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Chapter 2
Strengthening the Resilience of Rural Agricultural Societies in Indonesia: Agroecology with a Terroir Approach

Fitrio ASHARDIONO

1. Current Agriculture Outlook

We live in a world where success is measured by profitability in the short term, and long-term losses are rarely factored into the decision-making equation. Over the years this has inevitably led to the widespread adoption of monoculture in agricultural cultivation, where vast tracks of land are devoted to the production of a single crop. Agricultural scientists have been warning us that this will be more than likely to cause soil degradation and fertility loss. Years later we are reaping the harvest of spreading monoculture, which has created an imbalance between fertilizer supply and crop offtake, thus leading to soil erosion and further loss of nutrients. In addition to overproduction, industrial monoculture predisposes farms to pest problems. To keep up with intensified production, farmers have increased pesticide and fertilizer usage, but these may run off into the waterways causing further damage to neighboring ecosystems. Additionally, with heavily mechanized cultivation, almost all the energy consumption throughout every stage of the agricultural production releases greenhouse gases which further contribute to global warming. Today, the environmental issues that commonly arise due to intensified agricultural production can be observed in water and air pollution, biodiversity loss, and land

degradation. Until recently, farmers have ignored the downsides and agricultural production has continued to be optimized for generating profit, but in the light of the scientists' warnings, and growing public awareness, the farming industry is now coming under pressure to meet the environmental targets set to protect future generations from extinction.

In modern monoculture cultivation, high-input/high-output is always geared for profitability, and more often than not a holistic understanding of plants or animals achieving an optimum response to inputs is not adequately explored. When the environment is always treated as secondary, the loss of environmental resources is unlikely to be included in the costs when calculating the profitability of the agricultural industry.

It is time to change this paradigm into a more sustainable agricultural production process, to put a price on these environmental burdens and properly evaluate the resources taken from the ecosystem services and how these directly affect the whole cultivation process. In other words, to make agricultural production sustainable it is a necessary factor in the economic value of the environmental burdens and the resources from ecosystem services.

2. Agroecology and Terroir

In pursuit of sustainable agriculture production, a new approach in agricultural practice known as agroecology has been introduced, and furthermore in my research I have found another methodology which is the Terroir Approach.

As generally observed, when economists who are not agriculturalists perform cost-benefit analysis, they generally refer to the costs that do not appear in the calculations as indirect or external. These costs

can include environmental burdens, consumption of local ecological resources, as well as the valuation of existing ecosystem services. They are not factored into their calculations.

So, one of the approaches to address environmental and sustainability issues in agricultural production is to address the social and economic aspects in a holistic and systemic manner.

This includes understanding the organization, communication, and coordination among stakeholders in agriculture production as well as analyzing the farmer consumer relationship and how they affect each other.

Agroecology researchers in this field are trying to solve these questions by employing scientific methods and implementing ecological principles when designing agriculture management systems. It is no longer just about cost-benefit analysis, but more about how agriculture can benefit from the local ecological system and at the same time, how the agriculture production can give back and help balance the ecological system, thus ensuring the sustainability of the ecosystem procedures.

And building on agroecology, it is also very important to highlight the importance of the interconnected nature of local stakeholder relationships in landscape identity and territorial resources which are embedded in the local or regional food systems, and in this case, there's another landscape identity which is a territorial resource. These things are very much located locally, like the real food system, and so on.

The agroecology territories discuss three major domains (Wezel et al., 2016):

1. Adaptation of agricultural practices.
2. Conservation of biodiversity and natural resources all
3. Development of food systems embedded in the territories.

All of these three items refer to a much smaller area of local life. Building on this, it is clear that agroecology is always aiming at a smaller local space. So, in this case, it's heavily related to the concept of Terroir.

Derived from the wine industry the concept of Terroir describes the relationship between the character of an agricultural product and its geographical origin (van Leeuwen & Seguin, 2006). Human factors such as history, socioeconomics, as well as viticultural and or oenological techniques are also part of Terroir (Seguin, 1986).

The Terroir concept is linked to the unique biophysical properties of a particular area which contributes to the agricultural products (Berard and Marchenay, 2006); thus it can be argued that the special quality of an agricultural product is determined by the character of the place the product comes from (Gade, 2004).

