Economic Valuation for Organic Farming of Dragon Fruit: Cost Benefit Analysis Approach

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Abstract. This article is a descriptive analytic study that aims to analyze the organic farming economic valuation of dragon fruit. Data analysis method uses Contingent Valuation Method by calculating the Social Benefits and Social Costs of Organic Fruit Dragon Farming in order to obtain Net Present Value and B / C Ratio from organic farming of dragon fruit. The results showed that organic farming of dragon fruit provided social benefits of Rp. 3,736,890,099.95 / hectare per year. Net Present Value (NPV) Rp. 28,303,945,382.50 BCR = 56.77 and Total Economic Value (TEV) Rp. 3.671.069.440.01 per hectare per year. Based on the results of the study it can be suggested that the utilization of organic dragon fruit farming is managed well so that the environmental function can be maintained and economic assessment can be used as a reference and management for sustainable agricultural development

Keywords: Preservation, Social Benefits, Total Economic Value, Sustainable Agriculture

1. Introduction

The sustainability of organic fruit dragon farming is facing a downward trend. This is caused by several factors, including young people who have very low interest in working in the agricultural sector, the lack of a common perception of organic farming between farmers and the increasingly narrowing of agricultural land due to land conversion. and the flow of modernization and technological change is quite high in various aspects of people's lives. The phenomenon of declining quality (degradation) of natural and environmental resources in various parts of the world is one of the causes of problems faced by organic dragon fruit farming today. In relation to various issues of environmental degradation, agricultural economics is expected to be able to analyze the existing conditions of use of natural and environmental resources (positive) and then provide information about the implications that will arise from the existence of various policy alternatives or decisions regarding the use of natural resources, and then linked to proper use of natural resources (normative).

Organic farming of dragon fruit in Pamekasan Regency needs to be maintained in order to achieve the expectations as mentioned above. Related to that, an analysis is needed that provides and can be used as an alternative policy or decision regarding the use of natural
resources, towards the proper use of natural resources (normative). The analysis that needs to be done is an analysis of the value of social benefits and analysis of the total economic value on organic farming of dragon fruit in Pamekasan Regency. The economic value of organic farming of dragon fruit can be taken into consideration in various decision making / policies.

2. Methodology

The research is a descriptive analytic study which means doing a description of the facts, and then doing a monetary assessment of the social benefits and economic value of the existence of organic dragon fruit farming in Pamekasan Regency. There are two main variables identified to determine the economic value of dragon fruit organic farming, namely: (1) social benefit variable and (2) social cost variable. In the social benefit variable, there are six variable components that can be classified into three use values, namely direct use value, indirect use value, alternative use value and the value of existence.

3. Findings

3.1. Social Benefits in The Environment of Organic Farming of Dragon Fruit

3.1.1. Benefits of Farming Activities

The benefits of organic dragon fruit farming activities are assessed based on the amount of organic dragon fruit production multiplied by the average market price. Whereas for corn farming is determined based on the dominant farming by organic dragon fruit farmers in the 2016/2017 planting season, corn farming is assessed based on dry shelled corn production multiplied by the average market price. The benefits of farming activities on organic farming land are as much as Rp. 75,274,865.77 per hectare per year.

3.1.2 Benefits of Wildlife

The benefits of wildlife are assessed based on the number of species that can be identified. Wildlife in the canopy of organic dragon fruit farms is represented by dragonflies (Odonata) and butterflies (Rhopalocera), which is estimated to have 10 species of dragonflies and 17 species of butterflies, where there is one protected species of butterfly. In providing monetary value to wild animals, it is based on the Minister of Environment and Forestry of the Republic of Indonesia Regulation Number: P.86 / MENLHK / SETJEN / KUM.1 / 11/2016 concerning Determination of Benchmarks for Domestic and Overseas Plants and Animals that the benchmark price of dragonflies per species is Rp. 300, - and the benchmark price of the butterfly is Rp. 1,000, - So the benefits of dragonflies and butterflies are Rp. 20,000 per hectare per year.

