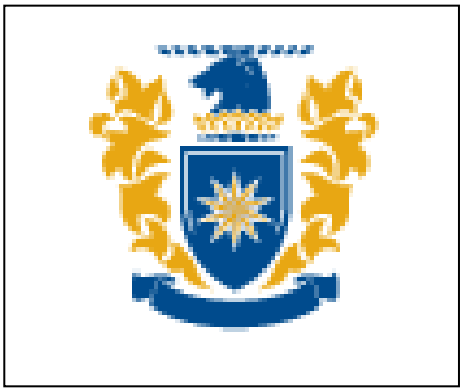
# Factors Affecting Rice Adoption in the Solomon Islands: A Case Study of Fiu village, Central Kwara'ae Constituency, Malaita Province

**A dissertation presented in partial fulfilment of the requirements for the degree of Master of Agri-Commerce**

**at**

**Massey University, New Zealand**



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## Abstract

In 2006, the Solomon Islands (SI) Government implemented the National Rural Rice Development Programme (NRRDP) through the Rice Section of the Ministry of Agriculture and Livestock, aimed at promoting the adoption of rice growing by SI farmers. However, the low level of rice adoption raised questions relating to the successful implementation of this programme.

To investigate the factors that have contributed to farmers' decision to adopt or not to adopt the rice technology, a single case study was used involving farmers of Fiu village, in Malaita Province. Data was collected between June and July 2010 through semi-structured interviews with selected farmers who adopted the rice technology including those that did not; FCRP leaders; and government officers (extension and the rice official). The findings of this study revealed that several factors influenced the adoption decisions of farmers and these were the characteristics of technology, internal factors, and external factors. The characteristic of the technology that influenced farmers' decision to adopt is relative advantage.The internal factors include personal characteristics of the farmer such as previous experience, proximity of the farm, land free of dispute, availability of a water source and cultural factors whereas external factors identified include government policy, infrastructure development in the area, agro-climatic condition, access to extension service and market. It was found that in late 2010, the adopters discontinued the use of the technology and their decisions were mainly influenced by factors such as poor leadership, poor implementation of the rice policy, and poor extension service. The results also revealed that many farmers did not adopt the rice technology in 2007 and their decisions were influenced by factors such as: relative disadvantage, complexity and incompatibility of the technology, input and labour intensive, land using, and risk. The study also shows that observability, poor leadership and the government's failure to implement the rice policy post 2007 influenced the non-adopters decision to continue with the non-adoption of the technology.

This research suggests that for a community rice project such as the FCRP to be successful, the government should facilitate the availability of funds to the Ministry of Agriculture and Livestock to ensure that the ministry is able to provide the necessary support to the farmers thus promoting their confidence in government's ability to support the implementation of the project. In addition, the selection of leaders who have the right skills, knowledge, and attitudes to manage and drive the project was integral in ensuring the success of the project.

**Acknowledgement**

First and foremost, I would like to thank the New Zealand Government for granting me a scholarship to undertake my postgraduate study at Massey University. Many thanks also to the Massey University International Student Support Office: Sylvia Hooker and her team. Your unrelenting support is very much appreciated.

It is difficult to put into words my deep gratitude to my two supervisors, Dr. Elena Garnevska and Dr. David Gray. Their guidance in this study has been beyond measure. Dr. David Gray, I used to read acknowledgements by students you had supervised and I always wondered about the strength of their affection for you — and now I understand. Your guidance with the analysis chapter of this study has been invaluable.

My sincere thanks go to the Solomon Islands Ministry of Agriculture and Livestock, Malaita Agriculture Division, and the farmers of Fiu village who volunteered to be interviewed. Without sacrificing their valuable time to respond to the case study questions, this study would not have been possible.

I wish to express my profound appreciation and love to my late wife's family members in Tonga, New Zealand, Australia, and American Samoa, who have stood behind me throughout these difficult times and to them I say "MALO AUPITO" for everything. My sincere thanks and love also go to my fellow Solomon Islands students studying at Massey during 2010 and 2011: Gloria and family, Elizabeth and family, Hickson and family, Tutuo and family, Simon Iro and family, Clarence Loe and family, and James Kwaimani, for their prayers, support, and encouragement. To all of them I say "TAGIO TUMAS NA EVRIWAN.

Finally, I would like to express my deepest gratitude to my children, for their love, patience and understanding "BAOLE'A BA'ITA NO'O FAMOURU". To my parents, sisters and brothers, thank you for your spiritual support all through these years: there is no-one like you all. Above all, my thanks to Almighty God, for through him all things are possible.

## Dedication

***This work is dedicated to my dear late wife who gave her life for the cause of completing this thesis……***

To my dear late wife, Mateaki Nomolo Seilani Baete, thank you for your undying support and for your unselfish love

***…and to my children who make my life worth living***

To my sons, Andrew Baete and Sunia Baete, and my daughter Lesieli Baete, thank you all for showing me what unconditional love is.

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## Abbreviations

**ADB** Asian Development Bank

**APSD** Asian Pacific Sustainable Development

**BSA** Brewers Solomon Associates

**CBSI** Central Bank of Solomon Islands

**COM** Church of Melanesia

**FCRP** Fiu Community Rice Project

**GPL** Guadalcanal Plantation Limited

**IMF** International Monetary Fund

**MAL** Ministry of Agriculture and Livestock

**MAD** Malaita Agriculture Division

**MDG** Millennium Development Goals

**NRRDP** National Rural Rice Development Programme

**NERICA** New Rice for Africa

**PRC** Provincial Rice Coordinator

**SIDTIS** Solomon Islands Diagnostic Trade Integration Study

**SI** Solomon Islands

**SIG** Solomon Islands Government

# CHAPTER 1

# INTRODUCTION

## 1.2 Background

For decades, the people of the Solomon Islands (SI) have depended on traditional staple crops such as sweet potato, cassava, taro, and yam for their dietary energy (SIG, 2008). However, this trend has slowly changed over the past 50 years, as a growing number of people in the Solomon Islands have developed a taste for rice (SIG, 2009). To date, rice has become one of the important staple foods, third only to sweet potato and cassava (McGregor, 2006; SIG, 2009; Warner, 2007).

Rice was first introduced into the Solomon Islands in 1942 by American soldiers to feed their local coastguards and watchmen who were located in the province of Guadalcanal during World War II (Statistics Office, 1963). However, 16 years after the war, the taste for rice had grown amongst the Solomon Island people and this resulted in the first importation of a large quantity of rice into the country in 1961 (FAO Statistics, 2010). From that time onwards, rice imports (in terms of volume) increased from 2,700 tons in 1961, to 3, 322 tons in 1970 (FAO Statistics, 2010). The price of rice also followed a similar trend increasing from US$144/tons in 1961, to US$ 201/tons in 1970 (FAO Statistic, 2010). A rapid increase in the price of rice was experienced worldwide, from 1961-1970, due to a limited supply of rice on the world market, following extreme and adverse weather patterns during the 1960s, which resulted in a sharp fall in rice production in Asia (Dawe, 2001).

The increase in the price of rice imports over a ten year period (1961-1970), together with the policy on conserving foreign reserves targeted at enabling SI to purchase more productive imports (Harris 1984), led the Solomon Islands Government (at that time) to intervene by implementing a food policy during the 1960s (Solomon Islands Central Planning Office, 1980). The government introduced a two-fold food policy, which was aimed at (1) limiting food imports, and (2) raising local food production (Harris, 1984). The rice sector came under this policy, which saw the government in 1966 leased around 4,235 hectares of land to the "Guadalcanal Plain Limited" (GPL)- a privately owned Australian commercial company to develop rice on the plains of Guadalcanal (Barrett, 1970). According to Barrett, the whole area that was leased to the company was the scene of intense fighting between the Japanese and American forces during World War II. Despite the heavy equipments and other war relics

left behind by the two departing forces, it did not take the company long to clear the war relics and remove the vegetation before bulldozers were used to level the fields so that mechanised rice production could begin (Barrett, 1970).

A year later, the company (GPL) grew 599 hectares of rice commercially and the Solomon Islands became self-sufficient in rice production (Barrett, 1970; Fleming, 1996; NCD, 1995; Statistics Office, 1978, 1987; World Bank, 1980). In 1975, Guadalcanal Plains Limited agreed to a joint venture deal with another company, the Solomon Islands Brewers Solomon Associates (BSA) which was a local based subsidiary of C. Brewer Corporation (a Hawaiian-based agribusiness firm) forming the Sol-rice Company which grew rice on a commercial basis (Fleming, 1996). As a result, the harvested area increased from 599 ha in 1975 to 2,512 ha by 1978 (World Bank, 1980).This led to a rapid increase in rice output much of which was surplus to domestic needs and this allowed the Solomon Islands to become an exporter of rice (Table 1.1). The major importing countries of Solomon Island's rice were Australia, New Zealand, and Fiji (Mitchell, 1985). When exports peaked at almost USD$5 million in 1980, (Fleming, 1996) rice had become the fifth most valuable export and the third most valuable agricultural export crop after copra and palm oil.

