CHAPTER 1

Introduction

Climatic factors are key determinants to crop production processes; solar radiation, rainfall, temperature fluctuations leads to water deficit, flooding, changes in soil moisture content, pest and diseases outbreak that constraint crop growth that can account for 15-80% of the variation of inter-annual yield. Climate is considers a vital factor to farmers who greatly depend on agricultural production, climate condition and rural resources (Oerke et al., 2012; Gommes et al., 2010; Yoshida and Parao, 1976; Lansigan et al., 2000).

Furthermore, the concern about climate variability has encouraged the scientific community to focus on the food production constraints on to what to expect under global climate change conditions and the corresponding adaptation strategies to support food security (Rosenzweig and Parry, 1994; Parry et al., 2005; Tubiello and Fischer, 2006).

Climate prediction or forecast is one among many sources of information that can be used by decision makers to adapt to climate variability and optimize gains in agriculture production and that the outcome is often closely linked to climate patterns and factors (Hammer et al., 2001). In many cases, the indigenous forecast systems based on local knowledge and past experience of farmers is becoming less credible (Baigorria, 2007). Thus, the provision of seasonal weather forecast data (SWF) that enables farmers to organize and carry out appropriate cultural operations to cope with climate risks or take advantage of the SWF conditions is essential (Gommes et al., 2010). In this case, SWFs should be seen a valuable source of climate information for farmers' decisions regarding farming activities. To date, there has been a great deal of efforts made to increase the accessibility as well as adoption of SWFs to farmers (Roncoli et al., 2009). However, such good weather information may not enable farmers to take effective actions on farming and their livelihood activities. Because of information provided by

meteorological services somehow is not appropriate or usable for local farmers (O'Brien et al., 2000; Hellmuth et al., 2011; Troccoli et al., 2008; Ziervogel and Calder, 2003).

Hu et al. (2006) indicated that currently, too few (or not too many) farmers considered SWF data when making agricultural related decisions. Moreover, the seasonal forecast about rainfall and temperature were not adopted or were used in very limited cases (Pielke and Sarewitz, 2003). Given the amount of effort and investment currently dedicated to developing and improving the SWF system, it is important to investigate and understand why the extent of their use and influence has not changed (Hu et al., 2006).

It is clearly that the behavior of human cannot explain without consider to both external factor as psychological and social and external as technology and organizational factors. Therefore, having many researchers studied about SWF type, accuracy, reliability, etc. influence on SWF use in farm decisions (Soka et al., 1987; Mjelde et al., 1998). Moreover, Artikov et al. (2006) pointed out that farmer's attitude, social norms and perceived controls explained the SWF use in farming decisions. The fact that both external and internal factors effect on SWF data usage have not been fully explored in Vietnam in general and the Central Highland in particular. Hence, the understanding these factors can assist to inform and improve the effectiveness of SWF usage to help farmer adapt to climate variability.

In Vietnam, rice production plays a crucial role in Vietnamese economy, with nearly 80% Vietnamese farmers cultivating rice (Thanh and Singh, 2006) and it is a major food crop for ethnic groups in highland area. Rice being considered essential crop in food security in for ethnic minority groups in the Central Highland areas (Thang et al., 2006). Rainfall is very erratic and drought is common in the highland areas. High and dry temperatures are key factors that affect rice yield in Vietnam (Young et al., 2002). It estimates that yield will decline by 0.6 tons per ha per 1^{o}C increase in average temperature. In addition, Yu et al. (2010) reported that it tends to have strongest crop yield decrease under both dry and wet climate change scenarios in the Central Highlands. MONRE (2009) indicated that rice yield decrease is observed in all climate change scenarios in Vietnam, ranging from 4.2% to 12.5% in 2030. The most impacts are mainly in the Central Highlands and the northern zones, emphasizing the large gaps to the food supply in these regions. Therefore, this study assumes that the society is

looking forward to improving the use of SWF data for the rice farmers to adapt to climate variability, it is necessary to focus on the recorded influences of climate variability on rice production and study goes beyond by shifting the focus to how farmers use the SWF data in rice production and more importantly, which factors compel the farmer to use the seasonal weather forecast data in rice production decisions.