3.1.3. Environmental Benefits as a Provider of Soil Nutrients

The assessment of the environmental benefits of organic fruit of dragon fruit as a provider of soil nutrients is assessed by the urea fertilizer cost approach. This is based on the benefits of urea fertilizer as a nutrient in the process of vegetative growth of plants such as leaves, roots, stems, shoots and so forth. Based on the results of soil laboratory tests we obtained from the Laboratory of Soil Chemistry from the Faculty of Agriculture, Brawijaya University, Malang, on organic farms of dragon fruit, it can be seen that the results of the total N analysis were 0.06% and the total N value was 0.06% including low, whereas standard N in soil is 0.20%
which is included in the medium category. So that the total N that needs to be increased is 0.2 - 0.06% = 0.14%. Urea fertilizer requirements in tons / ha are calculated by the following steps:

a. Increased total N content (soil weight of 10 cm depth, BJ = 1)
   \[ \frac{0.14}{100} \times 2 \times 1000 \text{ tons} = 2.8 \text{ tons} \]

b. Effective soil weight around roots: 10% x 2.8 tons = 0.28 tons = 280 kg
   15% x 2.8 tons = 0.42 tons = 420 kg

c. N content in urea fertilizer 45%
   So the need for urea fertilizer: \( \frac{100}{45} \times 280 \text{ kg} = 622 \text{ kg / ha} \)
   \( \frac{100}{45} \times 420 \text{ kg} = 933 \text{ kg / ha} \)

If the price of urea fertilizer is Rp. 90,000,- / 50 kg, then the required urea fertilizer cost is 933/50 x Rp. 90,000,- = Rp. 1,679,400,-

3.1.4. Environmental Benefits as Air Conditioning

Calculation of the benefits of the dragon fruit organic farming environment as air conditioning is based on the total cost of air conditioning installation services that apply in the market. The average land area of dragon fruit organic farming is 7.71 Ha. Whereas the total PK (Paard Kracht) or Horse Power needed per Ha is 555.55 PK / Ha (PK standard requirement is 2 PK for 36 m² land area). So that the land area of 7.71 Ha is needed 555.55 PK / Ha x 7.71 Ha = 4283.29 PK equivalent to 4283.29 PK / 2 PK = 2141.64 AC. So that the total cost of air conditioning installation services is Rp. 3,141,098,000.00. So that the environmental benefits of dragon fruit organic farming as air conditioning is Rp. 3,141,098,000.00 / 7.71 Ha = Rp. 407,405,706.87 per Ha.

3.1.5. Benefit from Existence Value Organic Farming of Dragon Fruit

The benefits of the existence of organic dragon fruit farming are used by using an survey technique, namely through interviews with a group of people to explore the willingness of people to pay for environmental goods at a certain level of quality and quantity, in terms of this offer of environmental goods for a wide scale of 7.71 hectares of land area.

For that, it begins with exploring people's views on certain qualities of organic dragon fruit farming as something that has an alternative existence value. The quality of environmental goods referred to consists of: organic farming of dragon fruit in a sustainable condition able to maintain soil fertility so that it can be passed on to future generations, as a place of habitat / wildlife protection, agricultural education tours or agrotourism.

Result search show that 7.54% are only willing to pay up to Rp. 1,000 then 12.26% are willing to pay above Rp. 1,000 to Rp. 2,000, 20.28% are willing to pay over Rp.2,000 to Rp. 3,000, 25.94% who are willing to pay above Rp. 3,000 to Rp. 4,000, while those who are willing to pay between Rp. 4,000 to Rp. 5,000 as much as 25.00% and only 8.96% are willing to pay above Rp. 5,000.
3.1.6. Benefit from Alternative Use (Value Option) Organic Farming of Dragon Fruit

The benefits of the use of alternate (option value) organic farming dragon fruit, used the approach by using the survey technique, namely through an interview to a group of people to explore the willingness of people to pay (willingness to pay) to offer environmental goods on the level of quality and a certain quantity, which in this matter offers environmental goods for a wide scale of 7.71 hectares of land area.

