

**FACTORS AFFECTING THE ADOPTION OF  
SUSTAINABLE UPLAND AGRICULTURE AT  
LAWU MOUNTAIN, INDONESIA**

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**DOCTOR of PHILOSOPHY  
UNIVERSITI UTARA MALAYSIA  
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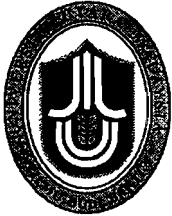
**FACTORS AFFECTING THE ADOPTION OF  
SUSTAINABLE UPLAND AGRICULTURE AT  
LAWU MOUNTAIN, INDONESIA**

**By**

**PUGUH KARYANTO**

**Thesis Submitted to the Centre for Graduate  
Studies, Universiti Utara Malaysia, In Fulfilment of  
the Requirement for the Degree of Doctor of  
Philosophy**

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Kolej Undang-Undang, Kerajaan dan Pengajian Antarabangsa  
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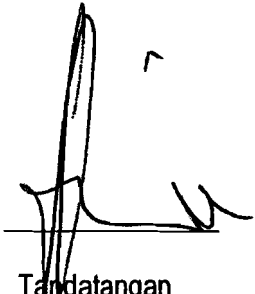
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## ABSTRACT

Sustainability in upland agriculture has faced a great challenge since a balance must be sought between environmental protection and economic orientation. Towards sustainable upland agriculture, stakeholders must perform particular strategies that address the economic orientation of the agriculture without compromising the upland conservation efforts to maintain the critical ecological properties of the upland. At the study site, organic farming and some other forms of environmentally friendly agriculture has been promoted as strategies that are in line with the idea of sustainable upland agriculture. However, despite the promotion of these green strategies, the upland farmers at the study site are still suffered from adopting these sustainable agricultural practices. This case shows that the diffusion of sustainable upland agriculture has faced many obstacles. Yet, this research is aimed to observe factors behind the poor diffusion of sustainable upland agriculture.

Framework for assessing linkage between capacity/incentive and natural resource degradation and the Driving Force-Pressure-State-Impact-Response Framework (DPSIR) were used in combination in this research. The capacity was translated into five types of livelihood asset *i.e.* social, human, financial, natural and physical capital. The incentive was translated into the governmental incentive and market signal. Both the capacity and incentive were proposed as predictors for the extent of adoption of sustainable upland agriculture. Stratified random sampling was the sampling technique used in this research. The data was collected by applying questionnaire upon 408 farmers. By using SPSS released 16.5, the obtained data was analyzed by the multiple-linear regression analyses.

The obtained  $R$  square from the regression analysis is 0.649 with the  $F$  statistic less than 0.05. The regression model did a good job in explaining relationship between the proposed predictors and the independent variable. All predictors except the market signal are significantly associated with the dependent variable. According to the value of the beta standardized coefficient, the Incentive is the major predictor in affecting the diffusion and adoption of sustainable upland agriculture. Ensuring the profitability of performing sustainable upland agriculture by building good market channel, providing credit and, allocating subsidy for the organic input are considered as critical. Buildings strong human capital in agriculture by providing assistances, trainings and guidance are also become one of important actions to improve the upland farmers' confident to adopt sustainable upland agriculture.

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## **LIST OF APPENDICES**

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Appendix 4 Village Profile

## LIST OF ABBREVIATIONS

ANOVA	: Analysis of Variance
asl	: above sea Level
BI	: Behavioural Intention
BIMAS	: <i>Bimbingan Massal</i>
CAC/GL	: Codex Alimentarius Code/Guide Lines
CGIAR	: Consultative Group on International Agricultural Research
DSR	: Driving force- State-Response
DPSIR	: Driving force-Pressure-State-Impact-Response
EEA	: European Environmental Agency
FAO	: Food and Agriculture Organization
GDP	: Gross Domestic Products
HEIA	: High External Input Agriculture
INTANPARI	: <i>INDustri, PerTANian, PARIwisata</i>
INMAS	: <i>Intensifikasi Massal</i>
IMF	: International Monetary Fund
IFPRI	: International Food Policy Research Institute
IDR	: Indonesian Rupiah
IFOAM	: International Federation on Organically Produced Food
KCL	: Kalium Chloride
Km <sup>2</sup>	: Kilometer Square
KOMASATU	: <i>Komunitas Masyarakat Sehat</i>
LEIA	: Low External Input Agriculture
LPTP	: <i>Lembaga Pengembangan Teknologi Pedesaan</i>
M <sup>2</sup>	: meter
NGO	: Non-Governmental Organization
NPK	: Nitrogen Phosphat Kalium
OECD	: Organisation for Economic co-operation and Development
POKJA	: <i>Kelompok Kerja</i>
PSR	: Pressure-State-Response
RT	: <i>Rukun Tetangga</i>
SLF	: Sustainable Livelihood Framework

SNI	: <i>Standar Nasional Indonesia</i>
SPIA	: Standing Panel on Impact Assessment
SPSS	: Statistical Programming for Social Science
TSP	: Triple Super Phosphate
UN	: United Nation
UN CSD	: United Nation, Commission on Sustainable Development
UU SISDIKNAS	: <i>Undang-undang Sistem Pendidikan Nasional</i>
VIF	: Vector Inflation Factor
WHO	: World Health Organization

## DEDICATION

To:  
My beloved wife:

*Khoirina Dwi Nugrahaningtyas*

My beloved children:

*Nisrina 'Abidah Qurratul 'Atini,  
Atiyah Nurul 'Ulmi,  
Muhammad Rasyad Mufarrid,  
Ikhsan Rasyid Atulrahman*

May Allah Subhanna Wata'ala Always bless us, amiin Yaa Rabbal  
'Alamiin



# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND

#### 1.1.1 Sustainable Agriculture

Sustainable has the root word “sustain”. It is derived from the Latin word *sustinere*; *sus-* from below and *-tenere* to hold (Gold, 1999). Referring to that grammatical meaning, sustainability can be interpreted as to handle something to keep it exist for the unlimited of time. As pertained to agriculture, sustainable agriculture then can be defined as a state when agricultural activity is handled to stay functional and productive for all the time. Functional means that agriculture must ensure its function, to allow the society to meet with their basic need. Productivity means that agricultural activity must be able to produce sufficient supply of food and fibre for the society along with its function. Towards sustainable agriculture, both function and productivity must be maintained without harming the environment.

Sustainable agriculture is an idea in agriculture that popularized after the widespread dissemination of Brundtland’s report “Our Common Future” especially, after the publication of UN conference on the environment and development held in Rio de Janeiro 1992 (Azar *et al*, 1996). The Brundtland’s report was the important starting point for the widespread popularization of

sustainable agriculture. The concept of sustainability itself, then had been ran by the UN by proposing a real-four section of plan, the Agenda 21, in which, the UN agenda to promote sustainable development for the next century becomes the major priority towards the sustainable planet (UN, 1992). Since this, sustainable agriculture has become not only a local or national issue but moreover, has become one of the important international issues.

Nowadays, sustainable agriculture has become an international mission and vision towards the global agricultural development. This global mission and vision challenges planners, decision makers and politicians to create efforts to meet with its criteria. This green mission and vision also forces some nations to address the concept of sustainable agriculture within their agricultural policies as it was ratified as an international agreement during the World Summit on Sustainable Development, September 2002 held in Johannesburg (Awiati, 2003).

Actually, at the time when the idea of sustainable agriculture was proposed, experts attempted to define the meaning of sustainable agriculture for its implementation. Numerous definitions of sustainable agriculture then were emerged. It is well recognized today that sustainable agriculture has at least 386 definitions since its popularization (Rigby and Caceres 2001). The same fundamental meaning unifies this enormous definition of sustainable agriculture; the agriculture must be able to provide an adequate supply of food and fibre for all society, indefinitely.

In addition, despite in having an undisputed fundamental meaning polemics appeared when an appropriate strategy must be made in order to achieve the state of sustainable agriculture. These polemics were emerged from several differences of background, several perspectives of thinking and, were strongly influenced by the economic and political power (Fernandes, 2004).

The above polemics moves from groups that totally ignore the use of agricultural external input and technology, to the other groups that decide to apply those two types of input (Azar *et al* 1996). These polemics can be classified into two major school of thoughts (Graves *et al.* 2004). The first school of thought belongs to particular agricultural paradigm in which the application of large amount of external input becomes the major key to achieve the agricultural goals, the High External Input Agriculture (HEIA) paradigm. HEIA is an agricultural paradigm where the proponent of green revolution resists their idea. This paradigm was very common in South East Asia, since it was promoted as “top down policy” in the early 1970s. Proponent of HEIA believes that agriculture needs technological innovations to attain its goal. Emerging agricultural technologies and external input then becomes the main backbone of agricultural management to answer the challenge of food and fibre adequacy for this incredible population growth. Indeed, HEIA views the poverty, hunger and food security as a function of the agricultural production. Hence, it places more attention on efforts to raise agricultural yield. Large quantities of external input and technology then must be purchased by the agriculture to maintain its function. By applying high amount of

external input and technology, HEIA has proven it self as the solution for the problems of food security and inadequacy. Indeed, HEIA has caused the sizeable increases of agricultural yield, even though such famous success story in Indonesia only occurred when it caused a short period of staple food self-sufficiency during the mid of 80s (Irham, 2003).

