sensitivity for Dimensions Social Sustainability

Sustainability Dimension Technology

In the technological dimension, analyzed nine attributes of sustainability, namely: management of urban farming, the type of technological innovation, organic waste treatment technologies, knowledge of the use of environmentally friendly technologies, the availability of environmentally friendly technologies, the application of environmentally friendly technologies, the use of space technology for farming town awoke, information technology farm town, the level of mastery and application of technology.

MDS analysis results Rap-Makassar-Urfarm shows that the value of sustainability index dimensional technology is at 44.69% and index interval 25.01 - 50% (less sustainable status). Furthermore, Leverage analysis results indicate that there are two attributes that are sensitive to the value of sustainability index technological dimension, namely: (1) management of urban farming, and (2) information technology urban farming (Figure 5).

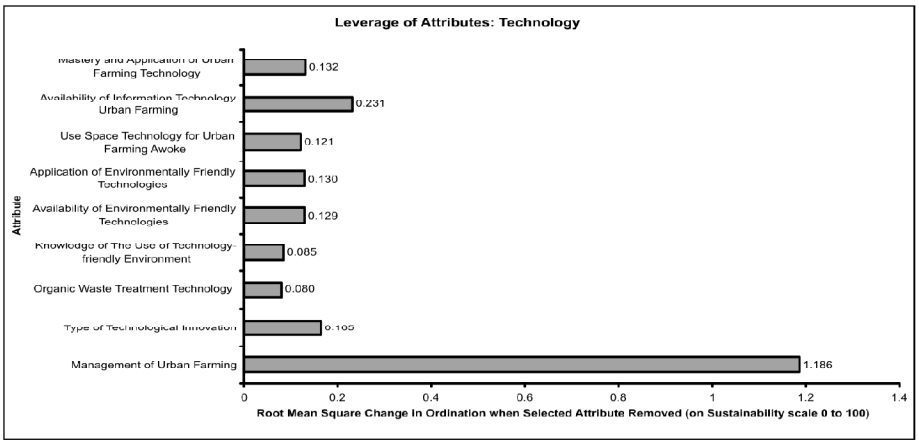

Figure 5: Analysis of Leverage/Sensitivity for Dimensions Technology Sustainability

Sustainability Institutional Dimensions

Institutional dimension of sustainability analysis conducted on ten attributes of sustainability, namely: the availability of urban farming management rules, the effectiveness of spatial planning, environmental NGO involvement, institutional education, training and extension of environmental management, the existence of environmental control authorities, women's organizations, organizations plant lovers, participation government agencies, and the participation of community leaders.

MDS analysis results Rap-Makassar-Urfarm shows that the value of sustainability index institutional dimensions are 51.04% and on the index interval

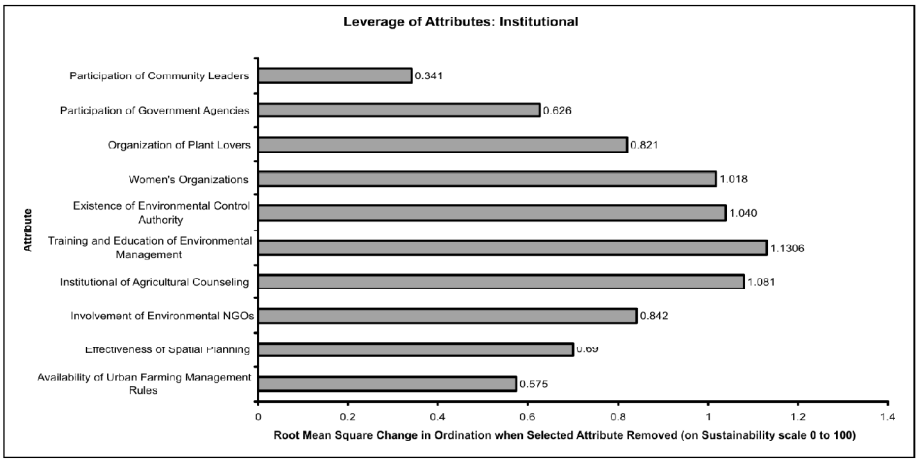

Figure 6: Analysis of Leverage/Sensitivity for Dimensions Institutional Sustainability

50.01 - 75% (sustained enough status). Furthermore, Leverage analysis results showed that there were eight attributes that are sensitive to the value of the institutional dimension of sustainability indices, namely: (1) the role of government agencies, (2) organizational plant lovers, (3) women's organizations, (4) the existence of environmental control authority, (5) training and extension of urban farming development, (6) an institutional counseling, (7) the involvement of environmental NGOs, and (8) the effectiveness of spatial planning (Figure 6).