For that, it begins with exploring people's views on certain qualities of organic dragon fruit farming as something that has an alternative use value (Value Option). The quality of environmental goods in question consists of: organic farming dragon fruit as a potentially provide environmental goods, as a place of biological resources (species) that needs to be preserved, and as one ecosystem to be protected.

Research result show that it can be seen that 7.07% is only willing to pay up to Rp. 1,000 then 11.79% are willing to pay above Rp. 1,000 to Rp. 2,000, 19.81% are willing to pay over Rp.2,000 to Rp. 3,000, 26.88% who are willing to pay above Rp. 3,000 to Rp. 4,000, while those who are willing to pay between Rp. 4,000 to Rp. 5,000 as much as 25.00% and only 9.43% who are willing to pay above Rp. 5,000.

3.2. Social Costs in the Organic Agriculture Environment of Dragon Fruits

3.2.1. Investment Costs

Based on research result, investment costs for organic dragon fruit is Rp. 507,477,288.15, where the investment cost component consists of the cost of land clearing, opportunity cost, equipment costs, production costs and labor costs.

3.2.2. Cost of Farming Activities

The components of the costs of corn farming activities and organic dragon fruit farming consist of fixed costs and variable costs. Fixed costs consist of land rental costs, equipment costs and electricity costs. While variable costs consist of seed costs, fertilizer costs, costs of eradicating pests and diseases and labor costs. Total cost of farming activities on organic farming dragon fruit is Rp. 14,904,335.91.

3.2.3. Wildlife Protection Costs

Wildlife in the organic farming environment of dragon fruit consists of 3 types of dragonflies and 5 types of butterflies, where there are 1 type of butterfly protected. The type of butterfly protected is Troides vandepolli. The cost of protecting butterflies per type is US $ 5 (Kusumastanto, 2000), so the cost of protecting the butterfly species can be calculated as follows: 5/1 x US $ 5 = US $ 25. If the dollar rate at the time of the research is 1 dollar = Rp. 14,000, - it is estimated that the cost of protecting wildlife in the environment of dragon fruit organic farming, especially the cost of protecting butterflies is US $ 25 x Rp. 14,000, - = Rp. 350,000, -
3.3. Investment Criteria Analysis Results

From the results of the analysis of investment criteria, NPV Rp. 28,303,945,382.50 > 0 which means that the social benefits obtained from dragon fruit organic farming conservation efforts are greater than the social costs incurred during the project life. This means that the preservation of organic farming of dragon fruit is feasible. B-C Ratio = 56.77 > 1 means that the social benefits obtained are 56.77 times the social costs incurred for project implementation during the project life. This shows that the preservation of organic farming of dragon fruit through a ban on the conversion of organic dragon fruit farms is feasible.

Net Benefit which is the difference between social benefit value and social cost per hectare / year after discounted with a discount rate of 15%, shows that the use of organic fruit dragon farms for development by converting rice fields in the environment organic farming of dragon fruit, giving an externality of Rp. 370,318,728.30 for each hectare of rice field function per year, namely the value of net benefits in the first year. Thus, if there is a change of function of the organic agricultural land of the dragon fruit as a result of human activities, then the perpetrators of the conversion of organic fruit from dragon fruit can be charged a minimum fee of that amount per year.

3.4. Total Economic Value of Organic Farming of Dragon Fruits

Use Value consists of activities of farming activities and the results of the utilization of wildlife. Whereas non use value consists of physical value, option value and existence value. Or direct use value consists of farming activities and the results of wildlife utilization, while indirect use value is the value of physical benefits. The Total Economic Value formula of organic farming of dragon fruit is as follows:

\[ TEV = UV + NUV \] or \[ TEV = (DUV + IUV + OV) + (EV + BV) \]

So the Total Economic Value (Economic Total Value) is obtained from the multiplication results between Net Benefit (Σ Bt - Σ Ct) / hectare per year (after discounted with a discount / factor at an interest rate of 15% = Rp. 3,671,069,440.01.

