Sustainability of Sago Agro-industry Using Rapid Appraisal (Case study : Sago Industri X in South Sorong, Papua)

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Abstract

Sago is a potential alternative food that can increase farmers' income. Sago production in South Sorong Regency still depends on the results of the sago forest. Sago varieties in South Sorong Regency are sago tuni and sago molat. The sago agroindustry in South Sorong Regency often experiences difficulties in providing fluctuating raw materials that occur in the sago agroindustry. For this reason, this research was conducted to determine the sustainability of sago agroindustry in South Sagu Regency. The research method used is descriptive quantitative. The sampling method is saturated sample. The data analysis method used is Rap-Sago. The results of the analysis show that the sago agroindustry X in South Sorong Regency is in a quite sustainable position with an index value as 54.27.

Keywords
Sago, Agroindustry, Sustaianble, *Rap-Fish for* sago

1. Introduction

Sago (Metroxylon spp.) is a monocot plant belonging to the order Spadiciflora, the family Palmae, genus Metroxylon, and species Metroxylon spp. This plant is native to Indonesia and is commonly found in Papua (Bintoro et al., 2010). This plant is spread in the wet tropical regions of Southeast Asia and Oceania, mainly grown in swamp, brackish land or often flooded (Scuiling and Flach, 1985).

Indonesia has the largest sago forest area and the largest genetic diversity in the world. The area believed to be the center of the origin of sago is around Lake Sentani, Jayapura Regency, Papua. In that place there is the highest diversity of sago germplasm with a total area of around 1.2 million ha (Bintoro et al., 2010). However, the attention of the Indonesian Government to the development of sago plants is still very lacking, this is indicated by the development of sago plant area data that is not yet known. Bintoro et al. (2010) stated that the data on sago area in Indonesia is 4,1833 million hectares. While sago productivity per tree, the potential for sago in Indonesia is estimated at around 5 million tons per year.

One of the districts producing sago is South Sorong district. Sago varieties in South Sorong Regency are sago tuni and sago molat. The sago agroindustry in South Sorong Regency often experiences difficulties in terms of fluctuating supply of raw materials that occur in the sago agroindustry. The fluctuations in the supply of raw materials are due to the fact that they are still very dependent on sago forests and their availability is supplied by sago farmers (people) of the indigenous tribes in Sorong Regency. In addition, there is competition to get raw materials in the agro-industry. For this reason, this research was conducted to determine the sustainability of sago agroindustry in South Sorong Regency.

2. Methods

Determination of the study area was carried out through a deliberate method (purposive method). The purposive method is done by selecting the research area, namely the selected area according to the criteria or specific characteristics possessed by the sample. Determination of the research area is based on the consideration that South Sorong Regency is a sago producer. Sampling in this study uses the Total Sampling method. This study uses primary and secondary data.

To answer the problems regarding the sustainability of sago agroindustry by using RAP-Fish (Rapid Appraissal for Fisheries) analysis with multi dimension scaling (MDS) method which is modified into Sago Rap-for (Rapid Appraissal for Sago Agroindustry). Sustainability analysis with Rap-Fish for Sago uses four dimensions namely ecological dimensions, economic dimensions, technological dimensions, and social dimensions. The five dimensions are then processed using the MDS technique which will carry out multidimensional transformation into 2 dimensions and determine the relative position of sustainability between 2 extremes in ordination bad (0%) and good (100%) for each dimension (Kavanagh, 2001). Steps taken in Rap for Sago analysis:

1. Reviewing the attributes in each dimension of sustainability and defining these attributes through field observations and literature review. The bigger the score chosen shows the better conditions.
2. Giving a score based on the results of field observations and expert opinions in accordance with predetermined requirements.
3. Analyzing using Rap-Fish for Sagu Ordination Analysis with MDS technique, to determine the position of the sustainability status of sago agroindustry in South Sorong Regency in each dimension and multidimensional expressed in the sustainability index value located between 0-100 (Mitchell et al, 2000) . The position of the sustainability status of the system under study is projected on a horizontal line in an ordination scale that is between two extreme points, namely the bad and good extreme points that are given an index value between 0 and 100 as in Table 1.

