Developing Sustainability Strategy for Organic Farming Using Analytical Hierarchy Process

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ABSTRACT

Organic farming in Indonesia is growing rapidly. market demand is very high but most organic farming businesses have not been able to meet market needs. the main problem lies in the business strategy used, which has not yet led to sustainability. This research tries to formulate a sustainable strategy that can be applied in organic farming in Indonesia. This research uses analytical hierarchy process to weight the available alternative strategies. alternative strategies and influencing factors and actors were obtained from a meta-analysis of the organic agriculture literature in Indonesia. Data collection was carried out through in-depth interviews with experts in the world of organic agriculture in Indonesia. The weighting results shows that most important factor in developing sustainability strategy is the development of HR (0.269). The most important actor that need to be involved in the development of the strategy is the agricultural manager (0.413), while the goal that need to be achieved once the strategy is implemented is increasing farmers' income (0.372) and the highest weighting alternative strategy is product innovation that has high added value and is responded well by the market (0.138).

Keywords

analytical hierarchy process, organic farming, pairwise comparison, meta-analysis, sustainability strategies.

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Introduction

Indonesia as an agrarian nation has immense potential for natural agribusiness. The Central Statistics Agency (2018) states that Indonesia has 12 million hectares of land which is incidentally not developed yet. Hubeis et al. (2013) said that the likely pay of natural food trades from the 12-million-hectare land is assessed at US $ 100 billion every year. All in all, the normal salary to be gotten from natural cultivating is around US $ 6,000 for every hectare. Regarding value, natural items in the global market go from 5-10 times the cost of standard items. At a large-scale level, this can drive the economy. Notwithstanding financial advantages, the improvement of natural items is work concentrated, which is sourced from neighborhood possibilities that are changed in accordance with the conveying limit of the earth. The formation of new openings has added to the social and monetary development of the rustic zones.

The increasing area of organic vegetable fields in Indonesia from 2007-2011 which experienced an increase in area of more than 180,000 hectares, identified the growing number of consumer demands for organic vegetables (Priastuti et al. 2014). Market aspects of organic horticulture products in Indonesia are also still relatively wide open from various market segments. On account of the local market, interest for natural agricultural items will in general increment. The agricultural market in Indonesia is extremely huge and shows an expanding pattern alongside the expanding pace of populace development (Chrysanthini et al. 2017).

The picture of this country is important to see the current situation of organic agriculture, especially horticulture in Indonesia. Indonesia began constructive development of organic agriculture in 1980. However, there are still many obstacles in the development of organic agriculture in Indonesia. In detail, the obstacles are mostly found at the level of small farmers. Some constraints can be described as follows: (1) farmers do not pay much interest in organic farming; (2) farmers' lack of understanding of organic farming systems; (3) there is no organization at the farm level which is an important key in organic farming cultivation; (4) farmers' lack of partnership and entrepreneurship; and (5) the sustainability of organic agriculture which has not been a focus for stakeholders (Mayrowani 2015).

In terms of strategy making, Amekawa (2010) in his research on agricultural strategies in developing countries, mentioned the importance of including indicators of sustainability, especially on the scale of small farmers. Stefan and Paul (2008) likewise stress that supportable arrangement making can prompt improved relations with partners, diminish input expenses,

and increment income through better access to business sectors and the chance of various items and new advances.

This research tries to offer a new concept of the stakeholder approach in making a strategy, which according to Adebiyi (2014), the approach is very effective to be used for making agricultural development strategies in developing countries. In addition, this research emphasizes the concept of sustainability which is an important indicator in strategy making (Fadlina et al. 2013).