**Table 1.1: Rice exports from the Solomon Islands 1977-1986**

| Year | Quantity of rice exported in tons |
|---|---|
| 1977 | 1.3 |
| 1978 | 3.2 |
| 1979 | 3.5 |
| 1980 | 5.0 |
| 1981 | 1.6 |
| 1982 | 2.0 |
| 1983 | 0.4 |
| 1984 | 0.3 |
| 1985 | 0.1 |
| 1986 | 0.0 |
| **Total tonnage exported** | **16.4** |

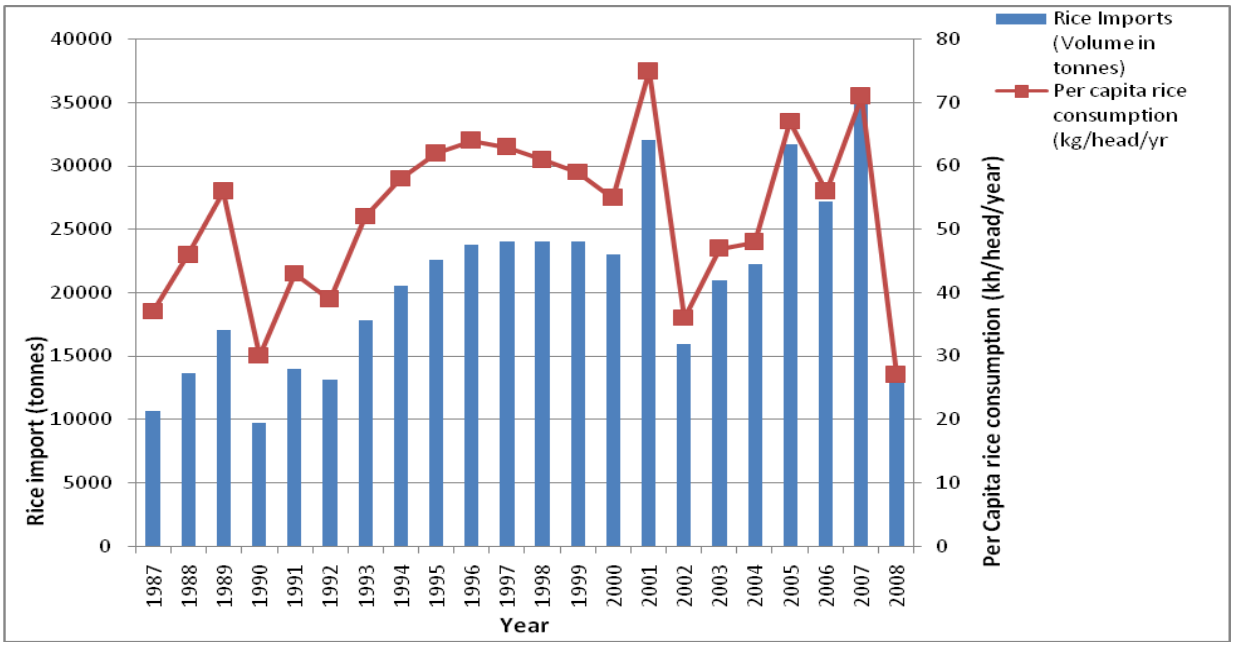
**Source:** Statistics Office (1978; 1979-1987).

However, the high level of rice exports was not to last because through the early 1980s, the rice exports industry went into a rapid decline. Brewers Solomon Associates Ltd withdrew from the joint venture in 1986, after four years of experiencing successive losses (Fleming, 2006). These losses occurred because of a drop in the price of rice on the world market from

1982 to 1985 (Dawe 2001), serious insect problems, and the high costs associated with mechanised production practices (Abeysinghe, 1981). These were further compelled by yields that were well below initial projections (Fleming, 1996). In 1986, the rice plantations suffered serious infrastructure damage, due to cyclone Namu and since the plantations were not profitable at that time, there were little incentives to re-establish them. As a result, in 1986 the Sol-Rice Company Limited ceased rice production and exports (Fleming, 1996).

Despite the closure of the Sol-Rice Company in 1986, the demand for rice did not decline in fact, rice consumption per capita increased from 37 kg/head in 1987 to 72 kg/head, in 2007 (Figure1.1). According to SIDTIS (2009), this increase of approximately 50% in per capita rice consumption was due to the rapid urbanisation of the population and changes in food consumption patterns. In 2008, however, rice consumption per capita dropped to a record low of 26kg/head due to a rapid increase in the price on the world market, a direct result of limited supply. This was caused by extreme shortage of water in China, which led to a 10% reduction in the area under rice cultivation (Smith & Edwards, 2008). This was further compounded by a drought in Australia, which destroyed approximately 98% of its rice industry (Bradsher, 2008).

**Figure 1.1: Rice consumption pattern in the Solomon Islands (1987-2008)**

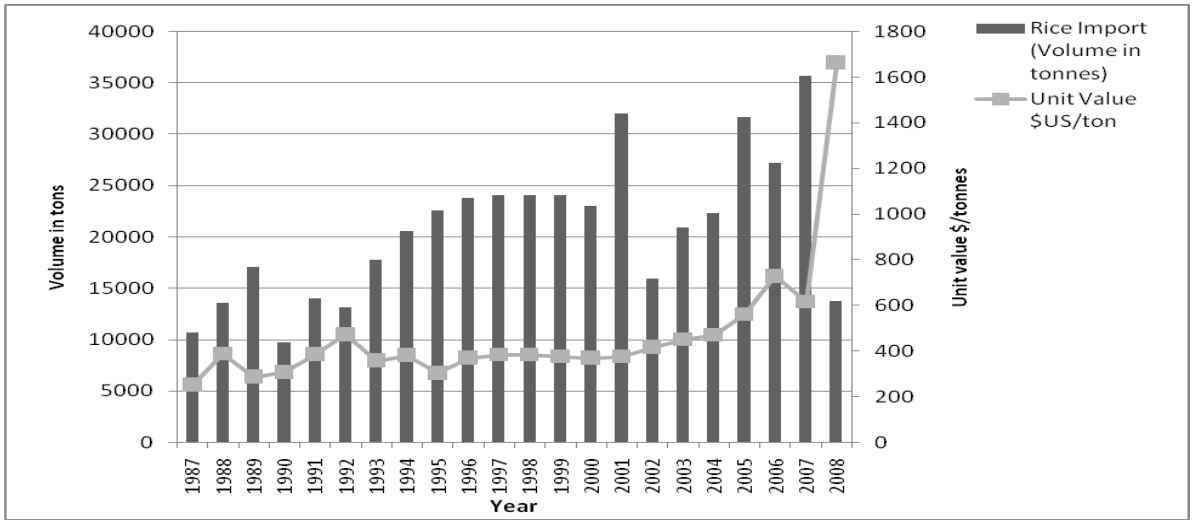



**Source:** FAO, 2010.

The price of rice increased from US$241/tons in 1987, to US$473/tons in 1992, before remaining stable from 1993-2001 (Figure 1.2). A rapid increase in the price of rice began in

2002, which saw the value per ton of rice increase from US$416/tons in 2002, to US$1,664/tons in 2008 (FAO, 2010).

**Figure 1.2: Rice imports into the Solomon Islands (1987-2008)**




**Source:** FAO, 2010

In the last 10 years, the Solomon Island's population has increased at a rate of 2.8% per annum (SIDTIS, 2009). This situation, combined with an increase in per capita rice consumption, in addition to the increase in price of rice, was of concern to the Solomon Islands' government. Therefore, as part of the government's efforts to save foreign reserves, increase local rice production, and ensure food security, the Ministry of Agriculture and Livestock (MAL) initiated the National Rural Rice Development Programme (NRRDP) in 2006 (SIG, 2008). As part of this programme, a Rice Section was established within the Department of Extension and Training of the Ministry of Agriculture and Livestock. The newly set up Section was tasked with implementing the NRRDP with its main being to encourage rural farmers to adopt rice growing.

In order to achieve these policy objectives, the Rice Section employed a community group approach in the planning and management of the project. Under this approach, individual farmers were encouraged to form community groups to grow rice. The Rice Section identified that rice production involved a lot of work and, therefore decided that it was best organised as a community activity. Beside using a community group approach, the Rice Section had also planned to provide farmers with assistance in the form of labour subsidies, in addition to other capital and variable inputs, such as tractors; extension services; fertilisers;

seeds; cultivation machinery; simple irrigation materials (e.g. PVC pipes), fuel and lubricants. These incentives were provided for three years in the hope that the subsidized rice farms would become viable and able to continue without government assistance after the third year of operation (SIG, 2009).

According to SIG (2009), since the inception of the programme in 2006, the government had spent approximately USD$1.73 million ($SBD 10.4 million) over a three year period. Additional funds were also invested into the programme in September 2008, when the government provided an extra US$4.1 million ($SBD 25 million) (SIG, 2009). In early 2010, a further USD$1.6 million ($SBD10 million) was allocated from the national government's budget, to provide further assistance with the rice programme (SIG, 2010).

Despite the significant capital investment made towards this programme, over the past five years, only a limited number of farmers had joined the programme (SIDTIS, 2009). For example, by the fifth year of operation, the NRRDP had only managed to establish 323 hectares of rice under the programme, compared to their target of 3,000 ha (SIG, 2008). This comprised of 48 rice projects and involved approximately 3,000 people (SIG 2009) which represented just over 10% of the target, set by the Ministry of Agriculture in 2008 (SIG, 2008). MAL (2009), in its annual report, identified a number of factors that were responsible for the failure of the programme. These included the significant delays experienced in the release of funds from the Ministry of Finance, which were needed to purchase equipment and tools for the rice farms; land disputes relating to the use of customary land; lack of technical support for the operation of irrigation systems; lack of adequate post-harvest and processing infrastructure; limited availability of rice germplasm; and the inadequate supply of rice farming materials and equipment within the country. However, while the above factors were identified as constraints to the development of the rice programme in the Solomon Islands, there has been limited research into the reason of why farmers have not adopted rice-growing technology, despite the implementation of this government intervention programme.

### 1.3 Problem statement

Rice has become an important staple food in the Solomon Islands since its introduction in 1942. The local consumption of rice, per head of population had increased from 37 kg/head in 1987, to 72 kg/head, in 2007 (FAO Statistic, 2010). This situation, combined with a rapid increase in the price of imported rice was of concern to the Solomon Islands government. In

2006, as part of its efforts to reduce rice imports, the Solomon Islands Government, initiated the National Rural Rice Development Programme (NRRDP) that was implemented by the Rice Section to facilitate the adoption of rice growing by farmers. However, it became evident over the past few years that a limited number of farmers had joined the programme (SIDTIS, 2009). With scarce empirical research having been undertaken to investigate why farmers' have not adopted the rice technology, this study aims to identify the factors that have contributed to farmers' decision to adopt or not to adopt the rice technology. Identification of such factors will provide insights and a better understanding of the situation, which could assist the government shape its future policy and programmes on rice development.