Based on the above success story, the paradigm used by HEIA becomes one of alternatives to combat the poverty and hunger. Nevertheless, the above success story of HEIA in overcoming problem of food and fibre demand is followed by many consecutive negative ecological externalities. The application of large amount of chemicals input by HEIA has been known as the major cause for the ecological degradations. Chemicals fertilizer causes dramatic soil degradation. The soil become loses its organic material for maintaining the soil fertility and function. The over use of farm chemicals also bring a negative impact towards the biological function of the soil. Other chemicals input such as pesticide also causes serious damage towards the genuine biological function of the nature. Yet, the use of farm chemicals may become a threat towards the ecological sustainability of the agro-ecosystem (Altieri, 1989; Altieri 2002). It can be summarized that the externalities of HEIA are related to its link on the usage of large external resources, to pollution and, to some environmental changes.

Besides on causing the above negative externalities towards the environment the application of HEIA has lead into many socio-economic externalities. Rural

farmers in the underdeveloped country bear several common characteristics of small and poor farmer. They have low educational background, have limited access to capital and credit, and are remain untouched by technical supports and services (Altieri, 1989). These characters of becomes a source of limitation prevent the implementation of HEIA since engaging with HEIA needs an adequate financial support and continuous services and guidances. The small and poor farmer becomes more marginalized as they begin to lose their livelihood (Altieri, 2002). Therefore, it can be concluded that applying HEIA paradigm upon small farmers can be considered as less appropriate.

Along with the negative externalities of the application of HEIA, researchers have sought for the alternative agricultural practices that are considered as more environmentally friendly and socially acceptable. Many forms of environmentally friendly agricultural practices for examples agroecology, organic farming, prescription farming, and bio farming then have been proposed to address the challenge of sustainable agriculture. These many forms of practices have the same common idea; agricultural activities must be performed in the way of agricultural activity that is less depends on the chemical and external input. This low dependent-chemical input agriculture is performed through maintaining the ecosystem services of the agro-ecosystem and, is characterized by cultivation that minimize the use of external input and focus on efforts to raise the ecological services of the agro-ecosystem. This environmentally friendly farming practice

belongs to the second school of thought, the Low External Input Agriculture (LEIA).

LEIA becomes an alternative farming practices that has been proposed by many people who stand at different side of opinion as opposed to HEIA. It is regarded as farming practices of the future that places a more sensitive approach to the challenge of environmental issues (Reijntjes *et al*, 2003). Approaches used by LEIA paradigm is emphasized on using techniques that integrate the natural-ecological processes such as nutrient cycling, soil protection and regeneration and enemies' management into agricultural practices. Generally, the management of LEIA is designed to minimize the lost of resources from agricultural system and the use of non-renewable resources from outside the agro-ecosystems. In addition, management of LEIA also gives priority to generate the use of appropriate technologies that fit with the resource limitation of the poor farmers, more environmentally sound, socially acceptable and economically viable. Indeed, LEIA incorporates ideas about the more socially sensitive and environmentally friendly approach to agriculture. However, despite its many positive characteristics, LEIA still leaves an open question about its capabilities to feed this incredible growing population as its application always results a relatively "low yield", even though it is claimed by Altieri (1987) as the most productive agricultural practices.

Despite the above polemics of strategy to achieve sustainable agriculture, researchers agree with two main criteria in achieving sustainable agriculture. These criteria can also function as indicators for the success of achieving the sustainability in agriculture. The first criterion deals with the required ecological prerequisites for the long-term capability of agricultural system to facilitate a good agricultural production. According to this criterion, agriculture is expected to be sustainable if the ecological properties of the agro-ecosystem are maintained (Altieri, 1987). The second criterion deals with the socio-economic dimension of the farmers. Some aspects such as social rights, income inequality, culture, risk (Altieri, 2002; Reintjntjes, 2003) and capability to access many forms of livelihood assets (Bebbington, 1999) are considered as critical to indicate the achievement of the sustainability in agriculture. Thus, sustainable agriculture can be defined as a particular state of agriculture when its management and practices address the socio-economic dimension of the farmer and farmer society while still conserving the ecological services of the system (Darst, 2000, and Reijntjes, 2003). Since the socio-economic conditions of farmers are varied among many types of farmer, even from region to region, the concept of socio-economic dimension within the sustainable agriculture must be specific for each type of farmer and region.

Now it can be concluded, sustainable agriculture is achieved when agriculture addresses both the ecological properties of the agro-ecosystem and the socio-economical dimension of the farmer. Finally, an appropriate definition of

sustainable agriculture referred by this research is; agriculture that is considered as integrated, site-specific and resource-specific and, can steadily be maintained over the long run

### **1.1.2 Sustainable Upland Agriculture**

Upland agriculture is about agricultural activities at particular area situated high up, where the land is at a slope and has a low capacity of water retention. There is a case that population pressure has affected the availability of the productive lowlands. Future increases of agricultural development then depend on using this upland area. Thus, the upland is potential and important to support the agricultural development. As this area is has a suitable climatic condition for horticultural cultivation many countries has paid their attention to this area by focusing it for horticultural production (Arsanti *et al*, 2007).

The sustainability of upland agriculture has become one of the greatest challenges faced by Asian agriculture, since efforts must address the balance between economic development and environmental protection (Partap, 2004). It is true that besides in having the above economical comparative value, upland also has many unique physical-ecological properties and functions as compare to e lowland. The land of upland is at a slope and is very susceptible to soil erosion and degradation. Hence, the upland is easily to lose its productivity and, yet, can be considered as a fragile ecosystem that is too vulnerable to any economic-orientation exploitations.

Moreover, upland usually functions as a water catchment area and, acts as a buffer area for its surrounding-regional microclimate. That is, upland is usually covered by a state forest that is prohibited to any encroachment. Considering the physical-ecological uniqueness and function of upland, all agricultural exploitations and expansions towards the upland must be performed in a judicious manner so that such important ecological properties are maintained due to its importance in sustaining the used of this area for the long run.

Upland is also unique in term of the socio socio-economic characteristic of its inhabitants. Most of the upland people lay their livelihood as farmer that performs their agricultural practices upon the non productive-marginal land (Altieri, 2002). They are catagorized as small-scale farmers or *petani gurem*, as they lay their livelihood to be depending on the small size agricultural land. Most of them have many common characteristics of small farmer *i.e.* low educated and, poor from the economic perspective. These characters, of course become a source of limitation to any agricultural development efforts and, give raise a polemic about whether policies should be made to make them economically viable or to regard them as social problem (Fernandez, 2004).

Nowadays, the agricultural invasion towards upland area can no longer be denied. Dense population has heavily forced agricultural invasion upward (Van Dijk, 2004), leading to many environmental and resources degradation at upland. These environmental and resources degradations problems, together with the socio-

economic limitation of the upland farmer are challenges to be addressed towards the sustainability of upland agriculture. According to the two main criteria for Sustainable upland agriculture (See section 1.1.1), upland agriculture is Sustainable if the agricultural practices address the ecological properties and, the socio-economic dimension of the upland. Therefore, upland agricultural practices then must emphasize on these following prerequisites:

1. Upland cultivation activity and management must give priority on the upland conservation efforts.
2. The choice of technologies and innovations must consider the characteristic of resources limitation of the upland farmers.

According to the above criteria, hence, upland agriculture is sustainable when the agricultural practices prioritizing a good land management. Such practices must, reduce the use of external chemical input and, adopt technologies that are considered as environmentally friendly and appropriate to the resource limitation of the upland farmers.

### **1.1.3 Environmental Context of the Study**

Lawu Mountain (3250 asl, 111°11. 5' Eastern Longitude and 7°37. 5' Southern Latitude) is one of the three top-highest mountains in Java (Figure 1). The mountain covers five districts (Sragen, Ngawi, Wonogiri, Magetan, and Karanganyar) distributed from the lower to the upper part of the mountain. The study was conducted at Karanganyar (Figure 2); the uppermost district at Lawu

Mountain. The district is about 772.20 Km<sup>2</sup> in size. Precisely, the study site is located at the highest area of this district where the upland cultivation is found.

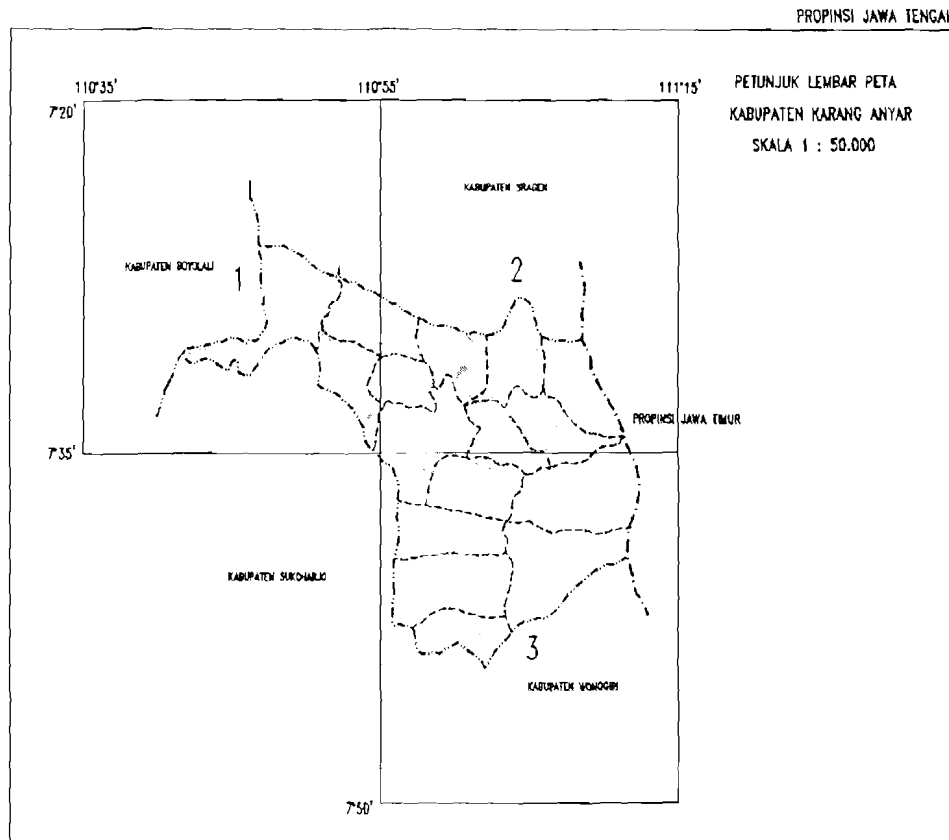
Karanganyar is the most important district according to this study. The local government has forced several sectors of development namely the industry, agriculture and tourism through the slogan INTANPARI (*IND*ustri/industry, *perTAN*ian/Agriculture, *PARI*wisata/Tourism). Agriculture is one of the important sectors as this sector serves as the major regional producer for vegetables and other horticultural products (Department of Agriculture Central Java Province, 2005). Upland and lowland farming practices can be found at this district. The upland is located at two uppermost sub districts, Ngargoyoso, and Tawangmangu and, is inhabited by 7688 upland farmers (personal survey on March 2008, based on the monograph data of each village).