Analytical Hierarchy process is used to quantify and weight the indicators for the sustainability strategy. It was created by Saaty (1990) and has been generally applied in application areas, including to decide research needs (Braunschweig 2000), credit assessment (Xu and Zhang 2009), appraisal of natural manageability (Kara and Köne 2012), choice help for spatially focused on arrangements (Gerber et al. 2008), item venture screening (Chin et al. 2008), choosing an organic pointer for a waterway stream reclamation (Huang et al. 2013), Water quality evaluation (Carbajal-Hernández et al. 2013), positioning the markers of

building execution and the clients' hazard (Khalil et al. 2016), foundational relative appraisals (Parra-López et al. 2008) and vital dynamic (Bhushan and Rai 2007). The main goal of this study is to quantify and weight the indicators used to build the sustainability strategies in organic farmin in Indonesia.

Literature Review

Organic Farming

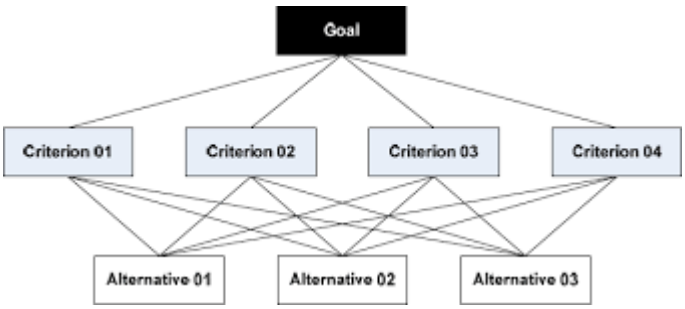
The philosophy that underlies organic farming is the principle of feeding the soil, which in turn provides the soil with food for plants (feeding the soils that feed the plants), and not directly feeding the plants. Natural cultivating as per the International Federation of Organic Agriculture Movements (IFOAM 2016) is an all-encompassing and incorporated farming creation framework, by advancing the wellbeing and efficiency of agro-environments normally, in order to deliver sufficient, quality, and manageable food and fiber. Natural cultivating is an all-encompassing cultivating framework that bolsters and quickens biodiversity, organic cycles, and soil organic exercises.

Identified with the use of natural agribusiness in Indonesia, Lumbanraja (2013) expressed the significance of procedure in the use of the natural way of thinking. The procedure received in natural cultivating is to move supplements rapidly from crop deposits, fertilizer and compost into soil biomass, which after experiencing the mineralization procedure will become supplements in the dirt. At the end of the day, supplements are reused through at least one phases of the type of natural mixes before they are consumed by plants. This is entirely unexpected from customary farming which gives supplements rapidly and straightforwardly as an answer, so it is promptly caught up with the sum and time of organization as per plant needs.

Analytical Hierarchy Process

Analytical Hierarchical Process (AHP) is utilized as a dynamic device for the distinguishing proof of reasonable natural cultivating locales. AHP was created by Saaty (1990), for setting-up a various leveled model dependent on standards and options for speaking to the intricate issues (Roig-Tierno et al. 2013). As a multicriteria dynamic strategy, the AHP has been applied for taking care of a wide assortment of issues that include complex models across various levels, where the connection among measures is normal (Feizizadeh et al. 2014, Tiwari et al. 1999).

AHP is a strategy that manages multi-rules dynamic and considers the interest of a few partners. Garfì et al. (2011) featured multifaceted perspectives in AHP, believing it to be a suitable instrument for the advancement of tasks focused on strategies to improve expectations for everyday comforts in creating nations; AHP is basic, adaptable, and straightforward to members, and spotlights on the requirements of recipients. To avoid confusion with many comparisons, which significantly increases, it is recommended that the number of elements in a category must not exceed 10 (Kukrety et al. 2013).



Picture 1. Hierarchy of Categories (Kukrety et al. 2013)

Pairwise Comparison

Pairwise comparison is utilized to decide the general significance of every marker. The appraisal was performed by leaders who were specialists in the field and who have an enthusiasm for it. Appraisal of markers and choices permit dynamic about the relative significance between two components in a single level corresponding to the level above it. This is finished utilizing a rating scale (size of 1 to 9 notwithstanding reverse qualities). The pairwise correlations have two standards:

1. The need of each factor comparative with itself is equivalent to 1.
2. If the need of factor A to factor B is equivalent to I, at that point the need of factor B to factor A ought to be equivalent to 1/I.