Table 1. Sago Agroindustry Sustainability Status based on the Index of Rap-Fish for Sagu Ordination with MDS techniques

1.

Indeks value	Sustainability status
0,00 – 25,00	Bad (Non sustainable)
25,01 – 50,00	Less (Less sustainable)
50,01 – 75,00	Quite (Quite Sustainable)
75,01 – 100,00	Good (Sustainable)

After that, an analysis of laverage is also needed to see the sensitive attributes that exist in each dimension. Monte Carlo analysis is used to see random errors that occur in the analysis process in each dimension. Laverage analysis is used to find out sensitive attributes, or interventions that can be done on sensitive attributes to improve sustainability status (Pitcher, 2001).

3. Discussion

The sustainability analysis of the sago agroindustry in South Sorong Regency uses the Rap-for Sago analysis approach. This analysis aims to look at the sustainability status of sago agroindustry in various dimensions. The Sago Rap-for analysis uses five dimensions including ecological dimensions, economic dimensions, technological dimensions, social dimensions and institutional dimensions. In each dimension a Rap-Sago ordination analysis will

be carried out, Leverage of Attributes analysis and Monte Carlo analysis to see sustainability on a per-dimensional basis. Then multidimensionally assessed from the value of the sustainability index which lies between 0-100. According to Kavanagh (2001) leverage analysis is an analysis carried out to determine the effect of ordinance changes when eliminating one attribute. For M attributes, the software will analyze M + 1 iterations. The first iteration is with complete indicators, while the next iteration is the number of different indicators based on the sequence of elimination. The effect of each attribute is seen in the form of RMS changes (root mean square) ordination, especially in the horizontal axis or scale of sustainability. The greater the value of the RMS changes due to the loss of an attribute or indicator, the greater the role of these attributes in the formation of a sustainability index or vice versa.

3.1 Ecological Dimension of Sustainability Status

Attributes that are considered to have an influence on the level of sustainability in the ecological dimension consist of five attributes: (1) Quantity of solid waste, (2) quality of solid waste, (3) utilization of solid waste, (4) waste disposal location, (5) knowledge of ecological impacts . The results of the analysis of the sago agroindustry sustainability index in South Sorong Regency ranged from 43.94-65.94 where the 13th month had the lowest ecological dimension sustainability index of 43.94 and entered into the unsustainable category, while month 4 had a sustainability index value the highest is 65.94 and belongs to a fairly sustainable category. The results of the ecological sustainability leverage analysis obtained 5 sensitive attributes, namely: (1) water efficiency has an RMS value of 2.17%, (2) the waste disposal area has an RMS value of 3.57%, (3) the use of solid waste has an RMS value of 2.74%, (4) the quality of solid waste has an RMS value of 2.55%, (5) waste quantity of 2.20%. Results Analysis of ecological dimension sustainability indices and sensitive factors that influence ecological sustainability is shown in Figure 1.