Figure 1 Mount Lawu



Source: <http://www.pu.go.id> downloaded 10 February 2008

Figure 2. Map of Karanganyar.



Hence, there are two interesting points of Karanganyar viewed by this research. The first is about the agricultural economic orientation programme planned by Karanganyar district. The local government knows their comparative value as a major source of many horticultural products and, has pushed their agricultural sector due to raise the regional income. The second is about the awareness of Karanganyar to conserve its upland area. The local government of Karanganyar is highly motivated to conserve their upland area as it serves as an ecological buffer

toward many districts surrounds. Indeed, the local government has been strongly motivated to perform the sustainable upland agriculture.

In order to tailor the above economic orientation plan and environmental challenges into the agricultural developmental plan, Karanganyar has set their agricultural development to be in line with many criteria of sustainable upland agriculture and upland natural conservation.

The achievement of the application of sustainable upland agriculture at Karanganyar depends on two main stakeholders; the local institution (the local government and NGO) and the upland farmers and. The upland farmers are considered as one of the important stakeholders. These people act as the main actor that plays an important role for the success of achieving sustainable agriculture. They play through their decision to adopt or not to adopt the sustainable upland agriculture. While the upland farmers are considered as important, the local institution may also important through their policies, services and guidances that serve as incentive to enhance the upland farmers' willingness and courage to adopt sustainable agriculture.

## **1.2 PROBLEM STATEMENT**

The global consensus toward sustainable agriculture and environmentally friendly agriculture has inspired the Indonesian agricultural view. The government of Indonesia has ratified this global consensus as a national agricultural mission and

vision by proposing the three pillars of sustainability i.e. economic viability, socially just and environmentally sound into their agricultural development programme (Awiati, 2003). Yudhoyono (2006) also remarked that these three pillars of sustainable development are very crucial for the agricultural development programme in Indonesia. The post-green revolution stage of agricultural development has been started as these three pillars have been integrated into the agricultural programme in Indonesia. According to Pranaji and Saptana (2005), this stage of agricultural development is regarded as the third period of agricultural paradigm in Indonesia; a period when environmentally friendly manner is taken within the agriculture.

The global idea of sustainable agriculture has been included within the national vision and mission of agriculture. Many forms of agricultural strategies then have been proposed to meet with the criteria of sustainable agriculture. Many agricultural strategies *e.g.* campaign for organic farming (Husnain *et al* 2003; Apriantono, 2007), campaign for doing efficiency of using the chemicals inputs (Notohadikusumo, 1999; Makarim 2005) and an integrated pest management farming (Fakih *et al*, 2003) have been urged and, have been regarded as agricultural strategies that fit with the criteria of sustainable agriculture.

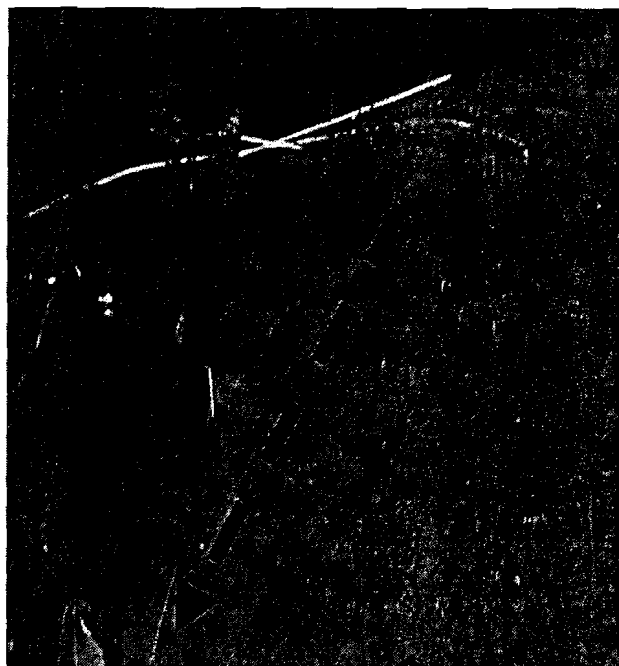
Despite above green governmental plan to promote sustainable upland agriculture however, realizing the state of sustainable upland agriculture still needs lots of exertion. At the study site (Karanganyar), the national mission and vision towards

sustainable agriculture has been adopted as a reference for the local agricultural policies. The local institution has urged their farmers to minimize the use of chemical external input and, has promoted organic farming and other forms of environmentally friendly agriculture (personal interview upon the extension agent, July 2008). Extension agent, a well-trained person in agriculture has also hired by the local department of agriculture to give services and guidance to the farmers.

However, despite the above efforts, three reports show factual phenomenon indicating the presence of the unsustainable upland cultivation activity. First, Sutarno *et al* (2006) reported that many agricultural practices were still considered as less environmentally friendly as their cultivation was not based on the site-suitability between type of cultivation and commodities and the land use management. Upland farmer still perform their cultivation activities with less attention towards the slopeland conservation efforts. Second, Karyanto and Rahayu (2007) reported a phenomenon of the decreasing of organic-material content of the soil at the western part of upland Lawu that might be the result of inappropriate land and fertilizer management. Third, Listriyana (2007) reported that the rate of soil erosion at the same location was very high due to the innapropriate land-use management. Those three reports show that the presence agricultural practices are still considered as unsustainable. In addition to the previous three reports, the phenomenon of mass landslide at upland farmland in 2008 that attacked many villages and caused the death of more than one hundred peoples (Figure 3) tells us that upland cultivation practices performed by upland

farmer are considered as carried out with less awareness about conserving the steeper land.

Figure 3 Farmland's Landslide at Ngargoyoso.



Source: personal survey, 2 March 2008

The above evidences show that governmental efforts to promote sustainable upland agriculture have faced obstacles. In spite of efforts that have been conducted by the local government, the upland farmers at the study site are still suffered from adopting sustainable upland agriculture. Hence, the diffusion of sustainable upland agriculture at the study site can be considered as ineffective. Many factors may play as important determinant affecting this ineffective diffusion. Identifying these factors then becomes important. Yet, this research is aimed to

determine factors behind this unsuccessful story of diffusion of sustainable upland agriculture.

Considering that the upland farmers are the main actor deciding particular management upon their land and, the their management itself is affected by particular reasons, yet, research that is aimed to uncover factors affecting the ineffective diffusion of sustainable upland agriculture must observe all possible factors constructing the upland farmers' decision. These all-possible factors then must be ascertained in order to verify their role in affecting the upland farmers' decision in performing particular agricultural management.

According to above statement, this research is focused on the study of ascertaining relationship between farmer decision and factors affecting farmer decision to adopt or not to adopt sustainable upland agriculture. This study focuses on the upland farmers as the main actor due to the importance role of them in making decision upon their land. Hence, this research has two main research variables, the dependent variable (farmer decision to adopt or not to adopt sustainable upland agriculture) and the independent variable (factors affecting farmer decision).

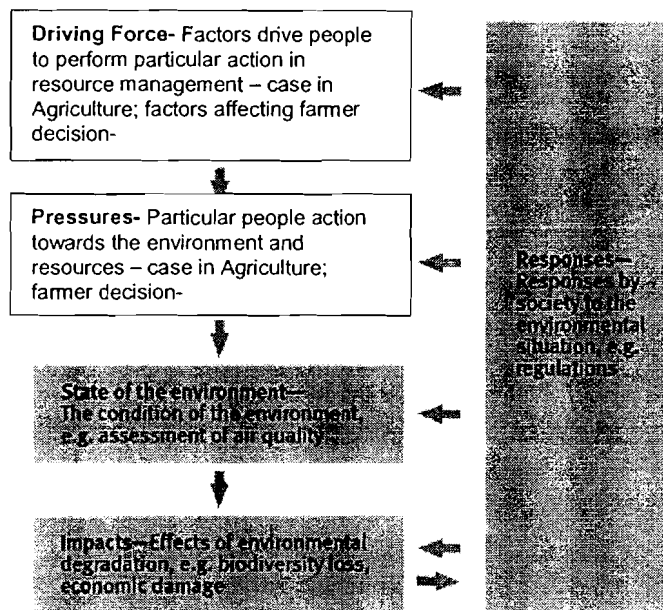
Actually, the dependent variable of this research can be assessed by proposing two types of indicator, the indicator of state (Fernandes, 2003) and the indicator of efforts (Azar, 1996). According to the indicator of state, farmer decision can be

indirectly assessed by examining the degree of the agri-environmental condition and degradation. A set of ecological observation then can be conducted in order to measure the environmental condition. However, performing this kind of measurement needs extra time and money. Besides, by performing ecological measurement, farmer decision can also be assessed by the indicator of effort (Azar *et al*, 1996; Fernandes, 2003). This type of assessment provides a better way to examine the state (Azar *et al*, 1996). According to the indicator of effort, farmer decision can be directly examined by looking at the actual societal activities of environmental exploitation. By this kind of assessment, the degree of environmental condition and degradation can also be directly assessed, moreover can also be predicted. This type of measurement is faster and cheaper than the first type.

