Driving Forces and Pressures on Organic Farming of Dragon Fruit: A Part of The DPSIR Analysis Framework

Kustiawati Ningsih\textsuperscript{1}, Halimatus Sakdiyah\textsuperscript{1}, Herman Felani\textsuperscript{1}, Rini Dwiastuti\textsuperscript{2}, Rosihan Asmara\textsuperscript{2}

\textsuperscript{1}Madura Islamic University, Pamekasan, Indonesia  
Email: kustiawatin@gmail.com

\textsuperscript{2}Brawijaya University, Malang, Indonesia  
Email: dwiastuti_fpub@yahoo.com

Abstract: Organic farming is a farming activity that is familiar with the environment. Western agricultural experts define organic farming as the law of return, which means a system that returns all types of organic matter to the soil, both in the form of residues and plant and livestock wastes which then aim to feed the plants. The philosophy is to give food to the soil then the land will provide food for plants (Sutanto, 2002). Organic dragon fruit farming in Pamekasan Regency has been running for 5 years, so the decision of organic farmers is a very important factor in the application of dragon fruit organic farming. There are two indicators that influence farmers' decisions in applying dragon fruit organic farming, namely driving forces and pressures. The research method used is DPSIR (Driving Forces-Pressures-State-Impact-Responses). However, in this study limiting analysis is only an element of Driving Forces and Pressures. The way to retrieve data is by in-depth study or in-depth interviews with 34 organic dragon fruit farmers. The results showed that there were 6 things that became driving forces of farmers' decisions in implementing dragon fruit organic farming, namely: (1) Unoptimal Use of Agricultural Land, (2) Lack of Irrigation Infrastructure and Management, (3) Lack of Farmers Knowledge about Pest and Disease Management, (4) Low Agricultural Quality due to Excessive Use of Chemical Fertilizers and Pesticides, (5) Respondents and Experiences of Organic Dragon Fruit Farming Education Levels are Short Term and (6) Lack of Infrastructure Availability to Support Organic Fruit Farming Fields Dragon. Meanwhile Pressures that influence farmers' decisions in applying dragon fruit organic farming are: (1) Ability to reduce the use of chemicals, (2) The use of organic matter is still lacking, (3) Lack of effort to prevent soil erosion and (4) Lack of awareness to increase land security capacity.

Keywords: Driving Forces, Pressures, Organic Farming, Dragon fruit

1. Introduction

On agenda 21 (chapter 14 on agricultural and rural development), the agricultural sector is a priority because of its huge contribution. According to Chunjiang and Guiqing (1999) the agricultural sector is the biggest contributor to the decline in environmental quality. So that it can be said, the agricultural sector has positive and negative impacts.

Organic farming systems are increasingly popular lately, as a result of the failure of chemical agricultural systems to maintain the sustainability of land and the environment in the long term. Until now organic agriculture continues to grow in Indonesia, including in Pamekasan Regency. Organic farming that develops in Pamekasan Regency is organic dragon fruit farming. Organic dragon fruit farming in Pamekasan Regency in Blumbungan Village has been running for 5 years. In its development the organic fruit of dragon fruit has progressed quite well. Although there are still some obstacles faced by organic dragon fruit farmers, it does not reduce their enthusiasm to continue to cultivate in the organic farming system. Therefore, we are interested in analyzing the driving forces and pressures of the dragon fruit organic farming, so knowing this will give the best strategy and a solution to the problems faced by organic dragon fruit farmers.
2. Methodology

This study uses qualitative methods using analytical methods Driving Forces-Pressures-State-Impact-Responses (DPSIR). The number of respondents was 34 organic dragon fruit farmers. Data retrieval method uses interview method in deep study and questionnaire. However, in this study, we limit only the analysis of Driving Forces and Pressures on dragon fruit organic farming. Conceptually, the DPSIR analysis framework can be seen in Figure 1.

Driving Force, Pressure, State, Impact and Response (DPSIR) is a development of the PSR (Pressure-State-Response) analysis model (OECD 1993 in Zacharias et al. 2008). This approach is based on a description of the business typology, the type of resource, the pattern of utilization and the impact it causes. This study relies on an ex-ante approach where the description of the DPSIR analysis framework before and after it occurs but will be described qualitatively through structured interview assistance.