1.1 Historical Background

Vietnam is an agricultural country with over 80% of the population living in rural areas to which their livelihoods are mainly or solely based on agriculture. For example, in Thua Thien Hue Province, farmers there rely chiefly on farm production for their livelihoods while off-farm activities are being developed. Their life is still difficult and not easily changed. Nam Dong is a poor mountain district in the Thua Thien Hue province, north central of Vietnam, where 90% of local habitants are ethnic groups which include the Cotu people with more than 50% of the population while the Ta Oi, Pa Koh, Ta Hy, Pru-Van Kieu comprise the other 50% of the population. Their livelihoods in that region depended mainly on agriculture production. Total natural land area is 651,95 km^2, in which agricultural land and forestland are is 4.019,38 hectare (ha) and 41.799,31 respectively, the remainder of the land available is not being used (Nam Dong Statistical Office, 2012).

Paddy rice, upland rice, cassava and maize are major crops cultivated under rainfed conditions. Almost 70% of the total cropped area is planted in rice, which accounts for 90% of total grain production (Nam Dong Socio-economic Report, 2012). Perennial crops such as rubber trees and Acacia hybrids were also introduced into this area several years ago. Many of the farming communities are identified as being subsistence farmers. Diversification of farmer's to non-farm related incomes is still a challenge due to lower personal education levels, the non-arable slope areas and the poor or little access to market.

In the Nam Dong mountain district, rice is planted and grown during two different seasons. The first rice season is typically planted in January and harvested in May. The second rice season planting is done in May and harvested in September. Disease outbreaks occur regularly and dry spells can cause of low plant yield. Rice production

for two seasons in 2012 decreased 9% in comparison with last year (Nam Dong Socio-economic annual report, 2012).

Hang and Trang (2010) observed that during 1967-2007 in North Central Vietnam, there was a slight increase of dry conditions that were basically calculated based on rainfall distribution. Drought was also projected to increase in coming years. The findings of Thuc et al., (2009) and MONRE (2009) showed that the temperature is likely to increase 2.8^{o}C by 2100 in comparison with that on average of the period 1980-1999 in North Central Vietnam. In addition, the precipitation was predicted to decrease 10-15% by the year 2100 in comparison with that on average of the period of 1980-1999. The patterns of precipitation are expected to change with more rainfall in rainy season and less in dry season. Consequently, drought is likely to become more severe and last longer in dry season.

In this situation, the support from hydro-meteorological centers will play a significant role for the farmers in terms of making decisions to adapt to the complicated climate conditions which will change in the Nam Dong district. However, forecasts are often probabilistic and in numeric forms that are considered too technical for farmers' to understand (Garcia, 2002). For instance, rainfall is often forecasted as the chance of being ‘above normal’, ‘below normal’ or ‘near normal’ in comparison with the average rainfall for the past number of years of rainfall data. In addition, there is a considerable gap between information needed by farmers and that provided by meteorological services (Hansen and Jones, 2000). In other words, the information provided by meteorological centers has not met the needs of farmers (Thuan et al., 2007). The limited capacity of the local agricultural extension workers is also a problem in translating the SWFs to farmers in proper forms as well as understandable and applicable advisories that can benefit the farmers in decision-making process.

When faced with increasing variability, traditional farming calendars and even several existing indigenous knowledge and experience on predicting weather has become less reliable to the farmer. As a result, farmers, particularly poor farmers owning mainly rainfed farmland may have a higher risk of failure in rice production. It can be concluded that the appropriate SWF use has the potential to help vulnerability farmer to adapt to climate change. Thus, it is necessary to help farmers to be able to access and

use more efficiently, climatic forecasts/information for preparedness and adaption to climate variability in rice production at Nam Dong district. However, the fact that there is a big gap between SWF data and farmer use. Hence, understanding farmers' SWF use as well as exploring internal and external motivational factors that enhance or motivate farmers to consider using or not using SWF data in their rice faming management play an significant role for scientist who working for rural development. This can inform and improve SWF data to enhance farmers in terms of adaptation toward to climate variability.

1.2 Objectives of Study

This study focuses on finding the answer and explanation in regards to these key questions under the context of rice farming in the Central Highland of Vietnam:

1. What are the impacts of climate variability on rice production in the study area?
2. How are rice farmers using SWF to adapt to climate variability in highland area?
3. What are the factors influencing the rice farmers' decisions making on using SWFs?

To answer these questions above, this study aims to achieve the following objectives:

1. To investigate the impact of climate variability on rice production in the Central highland of Vietnam.
2. To explore rice farmer's SWF use in rice production to cope with climate variability in the Central highland of Vietnam.
3. To assess the factors, which influence on farmers' SWF data use in rice production decisions in the Central highland of Vietnam.