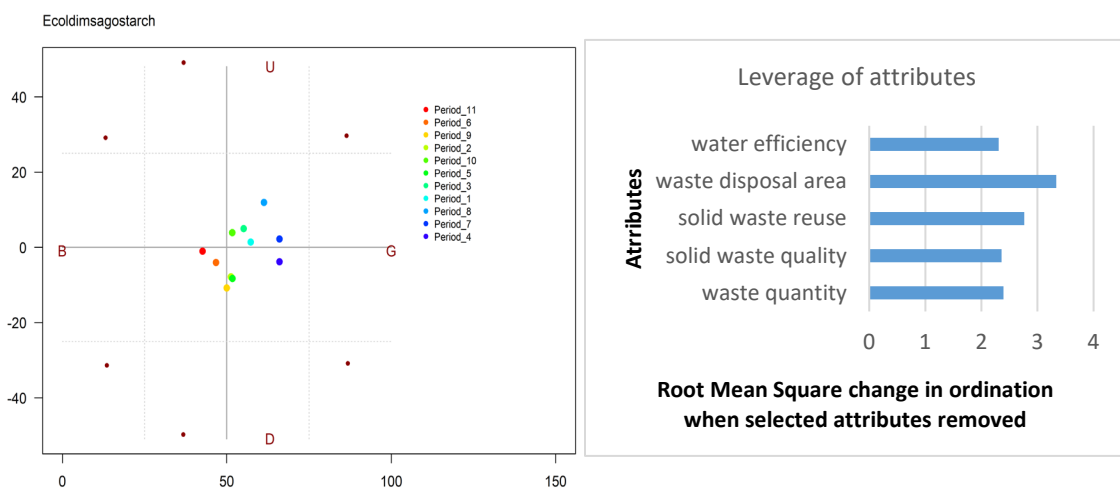


Figure 1. Analysis of the ecological dimension sustainability index and sensitive factors that affects ecological sustainability

After analyzing the ecological dimension sustainability index and sensitive factors that influence ecological sustainability then Monte Carlo analysis was carried out. The results of the Monte Carlo analysis as shown in

Figure 2.

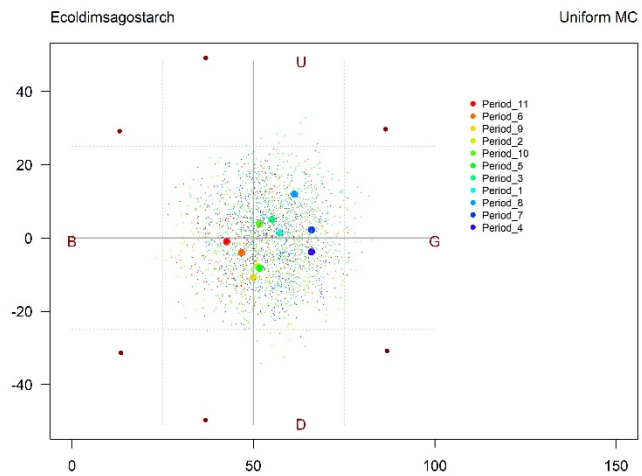


Figure 2. Monte Carlo analysis of ecological dimension attributes

Monte Carlo analysis carried out on ecological dimension attributes shows quite good results, this is indicated by gathering the points of MDS repetition between values 49.17-57.75 or ordination points in a position close to each other.

3.2 Economic Dimension of Sustainability Status

Attributes that are considered to have an influence on the level of sustainability in the economic dimension consist of eight attributes: (1) profit of agro-industry, (2) quality, (3) marketing system, (4) purchase price, (5) selling price, (6) storage cost .

Based on the results of MDS analysis with Rap for Sago, it is known the value of sustainability of Sago agroindustry X in South Sorong Regency at the Economic Dimension the value of sustainability is in the range of 50.00-75.00. This shows that the sago agroindustry X in the economic dimension is in a fairly sustainable state. The economic dimension sustainability index on sago agroindustry X in South Sorong Regency can be seen in Figure 3.