Material And Methods

Data was collected through in-depth interviews with experts consisting of Deputy Coordinating Ministry for Food and Agriculture, Director General of Horticulture, Expert Staff of the Ministry of Trade, Chair of the Indonesian Organic Alliance and owners of organic farming businesses in Indonesia, from January to July 2019.

The process of preparing a hierarchy consists of three stages, namely (1) identifying the overall objectives of making a hierarchy or commonly called a goal or focus, (2) determining the criteria needed or in accordance with the overall goal or focus, (3) identifying alternatives which will be evaluated under sub-criteria (Permadi 1992).

The sustainable strategy structure of organic agriculture is organized into five levels of hierarchy and the arrangement is based on interrelated matters and is very important in achieving focus. Prasetyaningtyas et.al. (2019) in her meta-analysis of organic farming literature in Indonesia shows 5 level of important indicators. These levels consist of: (1) The first level is determined as the goal or focus to be concentrated, namely the sustainable strategy of organic agriculture in Indonesia, (2) The second level is determined as a factor consisting of four things that are important for sustainable strategies of organic farming, i.e. improvement of human resources, capital, product innovation, and agricultural management models, (3) The third level is determined as an actor consisting of four actors involved in the sustainable strategy of organic agriculture, namely the owner of agriculture, the Foundation, the Regional Agricultural Service, and the Indonesian Organics Alliance (AOI), (4) The fourth level is determined as the goal in

achieving the development strategy, which consists of four objectives, namely increasing farmers' income, guaranteeing commodity prices, expanding the distribution / market network, improving water, soil and air quality, (5) The fifth level is set as an alternative strategy can be used in achieving goals or focus, which consists of nine strategies. The hierarchy structure of sustainable organic farming strategies can be seen in **Fig. 1**.

Alternative Strategies for Sustainable Horticultural Organic Business in Indonesia

Alternative strategies are the strategies obtained from the results of meta-analysis that support the success of the sustainable strategy focus on organic farming in Indonesia. The alternative strategies consist of nine strategies:

1. Innovating high value-added products and responding good by the market
2. Using a product traceability system on the packaging so consumers can trace the product if there is a problem with the product
3. National Certification or Indonesian Organic Quality Assurance (PAMOR) as an alternative to expanding marketing
4. Digital marketing
5. Building a network of cooperation with organic communities
6. Utilizing training and coaching programs organized by the Department of Agriculture to conduct financial management training and business negotiation strategies, administering improved knowledge of farmers and staff HR in terms of utilizing production technology
7. Utilize association's assistance program in increasing the knowledge of human resources in the use of technology to deal with pests and climate attacks and erratic weather
8. Opening new business lines (agritourism)
9. Open farm management system.

Simultaneously with the AHP questionnaire, researchers applied another questionnaire arranged in the form of closed and open questions for each family farmer to establish a socioeconomic profile and collect farmers' opinions about the organic industry and activities in the region. Before proceeding with the interview, informed consent was obtained from each participant.

Results

All participants utilized verbal scales to make subjective examinations, which were changed to quantitative qualities utilizing the major scale Saaty (1990). Utilizing a convenient PC during hands on work, appraisals acquired from pairwise correlations are gone into the AHP Excel Template, created by Goepel (2013) to discover nearby needs. Consistency proportions (RK) equivalent to or underneath 0.1 are checked for all appraisals. The outcome can be found in the **Fig. 2**.

Discussion

Table 1 shows a factor that has a high level of priority in sustainable organic farming strategies is HR development with a weight of 0.563. The next factor is capital, agricultural management models, and product innovation.