Driving Forces is a human activity that leads to various activities that can put pressure on the environment. The main driving factor for an individual is needs, such as the need for shelter and food. As the population increases, the need for housing causes the exploitation of natural resources. Secondary driving factors are the need for mobility, entertainment, culture and others.

Pressures are the result of the production or consumption process caused by the Driving Factors, namely human activities to meet their needs. The level of pressure on the environment depends on driving factors and other factors related to human and environmental interactions. Some human activities that can cause pressure are excessive use of natural and environmental resources, changes in the use of resources and emissions (chemicals, waste, radiation, noise) to air, water and soil.

3. Findings

3.1. Driving Forces in Dragon Fruit Organic Farming
3.1.1. Unoptimal Use of Agricultural Land

Based on an in-depth study of 34 respondents from farmer group members, of the total land area of all respondents, which is 15.01 hectares, the land area used for organic dragon fruit is only 6.08 hectares or about 40.5% of the total land area. Meanwhile, the area of land used for inorganic dragon fruit is only 3.24 hectares or about 21.58% of the total land area. So that the remaining land that has not been used for agricultural activities is 5.69 hectares or around 37.92% of the total land area. From these data it can be seen that there is an unused land of 5.69 hectares so that it can be concluded that the use of organic agricultural land is not optimal. This can be influenced by farming experience from farmers, where from an average experience of farming for 17 years, farmers who have experience of organic dragon fruit farming are only about 2 years and farmers who have experience in organic dragon fruit farming are only about 3 years. Based on the area of land and the experience of farming of the respondents, it can be concluded that there is a positive correlation where the longer the experience of farming of respondents, the more optimal use of land for organic farming, especially the organic farming of dragon fruit.

Besides that, there is a large amount of land that has not yet been built for organic farming, because the management of organic farming is not optimal. This is indicated by the area of land that is utilized for the cultivation of organic crops is not optimal when compared to the potential of available land and the use of land for organic agricultural plants has not paid attention to land suitability, so that it has an impact on agricultural production that is not optimal and tends to decrease and cause welfare farmers are also getting lower.
Irrigation is one of the most important infrastructures in agriculture, especially organic farming. Besides that irrigation has a very important role on the productivity of agricultural land, especially organic agriculture. Based on conditions in the field, irrigation facilities and infrastructure found in dragon fruit organic agriculture are still lacking and inadequate. This was stated by Rosidi as the Chairperson of Citra Lestari Gapoktan, that so far there is indeed a flow (PDAM) of irrigation which is only used for household needs and around organic farms there are indeed reservoirs or reservoirs of water storage, but the management is still not optimal. There is even a tendency for the water reservoir to not be managed because after the water reservoir was built, it was even left without the continuity of

Figure 1. DPSIR Conceptual Framework

3.1.2. Lack of Irrigation Infrastructure and Management

Irrigation is one of the most important infrastructures in agriculture, especially organic farming. Besides that irrigation has a very important role on the productivity of agricultural land, especially organic agriculture. Based on conditions in the field, irrigation facilities and infrastructure found in dragon fruit organic agriculture are still lacking and inadequate. This was stated by Rosidi as the Chairperson of Citra Lestari Gapoktan, that so far there is indeed a flow (PDAM) of irrigation which is only used for household needs and around organic farms there are indeed reservoirs or reservoirs of water storage, but the management is still not optimal. There is even a tendency for the water reservoir to not be managed because after the water reservoir was built, it was even left without the continuity of
irrigation maintenance and continuity. So that this causes the productivity of dragon fruit organic farms
to be low and this also affects the income level of organic dragon fruit farmers.

3.1.3. Lack of Farmers Knowledge about Pest and Disease Management

Pests and diseases in plants, especially organic dragon fruit, is one of the biotic stresses that
causes a gap between potential yields and actual results, and also causes unstable production. Based on
the results of the in-depth study of respondents at the study site, information was obtained that the pests
that attacked the organic farming of dragon fruit were ants. However, in eradicating these pests,
respondent farmers still did not fully implement organic pest control. They use chemical exterminators.
While in the application of organic farming it is recommended to use vegetable pesticides. Therefore,
the lack of farmers' knowledge about pest and disease control in dragon fruit organic farming in
accordance with the principles of organic farming will be one of the driving forces in the application of
organic farming holistically.