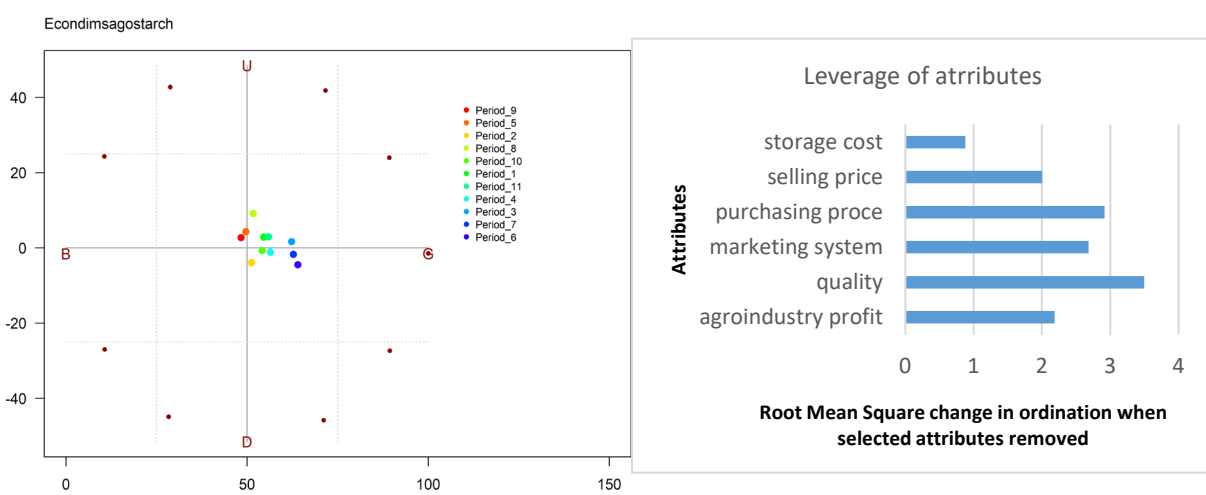


Figure 3. Analysis of economic dimension sustainability indexes and sensitive factors that affects economic sustainability

Leverage analysis results obtained by eight five sensitive, namely: (1) agro-industry profits have an RMS value of 2.23%, (2) quality has an RMS value of 3.07%, (3) marketing system has an RMS value of 2.70%, (4) costs the purchase has an RMS value of 2.64%, (5) the cost of sales has an RMS value of 31.96%. Quality has the largest RMS value of 3.18%. After obtaining the results of leverage analysis, Monte Carlo analysis is carried out, the results of which are shown in Figure 4.

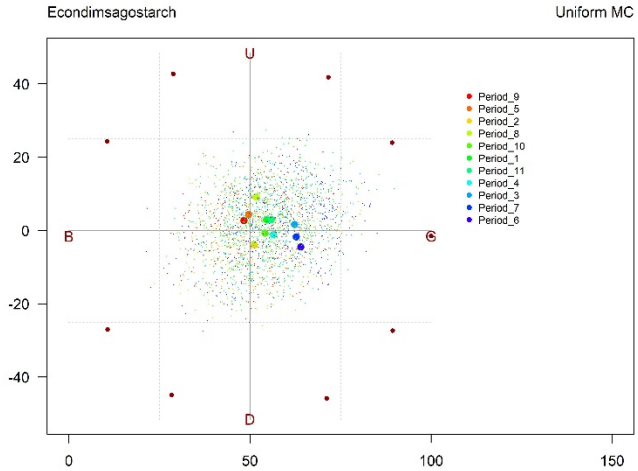


Figure 4. Results of Monte Carlo analysis on the attributes of the Economic dimension

Monte Carlo analysis performed on economic dimension attributes shows good results, it is indicated by gathering the points of MDS repetition between the values 50.20-59.79 or ordination points in a position close to each other.

3.3 Social Dimension of Sustainability Status

Attributes considered to have an influence on the level of sustainability in the social dimension consist of seven attributes: (1) employment, (2) human resource skills, (3) sago farmers income, (4) partnership, (5) pattern of public relations, and (6) social conflict. Based on the results of MDS analysis with Rap for Sago, it is known that the sustainability value of sago agroindustry X in South Sorong Regency is on the social dimension that is equal to 60.28. This shows that the sago agroindustry in the social dimension is in a fairly sustainable state. The results of the leverage analysis obtained 6 sensitive attributes, namely: (1) employment has an RMS value of 1.28%, (2) human resource skills have an RMS value of 1.75%, (3) sago farmers income has an RMS value of 1.66 %, (4) the partnership has an RMS value of 1.93%, (5) the pattern of public relations has an RMS value of 1.37%, and (6) social conflict 1.10%. Results Analysis of social dimension sustainability indices and sensitive factors that influence social sustainability is shown in Figure 5.

Figure 5. Analysis of social dimension sustainability indices and sensitive factors that affects social sustainability

Monte Carlo analysis performed on social dimension attributes shows good results. This is indicated by gathering the points of MDS repetition between the values of 53.78 - 60.85 or the ordination point is in a position close to each other. The results of the Monte Carlo analysis of the social dimension attributes are shown in Figure 6.