Put simply, Terroir explains about the relationship between the local natural environment and ecosystem characteristics and the local agriculture knowledge and practices where these two are directly influencing the characteristics of an agricultural product (Ashardiono, 2019).

The diagram depicting the framework of the terroir concept shows how all aspects are interconnected, and how they affect each other. Any particular agricultural product is affected by two main elements, which are the environmental ecosystem, and then the inherent agriculture knowledge and practices in that local area.

Figure 1. The Framework of Terroir Concept
Source: (Ashardiono, 2019)

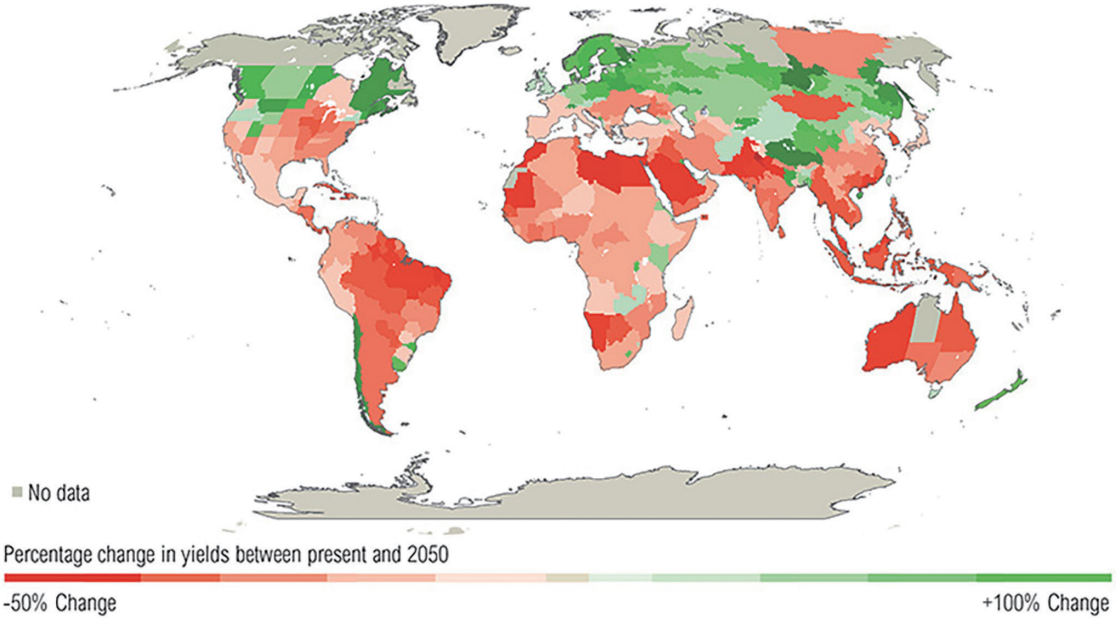

Figure 2. Projected Impact on Crop Yields due to Climate Change between Present and 2050 (3oC Warmer World)
Source: World Bank (2010) in World Resource Institute (2013)

3. Changing Southeast Asia: Indonesian Coffee Cultivation

In this era of climate change the tropical regions are among the most vulnerable. The temperature variability is predicted to increase, and so is the tendency of increasing local temperatures. (Bathiany et al., 2018). Other research has also found that there a is significant increase in the variability of precipitation patterns and increasing occurrences of severe weather events as well as temperature increases (ADB, 2010). The map highlighting temperatures in temperate and tropical regions shows that Indonesia is going to be heavily impacted in the near future.

Coffee cultivation in Indonesia began during the Dutch colonial period in the 17th century. From 2018 up until now, Indonesia is still the fourth largest coffee producer in the world with the combined production of both Arabica and Robusta beans totaling 612,000 tonnes. In the past years, this volume of production has largely been stagnant. But inside this total, the production of Arabica beans has been slowly increasing, as there has been a gradual switch among the growers from Robusta to the higher quality Arabica variety.

Historically, extreme weather events have been occurring in this region, and while they had significant impacts the farmers were able to recover. The current argument is that due to the steady increase in global environmental changes, this might not be so anymore, because the changes will become much more irreversible (Tucker et al., 2010). This changing climatic behavior means that coffee cultivation might no longer be beneficial (Gay et al., 2006).

