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Supplier Selection Based on Green Procurement of Agricultural Commodities of Cassava: Environmental Perspective From Jember Regency

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ABSTRACT

Industrial developments and increasing consumer concern for the environment and the issue of environmentally sound industrial concepts have forced the industry to adjust the concept of green industries in every business, including in procurement, which is better known as green procurement. Supplier selection is an important decision-making problem to get suppliers who can increase the company's competitiveness. This research was conducted in Jember regency to evaluate and select cassava suppliers based on green procurement using the AHP method. The criteria used are 6 criteria, namely quality, technology capability, pollution control, environment management, green product, and green competence. Each criterion has sub-criteria between 3 or 4 sub-criteria. The number of sub criteria is used to determine the RI value. The RI value is used to calculate the CR value of each criterion. The results of data processing show that the highest CR value is in the technology capability criteria and the lowest CR value is in environment management. The highest hierarchical criterion value for environmental management criteria is 0.273, because the selection of cassava suppliers can be expected to pay attention to environmentally sound controls.

INTRODUCTION

In the global competitive market, supplier performance is one of the key factors for business success. This is because it relates to receiving raw materials and services at the right price, time and quantity to produce quality and competitive advantage (AlNuaimi et al., 2021). Industrial developments and increasing consumer concern for the environment and the issue of environmentally sound industrial concepts have forced the industry to make adjustments to the green industries concept in every business process, including procurement, which is better known as green procurement (Khahro et al., 2021). Green procurement is a management process that regulates the relationship between suppliers, materials and raw materials and the environment, both natural and human (Blome et al., 2014). The concept of green procurement brings the

principle of protection into the supplier management system. The most important part in the procurement process business is supplier selection (Luthra et al., 2017). Choosing quality suppliers will produce quality products, can make purchasing cost efficiencies, increase customer satisfaction and increase the company's competitive ability (Taherdoost & Brard, 2019). The problem that arises is when determining alternative suppliers becomes increasingly complex along with the demands of the green procurement concept. This is very detrimental especially for industries that have types of materials or raw materials that are very vulnerable to disrupting environmental safety so that the application of green procurement is very necessary (Haeri & Rezaei, 2019), increase customer satisfaction and increase the company's competitive ability (Sunaraksa & Shin, 2019). The problem that arises is when determining alternative suppliers becomes increasingly complex along with the demands of the green procurement concept (Rane & Thakker, 2020). This is very detrimental especially for industries that have types of materials or raw materials that are very vulnerable to disrupting environmental safety so that the application of green procurement is very necessary. increase customer satisfaction and increase the company's competitive ability. The problem that arises is when determining alternative suppliers becomes increasingly complex along with the demands of the green procurement concept (Fu et al., 2019). This is very detrimental especially for industries that have types of materials or raw materials that are very vulnerable to disrupting environmental safety so that the application of green procurement is very necessary (Alberg Mosgaard, 2015).

Jember Regency has superior commodities in agriculture, including cassava. This is shown from the productivity and production of cassava in Jember Regency which is quite high in Jember Regency (Haris Putra et al., 2018). Several cassava processed product companies in Jember do not yet have a fixed cassava supplier, so cassava is sometimes available at the specified time due to supplier delays in shipping and impacting the production of processed products. Therefore, it is necessary to have definite criteria in determining suppliers so that cassava processing companies can evaluate and choose the right supplier. This study aims to evaluate and select cassava suppliers based on green procurement using the Analytical Hierarchy Process (AHP) method.

METHODS

The type of research conducted is qualitative and quantitative. Data collection was obtained from field research by interviewing cassava processing companies through questionnaires related to cassava suppliers and direct observation of the actual situation at the research site. Data is processed using the integration of the AHP and TOPSIS 3.2 (Oroojeni Mohammad Javad et al., 2020). Research Steps The object of data collection in this study is a shop for processed cassava souvenirs, by analysing cassava suppliers. The initial stage of the research was carried out with a literature study of the literature related to the research as a reference, followed by a direct interview and question and answer process with competent parties in this matter. The technique of taking respondents is done by deliberately selecting respondents who are related to the research topic or known as the purposive sampling method. This is done by considering that the respondent has competence in choosing suppliers that represent the company and has the authority to provide information about the data needed in the research. In this case, three representatives were appointed as category managers. Data processing is carried out using the AHP method as a decision-making method. This method produces weights for each criterion, sub-criteria, and alternatives. From the results of the questionnaire obtained, a paired matrix will be created. To make it easier to obtain the weight of the questionnaire results, it is assisted by Microsoft Excel.

Table 1. The criteria and sub-criteria used.