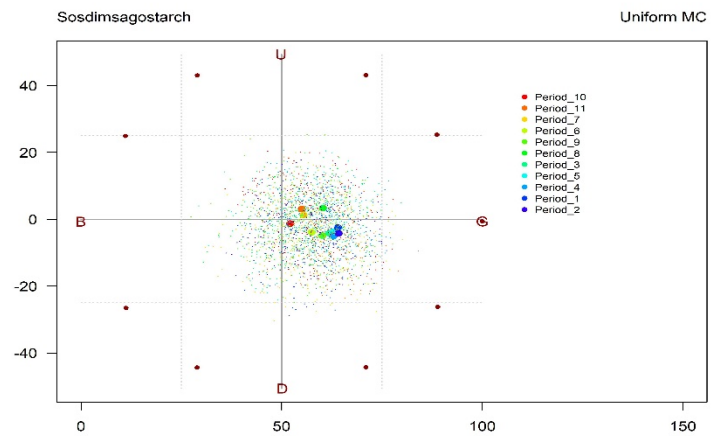
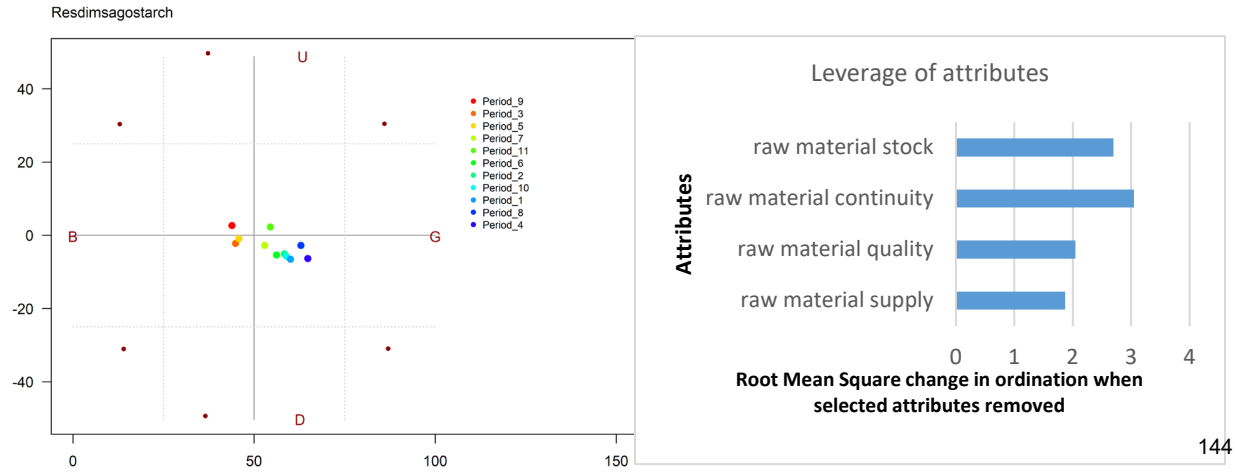


Figure 6. Results of Monte Carlo analysis on the attributes of the Economic dimension

3.4 Resources Dimension of Sustainability Status

Attributes that are considered to have an influence on the level of sustainability in the resource dimension consist of four attributes: (1) raw material supply, (2) quality of raw material, (3) raw material continuity, (4) raw material stock. Based on the results of MDS analysis with Rap for sago, it is known that the value of Sago agroindustry X sustainability in South Sorong Regency on the dimension of resources is equal to 56.18. This shows that the sago agroindustry X on the resource dimension is in a fairly sustainable state. Laverage analysis results obtained four sensitive attributes, namely: (1) raw material supply has an RMS value of 1.87%, (2) quality of raw material has an RMS value of 2.04%, (3) raw material continuity has an RMS value of 3.05%, (4) raw material has an RMS value of 2.70%. Results Analysis of the sustainability dimensions of the resource dimension and sensitive factors that influence resource sustainability are shown in Figure 7.