Moreover, increasing climatic variability such as sudden changes in precipitation patterns and their volumes will directly affect the coffee production quantity (Schroth et al., 2009; Jaramillo et al., 2013), thus bringing negative impacts on crop production yields, forest harvest,

and biodiversity. Furthermore, under the current COVID-19 pandemic agricultural communities are facing more economic pressures, and with the economic downturn, there is less demand for coffee products internationally (ICO, 2020). Even Starbucks is losing customers, and fewer people buying coffee means that fewer beans are being sold. At the same time, Indonesia and Vietnam, two of the biggest producers, are still actively producing coffee, which is contributing to further imbalance in the supply and demand (ICO, 2020), so there's going to be more impact on the economic side.

4. Coffee Cultivation in Solok Region


Figure 3. Arabica Coffee
Source: Author

How about the conditions in the coffee growing regions themselves? I'm going to explain one of my case studies, which is in the Solok region located in West Sumatra, Indonesia, which is famous for good coffees.

Some of the most well-known coffee products in Indonesia are produced on the island of Sumatra. I'd say that Aceh Gayo, Mandheling, Lintong and Solok are the four best coffees from the region, and the Arabica beans produced in these regions are regarded as high-quality coffees which have a distinct aroma and taste characteristic. In the past years, the popularity of Solok coffee in the domestic market as well as the demand from the international market has risen significantly. Solok is a kind of rising star, not yet widely known, but among coffee connoisseurs, it is known already.

The Solok region consists of three separate administrative areas which are Solok Municipality, Solok Regency and South Solok Regency.

The Arabica coffee varieties are mostly grown in Solok Regency and South Solok Regency.

In general this region is well known for its production of rice which has always been the main agricultural commodity, whereas coffee production is relatively quite low compared to other commodities.

Historical evidence shows that in this region coffee cultivation started in the early 18th century and most of the coffee, especially the Arabica variety is grown in areas with an elevation above 1,500 meters

While the Arabica variety was originally cultivated, it was wiped out by coffee rust disease in the late 18th century. At that time they switched to Robusta, which as its name implies, is less vulnerable to pest and climate issues. So production of the Arabica variety is comparatively low compared with other well-known coffee producing regions in Sumatra, but lately, they are trying to switch back to Arabica. Based on 2019 statistical data, the 2018 total coffee production in the Solok Region was 4,656.11 tons, and from this total the production of Arabica variety was 1,010.47 tons (21.7%) and the production of Robusta variety was 3,645.64 tons (78.3%).

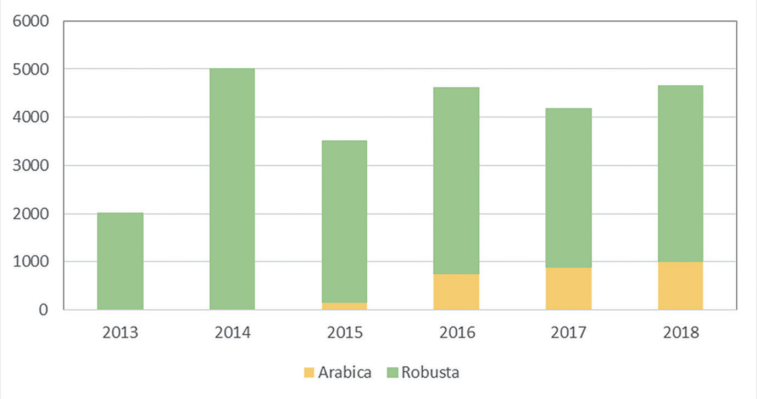

Figure 4. Total Coffee Production in Solok Region (tonnes)
Source: Statistics of West Sumatra, 2019