### 1.4 Research questions

1. Why are some farmers in the Solomon Islands adopting rice technology?

2. Why are the majority of farmers in the Solomon Islands reluctant to adopt rice technology?

### 1.5 Objectives of the study

- To identify the reasons why some farmers in the Malaita Province of the Solomon Islands are adopting the rice technology
- To determine the factors that influence farmers' decisions not to adopt the rice technology

### 1.6 Organisation of the thesis

This thesis is organised into eight chapters. The first chapter provides an introduction and background to the thesis. Chapter Two introduces the Solomon Islands, followed by an overview of its agriculture sector — in particular the National Rural Rice Development Programme. Chapter Three provides a review of the literature, which mainly focuses on factors, which have influenced farmers' decisions to adopt or not to adopt the technology. Chapter Four describes the methodology used in this study, including the data collection and analysis techniques used. Chapter Five provides a detailed description of the case study, and the results of the study are described in Chapter Six. Chapter Seven discusses the findings in light of the literature provided in Chapter Three. Chapter Eight presents the conclusions drawn from the study and their implications, evaluates the methodology and finally, suggests recommendations for future research on this topic.

# CHAPTER 2

# OVERVIEW OF THE AGRICULTURE SECTOR IN THE SOLOMON ISLANDS

## 2.1 Introduction

This chapter is comprised of four parts. The first part is an overview of the Solomon Islands and provides information on the country's history, geographical location, climate, demographics, and political organisation. The second part discusses the Solomon Islands' economy and presents a review of the agricultural sector. The third part provides the rationale for the national rice policy and the implementation of the National Rural Rice Development Programme. The fourth part presents a description of Malaita province and its agriculture sector, and the implementation of the NRRDP in Malaita province.

## 2.2 General overview of the Solomon Islands

### *2.2.1 History*

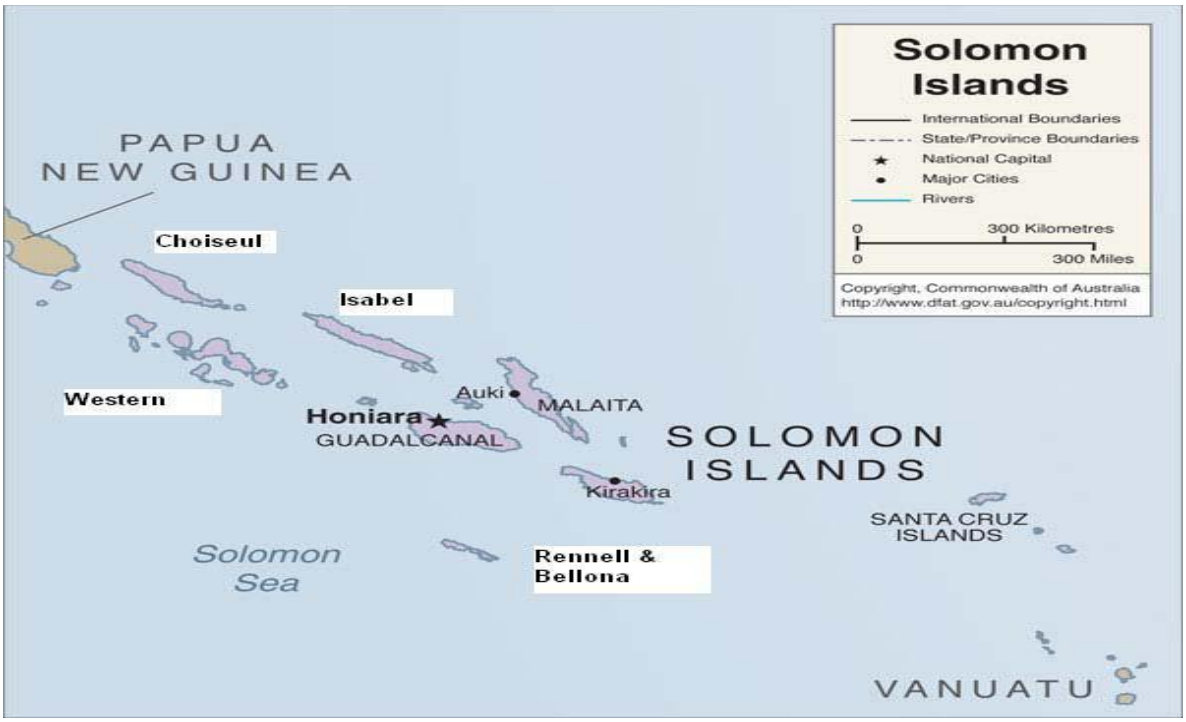
The Solomon Islands was discovered in 1568 by a Spanish expedition captained by Alvaro de Mendana (Hinton, 1969). After 1568, the Solomon Islands lost regular contact with other countries for a period of two hundred years. However, contacts resumed with the Solomon Islands with the arrival of British whalers and traders in the 1800s, which eventually resulted in the rapid exploitation of Solomon Islands' natural resources by whalers (Hinton, 1969; Waroka, 1997). These whalers settled in various parts of the country where they established coconut plantations such as the Levers Pacific Plantation Limited (LPPL) on Russell Island in the Central province and the three sister Islands in the Makira province. Great Britain eventually declared Solomon Islands as one of its protectorates in the 1890s and it administered the country until the Solomon Islands gained independence in 1978.

### *2.2.2 Location*

The Solomon Islands is a group of some 900 islands situated in the Southwestern Pacific, located between the latitudes of 5˚ and 12˚ south of the equator (Hansell & Wall, 1974). The group is an archipelago consisting of six large mountainous continental islands comprising of: Choiseul, New Georgia, Isabel, Guadalcanal, Malaita, and Makira plus numerous smaller islands, such as Rennell, Duffs, and Reefs. The islands extend over a distance of approximately 1,600km from the Shortland Islands in the northwest to Tikopia in the southeast. The group is bordered by Papua New Guinea and Vanuatu (Figure 2.1).

Although the Solomon Islands is not located on the major airline and shipping routes, its location is advantageous with respect to the large, developed markets of Australia and New Zealand, and also the world's most rapidly growing cluster of newly industrialised countries such as Japan, China, Taiwan, Korea South, and Thailand (Lomo, 2006).

**Figure 2.1: Map of the Solomon Islands**




**Source:** Atlas of the Solomon Islands

### *2.2.3 Climate*

The climate of the Solomon Islands is predominantly humid and tropical, although temperatures may at times be extreme, due to cooling winds blowing from the surrounding seas. Temperatures are normally 25˚ to 30˚C during the day, falling to approximately 23 to 25˚C at night (Lomo, 2001). The average rainfall pattern varies throughout the year, but there are two distinct seasons: the wet season is between November and May, and the drier season is from April to October.

Apart from the prevailing high rainfall and humid temperature, the Solomon Islands also experiences strong southeast and north-west trade winds from time to time. From April to October, the southeast winds blow, gusting up to 30 knots or more, at times. From November to March the north-west trade winds (monsoon) bring in warmer, wet, cyclone seasons.

### *2.2.4 Demography*

The national census conducted in 2009 revealed that the country's population was approximately 523,000, with an annual growth rate of 2.8% (Statistics Office, 2009). The three main ethnic groups in the country are as follows: Melanesian (90%), Polynesian (6%), Micronesian (3%), and 1.0% described as others (Statistics Office, 2009). Over 90 to 100 different languages are spoken in the Solomon Islands, and patrilineal, matrilineal, and ambilineal descent principles prevail in different parts of the country (Crocombe, 1989; Saeni, 2008). Communication amongst these language groups is a major problem and therefore, English and Pigjin English (a mixture of English and local languages) are the official languages of the country (Crocombe, 1989).

### *2.2.5 Government and Politics*

The Solomon Islands is a Commonwealth country with Queen Elizabeth II as its Head of State, represented by the Governor General. There is universal suffrage for citizens over 18 years of age. The unicameral National Parliament comprise of fifty members, who are elected for a four-year term under a 'first past the post' voting system. The Prime Minister is elected by a simple majority of Members of Parliament. Party structures in the Solomon Islands are fluid. The country is further divided into nine local administrative assemblies, which are administered by elected provincial premiers and their respective assemblies.

### *2.2.6 Land Tenure*

Land is central to the stability of Solomon Islands society and it has an impact on almost all large-scale development throughout the country. In the Solomon Islands, tribes own approximately 87% of the land, which is passed on from generation to generation — in many cases through the male lineage, but also through the female lineage in Guadalcanal and some parts of the Western Solomon. All members of the tribe have the right to use the land and the produce from the land is commonly shared with closed relatives. The area of land in which members of the kinship group live and carry out subsistence activities is kinship or tribal land. Each member of the kinship group considers the overall kinship land as his, by right of decent from an ancestor of the group. There is no individual ownership of land and (due to this situation) land is not a commodity that could be bought and sold, in the same way as other ordinary goods. Land is considered valuable because it was and is still regarded as part of the community or tribe. In short, one could say that the traditional land tenure system is

based on the close relationship between the land and the people, who not only ‘owned’ the land, but who also ‘belonged’ to the land (Zoloveke, 1997).

Land, to all people of the Solomon Islands is their basic source of livelihood. Not only does it provide food, but it also has a historical, political and religious significance. The land holds burial grounds and sacrificial places and monuments, which are mute witnesses to society’s history. As a result of these historical ties, the land has become an important link between the living and departed ancestors. The religious significance of land has resulted in it becoming the most valuable heritage of the whole community and therefore it is not lightly parted with (Zoloveke, 1979).

However, this situation has slowly changed since the arrival of the Europeans and the process of colonisation (Lomo, 2001), when the foreign system of land rights and ownership were introduced. This involved the selling and buying of land by individuals and as a result, some land became a marketable commodity that could be acquired by a purchaser. From the total land area of the country (28,000 square km), 13% has been acquired and purchased by individuals or inherited by the government from the colonial rulers. Such arrangements have resulted in numerous land disputes, because tribal members were selling off land without the consent of other tribal members. For example, in the case of Pavuvu Island, a logging row between landowners and the government resulted in the murder of a logging activist in 1997 (Solomon Star, 17 May, 1997). The increasing need for money has also pressured tribal leaders and members into selling land because many see it as an easy alternative to earning income. Disputes have also arisen because land boundaries have been tampered with, as a result of the increasing value of land offset mainly by its increasing market value. Nowadays, the importance of land is clearly reflected by the growing disputes and anxiety over land rights, triggered basically by the growing use of land for economic development, in particularly, commercial agricultural development on tribal-owned lands (Lomo, 2001). Therefore, any land related commercial development must consider the growing problems that are associated with land tenure in the Solomon Islands.