3.5 Status Keberlanjutan Dimensi Teknologi

Figure 7. Analysis of the sustainability index of the dimensions of resources and sensitive factors that affects the sustainability of resources

Monte Carlo analysis carried out on the resource dimension attributes showed good results. This is indicated by the gathering of MDS repetition points between values 53.91 - 64.80 or ordination points in a position that is close together. The results of the Monte Carlo analysis of the resource dimension attributes are shown in Figure 8.

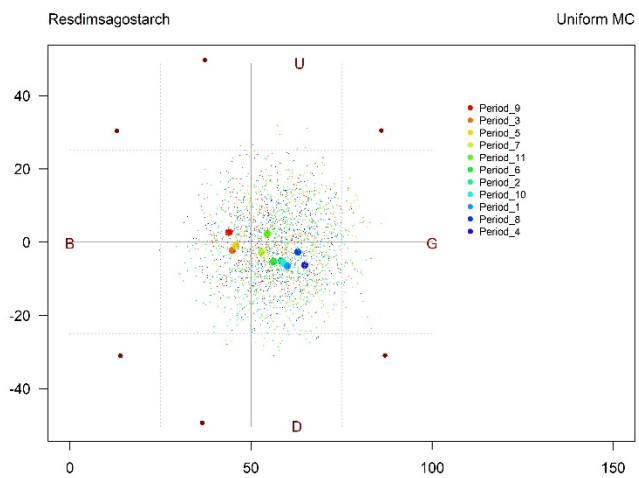


Figure 8. Results of Monte Carlo analysis on the attribute dimensions of resources

3.5 Technology Dimension of Sustainability Status

Attributes that are considered to have an influence on the level of sustainability on the resource dimension consist of four attributes: (1) technology suitability, (2) wate treatment, (3) water recycle, (4) starch standardization. Based on the results of MDS analysis with Rap for sago, it is known that the value of Sago agroindustry X sustainability in South Sorong Regency on the dimension of resources is technology 56.18. This shows that the sago agroindustry X on the resource dimension is in a fairly sustainable state. Laverage analysis results obtained four sensitive attributes, namely: (1) suitability technology has an RMS value of 1.32%, (2) wate treatment has an RMS value of 1.53%, (3) water recycle has an RMS value of 1.72% , (4) starch standardization has an RMS value of 1.86%. Results Analysis of the technological dimension sustainability index and sensitive factors that influence technological sustainability are shown in Figure 9.

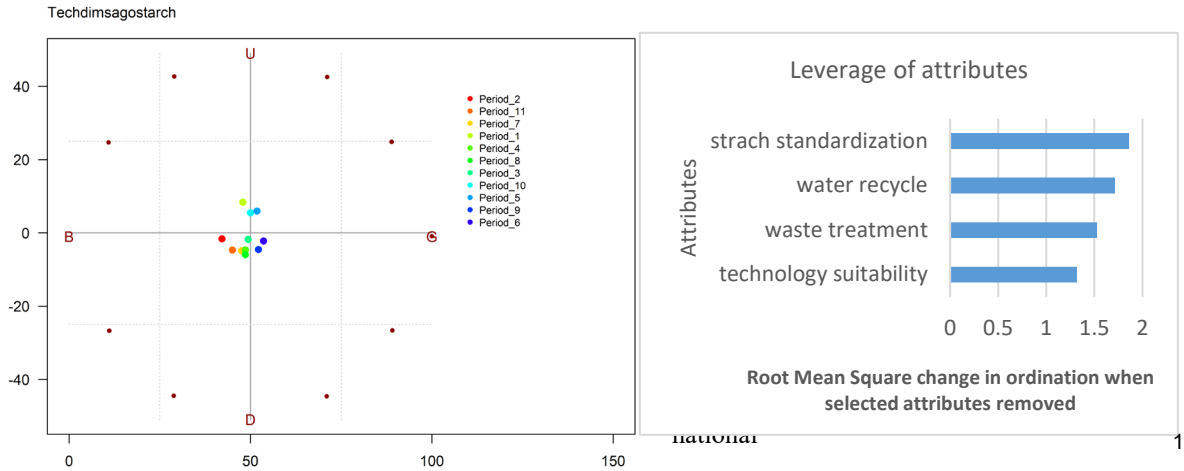


Figure 9. Analysis of technological dimensions and sustainability indexes sensitive that affects the sustainability of technology