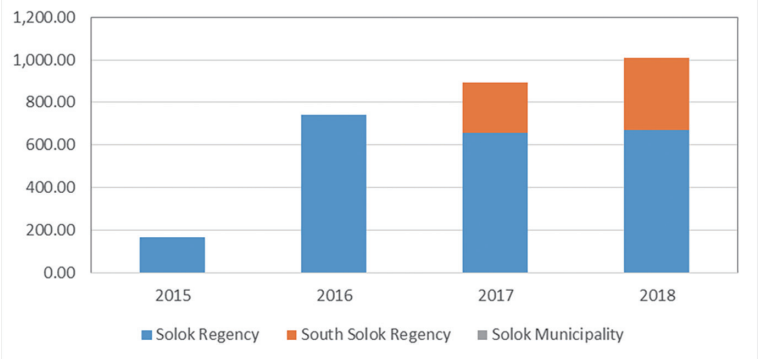

Figure 5. Production of Arabica Variety in Solok Region (tonnes)
Source: Statistics of West Sumatra, 2019

As seen in the previous graph, the production of the Arabica varieties is increasing, albeit slowly, and most of the production is in the Solok Region.

5. Farmers' Community in Solok Region

Now I would like to discuss the farmers' community. In the previous chapter, Dr. Iqra Anugrah has already mentioned about cooperatives, and one of my research subjects is a cooperative.

With the increasing domestic demand for Arabica coffee in the past few years the Solok Radjo Farmers' Cooperative was established in 2012 to address issues surrounding the coffee production system. The cooperative consists of coffee farmers, agricultural field advisors, coffee traders, and coffee enthusiasts. It operates as a post-harvesting processing center, purchasing coffee cherries from the farmers and marketing the processed green beans. Normally, they purchase and process the coffee cherries, and sell the processed beans to a myriad of buyers.

Currently, the total number of farmers who are members of the cooperative is around 800 whereas the members who have actively contributed to the coffee production system are only 23 farmers. Presently, there is relatively low interest from the farmers and the board members of the cooperative to change from cultivating Robusta to the Arabica variety.

Figure 6. Solok Radjo Farming Cooperative
Source: Author

One of the reasons is because they are dependent on the economic benefits, and switching to Arabica means they will have to use much more of their precious time in cultivation. I saw from direct observation that the farmers have mostly been caring for plantations on the same land for generations. They inherited knowledge about the local climate and the local soil from their predecessors. The farmers mostly focused their daily work on cash crops such as shallot, tomato, and potato, while work on the coffee plantation was only conducted a few times a week. In several coffee plantations, the farmers intercropped the coffee plants with other crops such as sweet potato and chili pepper, as well as passion fruit.

Based on direct interviews with the farmers (n=5), there are several reasons why the farmers have a low interest in increasing coffee production:

1. Reluctance to make coffee as their primary crop (n=5).
2. Preference to cultivate multiple different crops (traditional agriculture knowledge and subsistence agriculture) (n=3).
3. More work and resources are needed to cultivate Arabica variety (n=5).

4. Despite the increased popularity of Solok Coffee, most farmers have not enjoyed any direct benefits from coffee production (n=4).
5. Low sales value of coffee cherry (n=4).
6. Lack of agricultural assistance from the local government (n=5).

Figure 7. Solok Radjo Coffee Laboratory
Source: Author

So, they tend to just plant it and they leave it as it is which actually led to one of the interesting findings that I made. Most of the farmers think that climate change is not very important; it is there but they don't think that it is crucial to take any action immediately. The farmers are aware, but they are confident that things will be okay. However, the non-farming producers from the cooperative that processes the coffee beans think that it might be worrying in the future. So there are some disparities in information here.

The members of the cooperative perceived three climate change impacts as threats.

1. Extreme wind gusts
2. Longer drought season.
3. Changes in intensity and period of rainfall.

While the farmers (n=5) are aware of the climate change impacts on the coffee cultivation, they are confident that the coffee plants can survive drought and less worried about gust damages and precipitation changes.

On the other hand, the non-farming members (n=3) expressed their

worries as the incidences of coffee cherry damage from the coffee borer beetle have been increasing, due to the increasing climatic variability. Also, from the latest information obtained, due to the impact of COVID-19, there is a significant drop in the sales price.