The HR Improvement Factor is a priority because the successful organic horticulture business is supported by adequate HR. The number of active farmers who are members of various sustainable organic farming sites in Indonesia is currently less than 20, some even have only five farmers. This amount is felt to be very lacking, given the huge market potential that will require organic farming to be able to produce organic horticulture in accordance with consumer demand. If the farmers involved are still very lacking, while the demand from consumers increases, it will result in a lot of organic horticulture demand that cannot be fulfilled. HR improvement is not only seen in terms of quantity, but also the quality (knowledge and skills) possessed.

The capital factor occupies the second priority because in running this organic vegetable business, most organic farming owners use private capital, it does not rule out the possibility of agricultural owners, also requires additional capital to develop this organic vegetable business. The capital obtained can be obtained from loans from financial institutions, so it is expected that farmers can collaborate with the Regional Agriculture Office to be able to get capital. The capital obtained can later be used to improve advice and infrastructure in the process of producing organic vegetables.

The Actor's Element

Based on the results of the vertical processing showed in **Table 2**, the main actors should be involved in developing sustainable organic farming strategies in Indonesia are the Agricultural Owners (0.413), the second actor is the Foundation (0.280), the third actor is the Indonesian Organic Alliance (0.178) and the last actor is the Department of Agriculture (0.139). The role of the Agricultural Owner in an organic farm is not only as a product quality assurance agency, but also as a product marketing institution.

The Objective's Element

Based on the result shown in **Table 3**, the main objective in making strategies for sustainability of organic agriculture in Indonesia is to increase farmers' income (0.371), the second goal is to increase the market (0.238), the third objective is to guarantee commodity prices (0.212) and the final goal is an increase in the quality of water, air, soil (0.189). Increased income of farmers is an indication that the development of organic vegetable business has been going well. The existence of certification from the Organic Food Certification Institute and the existence of its own label is expected to be a high enough added value for the products produced, so that the welfare of farmers can increase, especially farmers' income.

The Strategy Elements

Based on the results of the synthesis of an alternative weight assessment carried out using Excel AHP (**Table 4**), the main alternative strategy is Strategy 1, which is innovating high value-added products and responding well to the market (0.138). The second alternative is Strategy 3, which is the granting of national certification and PAMOR to expand marketing (0.136). The third alternative is Strategy 5, which is building a network of cooperation with organic communities (0.121). The fourth alternative is Strategy 8, which is opening a new line of business (agritourism) (0.108). The fifth alternative is Strategy 4, namely digital marketing (0.105). The sixth alternative is Strategies 6 and 7, namely Utilizing training and coaching programs organized by the Department of Agriculture to conduct financial management training and business negotiation strategies, administering increased knowledge of farmers and staff HR in terms of utilizing production technology (0.104), and Utilizing AOI assistance programs in increase human resource knowledge in terms of the use of technology to deal with pests and climate and erratic weather (0.104). The seventh alternative is Strategy 2, which uses a product traceability system on the packaging so that consumers can trace the product if there is a problem with the product (0.093). The eighth alternative is Strategy 9, the Open Farm Management System (0.088).

The results of the vertical processing which is an amalgamation of the assessment of expert experts (respondents) described above can be used as information and consideration in achieving the focus of sustainable strategies of organic agriculture in Indonesia. From these results it can be concluded that each level of the hierarchy (factors, actors, objectives and alternative strategies) has one main priority that can help stakeholders in developing sustainable strategies for organic farming in Indonesia. These priorities are:

1. Level of factors

The most important factor to consider in a sustainable organic farming strategy is the development of human resources (0.269) because in organic agriculture, the number and quality of human resources play an important role in meeting the market demand for organic horticulture products. Human resources working in agriculture must have special knowledge about organic principles and how these organic principles can achieve sustainability in social, economic and environmental terms.

2. The actor's level

The most important actor to consider in developing an organic vegetable business is the agricultural management actor (0.413). The agricultural manager becomes the top priority because the agricultural manager is an actor who guarantees the quality of farmers' products, controls the activities of the production process carried out by farmers, markets products and develops SOPs that must be obeyed by farmers, in order to get good products.