Conclusion

Status sustainability of Urban Farmingin the city of Makassar is multi-dimensional, ie ecological, economic, social, technological, and institutional. Based on the analysis of MDS Rap-Makassar-Urfarm multi-dimensional sustainability index values obtained are relatively low, at 47.23%. The index is lower than 50%, which means that the status of urban farming development in the region less sustainable Makassar (Kavanagh & Pitcher, 2004). Furthermore, index and partially sustainability status for each dimension, as in Table 1 and Figure 1, shows that there are three dimensions are included in status is quite sustainable, economic, social, and institutional sustainability index successively 50.69; 51.29; and 51.04% Meanwhile, there are two dimensions in a continuous state of less status, namely the ecological dimension (42.66%) and technological dimension (44.69%).

This fact proves that the development of urban farming in the city of Makassar requires intervention for improvement, both from government and stakeholder urban farming. If there is no improvement, then the existence of urban farming for the environment and ecological balance functions in the Makassar area will continue to decline. According to Lovell (2010) the existence of urban farming need to be maintained and improved as it has multifunctional in supporting the implementation of the concept of Eco City town green or sustainable manner.

The analysis also showed that the level of 95%, the difference between MDS and the results of the analysis of Monte Carlo is very small, namely 3.37% (less than 5%). This indicates that the simulation of the sustainability index values calculated using the MDS Rap-Makassar-Urfarm have a high confidence level (Kavanagh and Pitcher, 2004). Furthermore, these conditions also explains that: (1) determining a score for each attribute is correct, (2) the diversity of opinion due to differences in assessment scores relatively small, (3) if the process is repeated analysis, the results are relatively stable, (4) errors in data entry and data loss can be avoided, (5) the system being studied have a high confidence level, (6) the method of MDS Rap-Makassar-Urfarm can be used as one means of evaluating the development of urban farming in the city of Makassar (Adriman, *et al.,* 2012; Hidayanto, *et al.,* 2009; Thamrin, *et al.*, 2007). This explanation is also supported

by the analysis of the coefficient of determination (R2) between 94.40 to 95.30 percent is quite high and indicates that the prediction model of sustainability indices including the good and adequate for use (Alder *et al.* 2003). Stress value (S) is in the range between 0.137 to 0.154 lower than 0.25 means that the model analysis MDS has earned high accuracy (goodness of fit) as a predictor of sustainability development index of urban farming in Makassar (Sampeliling, *et al.* 2012).

A sensitivity analysis of attributes of each dimension of sustainability of urban farming in Makassar done using analysis Laverage. Changes to the value of this attribute will affect sensitivity to changes in the index and the sustainability status. Laverage analysis results indicate that the sensitivity of the five dimensions of sustainability attributes different from each other. Number of attributes to be a factor lever of each dimension as follows: 4 attribute sensitive ecological dimension, economic dimension 7 attributes sensitive, social dimension 10 attributes sensitive, 2-dimensional attributes sensitive technology, and institutional dimensions of 8 attributes sensitive. In multidimensional, of 55 attributes that were analyzed contained 31 attributes to be a factor lever sustainability of urban farming in Makassar. According Sampeliling, et al. (2012) these factors need attention and good treatment, if there is no improvement then the existence of urban farming will not be sustainable in the future.

Conclussion

The development of urban farming in the city of Makassar is multidimensional in less sustainable status with the sustainability index 47.23%, while partial index of ecological sustainability dimension and the dimension of technology, respectively 42.66% and 44.69% in the category of less sustainable status, while the economic, social and institutional respectively 50.69%, 51.29%, and 51.04% in the category status is quite sustainable.Of the 55 attributes of the fifth dimension of sustainability is analyzed there are 31 attributes that need to intervene because the sensitive influence on the increase in the index and the status of development sustainability of urban farming in the city of Makassar.

Stress value (S) between 0.13 to 1.54 and a correlation coefficient (R^2) between 0.94 to 0.95 indicates Multi-dimensional analysis (MDS) Rap-Makassar-Urfarm appropriate and valid for assessing the sustainability index and status dimensional ecological, economic, social, technological and institutional development of urban farming in the city of Makassar.

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