Lack of farmers' knowledge about pest and disease control is closely related to their experience
of organic dragon fruit farming. Farmers who have experience of organic dragon fruit farming are only
about 2 years, so it can be concluded that organic dragon fruit farmers can be categorized as early
majority, namely individuals who are willing to make an initial investment in a new technological
innovation by ensuring the level of security of the investment. Rogers (2003: 22) states that based on
individual characteristics such as socio-economic conditions, behavior in interacting and
communicating, behavior in adopting an innovation can be divided into five categories, namely
innovators, early adopters, early majority, late majority, and laggards.

Respondent farmer categories as early majority on dragon fruit organic farming can be caused
because initially the respondent farmers conventionally cultivated dragon fruit farming, in the sense that
in their cultivation they still use chemicals and have not fully implemented organic farming holistically.
This is because conventional farmers are still difficult to accept organic farming systems. Because
according to them, organic farming practices are more complicated than the conventional farming they
have practiced so far. Especially with their low level of education, conventional farmers still have a
mindset that is skeptical of new technology.

3.1.4. The Low Quality of Agricultural Land Due to the Use of Excessive Chemical Fertilizers and
Pesticides

Green revolution or chemical farming systems are considered to be failing in maintaining the
sustainability of land and the environment in the long run, resulting in an increasingly popular organic
farming system these days.

Meanwhile, the quality of an agricultural land is reflected by the level of soil fertility. The low
quality of organic fruit of dragon fruit can be caused due to excessive use of chemical fertilizers and
pesticides and cause damage to agricultural land. Based on the results of our research in the first year,
we conducted a laboratory test of the soil on dragon fruit organic farms. We conducted soil laboratory
tests at the Soil Chemical Laboratory, Faculty of Agriculture, Brawijaya University Malang. The results
of soil laboratory tests show that the total N analysis results are 0.06% and the total N value is 0.06%
including low, while the standard N in the soil is equal to 0.20% which is included in the medium
category. So the total N that needs to be increased is 0.2 - 0.06% = 0.14%. The need for urea fertilizer
in tons / ha is calculated by the following steps:

a. Increased total N level (soil weight 10 cm depth, BJ = 1)

\[ \text{Increased total N level} = \frac{0.14}{100} \times 2 \times 1000 \text{ tons} \]

\[ = 2.8 \text{ tons} \]
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 level in urea fertilizer 45%
   So the need for urea fertilizer: 100/45 x 280 kg = 622 kg / ha
   100/45 x 420 kg = 933 kg / ha
   If the price of urea fertilizer is Rp. 90,000 / 50 kg, the cost of fertilizing urea needed is 933/50 x Rp. 90,000 = Rp. 1,679,400.

   Based on the results of the laboratory tests mentioned above, the level of soil fertility in organic farms of dragon fruit can be said to be low. Because the N content in the soil is in the moderate category. Because dragon fruit cultivation uses an organic farming system, it is necessary to add nutrients in the form of organic fertilizer equivalent to urea needs of 933 kg. So the cost of purchasing the required organic fertilizer is 933/50 x Rp. 100,000 = Rp. 1,866,000.

 3.1.5 Education Levels of Respondents and Experiences in Cultivating Organic Dragon Fruits Are Still Short Term

Education of organic dragon fruit farmers respondents spread at Primary School, Junior High School, Senior High School and Bachelor. This can be seen in Table 1.

| No | Level of Education    | Number of Respondents (people) | Percentage (%) |
|----|------------------------|---------------------------------|----------------|
| 1. | Primary School         | 2                               | 5.88           |
| 2. | Junior High School     | 8                               | 23.53          |
| 3. | Senior High School     | 15                              | 44.12          |
| 4. | Bachelor               | 9                               | 26.47          |
|    | Total                  | 34                              | 100            |

Source: Primary Data, Processed (2018)

From Table 1. above, it can be seen that most of the farmer respondents' education is high school which is as many as 15 people or around 44.12% of the total respondents. Meanwhile, respondents with a Bachelor level of education were in second place with 9 people or around 26.47% of the total respondents. Respondents with a junior high school education level were a total of 8 people or around 23.53% of the total respondents and respondents with elementary education level were 2 people or around 5.88% of the total respondents. So from Table 1., it can be concluded that the education level of the respondents of dragon fruit organic farmers has been at a high level, but the high level of education of the respondents has not been matched with the farming experience of the respondents, namely that the experience of organic dragon fruit farmers is only about 2 years 3 months.