### 2.3 The Solomon Islands Economy

The largest sector of the Solomon Islands economy is the service industry, which provides critical support to other sectors of the economy. This sector generally includes tourism, construction, hotels, and transportation. As in many Pacific Islands countries, the central

government forms a large component of this sector (SIDTIS, 2009). The service sector contributed to a 36% share of the country's GDP in 2009 (ADB, 2009). The service sector also employed approximately 20% of the total work force in 2008 (CBSI, 2009).

The agriculture sector accounted for 55% of the country's GDP in 2009 (ADB, 2009) and it has been referred to as the 'backbone of the Solomon Islands economy'. Agriculture provides food for domestic consumption and raw materials for local industries, in addition to being the major source of export earnings and employment. In 2008, approximately 75% of the country's total work force was employed in agriculture (CBSI, 2009).

The other important sector in the Solomon Islands is the industry sector (SIDTIS, 2009), which includes mining and logging industries. This sector accounted for 9% of the country's GDP in 2009 (ADB, 2009) and it employs approximately 5% of the total work force in the Solomon Islands. Despite its potential for growth, this sector is however, heavily dependent on the importation of materials. Therefore, an increase in the price of imports hinders the growth of this sector.

The three major export sectors are forestry (logging); fishery (fish-smoked and canned); and agriculture (palm oil, cocoa, and copra). Logging is the leading export earner for the Solomon Islands. In 2006, logging accounted for 67% of the country's total exports (IMF, 2007). The share of logging has experienced a slight decline from 67% in 2006, to 65% in 2007. This decline in log export is attributed to a subdued demand from importers, in particular from Asia, the country's main export market (SIDTIS, 2009). The share of fish exports as a proportion of the total export was 12% in 2006 (IFM, 2007). This sector's contribution to export has been declining over the past five years, due to unfavourable fishing conditions, a fall in world fish prices, and the cessation of fishing by one major company as part of a structural adjustment aimed at increasing efficiency in other areas of its operations (CBSI, 2009). The total share of agricultural commodities (cocoa, copra and palm oil) share in relation to total exports, in 2007, was 18%. This is an increase of 7%, from the total share compared with 11% in 2006. This increase was due to the resumption of palm oil production in 2006, complemented by an increase in world prices of agriculture commodities s (CBSI, 2008). In 2008, the country generated US$342.3 million in exports (FoB) from trade in agriculture (CBSI, 2009). The other smaller sectors accounted for the remaining 5% of export share in 2007.

## 2.4 The Solomon Islands agriculture sector

Farming activities in the Solomon Islands can be categorised into three levels: 1) subsistence smallholder farming; 2) semi-commercial; and 3) large scale plantations (SIG, 2009a; Waroka, 1997). Subsistence smallholder farming is the predominant occupation of the rural population (85% of the total population) and in many cases the sole source of livelihood (SIG, 2009a; Warner, 2007). Under the subsistence structure, farmers/households grow their own food and any surplus is sold at the local market. The structure of this farming system is characterised as low-input, with extensive rotational slash and burn agriculture carried out in forested customary owned land. The average size of land ranges between 0.2 to 1.0 hectare (McGregor, 2006; Warner, 2007).

The semi-commercial structure involves smallholder rural farmers/households, who grow their own food and also produce cash crops for the domestic market (Warner, 2007). The structure of this farming system is also low-input and extensive, with rotational 'swidden' (slash and burn) agriculture in forested customary owned land. However, a few imported basic inputs, such as spades, hoes, pesticides, fungicides and fertilisers are used by some farmers under this structure. The average size of the sub-commercial farms ranges between 1.0 ha to 5.0 hectares (Evan, 2006).

The plantation structure includes commercial oil palm, cocoa, and coconut plantations with average size ranging between 2,000 and 6,000 hectares (SIDTIS, 2009). However, this sector has yet to recover from its collapse during the unrest in 1999 and 2000 (CBSI, 2008). From the three major agricultural export commercial plantations: Solomon Islands Plantation Limited, Russel Islands (Lungga Planatation) and Yandina plantation, only oil palm has resumed production under a new company called the 'Guadalcanal Oil Palm Plantation Limited' where exports have increased since 2006 (CBSI, 2008). Unfortunately for the two other plantations (Lungga and Yandina), talks are still underway between the government and landowners to settle lands issues, before commercial production of cocoa and coconut can be resumed (McGregor, 2006; SIDTIS, 2009).

The agriculture sector of the Solomon Islands is comprised of three main sectors: 1) local crops; 2) cash crops; and 3) livestock. The most common local crops grown by farmers are sweet potato, cassava, and banana, followed by taro, yam, and pana (Dioscorea spp.) (Evans, 2006; Waroka, 1997). According to Evans (2006), the major problem associated with local

crops production in most rural areas is the decrease in fallow periods due to population pressures, which have resulted in less land being available for local crop gardening. Periodic cyclones and rainy seasons have also had a devastating localised effect on food availability, especially in isolated and vulnerable areas with high population densities (Evans, 2006; SIG, 2001). On smaller outer islands, where land pressure has always been high and where soils are unable to sustainably support ground-based staples, predominantly tree-based agricultural systems have evolved using a mix of multipurpose species to provide staples (e.g. breadfruit), protein (e.g. nuts) and edible leaves (e.g. Gnetum) (Evan, 2006).

The main cash crops grown in the Solomon Islands are coconut (copra and oil), betel nut (Areca catchu), cocoa, oil palm, spices, which are all woody perennials (Evans, 2006; Waroka, 1997). Today, coconut remains the predominant source of cash crop income. The last census, taken in 1985, recorded nine million trees on more than 60,000 hectares (SIG, 2002). Betel nut is also an important cash crop for many farmers in fact approximately 30% of all households produce betel nut for sale (double the proportion 15 years ago), making it the second most common cash crop (Evan, 2006). Cocoa was first planted in Malaita in the late 1950s and in Guadalcanal in 1962, but extensive planting only began in the late 1970s after in-country research had identified varieties that were resistant to SI pests and diseases (Trewren, 1992). The number of households producing cocoa has doubled every 10 years, from 5% in 1976, to 20% in 1999 (SIG, 2001). Palm oil was introduced in the 1970s. A joint venture between the Commonwealth Development Corporation and the SIG established Solomon Islands Plantation Ltd, a 6,000-hectare plantation and mill on Guadalcanal. Despite widespread damage by Cyclone Namu in 1986, palm oil, and to a lesser extent kernel oil, became important export revenue earners for the government and provided more than 10% of revenue, until the mill and offices were destroyed during the 2000 ethnic tensions eventually resulting in the plantation being abandoned.

Livestock is another important agricultural sector in the Solomon Islands. According to SIG (2009), the livestock sector consists of local inbred and free-range pigs, backyard chickens, and cattle tethering. Pigs (mainly free range) and backyard poultry are kept for protein intake, and in the case of pigs, for ceremonial purposes, and wealth accumulation. According to the SIG (2009a), the volume of domestic meat production does not meet the demand for local consumption and hence, the Solomon Islands imports its beef and lamb meat from Australia, New Zealand, Vanuatu and other neighbouring Pacific countries. The Solomon Islands has

the potential to increase its meat production if better animal husbandry, feeding practices, and breeding stock were made available to farmers (SIG, 2009a).

Despite its existing activities, agricultural productivity has been declining over the past ten years (Fleming, 2007; Reddy, 2007). According to Okekini (2009), this is due to a number of factors which include: a lack of improved production technologies in the farming systems; a lack of production inputs; increased incidence of pests and diseases; soil degradation; a lack of production incentives; a decline in export prices; limited market opportunities; limited access to land; and above all, a lack of private and public investment in the sector. Additionally, instability in the political and economic environment has hampered the development of this sector to a level where it can address the numerous challenges faced by Solomon Islands farmers (SIG, 2009).

Whilst agriculture productivity has been declining in recent years, there has been a significant increase in food imports over the past five years (Table 2.1). The value of food imports increased by 26%, from $US14.5 million ($SBD 102 million) in 2006 to $US54 million ($SBD 387 million) in 2009. This increase was related to an increase in the demand for basic food items, such as rice, wheat, cooking oil and canned food (CBSI, 2007; SIDTIS, 2009), due to increased urbanisation and changes in food consumption patterns. From total food imports in 2009, rice import alone constituted 52% valued at $US 29 million (SBD, 200 million). Local consumption of rice, per capita of the population is one of the highest in the Pacific region at 72kg/head in 2008 (FAO Statistics, 2010).

**Table 2.1: Value of food imports into the Solomon Islands**

| Year | Value in SBD '000" |
|---|---|
| 2004 | 102.000 |
| 2005 | 153.000 |
| 2006 | 166.00 |
| 2007 | 231.000 |
| 2008 | 384.000 |
| 2009 | 387.000 |

**Source:** CBSI, 2009

### 2.5 National Agriculture and Rice Policy

In 2006, the 'Grand Coalition for Change' government unveiled its 12 National Development Objectives (NDO), four of which focused on the agricultural sector (SIG, 2007b). These objectives included:

1. Address the basic needs of people in the rural areas where the majority of people live, and ensure improvement in their standard of living;

2. Work towards food security for the nation and ensure a healthy, literate and contented population;

3. Generate job opportunities for the growing population and achieve high economic growth, wealth and social wellbeing for all Solomon Islanders;

4. Ensure sustainable utilisation and conservation of natural resources, protection of the environment and successful adaptation to climate change.