This research considers the use of the indicator of efforts. In this research, the extent of the farmers' decision in adopting sustainable upland agriculture is assessed based on the criteria provided by organic farming and LEIA. As this research is about the study of linkage, several frameworks of linkage between causes and effects in environmental management studies are scrutinized. From many available frameworks explaining linkage between cause and effect, this research considers to use the Driving-Forces-Pressure-State-Impact-Response (DPSIR) framework as it has been widely used and accepted for many studies on environmental and resources management (Kristensen, 2004). DPSIR framework is also used as it has an ability to simplify illustration and linkage between causes

and effects in environmental management. In this research, factors affecting the farmers' decision are regarded as the driving force, whereas the farmers' decision to perform particular action towards their agricultural land is considered as the pressure. The DPSIR framework used in this research is illustrated below:

Figure 4 DPSIR Framework



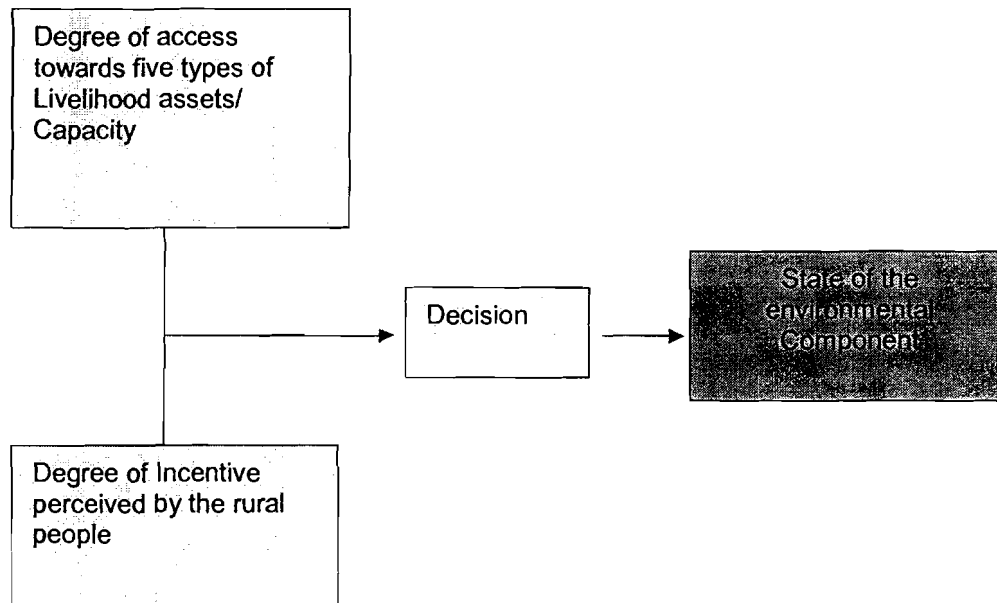
Adapted from :[www.derm.qld.gov.au](http://www.derm.qld.gov.au) (downloaded 6 july, 2010)

As pertained to this research, the driving force within the DPSIR is reorganized. Reardon of Vosti (1995) have introduced a framework to examine linkage between rural natural resource degradation and its causes. The notion of rural poverty as the major cause for environmental degradation has inspired Reardon and Vosti (1995) to emphasize the importance of rural poverty as a factor causing particular state of natural resources degradation.

According to Reardon and Vosti (1995), common poverty definition implies a so called 'welfare poverty'. Welfare is not enough. Rural households that are not poor by welfare definition may still suffer from so called 'investment poverty', in a sense of lacking adequate wealth/valuable possession to invest for their natural exploitation activity in a sustainable manner (Swinton *et al*, 2003). Recent studies about linkage between factors affecting environmental degradation and environmental degradation have suggested the importance of rural people capability to access such valuable possession in affecting rural people action in natural resource exploitation. The valuable possession consists of five types of rural livelihood asset/capital (Bebbington, 1999; Swinton *et al*, 2003; Bahamondes, 2003). The degree of rural farmer's access towards those five types of capital is called "capacity" (Bahamondes, 2003). As pertained to this research, the degree of upland farmers' access towards five types of livelihood assets/capital is an important determinant for farmer decision and behaviour.

However, while capacity is important to affect the upland farmers' behaviour, it is not sufficient. The upland farmers must perceive 'incentive' to invest in a Sustainable manner. Both the capacity and incentives are relatively new constructs that can be considered as the driving force determining the upland farmers' decision and behaviour. The framework of assessing linkage between capacity/incentive and natural resource degradation can be illustrated as follows:

Figure 5 Framework of Linkage between Capacity/Incentive and Rural Natural Resource Degradation.



Source: Bahamondes (2003)

The above framework (Figure 5) of assessing linkage between capacity/incentive and rural natural resource degradation can be arranged up into the DPSIR framework from the EEA (1999) as an organized driving force. The combined framework can be very helpful to analyse and ascertain factors affecting upland farmers' decision to adopt or not to adopt sustainable upland agriculture.

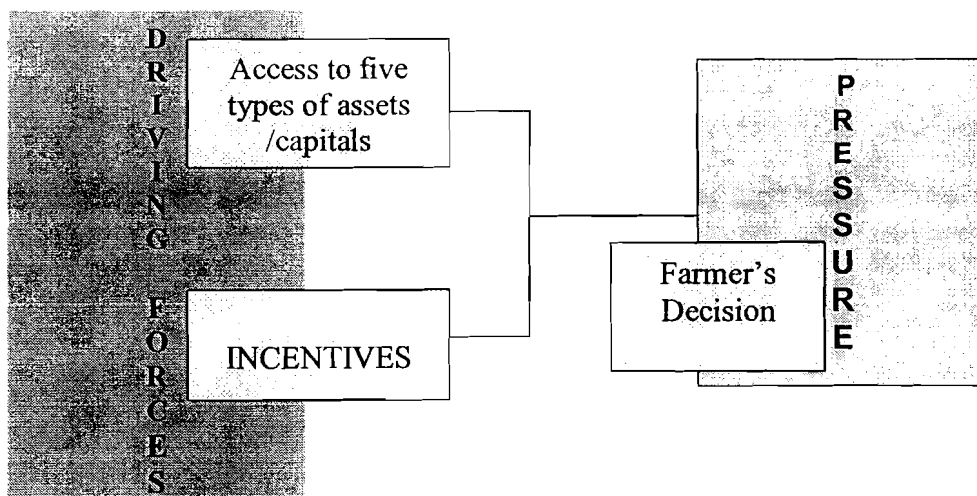
The logic of using DPSIR framework and framework of assessing linkage between capacity/incentive and natural resource degradation is because of agriculture is a kind of societal activities of natural resource exploitation (Sajogyo, 2006) and hence, can be considered as an area of natural resource and

environmental management study. Agriculture is also a kind of activity that potentially causes particular environmental condition and degradation. Therefore, it can be explained by using the proposed framework. Indeed, agri-environmental condition (degraded or not degraded) is the result of particular agricultural management, which is related to the farmer decision.

As has already mentioned, this research aims to ascertain linkage between the degree of the upland farmer's access towards livelihood assets (capacity) and incentives. The capacity and incentive are considered as the driving force affecting the upland farmer decision to apply any agricultural management. The capacity consists of five types of livelihood capital; the natural capital, physical capital, financial capital, human capital and social capital (Bebbington, 1999; Bahamondes, 2003) whereas the incentive consists of governmental signal and market signal (Bahamondes, 2003).

The combined framework used in this research is presented in Figure 6 as follows:

Figure 6 The Combination of DPSIR and Framework of Assessing Linkage between Capacity/Incentive and Natural Resource Degradation



### 1.3 RESEARCH QUESTION

DPSIR framework has been widely used and accepted for many studies on environmental and resources management (Kristensen, 2004). A framework of assessing linkage between capacity/incentive and natural resource degradation also commonly used to assess linkage between the cause and effect in environmental degradation study (Swinton *et al*, 2003; Bahamondes, 2003). This research combines these two frameworks in order to ascertain the linkage between capacity and incentive as the driving force for the upland farmers' decision to adopt sustainable upland agriculture as the pressure. According to the problem statement, the general research questions of this research then is; do capacity and incentive associate or correlate with the upland farmers' decision? Some specific research questions then are:

1. Does social capital associate or correlates with the upland farmers' decision to adopt sustainable upland agriculture?
2. Does human capital associate or correlate with the upland farmers' decision to adopt sustainable upland agriculture?
3. Does financial capital associate or correlate with the upland farmers' decision to adopt sustainable upland agriculture?
4. Does physical capital associate or correlate with the upland farmers' decision to adopt sustainable upland agriculture?
5. Does natural capital associate or correlate with the upland farmers' decision to adopt sustainable upland agriculture?