Monte Carlo analysis carried out on technology dimension attributes showed good results. This is indicated by collecting MDS repetition points between the values 42.11 - 53.60 or ordination points in a position that is close together. The results of the Monte Carlo analysis of the technological dimension attributes are shown in Figure 10.

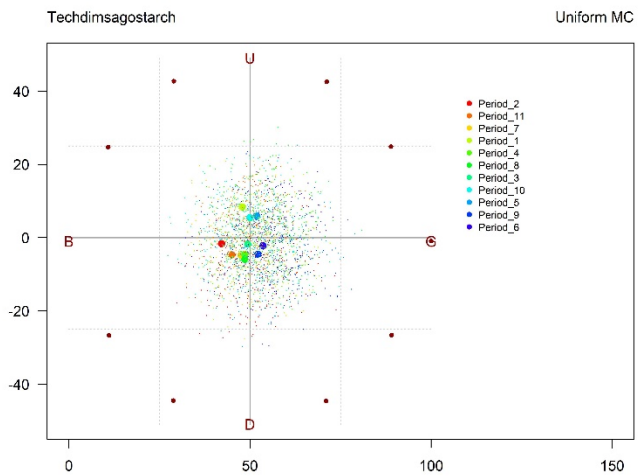


Figure 10. Results of Monte Carlo analysis on technological attributes

Based on the results of these analyzes, multi-dimensional shows that the sago agroindustry is in a quite sustainable status with an index value of 54.27 (on a scale of 50.01 - 75.00). Improved sustainability status can be done through improvements to sensititive attributes that have the highest RMS values in each dimension. The results of the multidimensional analysis can be seen in Figure 11.

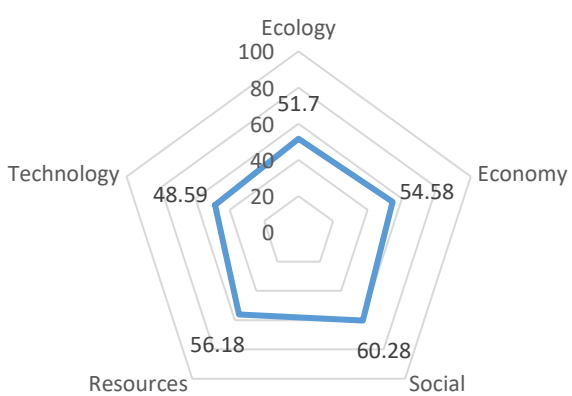


Figure 11. Kite Diagram of multidimenional analysis

On the ecological dimension of sensitive attributes with the largest RMS value is the attribute of the waste disposal location with an RMS value of 3.33%. Improvements that can be made is to have a personal waste disposal site to facilitate the use of waste. On the economic dimension sensitive attributes that have the greatest RMS value are the quality attributes of sago flour with an RMS value of 3.45%. The improvement that needs to be done is to improve the quality of sago flour with improvements in the processing of sago flour in accordance with the desired standards. This is closely related to process technology in sago agroindustry X. On the social dimension sensitive attributes that have the greatest RMS value are partnerships with a RMS value of 1.93%. Improvements can be made is to expand cooperation in various strategic fields in agro-industry so that it has a good impact on improving the social quality of the agroindustry X. In the dimension of sensitive attribute resources, the largest RMS value is raw material continuity with an RMS value of 13.84%. Improvements can be made is to expand partnerships with sago farmers to meet the needs of raw materials (sago). On the dimension of sensitive attribute technology with the largest RMS value is the sago flour quality standard with an RMS value of 1.86%. Improvements that can be done is to improve the process and optimize the work of the machine so that it has a good quality of sago flour so that it has a higher economic value.

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