3. Level of objectives

The most important objective to consider in developing an organic vegetable business is the goal of increasing farmer's income with an assessment weight of 0.372. The increase in farmers' income will have an effect on the sustainability of the organic horticulture business, because this increase in income is an indication of whether the organic horticulture business that has been carried out has gone well, or not.

4. The alternative level of strategy

The most important strategy to consider in developing an organic vegetable business is product innovation that has high added value and is responded well by the market (0.138).

Conclusion

The Hierarchy Analysis Process (AHP) produces the highest factor weighting is the development of HR (0.269); The actors who have the highest weight are the agricultural manager (0.413); The goals that have the highest weight are increasing farmers' income (0.372) and the highest weighting alternative strategy is product innovation that has high added value and is responded well by the market (0.138).

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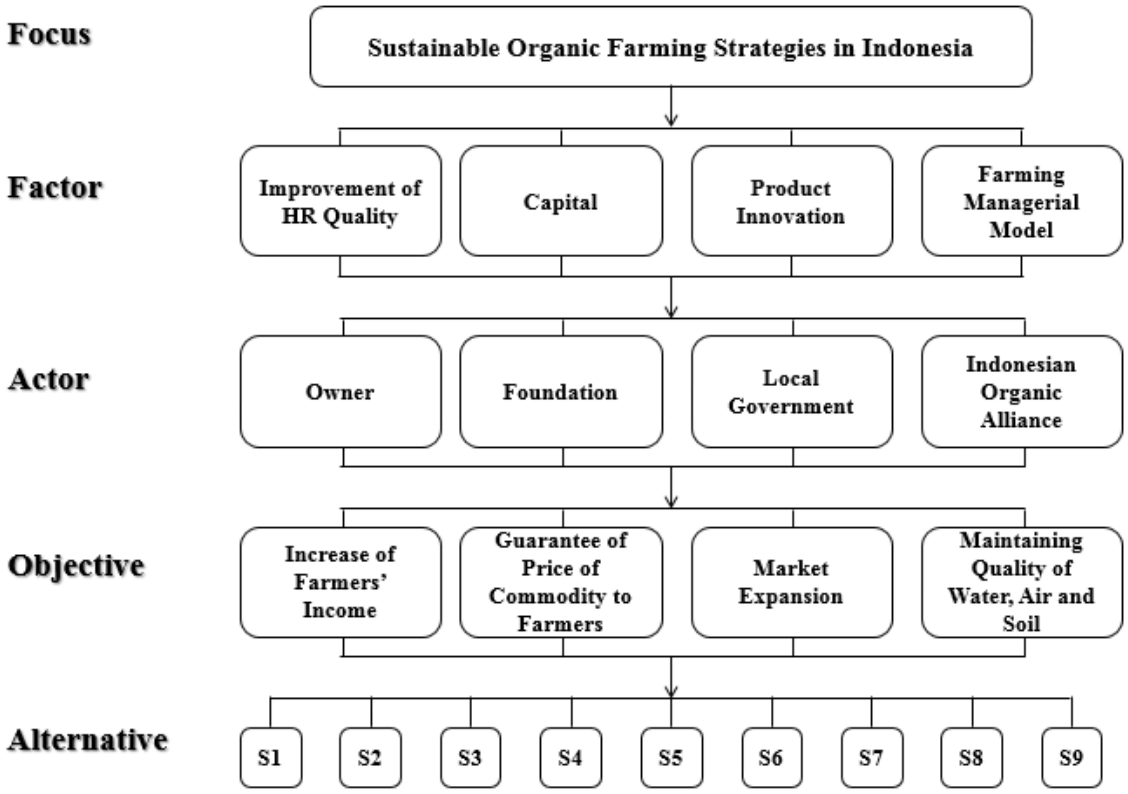