6. Does market signal associate or correlate with the upland farmers' decision to adopt sustainable upland agriculture?
7. Does governmental incentive associate or correlate with the upland farmers' decision to adopt sustainable upland agriculture?

#### **1.4 RESEARCH HYPOTHESIS**

Discussing the farmer decision is more likely to deal with only an individual decision. However, there are many reason of why people perform a particular action. Three main theories can be used as tools of analysis explaining the farmer decision. The first theory comes from Talcott Parson (1975), the Action Theory. According to Parson (1975), people's decision is affected by four central components i.e. the actor, goal, condition and normative values. Hence, the decision is determined by four systems i.e. organismic systems, self-systems, social system and cultural system (Parson 1975; Parson, 1996). Second theory comes from Mead (1972), the Symbolic Interactionism Theory. According to the Symbolic Interactionism Theory (Mead, 1972), the decision and behaviour are influenced by three aspects i.e. mind, self and society. Third theory comes from Iceck Azjen (2001), the Theory of Reasoned Action. According to the Theory of Reasoned Action (Ajzen, 2001), action is driven by the behavioural intention. Behavioural intention is affected by three constructs; behavioural attitude, subjective norm and perceived behavioural control. The behavioural attitude is about individual's positive or negative evaluation about particular behaviour that

will, or have been performed (Ajzen 2001). Subjective norm is about the norm and sanction that exist within the society (Loomis and Beegle, 1975). Perceived behavioural Control is closely related to the self-efficacy and perception about resources owned by the actor (Abdul-Muhmin, 2006). From those three theories, it can be summarized that the upland farmers' decision is the result of their individual action and their society. Indeed, when the upland farmers live in society, their behaviour is affected by many values that are embedded within their society (Pretty, 2003).

Moreover, small farmers are rational (Li, 2002). Their individual actions are always made as it is based on many particular considerations. Natural capital, a capital and resources provided by nature (Altieri, 1987; Altieri, 1989) plays an important role in determining their decision. Small farmers perceive themselves as a natural resources dependent community as they live close to resource and, directly depend on them (Li, 2002). Yet, natural resource is often critical to affect their decision. Physical capital and financial capital is kind capital that refers to stocks of money and goods. Both are considered as farming determinants (Sinukaban, 2001; Pretty, 2003; Fernandes, 2004; Shaw, 2008). A better upland farmers' financial capability will enhance their financial security and their willingness to invest in a sustainable manner. Indeed, poverty and lack of means are believed as the main factor causing the environmental degradation (Levins, 2006; Swinton et al, 2003). Human capital is defined as the total capability resides in the individual (Pretty, 2003). Human capital is critical in determining the

farmer decision (Davis *et al*, 2005; Levins, 2006; Soukup, 2007). Education and training have been known as factor that makes up the farmer's skill and, help them to make a considerably decision. Education and skill also enhance farmer's opportunities to access wider job opportunities, which in turn affect their financial performance. Governmental incentives may also play as an important determinant (Fernandes, 2004; McAfee, 2006). The governmental incentives in a form of service and guidance and subsidy allocation are important to make up farmer's courage to perform sustainable agricultural. Besides the incentive from the governmental and NGO, market signal is also considered as an important agricultural determinant. It is reasonable that farmer cultivates agricultural commodities as the market provides a good opportunity to sell their agricultural products in a good price. Hence, the market signal is considered as a factor that affects the farmer decision (Swinton *et al*, 2003; Bahamondes, 2003). In addition, small farmers place higher attention to minimize their production risk related with the market signal (Altieri, 1987; Suryantini, *et al*, 2003).

Based on those brief theoretical reviews, this research proposed several Hypotheses as follows:

1. Social capital associates or correlates significantly with the upland farmers' decision to adopt sustainable upland agriculture in positive direction.
2. Human capital associates or correlates significantly with the upland farmers' decision to adopt sustainable upland agriculture in positive direction.

3. Financial capitals associates or correlates significantly with the upland farmers' decision to adopt sustainable upland agriculture in positive direction.
4. Physical capital associates or correlates significantly with the upland farmers' decision to adopt sustainable upland agriculture in positive direction.
5. Natural capital associates or correlates significantly with the upland farmers' decision to adopt sustainable upland agriculture in positive direction.
6. Market signal associates or correlates significantly with the upland farmers' decision to adopt sustainable upland agriculture in positive direction.
7. Governmental incentive is associate or correlate significantly with the upland farmers' decision to adopt sustainable upland agriculture in positive direction.

### **1.5 RESEARCH OBJECTIVE**

In accordance with the above problem statement and research question, the general research objective of this research is to ascertain the five types of livelihood assets and incentives in affecting the upland farmers' decision to adopt sustainable upland agriculture. The general research objective is achieved by examining linkages between five types of livelihood asset/capital (the capacity) and incentives as the driving force and the upland farmers' decision to perform particular agricultural practices (the pressure). This general objective then is derived into some specific research objectives namely:

1. To determine linkage between social capital and the upland farmers' decision to adopt sustainable upland agriculture.
2. To determine linkage between human capital and the upland farmers' decision to adopt sustainable upland agriculture.
3. To determine linkage between financial capital and the upland farmers' decision to adopt sustainable upland agriculture.
4. To determine linkage between physical capital and the upland farmers' decision to adopt sustainable upland agriculture.
5. To determine linkage between natural capital and the upland farmers' decision to adopt sustainable upland agriculture.
6. To determine linkage between market signal and the upland farmers' the upland farmerd' decision to adopt sustainable upland agriculture.
7. To determine linkage between governmental and NGO signal and the upland farmers' decision to adopt sustainable upland agriculture.

## **1.6 SIGNIFICANCE OF THE STUDY**

The Driving Force-Pressure-State-Impact-Responses (DPSIR) framework (EEA, 1999) has been widely used in the environmental management studies (Kristensen, 2004). That framework emphasizes on the causal relationship between the driving force, pressure, states, impact, and the response. The driving force is a need. Examples of primary driving force for an individual are the need

for shelter, food and water, while examples of secondary driving forces are the need for mobility, entertainment and culture. The driving force are factors that lead to activities (pressure) which then are causing the changes in the state of the environment (state). State refers to a change in environmental conditions resulted from particular driving force (Fernandes, 2004). A particular state gives impact to human life, which is followed by particular reaction, the responses. Indeed, the response refers to any action and strategy corresponds to a particular impact (Kristensen, 2004).

However, the driving force within the DPSIR framewok is still considered as not specific. In this research the driving force of the DPSIR framework is reconstructed in order to know about the precise driving force that affect the upland farmers' decision. A framework of assessing linkage between capacity/incentive and natural resource degradation is arranged up into the driving force of the DPSIR framework. Originally, this framework is used to assess factors affecting rural household's decision in natural resources management. The use of this framework in the agricultural sector has never been done. Yet, there is a new knowledge's contribution as this research uses the framework of assessing linkage between capacity/incentive and natural resource degradation. In addition, as according to Swinton *et al* (2003) the results of the framework of assessing linkage between capacity/incentive and natural resource degradation may vary between different assets level and eco-region. Therefore, this study will provide a

recommendation in verifying linkage between the proposed constructs and the agri-environmental degradation especially in the study site.

In the above framework of assessing linkage between capacity/incentive and natural resource degradation, two constructs are recognized; the capacity and the incentives. Both two constructs are considered as critical factors driving rural household to invest in a sustainable manner (Swinton *et al*, 2003; Bahamondes, 2003). The capacity consists of so-called “capital”, which is identified by Bebbington (1999) as five types of capital for the sustainable livelihood.

As pertained to this research, the framework of assessing linkage between capacity/incentive and natural resource degradation is used in combination with the DPSIR. Using the the DPSIR framework in agri-environmental management may not be a new thing. Fernandes (2003) has used this framework to build his agri-environmental indicator to assess the agricultural sustainability. However, arranging the framework of assessing linkage between capacity/incentive and natural resource degradation into the driving force of the DPSIR, has not been conducted. Yet, the theoretical significance of this research is in using this two-combined framework to examine linkage between capacity and incentives the upland farmers' decision.

Other theoretical significance of this study is in using the social capital as one of factors affecting the upland farmers' decision. social capital has not been widely

used in Indonesia. This sort of capital is regarded as a newly introduced term of capital in Indonesia (Hasbullah, 2006). Using social capital as a variable in the agricultural management study is considered as a new study.

Besides, in providing a theoretical significance, this research also bears recommendation significance. The results of this research will contribute to the local policy makers in making strategies and policies.

### **1.7 SCOPE AND LIMITATION OF THE STUDY**

Physiology, agronomic science and ecology are disciplines that are closely related to agriculture. Nowadays, researches in agriculture have been spread across boundary into many disciplines including environmental management, economy, sociology and even politics. This is because of many contribution of those discipline towards the agriculture. Therefore, a research deals with the agriculture must specify its scope to make clear at what disciplin the researcher is standing on. The scope's limitation is also important to confine the research area to be more specific as according to the research's goal.

This research is confined with only the driving force and the pressure. The researcher's background of study as an ecologist is the main reason of choosing this limitation. Since the study towards pressure comprises of studies deals with

ecological approaches, further discussion about pressure can be allowed based on the researcher's competence.