In order to achieve these National Development Objectives, the government, through the Ministry of Agriculture, set numerous activities to be implemented during the period from 2006 to 2015 (SIG, 2007). These activities included:

1. Development of the Oil Palm plantation to target 40,000ha development over the next ten years;

2. Establishment of 3000 hectares of rice projects throughout the nine provinces of the Solomon Islands, by 2015;

3 Continue the rehabilitation and development of cocoa and coconut plantations

4. Set-up small livestock projects;

5. Revival of the cattle industry; and

6. Pursue the development of exotic and indigenous fruits (SIG, 2007b).

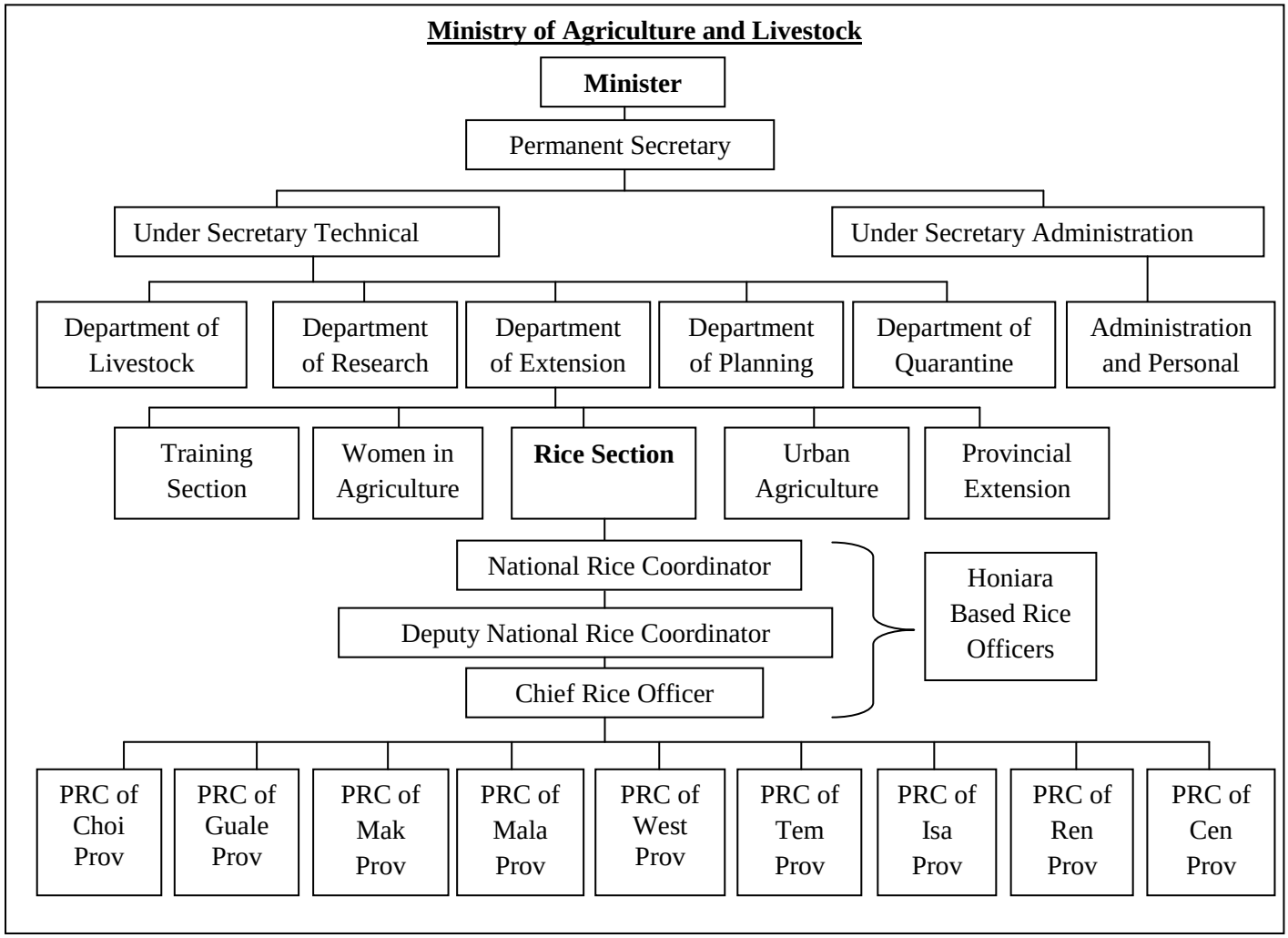
Amongst these priorities activities, rice development was assigned as the top priority by the government. The government recognised that rice was an important staple in the diet of many people in the Solomon Islands and with the increase in the price of rice in the world market in recent years, coupled with the country's increasing population growth rate of 2.8%, it stood to lose a significant level of its foreign reserves, if it did not act immediately (SIG, 2007a). Therefore, the government, through the Ministry of Agriculture, initiated the National Rural Rice Development Programme (NRRDP) in 2006, with a shift towards community- based rice production (SIG, 2009a; SIDTIS, 2009). The government believed that by targeting rice

policy towards rural communities (where 87% of people lived), the country would be able to become self-sufficient in rice, thereby reducing the increase in demand for rice imports: and it would ensure food security in rural areas within the country (SIG, 2007b).

### 2.6 NRRDP Implementation (2006-2010)

In order to implement the NRRDP, the government set up a 'Rice Section' within the Department of Extension and Training in the Ministry of Agriculture and Livestock (Figure 2.2).

**Figure 2.2: Structure of Rice Section within the Ministry of Agriculture and Livestock**




**Source: Adapted from the Ministry of Agriculture Rice Policy 2010**

The role of the Rice Section is to ensure that National Rural Rice Development Programme (NRRDP) is implemented and it meets the targets set by the government. The Rice Section is also responsible for developing the annual rice budget and preparing protocols for the release

of funds from the Ministry of finance, in addition to coordinating the procurement of rice materials and equipment for use by rice growing communities in the rural areas.

In the middle of 2006, an office was established and the Rice Section started to facilitate the implementation of the National Rural Rice Development Programme. The Rice Section was based in the capital Honiara headed by the National Rice Coordinator, who was assisted by the Deputy National Rice Coordinator, and the Chief Rice Officer. Each province has Provincial Rice Coordinators (PRC) (Figure 2.2), based at the provincial capital's Agriculture Extension Office. These coordinators are assisted by the Provincial Agriculture Extension Officers. According to SIG (2009a), a total of 17 officers have been directly involved in the rice programme since 2007 of whom 12 are Technical Officers and the remainder work in supporting roles (SIG, 2009a).

The major role of the National Rice Coordinator is basically to develop policy, deal with staff matters, and coordinate agricultural development projects in the provinces. The Deputy National Rice Coordinator on the other hand, assists the National Rice Coordinator to develop the rice policy and prepare protocols for the Ministry of Finance. The Chief Rice Officer is responsible for the procurement and shipment of rice machines, such as power tillers, polishing machines, and equipment to the country's nine provinces. He is also responsible for liaising with the Provincial Rice Coordinators on matters regarding each project in the county's nine provinces (SIG, 2009 a).

The Provincial Rice Coordinator (PRC) receives the inputs from Honiara and coordinates their distribution to all rice projects in his province. The Provincial Rice Coordinator also visits farmers to evaluate provincial rice projects and he reports on the progress of rice developments in the province to the Provincial Government and the Rice Office in Honiara.

### *2.6.1 NRRDP intensification*

The Rice Section within the Department of Agriculture Extension and Training and the provincial agriculture divisions promote the NRRDP in two ways. Firstly, they use the farm visit extension-awareness programmes, which are carried out by the Provincial Extension Officers and Provincial Rice Coordinators, for farmers in rural areas. The second method is through training workshops for interested farming groups. This method involves practical fieldwork and theory and it is conducted over a period of three to four weeks (SIG, 2009a).

Any interested community group who wants to participate in growing rice must go through several procedures and guidelines (set out by the Rice Section) for the implementation of NRRDP. The first step in the process requires individual farmers to form community groups and appoint a chairperson, secretary and a treasurer. Once this is done, the members form a project committee responsible for managing the project (SIG, 2009a).

The Rice Section has recognised that rice production involves a great deal of work and therefore, decided that it was best organised as a community activity. Their decision was also influenced by the facts that land in the Solomon Islands is owned tribally and therefore, the formation of a community groups would minimise land dispute problems. Once a committee is formed, community groups are then required to write a letter of intent to their respective Provincial Rice Coordinator, indicating their willingness as a community group to grow rice (SIG 2009b). Upon receiving the letter of intent from a group, the PRC then sends the Extension Officer to the field to carry out a field assessment of the group's proposed rice site. According to SIG (2009), the aim of the assessment is threefold: firstly, to ascertain whether the land is suitable for rice production (10 ha minimal) and free of land disputes; secondly, to assess whether the site has a suitable water source and road access; and thirdly, to ascertain whether the community group has sufficient manpower for rice cultivation.

In the event that the proposed site meets the requirements, the Extension Officer then develops a project proposal for the community group, based on the available data collected from the field tour. Upon completion of the proposal, the Provincial Rice Coordinator (PRC) evaluates it and if the proposal meets the PRC criteria, it is endorsed. The proposal is then sent to the Honiara-based Rice Office for final screening by the Rice Projects screening committee (SIG, 2009a). This process is normally completed over several days by the committee. However, in the event that a proposal is rejected, a letter of regret would then be sent to the community group through their Provincial Rice Coordinator, advising them of the reasons why their proposal has not been accepted. However, if the proposal is approved by the committee, a land-use agreement is signed between the landowners and the rice project committee, which gives permission for the rice community group to establish rice on their land.

Another important agreement that needs to be signed is a 'Memorandum of Understanding' (MOU) between the community and the Ministry of Agriculture and Livestock (Rice Section) (SIG, 2008; 2009a; 2010). The MOU grants permission for MAL, through NRRDP (Rice

Section), to develop a minimum of ten hectares of the agreed land for rice farming. This permission also includes the right to access the land, build infrastructure, and use subsidiary equipment necessary for rice growing. Once the land-use agreement and the MOU have been signed, the community project is in a position to receive support such as inputs and a labour subsidy from the Ministry of Agriculture and Livestock.