Fig. 1. AHP hierarchy for sustainability strategies in Indonesia

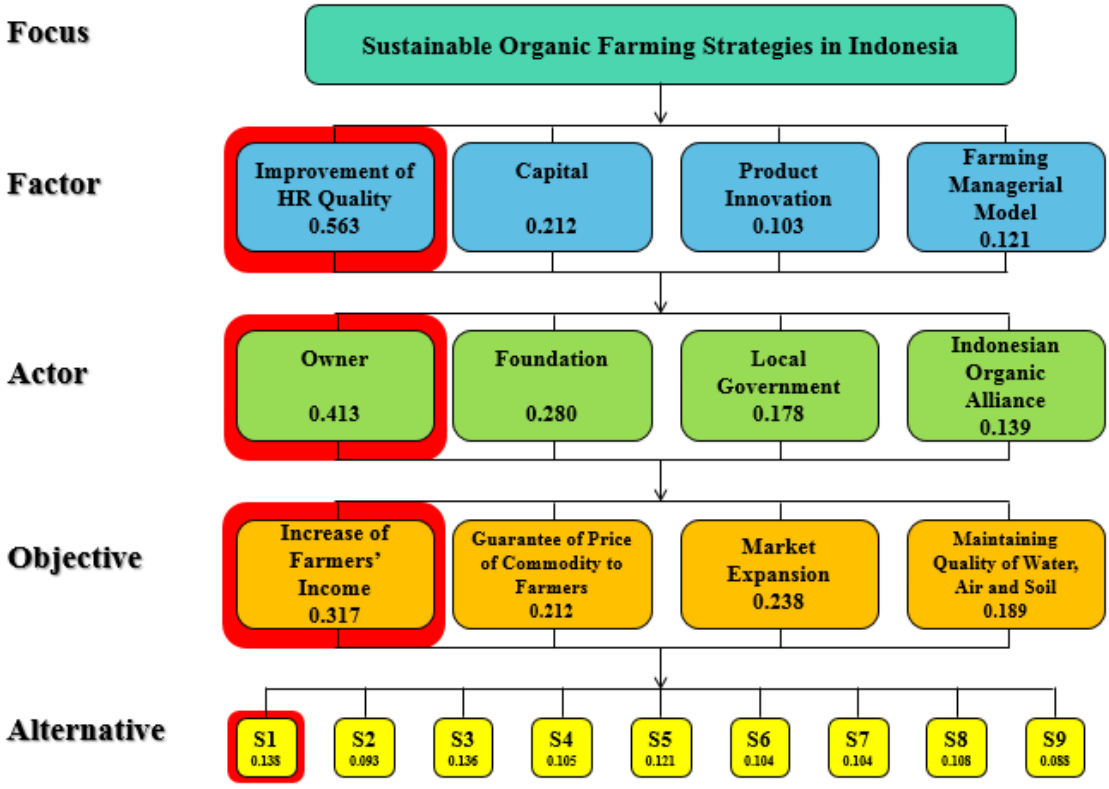

Fig. 2. AHP result for sustainability strategies in Indonesia

Table 1. The weight and priority of the factor towards focus

Factors	Weight	Priority
HR Improvement	0.563	1
Capital	0.212	2
Product Innovation	0.103	4
Farming Managerial Model	0.121	3

Table 2. The weight and priority of the actor towards the focus

Actor	Weight	Priority
Owner	0.413	1
Foundation	0.280	2
Department of Agriculture	0.178	3
Indonesian Organic Alliances	0.139	4

Table 3. The weight and priority of objectives towards the focus

Objectives	Weight	Priority
Increased farmer income	0.317	1
Market Expansion	0.238	2
Commodity Price Guarantee	0.212	3
The quality of air, water and soil	0.189	4

Table 4. The weight and priority of alternative strategies towards the focus

Strategies	Weight	Priority
Strategy 1	0.138	1
Strategy 3	0.136	2
Strategy 5	0.121	3
Strategy 8	0.108	4
Strategy 4	0.105	5
Strategy 6	0.104	6
Strategy 7	0.104	6
Strategy 2	0.093	7
Strategy 9	0.088	8