4. Discussion

Economic valuation using cost benefit analysis is often used to determine the level of investment in agricultural land. Cost-benefit analysis quantifies the impacts to all members of society arising from the implementation of a project or policy. In particular, the selected methodology was directed to agricultural projects involving smallholders. This method also proposes alternative projects and compares the net benefits with the status quo. Economic valuation has mostly focused on the use value of provisioning services and cultural services, with limited valuation of non-use value of cultural services. Beside that cost benefit analysis can used to determine preservation of environment such land conservation. Cost benefit analysis already widely applied by researchers in several countries. In the Malaysia, cost benefit analysis applied to Cameron highland. The result are several instruments such willingness to pay, sustainable agriculture and ecotourisme management calculated which the object is Cameron Highland and the conclusion is for the Cameron Highlands development,
especially in agriculture and tourism are vital for economic growth especially in Pahang and the nation in general. In Uzbekistan, cost benefit analysis applied to the implementation of Conservation Agriculture (CA). The result is investment in CA implementation results in positive incremental benefit if the advantages of CA are monetized. In Kuwait, the same method applied to determine consumer’s Willingness To Pay (WTP) by using Contingent Valuation Analysis, which this method is a part of cost benefit analysis to know the benefits of environment as non use value, there are option value and existence value. The result is socio-economic variables have no significant influence on the respondent’s WTP. As expected income has a positive relationship with WTP and bid price has negative relationship with WTP to protect the environment in Failaka island. Willingness to pay (WTP) applied too in Ecuador. WTP used to determine Economic Valuation of Environmental Services of the Ecological Reserve Mache Chindul, Ecuador Climate Regulation. The result show that economic valuation is a useful tool to bring out the different uses of biological resources and biodiversity. If it is possible to show that the conservation of biodiversity can have one positive economic value greater than the activities which endanger it, information about their ecological, cultural, aesthetic and economic benefits will encourage actions to protect and preserve it productively.

Although several countries applied cost benefit analysis for environment such as conservation agriculture in Malaysia, Uzbekistan, Kuwait and Ecuador have the same goal that is determine level of investment to the conservation agriculture, with the long term goal is preservation the environment of agriculture, include organic agriculture. Especially organic farming dragon fruit in Pamekasan Regency.

5. Conclusion

Based on the results of the study, it can be concluded that organic farming of dragon fruit must be preserved so that the balance naturally is (ecologically) is not disturbed, so that the environmental function (carrying capacity and capacity) of organic farming of dragon fruit as an ecosystem can function properly.

Organic farming of dragon fruit will remain sustainable if efforts are made to increase the Total Economic Value (TEV) contained therein, so that land conversion is not carried out for other development purposes. Therefore, further research is needed to increase the social benefits of organic dragon fruit farming.

6. References

[1] E. Alvarado, "Cost-Benefit Analysis of an Agricultural Project Involving a Smallholder Production System," Department of Agricultural Economics McGill University, Montreal, 2013.

[2] A. Daujanov, R. Groeneveld, A. Pulatov and W. J. Heijman, "Cost-Benefit Analysis Of Conservation Agriculture Implementation In Syrdarya Province Of Uzbekistan," *Visegrad Journal on Bioeconomy and Sustainable Development*, vol. 5, no. 2, pp. 48-52, 2016.
[3] E. Quillérou and R. J. Thomas, "Costs of Land Degradation and Benefits of Land Restoration: A Review of Valuation Methods and Their Application," *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources*, vol. 7, no. 0606, 2012.

[4] H. Rahim, M. A. M. A. Wahab, M. Z. M. Amin, A. Harun and M. T. Haimid, "Economic values of conservation attribute options in Cameron Highlands," *Economic and Technology Management Review*, vol. 11b, pp. 123-133, 2016.