This research is limited study spatially only at the district of Karanganyar. The reasons for this are:

1. Considering the era of decentralization that allow the government at the district level to formulate they own strategy of agriculture.
2. The district of Karanganyar has placed serious attention in realizing their upland as a conservation area. This district has in collaboration with the Research Centre for Biotechnology and Biodiversity, Universitas Sebelas Maret, Indonesia. Yet, the secondary data is available and accessible if needed.
3. The researcher has been familiar with the study site and has performed several researches related with it.
4. According to Swinton *et al* (2003) and Bahamondes (2003), the strength and direction of the influence of each variable within capacity and incentive are varied from region to region, and depend on the local asset level and socio-economic and environmental condition.

## **1.8 OPERATIONAL DEFINITION**

Three main constructs are used in this research. Each construct is divided into several research variables. Those three main constructs, namely:

## **1. Sustainable Upland Agriculture**

Sustainable upland agriculture can be defined as an upland cultivation practice that is in line with environmentally friendly agriculture, ecology based agriculture and Low External Input Agriculture (LEIA). Sustainable upland agriculture is characterized by particular agricultural practices that enhance the ecological services of the agro-ecosystem, is economically viable and, socially just. Here, the extent of the application of Sustainable upland agriculture is considered as the dependent variable. This dependent variable is measured by using a questionnaire. This variable is shaped by proposing three main indicators for assessing its achievement i.e. indicator for biodiversity and pest management, for upland soil quality and fertility management and for soil-prevention management. Indeed, Sustainable upland agriculture must give priority to soil conservation and ecological services enhancement and, reduce the use of chemical-external input (Altieri, 1987 and Dumansky, 2001).

## **2. Capacity**

Capacity is conceptualized as an access to the five types of livelihood assets/capital (Bahamondes, 2003). According to Bebbington (1999), the five types of livelihood asset consist of human capital, financial capital, physical capital, natural capital and social capital. These five types of asset/capital are considered as the independent variable affecting the extent of the application of Sustainable upland Agriculture. These five variables are measured by using questionnaire. Indicators for human capital are education and training, information and guidance and nutritional status. The indicators for financial

capital are family income and credit. Indicators for physical capital are land holding's size, access to infrastructure and basic agricultural means. Indicators for natural capital are about the upland farmers' perception toward their land. Indicators for social capital are trust, reciprocity and exchange, common rule norm and sanction and, connectedness, network and group.

### **3. Incentives**

Incentive is conceptualized as factors related with signals received from the external institution e.g. market, policies, institution and social organization (Bahamondes, 2003). Here, incentives are divided into two variables, the market signal and the incentive from the government and NGO. The market price and trend in marketplace are indicators for the market signal whereas the governmental supports and services are indicators for the governmental signal.

## **1.9 STRUCTURE OF THE THESIS**

This thesis is divided into seven chapters, first of which is this introduction. The introduction presents the sustainability, the environmental context of the study and the systematic steps showing of what this thesis deals with. The sustainability and the upland agricultural sustainability are defined along with many efforts that have been conducted to achieve its state.

Chapter 2 reviews the history of agriculture and many things related to agriculture including definition, goal, issues, resources and determinants. This chapter also

reviews strategies to achieve agricultural sustainability from the perspective of small and poor farmer. This is aimed to give a reasonable argument of choosing the environmentally friendly management as an appropriate strategy in achieving sustainable upland agriculture. In this chapter the agricultural development in Indonesia from past to recent is also reviewed.

Chapter 3 presents several theories and reviews used in this research. The discussion begins from the four major theories used in this research to the discussion of many factors that is considered as affecting the farmer decision. Here in this chapter, several researches, reviews, reports and framework are observed. Based on those several researches, reviews, reports and framework, dimension and indicator for the research's variables are constructed. The linkage between the research variables is diagrammatically illustrated in a form of conceptual framework. In the last sub-chapter, the position of this research among many previous research and reviews is presented.

Chapter 4 presents a description of the methodology adopted in this research, including the research design, population and sample, instrumentation and the data collection procedures and analysis. The results of the pilot project are also presented in this chapter.

Chapter 5 summarizes all the information collected during the research (research Findings). The results of the descriptive statistic are presented in the first section.

The results of the statistical analyses including the regression analysis are presented in the next section, Chapter 6.

Chapter 6 discusses the findings in Chapter 5 and draws on these to answer the research question.

Chapter 7 concludes this first chapter by summarising the results and exploring the possible contribution that the researcher can have.



## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

This chapter aims to introduce some basic information about agriculture and upland agriculture including definition, issues and factors within its scenario. This chapter is divided into seven sections. This chapter starts with a broad discussion of agriculture where three representative definitions of agriculture, ecological characteristics of agricultural system and, resources and determinants within agricultural management are presented. This section aims to give a holistic view about agriculture including a comparison of characters between agricultural system and natural ecosystem.

Next, Section 2.3 presents three issues in agriculture in order to give information about the basic idea or the goal of agricultural practices and, presents challenges that must be faced and addressed by recent agricultural practices towards its sustainability. From this section, an important notification is that agriculture must place attention for not to ignore the ecological properties of the agro-ecosystem as it plays as one of important aspects for sustainable agriculture.

Subsequently, Section 2.4 presents the idea of sustainable agriculture and starts with definition of sustainability in general. Section 2.4 also encloses strategies to

achieve agricultural sustainability from many perspectives of thinking. The aim of this section is to give an understanding of choosing environmentally friendly management as an appropriate strategy to achieve the agricultural sustainability for upland farming.

Section 2.5 presents factors affecting farming and agricultural scenario in relation with environmental degradation.

Finally, Section 2.6 discusses about efforts in achieving agricultural sustainability of the upland farming in Indonesia. A brief history of agricultural development in lowland farming is also presented, as compared to the upland. This section also gives a portrait of agriculture development in Indonesia from past to recent. All chapters are summarized in Section 2.7.

## **2. 2 AGRICULTURE**

During the early human civilization, food was directly obtained from the wild, a hunter-gatherer period. When food value was discovered people had began to manipulate their surrounding ecosystem to produce their favoured species (Wood and Lenne, 1999). Indeed, when people decide to settle in colony to form a society, they know that they have to decide to be depending on their ability to manipulate their surrounding environment. The story of agriculture has been

started when people started to give value towards their food and begin to select and domesticate their favoured species.

Agriculture is a definitive action; however, its definition can be varied. Here, three representative definitions of agriculture are presented. Sauer (1969) in Wood and Lenne (1999) defined agriculture in a sense of the way in which people help the cultivated and domesticated species to compete (Wood and Lenne, 1999). Hence, agricultural activity is about to make plants and animals to be more depending on people's management. This definition encloses two important mechanisms within agricultural management *i.e.* tilling of field and sowing of seed. Tilling of field means to help the domesticated plant to compete with the non-food plants through performing particular mechanism of soil management. Sowing of seed means to enhance the competitive ability of the food plant through particular management that allow the targeted plant to grow faster than the non target plant. There are two important things embedded within Sauer's definition. The first is about "the way" or management applied within the agricultural production. The second is related with "the objective" of agricultural activities. Agricultural management includes efforts to maintain yield by performing land management, fertilizer management, and pesticide management. That kind of management performed by agricultural activities is carried out in order to meet with its objectives; to fulfil the basic human need on particular preferred species. Sauer's definition sounds similar with the behaviour of the past farmers.

Harris (1969) *in* Wood and Lenne (1999) presents a quite different definition. Agriculture is defined as manipulation of natural ecosystem by substituting domesticated species for wild species in appropriate ecological niches. Harris' definition implies the presence of ecological perspective as Harris quoted the importance of ecological aspects to support agricultural production processes (Wood and Lenne, 1999). From Harris' definition, it can be recognized the presence of two types of comparable systems *i.e.* agro-ecosystem and natural ecosystem.

Another definition of agriculture was presented by Izac and Sanchez (2001); agriculture is defined agriculture as activities of cultivation on a given soil, and performing particular operations in order to that the land may produce the highest yield in perpetuity. The agricultural definition presented by Izac and Sanchez (2001) is considered as an appropriate definition that can be considered as in line with the idea of sustainable agriculture. This definition gives more complete meaning than two previous definitions. There are three keywords that can be clearly recognized from that definition *i.e.* the management applied (particular operation), the objective of activities (yield) and last but not least, the sustainability of the production system (perpetuity).

From above discussion of three representative definition of agriculture, it can be quoted that agriculture is a kind of farming activity upon particular-ecological site

that is performed through specific management and strategy to provide sufficient agricultural products for the population for the unlimited of time. The particular-ecological site is familiarly known as the agro-ecosystem (Wood and Lenne, 1999); it is an artificial system created by human that is routinely incorporates technique and mechanism to accommodate crops to the variability of natural environment (Hecht, 1987).

Agriculture may be relatively recent in the human history as it began at about 10.000 years ago (Wood and Lenne, 1999). At that time, agriculture was considered as an activity of producing food through domestication activity towards plant and animal altering the hunter-gatherer method. This past agricultural activities was heavily depending on the environmental restriction. Hence, agricultural activity was mainly, determined by environmental factors such as the availability of water and soil and climatic condition. Nowadays, agriculture corresponds to not only the environmental restriction. Agriculture is very unique, despite its dependency upon the environmental condition; agriculture also has adapted to the particular socio-economic dimensions of the society (Altieri, 2002). Therefore, agriculture is determined not only by the agronomic and the environmental aspects but also is determined by the socio-economic and cultural aspects as well (Reijntjes, 2003). Those above agricultural determinants play in interaction; give result to particular agricultural activity that has been adapted to the environmental factors and the socio-economic condition of the society (Altieri, 1987).