### *2.6.2 NRRDP Project support*

The National Rural Rice Programme (NRRDP) which has been implemented by the Rice Section of the Ministry of Agriculture and Livestock has three stages of programme support: development, processing and marketing (SIG, 2010). The development stage is the first stage of the Rice Section support programme and under this stage, the community rice projects are provided with inputs such as power tillers, tractors, pesticides, fertiliser, rice seed, water pumps, irrigation pipes, and fuel/lubricants. The provision of these inputs enables the community to clear the field, cultivate the land, and irrigate the rice field. However, inputs are provided only once in the lifecycle of the project and should there be any damage to any of these items, it is the responsibility of the community to replace any damaged item, at their project's expense. On the other hand, if the community has not received its full input support from the Rice Section, it is the responsibility of the Rice Section to meet the full input requirements of that community, before they begin to implement stage two of their support programme. A labour subsidy is also paid to the community members for their time and effort spent on rice farming. This is recommended by MAL, as a token of appreciation for the time and effort community members put into the farm.

The second stage is processing. This stage involves financial support provided for the community thus enabling them to build a farm warehouse and to install rice-processing equipments. Unfortunately, the Rice Section is yet to implement this stage due to a lack of finance from the Ministry of Finance (SIG, 2010). The marketing stage is the third and final support stage of the NRRDP. Under this stage, all support from the Rice Section will be provided, which includes the development of storage centres and marketing facilities for the rice farming communities. Again, this phase is yet to be implemented by the Rice Section of the Ministry of Agriculture and Livestock (SIG, 2010).

## 2.7 Malaita Province

Malaita is one of the nine provinces of the Solomon Islands. The selected case study village of Fiu is located in Maliata province. In the next section, a description of Malaita province, in terms of its geography, population, and infrastructure development is provided. Furthermore, the agriculture sector and implementation of the NRRDP within the province are also described.

### *2.7.1 Topography*

Malaita Province covers 4,200 square kilometres (McGregor et al., 2006; Moore, 2007; SIG, 2001), and its rugged central mountains rise to 1,000 metres (and in places to 1,300 metres) with razor-backed ridges and deep valleys that make travelling an ordeal. Malaita is really two islands: the main island and the adjoining South Malaita, which are separated by a narrow passage (Figure 2.3). The central mountains combine volcanic ridges with limestone-rich karst land and they are flanked by hilly plateau, hills, and narrow coastal terraces interspersed with valleys and swamps (Moore, 2007). Most of the coastline is made up of low terraces broken by river valleys but on the east coast, the high karst plateau extends to the coast and the descent is often steep. There are extensive and heavily populated lagoons along the northeast (Lau), central west (Langalanga) and southwest coasts (‘Are‘are) and other swampy areas that were once part of lagoons (Moore, 2007; SIG, 2001).

**Figure 2.3: Map of Malaita Province**


**Source:** Anthony Bright, Coombs Cartography, Australian National University

### *2.7.2 Demography*

The population of Malaita stands at 140,620 (Statistic Office, 2009) which is 30% of the country's total population. The average annual growth rate for the province between 1999 and 2009 was 3.3% (Statistics Office, 2009), and this is higher than the national growth rate of 2.8%. The 2009 census also revealed an average household size of 6.6, which is also higher than the national average of 6.3 people per household. Based on the 1999 census, the gender ratio (male to female) is 99.7:100 (99.7 males for every 100 females). This is a slight increase of 1.7% from the 98.0 registered in the 1986 census. On average, approximately 29 people occupy one kilometre of land. This rate is almost double the national average of 14.8 people per square kilometre. From the four regions of the province, the central Kwara'ae region where the case study is conducted, is the most populated with 36.3% of the province's total population. The least populated region is the Malaita outer islands region (Siakaiana and Ontong Java) with just 1.7% of the province population (Statistics Office, 2009).

### *2.7.3 Infrastructure*

Malaita province's road system is reasonably more developed than the other eight provinces in the country (SIG, 2001; McGregor et al., 2006). The province is accessible by sea, land and air. There is no international port in the province but there are approximately 16 wharves located throughout the province. From these 16 wharves, Auki wharf, which is located in the provincial capital is the busiest. The north road runs from Auki to Fouia, the south road runs from Auki to Hauhui, and the east road runs from Dala north to Atori in East Malaita. There are also 18 feeder roads and 63 bridges around the island. The province also has five domestic airfields served by Solomon Airlines and they are Auki, Atoifi, Parasi, Afutara and Ontong Java. Gwaunaru, which is located close to the provincial capital Auki is the busiest airfield with a total of 14 flights per week that link Honiara and other parts of the province to the provincial capital, Auki (SIG, 2001).

## 2.8 Agriculture sector of Malaita Province

Farming activities in Malaita province can be categorised into three main farming structures: 1) subsistence farming; 2) semi-commercial; and 3) large scale plantations (MAD, 2007; SIG, 2001). Under the subsistence structure, farmers/households grow their own food and the surplus is sold at the local market. The structure of this farming system is low-input and extensive, with rotational slash-and-burn agriculture in forested customary owned land. The

average size of each farmer's plot ranges between 0.2 ha to 1.0 hectare (McGregor, 2006; Warner, 2007).

Under the semi-commercial structure, smallholder rural farmers/households grow their own food and also produce cash crops for the domestic market (SIG, 2001). The characteristic of this farming system is low-input and extensive, and rotational 'swidden' (slash and burn) agriculture is practiced in forested customary owned land. The average size of the sub-commercial farms ranges from between 1.0 ha to 5.0 hectares (Waroka, 1997). The plantation structure in Malaita province is limited to coconut plantations owned previously by expatriates in Baunani and Mafu in the West Kwaio region of the province (SIG, 2001). These plantations have been operational since the expatriates handed them back to its landowners.

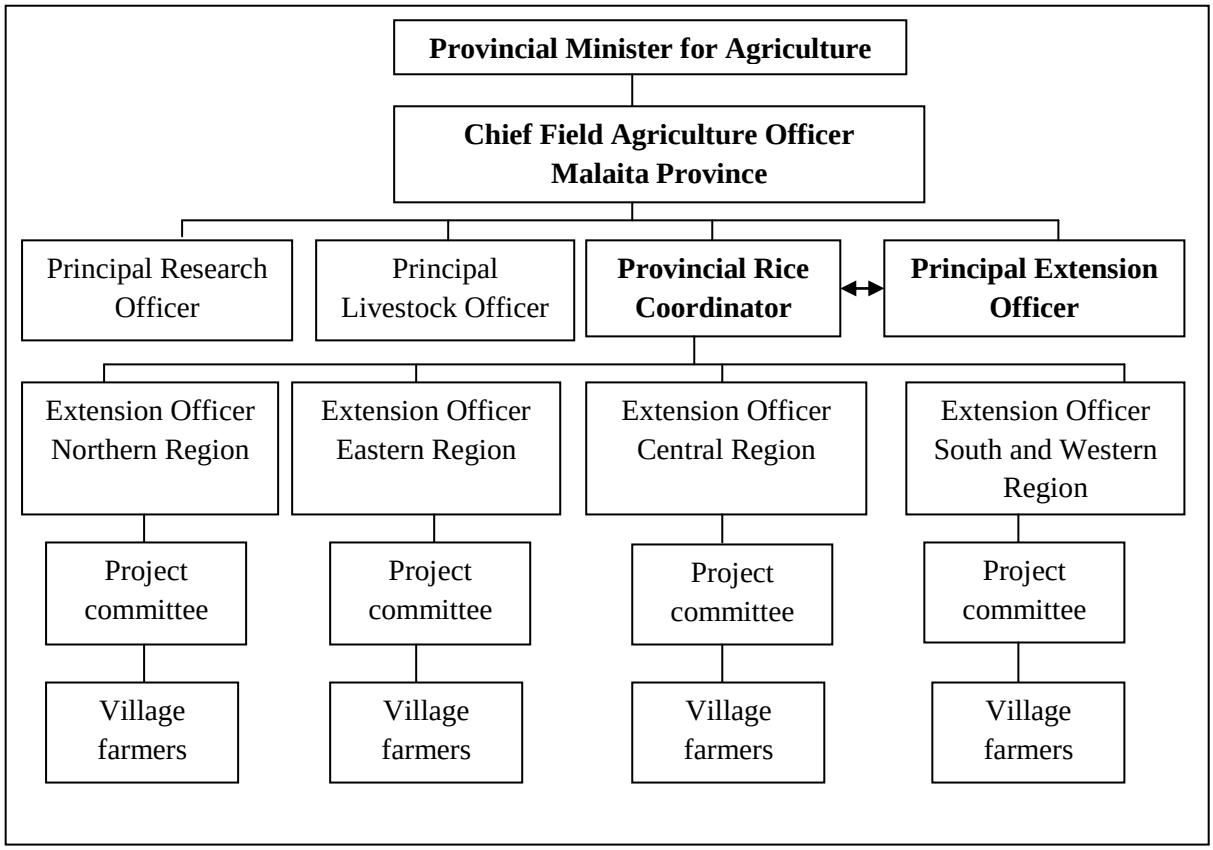
The major agricultural sectors in the province are local crops, cash crops, and livestock. The main local crops that farmers grow in their gardens for consumption are kumara, cassava, taro, pana, banana, vegetables such as slippery cabbages, fruits such as pawpaw, and pumpkin. These local crops are produced for home consumption and any surplus produced is sold at the local market. The cash crop sector consists of crops such as coconut, cocoa, betel nut, and pineapple (Evans, 2006). Coconut (when it is green), betel nut, and pineapple are sometimes consumed at home by farmers. However, most produce is sold at the local market for cash. Both cocoa and copra are processed, then bagged and sold to an exporter in Honiara. The livestock sector of Malaita province consists of local inbred and free-range pigs, backyard chickens, and cattle tethering. Pigs (mainly free range) and backyard poultry are kept for protein intake and (in the case of pigs), for ceremonial purposes, and wealth accumulation. The province's islands have the potential to increase their meat production provided that better animal husbandry, feeding practices and improved breeds are made available to the farmers (SIG, 2009).

### 2.9 NRRDP implementation in Malaita Province

The Malaita Provincial Agriculture Division is a section established under the department of Extension and Training of the Ministry of Agriculture and Livestock. It is headed by the Chief Field Officer, who is assisted by three principal officers and the Provincial Rice Coordinator. Similar to the establishment of the Rice Section at national level, in the middle of 2006, an office space was established within the Malaita Provincial Agriculture Office in

Auki and a former extension officer was promoted to take up the position of the Provincial Rice Coordinator, tasked with overseeing the implementation of the NRRDP in Malaita Province (Figure 2.4).