The experience of farming is closely related to the level of mastery of technology that supports activities in dragon fruit organic farming. Lack of farming experience will lead to low skill levels and mastery of organic dragon fruit cultivation technology so that the level of productivity of organic farm dragon fruit is also low.
3.1.6. Lack of Availability of Infrastructure to Support Organic Fruit in Dragon Farms

Infrastructure in a region is related to its function and role to the development of a region so that the seriousness of the local government is needed in handling it. The lack of seriousness of the local government can be seen from the lack of availability of infrastructure that supports the dragon fruit's organic farmland. This is indicated by the condition of damaged roads, some roads that have not been paved and it is very necessary to increase farm roads to connect each village. Besides that there is still a lack of trenches as a water channel, a decrease in the capacity of water storage structures such as reservoirs as a result of increased sedimentation, reservoirs and water sources to support the organic farming activities of dragon fruit.

3.2. Pressures on Dragon Fruit Organic Farming

3.2.1. Ability to Reduce Use of Agricultural Chemicals

The chemical farming system that requires the use of chemical fertilizers and other chemical production facilities causes farmers to be unable to abandon chemical farming systems. But a worse impact occurs on agricultural land. As a result of the long-term use of chemicals, the fertility rate of agricultural land has decreased. Therefore the ability of farmers to reduce the use of agricultural chemicals is one of the pressures on dragon fruit organic farming. This pressures factor will influence the decision of organic dragon fruit farmers to implement dragon fruit organic farming holistically.

3.2.2. Good Watering System

Irrigation systems on agricultural land play a very important role so that it can affect the level of productivity of the agricultural land. Likewise, dragon fruit organic farming. To support its growth and development requires a good irrigation system. If you see the condition of rocky and sandy land in the research location, it can be said that you really need good irrigation. However, irrigation facilities and infrastructure that are not yet available properly can be a barrier in the growth and development of organic dragon fruit plants. So that it will automatically affect the level of production of the organic dragon fruit plant itself.

3.2.3. Improving the Intercropping Planting System to Support Environmental Resilience

Intercropping is a system of planting two or more types of plants simultaneously on the same land within one year. The advantages of applying the intercropping system can be seen from the Land Equity Ratio (NKL). The value of land equality of more than 1 indicates profit (Yuwariyah, 2011). Based on conditions in the field, out of a total of 34 respondents, only 4 respondents applied the intercropping system between organic dragon fruit and peanuts or only about 11.8% of the total respondents.

3.2.4. Lack of Use of Organic Materials

The benefits of organic materials for plant growth are as a granulator or improving soil structure where it will be very beneficial for plants. Organic materials contain nutrients and will be decomposed by bacteria and microorganisms in the soil and can then be utilized by plants. Conditions in the field indicate that there have been 24 respondents who began to reduce the use of chemical fertilizers and switched to using organic fertilizers. Likewise with the use of vegetable pesticides, out of the total respondents, 24 people also started using vegetable pesticides. However, out of a total of 34 respondents, only 24 people or about 70.6% of the total respondents started using organic materials, so that the perception of the application of the organic farming system as a whole was needed.

3.2.5 Lack of Efforts to Prevent Land and Landslide Erosion

Soil erosion is a process or event of loss of the upper surface layer, both caused by movement of water and wind. This erosion process can cause a decline in soil productivity, soil carrying capacity and environmental quality. Conditions on the ground indicate that the contours of the land are sloping
and there are cliffs. So that this can cause differences in soil fertility. The difference in the level of soil fertility also affects the productivity of a land.