6. Towards a Sustainable Coffee Production System

The discussion up to now can be summarized as follows:

1. Coffee products from the Solok Region are perceived to have special quality characteristics by coffee experts and coffee connoisseurs.
2. The farmers have been cultivating coffee for several generations.
3. Coffee cultivation is intercropped with other crops (sweet potato, passion fruit, chili pepper, etc.).
4. Post-harvest processing is mainly conducted by a farmers' cooperative.
5. Changing climatic conditions are already observable, although the impact is still thought to be negligible by the farmers.
6. The farmers have not received significant economic benefits.
7. COVID-19 brought significant changes in the domestic market demand.

There are many issues as we can see. The economics and social issues are somehow interconnected, and climatic issues are quite complicated. How can we approach all of these issues? I argue that it is really important to understand the relationship between the existing agricultural knowledge and the local environmental ecosystem. This will be the key to developing a new, more robust, localized approach, and understanding the special characteristics of the coffee products.

Instead of going for a more mass production process, it is more

important to focus on producing quality products, and together with that, by projecting the future climatic conditions we can also understand how this will impact the quality of the coffee itself.

There are many studies that need to be conducted such as the identification of important factors in the local environmental ecosystem through monitoring and measurement of the Terroir factors, leading to the development of local bioclimatic indicators, and this might be related to Dr. Sianipar's research in the following chapter. Then we need to make an analysis of the local cultivation methods through observation of the cultivation processes as well as conducting focus group discussions among the farmers, to learn how the local knowledge is being inherited, how it's transferred, and how it affects the production process.

Factors with a direct influence such as local identity and place attachment, which is also related to the research of Taufiq Hidayat described in Chapter 4, also need to be clarified, especially in relation to how it changes the timing and types of cultivation process selected by the farmers. From the social survey and observation, it was also observed how the coffee farmers are highly dependent on coffee processors, and thus vulnerable to price variability.

By complementing their local agricultural knowledge with the bioclimatic indicators, farmers will be able to predict the level of productivity as well as further enhance the quality and characteristics of their agricultural products. The values of bioclimatic indicators will be a critical source of information regarding the local ecosystem services and real by biophysical condition of the plants. Bioclimatic indicators will help farmers to conduct effective and optimal cultivation processes as well as swiftly adapt to the climate changes while ensuring the sustainability of coffee cultivation in their region.

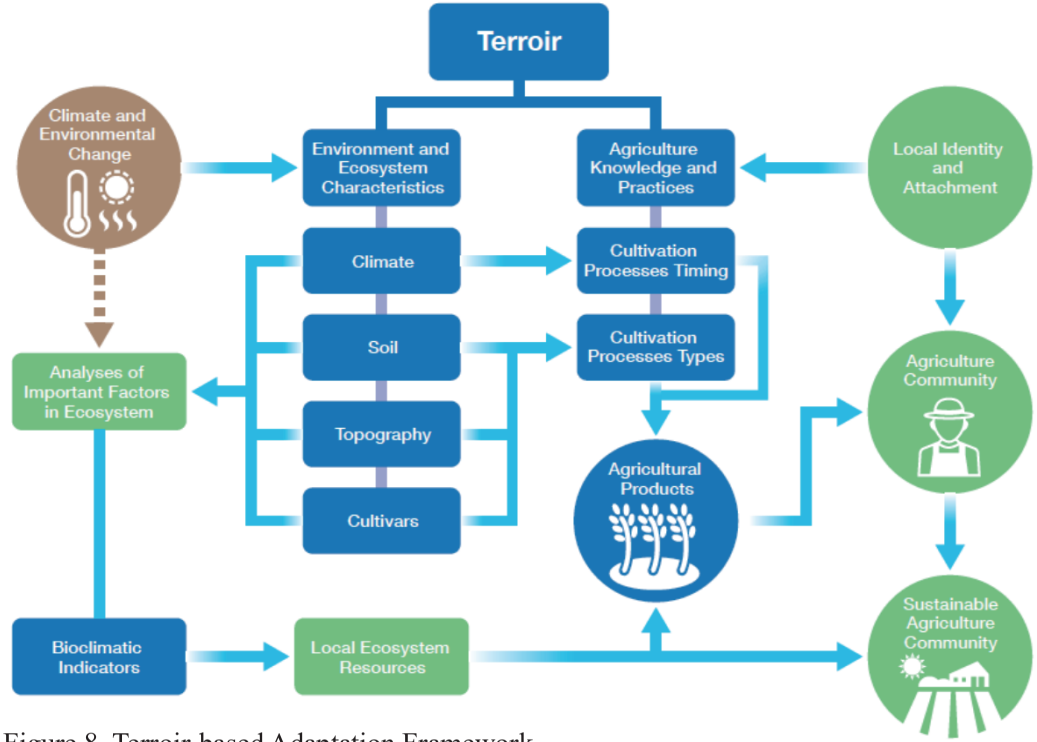

Figure 8. Terroir-based Adaptation Framework
Source: (Ashardiono, 2019)