**Figure 2.4: Structure of Rice Section in Malaita Province**




**Source:** SIG, 2009

The Malaita Provincial Rice Coordinator (PRC) usually makes a request for inputs to the Rice Section in Honiara on behalf of rice farming communities in the province. He is also responsible for receiving these inputs from Honiara and coordinating their distribution to all rice projects in the province. The Provincial Rice Coordinator also visits farmers, evaluates provincial rice projects, and reports to the provincial government (through the Chief Field Officer and the Rice Office in Honiara) on the progress of rice development in the province. In addition, he also works closely with the Principal Extension Officer and the Regional Extension Officers on matters relating to rice in the province.

The four Regional Extension Officers assist the PRC to receive the supplies from Honiara and also distribute and deliver these inputs to the rice community groups in the villages. In addition, they also visit rice communities and provide necessary information on rice

production to interested farming communities. Furthermore, they assess rice farming community projects in their region and report back to the Provincial Rice Coordinator.

The project committee is a body of either elected or appointed members, who are trusted by the farmers to manage their community project and responsible for planning and developing work programmes for the project. The committee works through the Regional Agriculture Extension Officer and receives technical support and a subsidy payment from the Provincial Rice Coordinator through the Regional Agriculture Extension Officers (SIG, 2010).

**2.10 Summary**

The Solomon Islands are a group of some 900 islands in the Southwestern Pacific located between the latitudes of 5˚ and 12˚ south of the equator. Approximately 87% of the country's population lives in rural areas and they depend on agriculture for food, raw materials for local industries, and employment. In addition, agriculture is a major source of export earnings for the country. However, despite existing activities, agricultural productivity has been declining over the past ten years. Apart from the decline in agricultural productivity, the country has also experienced a significant increase in food imports over the past five years.

In order to address these situations, the government through the Ministry of Agriculture, set numerous activities, which were to be implemented during the period 2006 to 2010. One of these projects, which were considered top priority by government, was the development of rice projects. Therefore, in 2006, the government, through the Ministry of Agriculture, initiated a National Rural Rice Development Programme (NRRDP), with a shift towards community- based rice production. The government believed that by targeting rice policy towards rural communities (where 87% of people lived) the country would be able to be self-sufficient in rice and thereby, reduce the increase in demand for rice imports — and ensured food security in the country. The National Rural Rice Programme (NRRDP) has been implemented by the Rice Section of the Ministry of Agriculture and Livestock, together with the country's nine provincial agriculture extension divisions.

The support provided by the NRRDP to community rice projects includes three phases: phase one includes the provision of capital and variable inputs such as power tillers, tractors, pesticides, fertiliser, rice seed, water pumps, irrigation pipes and fuel/lubricants to farmers, in addition to a labour subsidy payment. Phase two includes the building of farm warehouses and the installation of rice processing machinery; and the final phase includes the

development of storage centres and marketing facilities for the rice farming communities in the provinces.

# CHAPTER 3

# LITERATURE REVIEW

## 3.1 Introduction

The purpose of this chapter is to review the literature relevant to this study. The chapter begins with a definition of food security, followed by a review of food security strategies and their links to agricultural technology. A definition of technology is then provided, followed by a review of the literature on decision making on technology adoption. The factors that influence the adoption decision are then reviewed which includes: 1) the characteristics of the technology; 2) internal factors; and 3) external factors. In the final section, a review of the impacts of technology adoption on food security and the income levels of farmers are examined.

## 3.2 Food security

Food security is a global concern. According to the FAO (2009), over one billion people experience the hardship that hunger imposes — a figure that continues to rise, despite economic development taking place within most countries of the world. As a result of increased population growth, economic instability, and climate change, food security has become a major national and global challenge. The FAO (2002 p. 38 ) defines food security as a situation "when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food which meets their dietary needs and food preferences for an active and healthy life." In contrast, a lack of food (or food insecurity) leads to human suffering (Von Braun et al., 1992). According to the FAO (2002), the first Millennium Development Goal fall short of food security aspirations since it seeks to only reduce by half (by 2015) the proportion of the world's population who are experiencing hunger. However, without achieving the first Millennium Development Goals, which is to reduce hunger, it would be difficult for any country to achieve the other MDG goals. Based on the first Millennium Development Goal, which is to reduce hunger and highlight the importance of food to humankind, several strategies have been developed over the past four decades by various international communities and even national governments to improve food security and the livelihood of the poor.

### 3.3 Food security strategies

According to Von Braun et al., (1992), food security is a complex issue and hence, there is no general strategy or programme that could address it. However, Phiri (2011) states that food security strategies can be usefully placed under two major groups: 1) those that focus on increasing agricultural production (Bartel, 2009; Sahn, 1998; Von Braun et al., 1992); and 2) those that focus on multiple approaches, which provide income and food, and also reduce the risk of hunger (Devereux, 1999; Gladwin et al., 2001). The strategy for increasing agricultural and food production focuses on the adoption of new technologies such as new varieties, new crops and modern inputs, and the commercialisation of agriculture-these are vital in order to help alleviate poverty (Pretty et al., 2003; Von Braun et al., 1992). The adoption of new varieties, new crops and modern inputs increase yields and these directly reduce food insecurity, resulting in the improvement of employment opportunities and the expansion of food supplies (Minten & Barrett, 2008). These gains in real income for farmers led to improvements in food consumption and nutritional welfare (Dontsop et al., 2011). In contrast, several studies by IFPRI (1992), Sijim (1997) and Stevens et al., (2001), suggested that policies for increasing food production should include: 1) the provision of input credit, 2) subsidies or free inputs, 3) research and extension, 4) capital expenditure and investment promotion, 5) land reform, and 6) price support as a means of enhancing adoption of technologies to increase food production by smallholder farmers.

The multiple livelihood strategy includes on-farm production and diversification of income (Gladwin et al., 2001). It is based on multiple approaches, such as non-farm income generating activities (e.g. sewing, buying and reselling of items), and the provision of agricultural labour in exchange for food (Orr & Orr, 2002). This strategy has been implemented because of the belief that none of the strategies on their own are capable of saving households from starvation (Gladwin et al., 2001). For example, Peterson (1999) found this scenario to be true in Malawi, where households that had multiple sources of income were better off in terms of food security, than those who did not have alternative sources of income during times when pests and diseases decimated their crops. In a study on household response sequencing during food shortages in Malawi, Devereux (1999), also supports this view. He found that female farmers who combined farming and non-farm income earnings were better off in terms of food security during the drought season, than

those who only undertook farming as a source of livelihood. In the next section, the food security and the agricultural technology adoption decisions are reviewed.

### 3.4 Food security and agricultural technology adoption

There are 1.2 billion extremely poor people in the world surviving on less than US$1 a day (IFAD, 2001; Lipton, 2001), and 75% of them live in rural areas, where their uncertain livelihoods depend on agriculture and related activities (Ravallion et al., 2007). Improved agricultural technology therefore plays a critical role in promoting the growth of agriculture and the improvement of food security for the poor (Pandey, 2000). Whilst it is true that food security is more than solely an agricultural issue, there is convincing evidence, which suggests that development, food security, and poverty alleviation will not be achieved without the adoption of new agricultural technologies (Wu et al., 2010). Since 1990, there has been significant empirical evidence to suggest that the adoption of new agricultural technologies, which play an important role in promoting agricultural growth not only effectively alleviate rural poverty, they are also more effective in improving the food security of the poor than industrial growth. For example, Kijima et al., (2008), in a study on the impact assessment of the adoption of NERICA rice varieties by Ugandan farmers found a positive effect on the household wellbeing of those farmers. More recently, Dontsop et al. (2011) conducted a study on the impact of NERICA rice varieties on farmers in Nigeria and they found that the adoption of NERICA rice varieties had greatly reduced the poverty and food insecurity of the poor, without any deterioration in their income distribution. Other studies have shown the positive impacts of the adoption of agricultural technologies on the food security of the poor, include those of DeJanvry & Mendola, (2006); Sadoulet, (1992); and Winter et al., (1998). Therefore, it can be concluded that the development and adoption of agricultural technology is a key to rural development, poverty alleviation, and food security.

### 3.5 The extension service and its role in technology adoption and food security

The extension service plays an important role in the adoption process, through the transfer of information about a technology to the prospective adopter (Azilah, 2007; Feder et al., 1985; Feder & Umali, 1993; Johnson et al., 2005; Ogunlana, 2004). The extension service or their agents act as mediators for the farmers and they convey research outcomes to farmers (Azilah, 2007; Birkhaeuser et al., 1991; Ogunlana, 2004). Aside from information transfer,

with regards to cropping techniques, optimal input use, high-yield varieties, and prices, extension services also enhance the quality of rural life, through their involvement in community development projects aimed at improving the livelihood of the rural population (Phiri, 2011). For example, Rivera & Quamar (2003) observed in Pakistan that the extension service played a major role in organising farmers into 'interest groups,' whereby each group took part in various agricultural activities, such as the building of a greenhouse and processing facilities. The extension service or their agents also taught farmers about improved record keeping and assisted in the development of the farmers' managerial skills, thus facilitating a shift to more efficient methods of production. By accelerating the diffusion process of improved technology, an extension service can bring about improvements in yield and rural incomes, than what would have been achieved in the absence of such an extension service (Birkhaeuser et al., 1991). This support has led to increased food production and an improvement in the income of rural farmers. In the next section, the technology adoption definitions are reviewed.

### 3.6 Technology adoption

The term 'technology' has been defined in different ways by various authors. Rogers (1995 p.12) defined technology as, "the design for instrumental action that reduces the uncertainty in the cause-effect relationship involved in achieving a desired outcome." According to Guerin & Guerin (1994), and Rogers (1995), technology is usually comprised of hardware (the object component) and software (idea component) but it can also be made up entirely of information, which is the software component. In contrast, however, Ison & Rusell (2002) defined technology as the application of scientific knowledge to practical tasks. Abara & Singh (1993) in their work on the ethics and biases of technology adoption supported this view. They argued that it is the actual application of knowledge that is termed "technology." According to Phiri (2011), this definition by Ison & Rusell (2002), and Abara & Singh (1993) can be best used to describe those technologies that are comprised of entirely new ideas or information. Feder & Just (1995) on the other hand, described technology as an agricultural practice that is considered new to an area. These agricultural practices (technology) may take the form of new machinery, a high yielding crop, a recommendation for a new method of fertiliser use, or new methods of controlling pests and diseases (Guerin & Guerin, 1994).