[5] Mohamed M. Mostafa and Mohaned Al-Hamdi, "'Kuwaiti consumers’ Willingness to Pay for Environmental Protection in Failaka Island: a Contingent Valuation Analysis'," *Tourism Review*, vol. 71, no. 3, pp. 219-233, 2016.

[6] M. L. Feijóo, J. B. Valle, L. Tachong and E. C. Litardo, "Economic Valuation of Environmental Services of the Ecological Reserve Mache Chindul, Ecuador Climate," *Weber Economics & Finance*, vol. 2, no. 1, pp. 506-511, 2016.

[7] I. K. Arnawa and G. M. K. Arisena, "Model Pelestarian Subak Di Bali Kajian Dari Aspek Ekonomi Lingkungan," *GaneÇ Swara*, vol. 4, no. 2, pp. 67-72, September 2010.

[8] Bondansari, K. E. Sularso and E. Dewanto, "Studi Tentang Budidaya Tanaman Kentang Solzum Tuberosum L Di Dataran Tinggi Dieng," *Jurnal Pembangunan Pedesaan*, vol. 11, no. 1, pp. 17-28, 2011.

[9] R. Dwiastrtuti, T. W. Nugroho, R. Isaskar and N. Baladina, "Sistem Produksi, Ketersediaan Dan Distribusi Benih Padi Di Jawa Timur: Pendekatan Organisasi Industrial," Universitas Brawijaya, Malang, 2014.

[10] I. M. Ningsih, R. Dwiastrtuti and . Suhartini, "Determinan Efisiensi Teknis Usaha Tani Kedelai," *Jurnal Manajemen & Agribisnis*, vol. 12, no. 3, pp. 216-225, November 2015.

[11] J. Gittinger, Economic Analysis of Agricultural Projects, Baltimore: John Hopkins University Press, 1982.

[12] H. M. Husein, Lingkungan Hidup, Masalah Pengelolaan dan Penegakan Hukumnya, Jakarta: PT, Bumi Aksara, 1993.

[13] "www.ifoam.org," ifoam, November 2015. [Online]. Available: www.ifoam.org. [Accessed Mei 2016].

[14] "www.jakerpo.org," jakerpo, 2005. [Online]. Available: www.jakerpo.org. [Accessed Juni 2015].

[15] J. Lansing, The Balinese, Tokyo: Harcourt Brace College Publisher, 1995.

[16] Environmental Impacts of Macroeconomic, United States of America: International Society Bank for Reconstruction and Development/The World Bank, 1996.
[17] K. Ningsih, "Model Pengembangan Pertanian Organik Buah Naga : Sebuah Implementasi Sustainable Agriculture," Universitas Islam Madura, Madura, 2015.

[18] K. Ningsih, "Model of Development from Organic Farming Dragon Fruit: an Implementation of," Academic Research International, vol. 4, no. 1, January 2013.

[19] K. Ningsih, H. Sakdiyah and H. Felani, "Testing Model Of Development Organic Farming Dragon Fruit," International Journal of Modern Engineering Research (IJMER), vol. 4, no. 9, pp. 1-9, September 2014.

[20] M. R. Purwaningsih, "Analisis Biaya Manfaat Sosial Keberadaan Pembangkit Listrik Tenaga Sampah Gedebagai bagi Masyarakat Sekitar," Jurnal Perencanaan Wilayah dan Kota, vol. 23, no. 3, pp. 225-240, Desember 2012.

[21] I. Supardi, Lingkungan Hidup dan Kelestariannya, Bandung: Alumni, 1985.

[22] R. Sutanto, Pertanian Organik Menuju Pertanian Alternatif dan Berkelanjutan, Yogyakarta: Kanisius, 2002.

[23] A. A. Suwantoro, "Analisis Pengembangan Pertanian Organik Di Kabupaten Magelang (Studi Kasus di Kecamatan Sawangan)," Universitas Diponegoro, Semarang, 2008.