Criteria	Sub Criteria
Quality (Razali et al., 2021)	[1] Certificates related to quality. [2] Quality management capabilities [3] Ability to deal with abnormal qualities
Technology Capability (Wang et al., 2021)	[1] Technology level [2] R&D capability [3] Design ability [4] Pollution prevention ability
Pollution Control (Hadi et al., 2021)	[1] Air emissions [2] Waste (liquid, solid) [3] Energy consumption [4] Use of hazardous materials
Environmental Management (Bhatia et al., 2020)	[1] Environmental related certificate [2] Ongoing monitoring and regulatory compliance [3] Green process planning [4] Internal control processes
Green product (Xie et al., 2019)	[1] Recycle [2] Green packaging [3] Cost of disposal components
Green competencies (Yafi et al., 2021)	[1] The materials used in the components are provided [2] reduce the impact on natural resources [3] Ability to modify processes and products to reduce impact on natural resources [4] social responsibility [5] The ratio of green customers to total customers

Table 2. Ratio weight scale

Scale	Meaning
1	Both elements are equally important
3	One element is slightly more important than the other elements
5	One element is very important compared to other elements
7	One element is clearly more important than the other elements
9	One element is absolutely more important than the other elements
2,4,6,8	The values between the two considerations are close together

Table 3. Random Index Value (RI)

Matrix Size (n)	1,2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI value	0.00	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.46	1.57	1.58

a. Identification of problems, determining the specifications of the objectives and the desired solution. The following are the criteria and sub-criteria used in the study.
b. Arrangement of problems in a hierarchy so that complex problems can be seen clearly. Problems are arranged starting from objectives, criteria, sub-criteria, and at the lowest level there are possible alternatives used.

c. Compilation of pairwise comparison matrices for each level. Pairwise comparisons are first carried out by comparing level 2 with level 1, namely the criteria compared to the goals to be achieved, then comparing the criteria with the sub-criteria in these criteria.
d. Completion of the pairwise comparison matrix by decision makers. The matrix is filled at the top of the diagonal line from left to right, the numbers 1 to 9 are used as comparison numbers. The following is the value of the ratio weight scale (Taherdoost & Brard, 2019) in Table 2.

e. Calculates the geometric mean. If there is more than one decision maker, a calculation called the geometric mean is performed (Setiawan et al., 2021). The way to make a geometric mean is to multiply the numbers from each of these cells, then take the number of respondents squared. The results obtained from the three decision makers are then taken for the geometric mean as the weight value used.
f. Perform logical consistency (CI) tests/calculations.
g. Testing for consistency using the formula CR = CI/RI, where RI is a random index of consistency. If the consistency ratio ≤ 0.1, the data calculation results can be justified. Random index values can be seen in Table 4, where n is the comparison matrix used.

RESULTS AND DISCUSSIONS

Data processing uses Microsoft Excel with weighting between criteria, sub-criteria, and alternatives that influence decision making in selecting suppliers. The overall structure of the hierarchy of objectives, criteria and sub-criteria can be seen in Figure 1. The complete pairwise matrix formed between the criteria is shown in Table 4 below.

Determination of CR and RI Values

The RI value in the AHP calculation is obtained from the random index value (RI), which is a constant. The RI value for each criterion is different because it depends on the number of sub-criteria (n) for each criterion, which can be seen in Table 4. The CR value is obtained from the division between the CI value and the RI value. The CI value is the total value of the average priority weight divided by the number of sub-criteria for each criterion. From the results of the overall AHP weight in Table 5, the highest alternative is Technology Capability with the highest weighted CR being 0.90 while Environment Management with the lowest CR is 0.03. The CR value is generated at the highest level, namely technology capability, this can make it easier for managers to dig up information to increase efficiency in production activities, creating synergy or company integration. Building a data center will help in obtaining real-time employee information as well as being able to analyze finances and manage them neatly. resulting in increased industrial productivity with technological advances. Various economic reports in various countries are increasingly recognizing the importance of technology in increasing productivity. Various experts in the field of technology have predicted that in the future technology will play an important role, especially after many industries have recapitulated costs and other matters related to their business

using technology. Not only in the field of large-scale industry, many small and medium-level companies have emerged with the use of technology. This is also influenced by several trends that have been and are being developed in the current global market. Whereas the lowest value generated by CR is in Environment Management with a weight value of 0.03, this is because the more manufacturing industry sectors, the more industrial activity, especially the manufacturing industry.

Table 4. Table of weighting results between criteria and sub-criteria.