From the ecological perspective agricultural system belongs to a particular level of biological hierarchy, the community. Community is considered as a particular level of biological organization where populations (plants or animals) occupy the same area at the same time and, performs many specific interactions among its constituent (Krebs, 2002). Indeed, an agro-ecosystem usually accommodates many commodities that are cultivated together within the same particular area. As agricultural system belongs to community level, it must be ruled by the law of community ecology respectively. Phenomenon like energy flow, nutrient cycle and the law of diversity-stability relationship has been known to affect the agro-ecosystem profile and the sustainability of the system as well (Becker, 2005).

As community however, agro-ecosystem is characterized by simpler composition of species and energy flows as compare to the natural community. Odum in Altieri (1987) quotes several characters of the agricultural system as compare to the natural ecosystem, namely:

1. Agro-ecosystem incorporates the auxiliary source of energy like human, animal and fuel energy to enhance its productivity.
2. Has lower diversity as compare to natural ecosystems.
3. Artificially controlled by human rather than by natural selection
4. The controls on the systems are largely external rather than internal via subsystem feedback.

Yet, agricultural system needs outside input to maintain its ecological balance and productivity. Agro-ecosystem must be an opened system that needs input from outside the system to produce output that leaves the system and enters the external system (Altieri, 1987). However, judicious application of external inputs and appropriate agricultural management are becoming critical aspects to be addressed in order to reach the balance of input and output ratio and to achieve the ecological sustainability of such production system.

Now two important notifications are identified. (1) The ecological requirements and characteristics of the agro-ecosystem. Agro-ecosystem depends on external input to ensure its continuous productivity. Thus, the use of external input to maintain agricultural production is a must. (2) The appropriate agricultural management. Even though the use of external input is necessary, its application must be performed in a judicious manner, since the injudicious application of external input has been known to cause environmental degradation (Chunjiang and Guiqing, 1999).

Those above two notifications are considered as important things to be synergised in order to achieve the success of agricultural production system for the long run. Similarly, Altieri (1987) acknowledges that the success of agricultural production depends on the management and the environment. If the yield (Y) is used as an

indicator for the success agricultural production, then Y is the function of the management applied (M), the environmental resources (E) and the genotype (G):

$$Y = f(M, E, G)$$

However, as agriculture is very complex, it has many resources and constraints that play as determinant. Indeed, agricultural successfulness is about the success to manage those resources and constraints. Environmental resource is only one of resources that determine agricultural production. Beside that type of resource, agricultural activity is also determined by the availability of the human resource, capital (financial and physical resources) and production resource. Human resource consists of people who live and work within the farm including for example the number of people and their capacity for work as influence by health and nutritional status. Capital resources are things that are related to the financial goods created, purchased or borrowed by the farmer. In addition, changes in economic orientation and political interest may also act as determinant for agricultural activities and successfulness (Altieri, 1987).

### **2.3 ISSUES IN AGRICULTURE**

The basic goal of agriculture is to provide agricultural products for the society and its economic activity. Indeed, when such goal is in ruling, many issues are emerged. Issue is defined as a subject or problem, which people are thinking and talking about (Cambridge Advance Learner Dictionary, 2008). The agricultural

issue then is related to what people thinking and talking about agriculture. There are three issues in agriculture as acknowledged by Gold (1999), socio-economical, ecological and philosophical consideration issue. Each of those three issues is presented below:

### **2.3.1 Socio-Economic Issue**

Socioeconomic issue views agriculture as manifestation of human civilization activities that provide socio-economic benefits (Gold, 1999). During the early stage of agricultural development, the socio-economic benefit of agriculture is achieved when farmer's family and society has met their daily need toward food and fibre (Hecht, 1987 *in* Altieri 1987). Nowadays, business orientation becomes a more prominent goal for agricultural activities. The aim of those activities then, is mainly, focused on increasing yield and links it to markets. Agriculture has changed its orientation from subsistent to activities of making money rather than making food (McAfee, 2006).

In the name of to feed the incredible world's population agriculture has been forced into yield orientation activity by introducing series of innovation to meet with its new objectives (Steward, 2006). Green revolution paradigm had emerged as agriculture began to deal with such innovation. The, high yield-modern agriculture has been dominating the history of agriculture as it has led to the sizeable increases on agricultural yield and on economic increases of the farmer

(Hazell, 2002). The problem of world's food and fibre demand and poverty seems to meet with its solution.

However, the success story of green revolution paradigm has been followed by many unexpected negative externalities. This modern agriculture has changed farmer characteristics as well as their farming characteristics. Green revolution's innovations are released together in package and, must be facilitated with sets of services and guidance (Altieri, 2002). The application of such innovation has made the farmer to be depending on services, guidance, and packages of external input in order to minimize their production risk (Sri Hartoyo *et al*, 2003). Indeed, farmer looks like to lose their knowledge of how to farm and has become highly depends on the guidance and the availability of external inputs.

In addition, innovations need adequate financial capital. While that sort of capital is inaccessible, the socio-economic problems may emerge (Altieri, 1987). Those socio-economic problems are mainly coming from farmers that are having problem with financial capital. As most farmers in many developing countries are considered as poor with small land holding size, agricultural innovations may become inappropriate or needs to be carefully applied. When the innovation is set within the "top down policy" in agriculture by which all farmer are ruled, those small and poor farmers are marginalized as they must compete with the high resources farmer. New socio-economic problems then emerged as the poor farmer

is marginalized. Agriculture goes into the state of inequitable for poor farmer as well as their absolute poverty that goes into the worst. Finally, small and poor farmer has lost their livelihood (Altieri, 2002).

The above socio-economic externality has also found at the higher economic level. Agricultural products that are coming from the developing country have problems when it sold outside their country. Their products have lost its ability to compete with high-subsidized farming products overseas, which sold at less than its actual cost (McAfee, 2006). Their agricultural products are also failed to enter the global market system because of its low quality and quantity of the products (Altieri, 1987).

### **2.3.2 Ecological Issue**

Second issue deals with the ecological challenge. Ecological issue views agriculture in a standpoint that agricultural system belongs to community level that must be ruled by the law of community ecology in order to maintain its existence. Indeed, the natural-ecological properties of agro-ecosystem have been drastically modified in order to raise the agricultural yield. Agro-ecosystem produces crops in field where the plant is genetically identical (McAfee, 2006); hence its diversity falls into the lower degree. According to the law of diversity-stability in community ecology, the case of low diversity can be followed by the decrease of ecological stability which in turn making the community more

susceptible to disturbances (Krebs, 2002). Pest outbreaks and diseases then become consecutive consequences. Such drastic modification has also caused the genuine natural ecological processes to break and has caused agricultural system to lose its self-sustain ability (Altieri, 1989). Agri-environmental degradation then could harm the agricultural activities and the food security and poverty alleviation programme respectively.

As already mentioned, yield orientation has forced agriculture to deal with innovation. Such innovation is characterized by agricultural activities that performing input saving and labour saving strategy (Altieri, 1987). External chemical input is purchased replacing the natural soil nutrient. Agricultural machinery that fuelled by fossil fuel is used substituting the human labour and animal. Agriculture then has depended on both a set of external inputs and technologies (Reijntjes *et al*, 2003). Since the agriculture heavily depends on the synthetic-chemical fertilizer, pesticide and mechanization, negative externalities towards the environment have been emerged. Here are several examples of the negative externalities of the application of agricultural innovation towards the environment:

1. **Soil degradation.** There is no doubt that land is degrading in highly visible manner. Agricultural activity is the main factor that causes soil degradation and erosion (Anderson, 2002). The main erosion is caused by the invasion of salt that is resulted from the excessive use of chemical fertilizer. Injudicious application of such chemicals fertilizer has also caused soil compaction and has made the soil to

become infertile, damage, and moreover, has lost its natural capability to support good agricultural practices (Cecil, 2004).

2. **Water waste and water overuse.** Agriculture dominates the world's water consumption. UN food and Agriculture Organization FAO (UN, 2002), estimates that agriculture has used at about 70 percent of water withdrawals. Indeed, the phenomenon of water crises does occur since agricultural activities consume two thirds of the global water uses (Levins, 2006). Despite that phenomenon of water crises, agricultural activities have also caused pollution to the surface and sub-surface water (Anderson, 2002). Particular water column has been polluted by the accumulation of residual fertilizer because of its inefficient use/eutrophication which causes the weed accumulation in the downstream river (McAfee, 2006). High erosion in upland agricultural practices has also caused the sedimentation phenomena offshore that transported by the runoff (Sudarmadji and Sutikno, 2001). That is, Chunjiang and Guiqing (1999) regarded agriculture as the biggest contributor to global climatic change.

3. **Declining in ecosystem services and the lost of genetic diversity.** The option of short-term productivity by applying high yield varieties has displaced and made extinct many traditional varieties worldwide (Gliessman 1987 *as acknowledged by* Fernandes 2004). In addition, the uniformity of agricultural commodities has reduced the biodiversity of the agricultural system, and has caused the ecosystem services to be inadequate. Biodiversity provides services for nutrient recycle, control local microclimate, regulation of local hydrological processes, regulation of the abundance of undesirable organism and,

detoxifications of noxious chemicals (Altieri, 2002). As biodiversity is under crises, then those ecosystem services are considerably decreased.

Those above externalities then have put global attention to formulate the more environmentally friendly agriculture. The UN Conference on Sustainable Development that was held in Rio de Janeiro 1992 had accommodated this issue into their agenda toward sustainable development and sustainable agriculture (UN, 2002). The concept of sustainability in agriculture then has become more familiar and has become an alternative solution to overcome the environmental problems that are caused by agricultural activity (Azar, 1996).