It is hoped that this will help the farmers to understand more about the reality of the local climate and soil, as with ongoing climate change actually happening, things are becoming more and more unpredictable. Under these circumstances, the farmers' own intuition might no longer be enough to avoid the destruction of their crops. Hopefully with this information, then also the farmers should be able to safely adapt to the ongoing change and make their cultivation processes more sustainable.

So, to sum up, the Terroir-based adaptation framework can be utilized to characterize the environmental potentials of a region, which are strongly linked with the qualitative potential and characteristics of the agricultural products.

This framework will be the basis for evaluating the quality of agriculture products leading to the classification and categorization of products and delineation of terroir boundaries in this case, such as the application for GI, (geographical indications). In this diagram, you can see how the terroir, if it is being used properly, can help with the farmer and consumers' direct relationship.

It's very important to use this framework as there are lots of interrelated aspects that can be improved throughout the whole production system. Research to date has noted the following benefits of adopting this framework:

1. Optimal and effective use of ecosystem resources
2. product traceability,
3. Direct consumer relationship with farmers
4. increase in product values recognition,
5. economic benefit to the rural community
6. increased community awareness of climate change.

In conclusion, I would like to highlight the following point which is almost the same as was made by Dr. Iqra Anugrah. In order to sustain the local economies, and especially for the survival of the smallholders themselves, it is very important for the local government and agriculture

institutions to be involved on the ground and for them to provide comprehensive support to the coffee farmers in the post-harvesting period, as well as recognizing the importance of ecosystem services and the terroir characteristics of the local agriculture production.

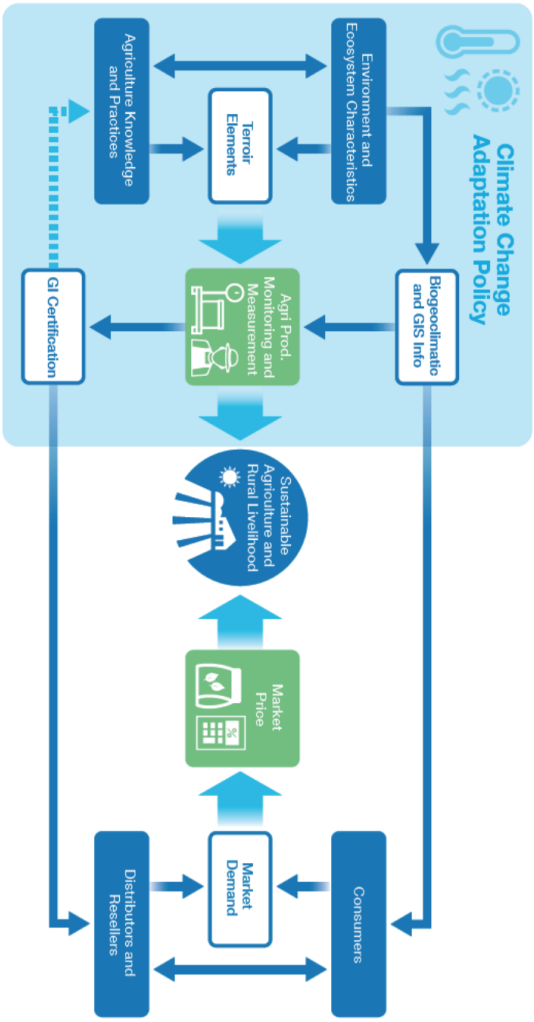

Figure 9. Terroir-based Adaptation Framework as a Comprehensive Agricultural Policy
Source: (Ashardiono, 2019)

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