4. Discussion

Elements of the driving factors and pressures on dragon fruit organic farming are very important elements in the farmers’ decision making process to implement organic farming. This is in accordance with the results of Kristensen's study (2004) which stated that the driving factors are needs. The driving factors in the agricultural sector include the number of animals, types of plants, stability, fertilizer and soil types. Pressure factors in the agricultural sector include resource use, gas emissions, radiation and risk. The fact is that the DPSIR framework is not only enough to just describe it. However, it must be able to understand and manage social and ecological interactions (Levrel et al, 2009). Hartanto's research (2017) shows that changes in land use do not significantly affect the incidence of flooding but floods affect land use patterns. So it can be concluded that the more land is used for agriculture, the more erosion of the soil will be. This is in line with the results of the research that we obtained, which is included in one of the pressures, namely that it is very necessary to strive to prevent soil erosion by increasing land use, especially the dragon fruit organic farms.

According to Pinuji (2018) population activities on land are strongly influenced by economic growth, climate change which causes the ebb and flow of marine fisheries, and population growth both due to birth and migration. In dragon fruit organic farming, the same thing also happens, namely the driving factors of dragon fruit organic farming, one of which is climate change. Where during the dry season, organic dragon fruit plants need a lot of water, especially for watering activities. The opposite is different when the rainy season. However, the obstacle during the rainy season is the growth of weeds that cause nutrient competition with organic dragon fruit plants.

As a tropical country, the agricultural system in Indonesia only relies on rainwater as a source of irrigation. So that this will affect the growth and development of plants that automatically also have an impact on the level of productivity of a land. No exception on organic dragon fruit farms. Because it is a major driving factor, some researchers are very concerned about the importance of irrigation to the level of productivity of agricultural land. The results of the Svarstad et al (2007) study show that the role of policy makers is very important in providing solutions to irrigation problems faced by farmers and stakeholders so that good communication is needed between researchers, policy makers and other stakeholders. This is in line with the results of the study of Siwailam et al (2019) which shows that the role of the Egyptian government is very important as policy makers and must take measures to improve the efficiency of water use and increase renewable water resources to compensate for water shortages.

Although many studies use the DPSIR framework as a method for example Egypt and Germany, the research they conducted has one common goal, namely increasing the role of the government as policy makers on the driving factors and pressure factors that occur in agriculture, especially dragon fruit organic farming in the Regency Pamekasan so that the synergy between researchers, policy makers and stakeholders can provide solutions to the driving factors and pressure factors that occur in dragon fruit organic farming.

5. Conclusion

Based on the results of research that has been obtained, it can be concluded that the driving factors and pressure factors on dragon fruit organic agriculture are factors that require special attention because considering organic farming is one of the efforts to realize sustainable agriculture so that in the long run can realize the preservation of organic agriculture dragon fruit. Of course this is a shared responsibility between local government and stakeholders so that good communication needs to be established between researchers, policy makers and stakeholders.
References

[1] 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.

[2] Bondansari, K. E. Sularto 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.

[3] J. Dixon and M. Hufschmidt, Economic Valuation Techniques for the Enviromental : A Case Study Workbook, The John Hopkin University Press, 1986.

[4] R. e. a. Dwiastuti, "Determinan Efisiensi Teknis Usahatani Keladai," *Jurnal Manajemen dan Agribisnis*, vol. 12, no. 3, 2015.

[5] R. Dwiastuti, 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.

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

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

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

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

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

[11] M. Munasinghe and L. E, Environmental Economics and Valuation in Development Decision Making, Washington: CIDIE by The World Bank Washington, 1993.

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

[13] K. Ningsih, "Model Pengembangan Pertanian Organik Buah Naga : Sebuah Implementasi Sustainable Agriculture," Universitas Islam Madura, Madura, 2015.

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

[15] K. Ningsih, H. Sakdiyah, H. Felani, R. Dwiastuti and R. Asmara, "Analisis Willingness to Pay Masyarakat terhadap Pertanian Organik Buah Naga," *Agriekonomika*, pp. 1-12, 2019.

[16] W. Pearce David and .. Turner R Kerry, Economic of Natural Resources and Environment, London: Harvester Weatsfah New York, 1990.

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

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

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

[20] A. A. Suwantoro, "Analisis Pengembangan Pertanian Organik Di Kabupaten Magelang (Studi Kasus di Kecamatan Sawangan)," Universitas Diponegoro, Semarang, 2008.
[21] I. G. B. M. Wiradharma and .. Made Antara, "Pelestarian Hutan Mangrove di Teluk Benoa Bali : Tinjauan dari Aspek Lingkungan," *Jurnal Sosial Ekonomi Pertanian dan Agribisnis SOCA*, vol. 6, no. 2, pp. 109-216, 2006.