### **2.3.3 Philosophical Consideration Issue**

The third issue is about the philosophical consideration of the agricultural activities. The basic goal of agriculture is to fulfil the basic need of the human life. The problem of agriculture then is about to meet with the demand on agricultural products for all world's population. However, world's population are growing faster whereas farmland are going to shrink and, decreasing its capacity to support high yield agricultural production. The fast growing populations is worried to be followed by its consecutive problems, *e.g.* poverty, hunger and undernourished generations that has commonly occurred in many under developing countries. The worry about this problem has been acknowledged by Gold (1999) as follows:

*The rate of population increase is especially high in many developing countries. In these countries, the population factors, combined with rapid industrialization, poverty, political instability, and large food import and debt burden, make long-term food security especially urgent*

(Gold, 1999)

However, despite such shared-acceptable worry, there are two perspectives of thinking that may give result to different strategies in addressing this philosophical consideration challenge. The first perspective views poverty and hunger in a perspective of production. Efforts to raise agricultural yield are very crucial. The improved management must be applied into the agricultural system. Such management will encompass high external input strategies that must be performed in an efficient manner. Hence, agricultural practices must be performing adequate crop protection, advance genetics application and, crop management practices which are minimizing soil erosion, enhancing soil productivity and improving water quality (Darst, 2000). The second perspective views that poverty and hunger and food security is not problems of food production. It is problems of the unjust distribution of food and assets worldwide. Proponents of the second perspective views that such unjust distribution is closely related to agricultural economic domination of the developed country that can be regard as a new economic imperialism (Levins, 2006). Hence, considering food sovereignty is also important despite of thinking about the problem of food security.

Darst's statement (2000) about the threat toward world food security may be realistic as the world's population is incredibly increasing. Yet, applying agricultural innovations may be critical. However, applying agricultural innovations must consider for not to ignore the ecological properties of the system that are important to support the long-term usage of the system for future unlimited practices. Innovations must also specify its target; hence it will be specific for each type of farmers, rich resource and the poor one. Therefore, a relatively new way of thinking and specific appropriate strategy is needed in achieving the state of sustainable agriculture. Agricultural practices must address those above three issues within agricultural activities toward particular state, the sustainable agriculture.

## **2. 4 SUSTAINABLE AGRICULTURE**

Sustainable agriculture has become popular since the publication of UN conference on the environment and development in Rio de Janeiro 1992 and, especially, after the widespread dissemination of Brundtland reports "Our Common Future" (Azar *et al*, 1996). The discussion about sustainability idea cannot be separated with the discussion about sustainability concept in general sense. Indeed, sustainable agriculture is of one sectors of development that is included within the topics of sustainable development.

Sustainability has been defined variously. It has been defined from many perspectives of thinking and has been influenced by the economic and political interest (Fernandes, 2004). According to Rigby and Caceres (2001), sustainability has at least 386 definitions since its popularization. Sustainability can be defined based on the longevity of production system or activity to stay. Sustainability is achieved when such production system or activity is capable to maintain its productivity for the long run (Ikerd, 1993). Such production system or activity must be environmentally sound, resources conserving, economically viable and socially supportive, commercially competitive, and environmentally sound.

Since it is defined differently, it is necessary to give the grammatical meaning of what called “sustainability”. The word sustainability having the root word “sustain”, this derived from the Latin word *sustinere* (*sus-* from below and *tenere* to hold). Yet, sustainability can be interpreted as to handle something to keep it exist at all the time. This word implies efforts to keep something to exist or to be maintained and, implies the long-term support and uses for the society (Gold, 1999). According to the Webster’s II New Riverside Dictionary sustainability mean:

*Keeping in existence: maintaining; enduring; withstanding.*

Besides having numerous definitions, no one denies that sustainability is about to meet with the human need in perpetuity. It means that sustainability should address both, the intergenerational justice and the intra-generational justice as well (Rigby *et al*, 2000). Intra-generational justice is about to fulfil recent human need, whereas intergenerational justice is about to consider for future need. As sustainability is pertained to agriculture, Sustainable agriculture then is about farming activities (agricultural activities) that are capable to maintain its activities steadily productive to support its usefulness to the society indefinitely. This is the representative meaning of what called sustainable agriculture. Indeed, it may be defined from many perspectives, but it is commonly acceptable that sustainable agriculture is about to meet with adequate agricultural products for recent and future generation.

Although there is no dispute about the basic meaning of sustainable agriculture, strategy to achieve its state is extremely varied. The polemic on strategy achieving sustainable agriculture emerged from several differences of background, several perspectives of thinking and, strongly influenced by the economic and political power (Fernandes, 2004). That strategy moves from groups that totally ignore the use of agricultural external input and technology, to the other groups that decide to apply those two types of input (Azar *et al* 1996). Hence, according to the presence polemics, strategy to achieve sustainable agriculture can be classified into two major schools of thought (Graves *et al*. 2004).

Agricultural sustainability implies efforts to maintain agricultural productivity indefinitely (Ikerd, 1993, Gold, 1999, Rigby *et al*, 2000). However, when interpreting the term “productivity”, polemics do occur. Indeed, productivity can be interpreted differently. When productivity is dominantly viewed as problem of production, yield orientation becomes the main goal. A quantitative measurement of the rate and amount of production per unit of land or input then become the main measurement for so called “productive”; product maximizing becomes the main goal to be achieved. Yield per unit area of land becomes one of indicators in achieving the agricultural sustainability (Darst, 2000). Greater input and advance management and skills then are engaged to maintain the agricultural productivity even it is followed by a consequence that the agro-ecosystem quality is heavily degraded (Cassman and Harwood, 1995).

In contrast to above thought, productivity can be expressed as an energy ratio (Altieri, 1987). Productivity in this sense is measured by valuing ratio between input of production and its output. Indeed, applying large amount of input gives result to large amount of yield respectively. However, the efficiency of ratio between input and output is decreased. According to this thought; purchasing high amount of external input into agriculture is considered as less efficient. The application of HEIA possess input/output ratio of three/one whereas LEIA possess ratio of one/10-15. LEIA is regarded as more productive than HEIA when productivity is measured by valuing input and output ratio.

From small farmer's perspective, LEIA is considered as an appropriate strategy to achieve the sustainability of their agricultural practice. There is a fact that small farming activities are placing higher value on reducing risk than maximizing production (Suryantini *et al*, 2003). Hence, performing farming activities that is considered as efficient is preferred. Such farming practices are characterized by minimizing the use of expensive-external input within its practices. Therefore, as according to this perspective, the application of HEIA may be considered as inappropriate.

Debate also occurs during interpreting the meaning of "indefinitely usefulness". There are two dichotomies in interpreting this term. On one hand, there are peoples who believe that human genius overcomes any agricultural problem that is resulted from the application of innovative technologies (Eckersey, 1992; Peace and Warford, 1993). However, externalities often accompany along with the application of science and technology into agriculture. The unpredictable negative externalities of the application of agricultural innovations often occur without solved (Levins, 2006). Hence, a new thought that believes to impose limit and to construct a new paradigm of resources management within agricultural activities is emerged (Izac and Sanchez, 2001). Therefore, it can be understood that the dichotomy of definitions and strategies on achieving agricultural sustainability may be the results of this difference in interpreting these two terms, "the productivity" and 'the "indefinitely usefulness"'.

Previous dichotomy leads into a different indicator to measure the achievement of the sustainability in agriculture. Darst (2000) quotes that to address the challenges in agricultural activities toward its sustainability, agriculture must include the mechanism of how to raise agricultural yield for the food adequacy and to support its profitability. That strategy must include farming management that adopt outside chemicals input and genetics improvement. Indeed, according to this view, the main indicator for agricultural sustainability is the amount of yield.

Stand in the opposition, many researchers of LEIA proposes a different view. Yield and economic orientation are not the only goal to be achieved. Fernandes (2004) acknowledges three dimension to be addressed proportionally to achieve the sustainability in agriculture *i.e.* ecological-environment dimension, social dimension and economic dimension. Similarly, Reijntjes *et al* (2003) proposes five criteria for the agricultural sustainability namely:

- a. **Ecological steadily**, it means that agricultural practices must maintain the natural services of the agro-ecosystem and maintain its resources uses below its carrying capacity. These practices would result good ecosystem services to support the long-term practices.
- b. **Economic viability**, it means that agricultural practices should maintain its role to support long-term economic activities of the farmer. This also implies that the business risk and the production risk faced by farmers must, be minimized, yet

the agricultural activities would give benefit to farmers in a sense of their subsistence need or moreover, in a sense of agribusiness for the long run.

c. **Socially just**, this aspect is achieved when basic need of the farmers and the poorest society are satisfied. Such aspect also implies the sovereignty of the farmers and the society.

d. **Humane**, it is about respects and attitude toward humanity.

e. **Flexibility**, it is an implication when agricultural activities should be responds to the dynamics of the environmental factor and, to the socio-economic aspects.

Dichotomies are also found when interpreting poverty and hunger and food security. Poverty and hunger and food security often viewed as a problem of production. This assumption is based on the factual data that population grows in a rapid rate making peoples are worried about how to meet with their food adequacy as the farmland are considered to shrink (Darst, 2000). This assumption also gives legitimacy to the yield orientation farming under the green revolution paradigm which is believed as the best strategy to combat poverty and hunger, especially in the developing countries.

The criticism towards above view comes from the opposite proponent who believes that food inadequacy is not just a problem of production, but is of the unjust distribution and accessibility of the global food production (Altieri, 1987). This view criticizes the above view and regards the green revolution paradigm is a

















































































































































































































































































































































































































































































