Criteria	Sub Criteria	Vector value Priority	CI (a)	RI (b)	CR (a/b)
Quality	[1]	0.74	0.02	0.58	0.04
	[2]	0.17			
	[3]	0.09			
Technology Capability	[1]	0.29	0.08	0.90	0.09
	[2]	0.50			
	[3]	0.15			
	[4]	0.06			
Pollution Control	[1]	0.20	0.06	0.90	0.07
	[2]	0.55			
	[3]	0.15			
	[4]	0.10			
Environmental Management	[1]	0.28	0.02	0.90	0.03
	[2]	0.50			
	[3]	0.16			
	[4]	0.06			
Green product	[1]	0.35	0.03	0.58	0.06
	[2]	0.56			
	[3]	0.09			
Green competencies	[1]	0.22	0.08	0.90	0.08
	[2]	0.54			
	[3]	0.17			
	[4]	0.07			

As a result, it will have an impact on environmental problems, such as air pollution, water pollution, noise pollution, and the process of procuring raw materials from suppliers. Pollution occurs due to intentional or unintentional activities. Besides that, pollution can be caused by human activities and natural processes that can cause a decrease in the function of water and air. Manufacturing companies in caring for the environment tend to be influenced by consumer complaints and demands from stakeholders. They have not realized that environmental problems require more than just demands from outsiders, they should be proactive. The root of the problem in environmental damage is rapid population growth and rapid economic growth, and at the same time industrial growth is also quite rapid which is followed by exploitation of natural resources, use of technology in almost every company, the desire to follow globalization. Environmental initiatives are initiatives in corporate management to improve corporate environmental performance, improve complaints, and increase competitive advantage They have not realized that environmental problems require more than just demands from outsiders, they should be proactive. The root of the problem in environmental damage is rapid population growth and rapid economic growth, and at the same time industrial growth is also quite rapid which is followed by exploitation

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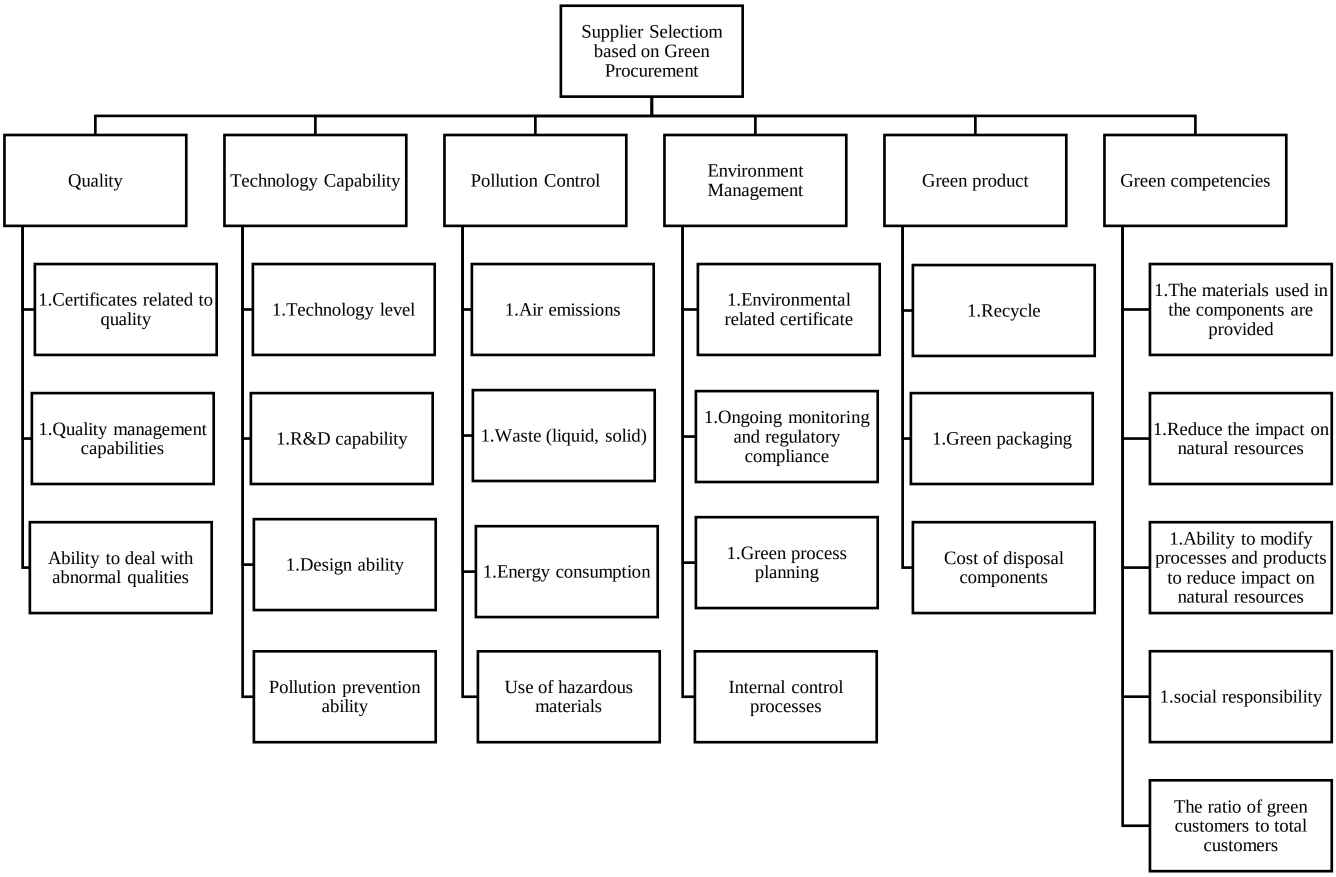