[22] S. G, "Strategi Efisiensi Penggunaan Bahan Organik Untuk Kesuburan dan Produktivitas Tanah melalui Pemberdayaan Sumberdaya Hayati Tanah," *Jurnal Sumberdaya Lahan*, vol. 4, no. 1, pp. 13-25, Juli 2010.

[23] I. S. Roidah, "Manfaat Penggunaan Pupuk Organik," *Jurnal Universitas Tulungagung BONOROWO*, pp. 30-42, 2013.

[24] H. Mayrowani, "Pengembangan Pertanian Organik di Indonesia," *Forum Penelitian Agro Ekonomi*, vol. 30, no. 2, pp. 91-108, Desember 2012.

[25] A. M. Purnamasari, "Pengembangan Masyarakat Untuk Pariwisata Di Kampung Wisata Toddabojo Provinsi Sulawesi Selatan," *Jurnal Perencanaan Wilayah dan Kota*, vol. 22, no. 1, pp. 49-64, April 2011.

[26] M. Khorniawati, "Produk Pertanian Organik di Indonesia : Tinjauan Atas Preferensi Konsumen Indonesia Terhadap," *Jurnal Studi Manajemen*, vol. 8, no. 2, pp. 172-182, Oktober 2014.

[27] G. Subowo and J. Purwani, "Pemberdayaan Pemberdayaan Sumber Daya Hayati Tanah Mendukung Pengembangan Pertanian Ramah Lingkungan," *Jurnal Litbang Pertanian*, vol. 32, no. 4, pp. 173-179, Desember 2013.

[28] R. S. Rivai and I. S. Anugrah, "Konsep Dan Implementasi Pembangunan Pertanian Berkelanjutan Di Indonesia," *Forum Penelitian Agro Ekonomi*, vol. 29, no. 1, pp. 13-25, Juli 2011.

[29] S. Khoiriyah and M. J. Suam Toro, "Faktor-Faktor Yang Mempengaruhi Kesediaan Membeli Produk Hijau," *Jurnal Bisnis & Manajemen*, vol. 14, no. 1, pp. 63-76, 2014.

[30] P. Kristensen, "The DPSIR Framework," in *workshop on a comprehensive / detailed assessment of the vulnerability of water resources to environmental change in Africa using river basin approach*, Nairobi, Kenya, 2004.

[31] H. Levrel, C. Kerbiriou, D. Couvet and J. Weber, "OECD pressure–state–response indicators for managing biodiversity: a realistic perspective for a French biosphere reserve," *Biodiversity and Conservation*, vol. 18, no. 7, pp. 1719-1732, 2009.

[32] I. S. Hartanto and R. Rachmawati, "Assessing the Spatial-Temporal Land use Change and Encroachment Activities Due to Flood Hazard in North Coast of Central Java, Indonesia," *Indonesian Journal of Geography*, vol. 49, no. 2, pp. 165-176, 2017.

[33] S. Pinuji, M. A. Suhattanto and T. Arianto, "Dinamika Dan Tantangan Penggunaan Dan Pemanfaatan Tanah Di Wilayah Pulau Kecil," *Bhumi*, vol. 4, no. 1, pp. 104-116, Mei 2018.

[34] H. Svarstad, L. K. Petersen, D. Rothman, H. Siepel and F. Wa”tzold, "Discursive biases of the environmental research framework DPSIR," *Land Use Policy*, pp. 1-10, 2007.

[35] M. Siwailam, H. Abdelssalam and M. Saleh, "Integrated DPSIR-ANP-SD framework for Sustainability Assessment of Water Resources System in Egypt," *International Journal of Academic Management Science Research (IJAMSR)*, vol. 3, no. 3, pp. 1-12, March 2019.

[36] Y. Yuwariah, D. Ruswandi and A.W. Irwan, "Pengaruh pola tanam tumpangsari jagung dan kedelai terhadap pertumbuhan dan hasil jagung hibrida dan evaluasi tumpangsari di Arjasari Kabupaten Bandung," *Jurnal Kultivasi*, vol. 16, no. 3, pp. 514-521, Desember 2017.