Figure 1. Structure Hierarchy of objectives, criteria and sub-criteria for supplier selection

AHP Weighting Results

The calculation results from the AHP weighting are shown in Figure 2.

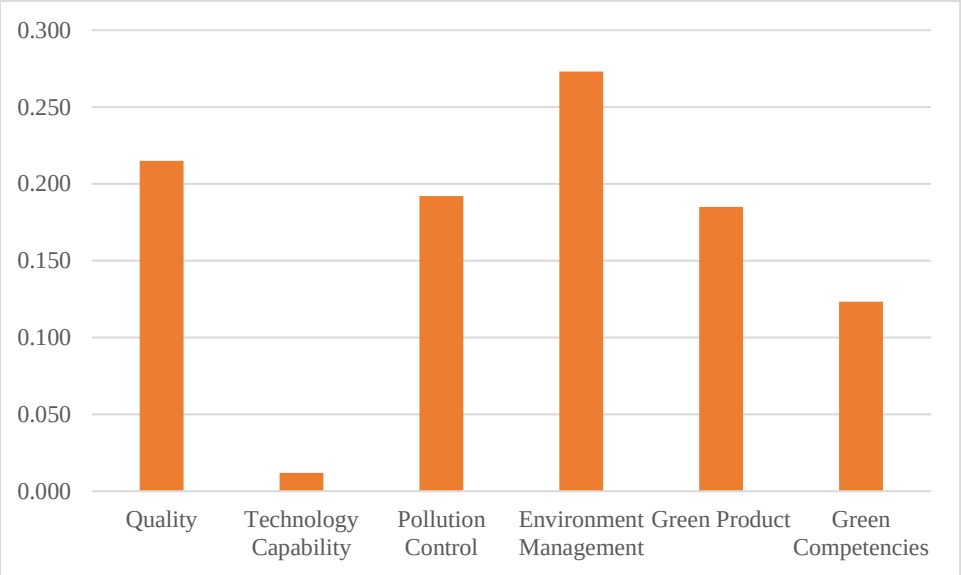

Figure 2. AHP weighting results

From the picture above it can be seen that the criterion that has the highest weight is the environmental management criterion with a value of 0.273. Environment management in the selection of cassava suppliers has continuous environmental monitoring according to the priority vector values. This value is higher than the other values. This is because the sub-criteria for continuous monitoring is an important aspect that is of more concern to cassava supplier companies, namely regarding the availability of products or goods traded in a timely manner. in the sense that the goods being traded can meet consumer needs exactly when they are needed with the hope that they will not harm the company later due to the attention to investment in providing excessive products regardless of the economics aspect for cassava retail companies, especially considering the durability/freshness of the products. agriculture that is highly unlikely to sustain over the long term. Availability of high quality fruit with the classification/classification of fruit quality in accordance with the intended sales target which will be very useful for consumers, by making it easier for consumers to choose the type of product according to the desired grade. especially considering that in terms of the durability/freshness of agricultural products it is very unlikely to be maintained for a long period of time. Availability of high quality fruit with the classification/classification of fruit quality in accordance with the intended sales target which will be very useful for consumers, by making it easier for consumers to choose the type of product according to the desired grade. especially considering that in terms of the durability/freshness of agricultural products it is very unlikely to be maintained for a long period of time. Availability of high quality fruit with the classification/classification of fruit quality in accordance with the intended sales target which will be very useful for consumers, by making it easier for consumers to choose the type of product according to the desired grade.

CONCLUSIONS

Based on the results of research that has been done that the criteria used to determine suppliers based on green procurement are 6 criteria, namely quality, technology capability, Pollution control, Environment Management, Green product, and Green competence. Of the 6 criteria are divided into several sub-criteria. Each sub-criteria is given a weight according to the scale of its importance.

The overall weighting result which is the highest alternative is Technology Capability with the highest weighted value on CR is 0.90 while the lowest CR value on Environment Management is 0.03. This means that it can make it easier for managers to dig up information, improve efficiency in production activities, create synergy or company integration.

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