The word technology and innovation are used synonymously (Rogers, 2003). Various definitions are used in the literature to refer to the ideas, practices or objects perceived to be

new by a potential adopter. Guerin & Guerin (1994) support Rogers (2003, p. 12) definition of innovation as an "idea, practice or object perceived as new by an individual or other unit of adoption." They defined innovation in terms of how it is viewed by farmers whilst making a decision to adopt or reject it. Therefore, a technology can be a new idea, technique or object. For this study, the term technology will be used from this point onward to also mean innovation. In the following section, the adoption process is reviewed.

### 3.7 Adoption process

Rogers (2003) described adoption as the decision by an individual to use the introduced technology as the best available alternative. Feder et al., (1985, p. 256) on the other hand defined adoption as "the degree of use of a new technology in the long-run equilibrium when farmers has the full information about the new technology." According to Spence (1994), adoption is not a one-off decision but a process in which the individual finally decides to use the introduced ideas or techniques, after a thorough assessment has been carried out. On the other hand, Guerin & Guerin (1994 p.21) defined technology adoption as "the implementation of the already transferred knowledge about a technological innovation and is the end product of the technology transfer is the process." According to Rogers (2003), technology adoption involves a mental process that individual goes through when he or she becomes aware of information regarding the idea that is perceived to be new. The adoption process continues until decisions are made to use or reject the new idea (Rogers, 2003).

The five steps in the adoption decision process are conceptualised as knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2003). Spence (1994) on the other hand, indicated awareness, interest, evaluation, trial and adoption, as the stages involved in the adoption process. Although these authors term the adoption process differently, the steps described by them although have some minor differences, are very similar. These two models are compared in the following paragraphs.

The knowledge stage of the model is when an individual becomes aware of the existence of a technology as he/she receives information about it and understands how it works (Rogers, 2003). However, Spence (1994) described this stage as the awareness stage. Spence further pointed out that the individual may obtain the information through mass media, or from written, spoken or visual material which the individual farmer can access.

The second stage of Rogers' (2003) model is persuasion. At this stage, an individual may change his/her attitude towards the technology being introduced. Spence (1994) described this as the interest stage, whilst Pannell et al., (2006) referred to it as the non-trial evaluation phase. During the interest stage, an individual will typically attempt to gain more factual data in order to enable an examination of the innovation at a closer level and to explore it in the context of personal circumstances, past experiences, and prevailing beliefs (Spence, 1994).

The third stage of Rogers' (2003) model is decision. During this stage, the individual farmer engages in the activities that will consequently lead to the adoption (or rejection) of the new idea or technique. Spence (1994) considered this to be the evaluation of an innovation. Furthermore, during this process, an individual is attempting to assess whether the advantages will outweigh any perceived disadvantages. Pannell et al., (2006) however, described this stage as the trial evaluation. They stressed that trials contribute substantially to both the decision-making and skill development aspects of the learning process. If small-scale trials are not possible (or not enlightening) for some reason, the opportunities for widespread adoption are greatly diminished. Farmers will be cautious about leaping into full-scale adoption due to the risk that the innovation may prove to be a full-scale failure. Practices which are not trialable may still be adopted, but generally the adoption occurs only after substantial information-seeking, discussion, analysis, and reflection (Pannell et al., 2006).

The fourth stage of Rogers (2003) model is implementation. At this stage, the individual begins to completely apply or use the new idea (Rogers, 1995, 2003). Also, at this stage, farmers often look for more information to find out whether they have made the correct decision by adopting the technology (Van den Ban & Hawkins, 1996). Spence (1994) considered this stage as a trial stage, since the implementation of the new idea is undertaken on a smaller scale. Duncan (1969) confirmed Spence's argument by stating that adoption is not an all-or-nothing decision. He suggested that there is a grey area between small-scale trialing and the eventual scale of adoption. Adoption is often a continuous process and it may occur within a gradual or stepwise manner, which sometimes results in only a partial adoption (Wilkinson, 1989). Farmers often change and modify their practices or technology, in order to adapt it to their own circumstances. However, Rogers (1995, 2003) argued that this is a full implementation stage, since the decision has already been made.

The fifth stage of Rogers' (2003) model is confirmation. This stage is reached when the individual seeks more information towards supporting and reinforcing the decision he or she

has made or when he or she discontinues the use of the new idea because of resultant difficulties (Rogers, 2003). Adopters, who are sometimes confronted with conflicting messages from change agents or peers, regarding the new practices, tend to discontinue using the new practice (Van den Ban & Hawkins, 1996). Some adopters may discontinue the use of a new idea or practice after adoption (Rogers, 2003). The discontinuation of a technology may be a result of the individual adopter being dissatisfied with the performance of the new idea or practice. It may also due to the fact that the individual has found a new practice that surpasses the existing one and as such they would like to replace it (Rogers, 2003). Spence (1994) on the other hand indicated that such a rejection could happen immediately after the acceptance of a technology, if there is a better alternative. The adoption of technology is influenced by a range of factors. In the following sections, the factors that influence the adoption decision of a new technology are examined.

### 3.8 Factors that influenced the adoption of agriculture technology

There were a number of factors identified in the literature, which have influenced the adoption of agricultural technology. Drawing on several studies on technology adoption such as Adesina & Zinnah (1992); Aguila-Obra & Melendez (2006); Chau & Tam (1997); Doorman (1991); Feder, Just & Zilberman (1985); Rogers (1985); Souza et al., (1993) it can be ascertained that the factors, which influence the farmers' decision to either adopt or not to adopt a technology can be grouped under three major headings: 1) the characteristics of the technology; 2) internal factors; and 3) external factors. These factors are discussed in the following section.

#### 3.8.1 Characteristic of technology

Rogers (1995) identified five characteristics of a technology that influenced adoption. These are: 1) relative advantage; 2) compatibility; 3) complexity; 4) trialability; and 5) observability. Feder et al., (1985) identified three others and classified these technologies in relation to resource use. These characteristics included: 1) capital-saving or capital intensive; 2) land-saving or land-using; and 3) labour-saving or labour using. Feder & Umali (1993), Leathers & Smale (1992), and Pannell et al., (2006) also identified associated risks with a new technology as an important factor that influenced adoption decisions of individuals. The following sections draw on the relevant literature to describe in detail each of these factors and their impacts on the adoption decisions of individuals.

***Relative advantage***

Relative advantage is the degree to which an innovation is perceived to be better than the idea it supersedes (Rogers, 1995). Relative advantage can also be described as the advantage of an innovation to achieve goals better (or at a lower cost) than previously (Van Den Ban & Hawkins, 1996). The degree of relative advantage is commonly expressed as economic profit, social prestige or other benefits (Rogers, 1995). It has been found that agricultural practices, which are believed to be profitable, have an increased likelihood of adoption, whilst those that are believed to provide less return are less likely to be adopted (Barr & Cary, 1992; Carey et al., 2002; Webb, 2004).

***Compatibility***

Compatibility refers to the degree to which an innovation is perceived as consistent with existing values, past experience, and the needs of the potential adopter (Roger, 1995; 2003). The more compatible an innovation is to a potential farmer's life experiences and situation, the more familiar they will be with the innovation and the less uncertain they will be about adopting the innovation (Deressa et al., 2009). Ogunlana (2004) also defined compatibility as being the ease by which the farmers can integrate the new practices into their farming system and access other relevant inputs that would help in its adoption.

***Complexity***

The complexity factor is the degree to which a technology is perceived to be difficult to understand and use (Rogers, 2003). The greater the complexity of an innovation the more negatively a new farmer may view the technology. For example, the discontinuation of a system of rice intensification programme, which was introduced in Madagascar for rice farmers, was largely due to the difficulties faced by farmers in understanding the application of the new practices and methods (Moser & Barrett, 2002). Gibson (1994) shared a similar view and reported that farmers in Papua New Guinea rejected growing rice because rice cultivation was seen as complex and difficult to manage.

***Trialability***

Trialability is the degree to which the technology can be tested on a small scale (Rogers, 2003). Ogunlana (2004) pointed out that farmers are always keen to adopt technologies which

they have first trialed on a limited basis on their farm, compared to one they have to adopt on a larger scale — which might fail. Floyd et al., (2003) and Rogers (2003) added that a technology, which can be gradually implemented without a large capital investment from outside, is important, since it will certainly enhance the farmers' decision to adopt the technology. For example, Lakham et al., (1995) found that farmers in Guyana were keen to adopt rice growing because they had trialed rice on a small-scale and found it yielded good results.

***Observability***

Observability is the degree to which the results of a technology can be visible to others (Rogers, 1995). Cary et al., (2002) argued that a profitable outcome is an important factor that influences the adoption decision. A lack of observable profit, as result of adopting a technology would inhibit the adoption of the technology by others. The more observable the outcomes of an innovation offers and is perceived as being suitable by the farmer, the rate of adoption will become more positive (Rogers, 2003). For example, in a study on mangrove swamp rice varieties in Sierra Leone, Adesina & Zinnah (1992) found that farmers adopted a new variety of rice introduced to the area because they observed that the results were highly visible.

***Resource use characteristics***

Resource use characteristics of a technology were also other factors that influenced adoption decision of farmers (Feder et al., 1985). It was also found that technologies, which are capital-intensive, are less likely to be adopted by farmers than those that are less capital-intensive (Feder et al., 1985; Khanna, 2001). Furthermore, Floyed et al., (2003) and Rogers (2003) added that a technology which requires a large initial capital outlay is less likely to be adopted by farmers. In addition, changes involving minimum cost are adopted more quickly than those changes that require a large expenditure (Zepeda, 1990). Bangura (1983) and Feder et al., (1985) found that technologies, which are labour demanding and require more time, are less likely to be adopted by farmers than those that leave farmers time, for other sources of income accumulation. This view has been supported by Gibson (1994) who found that the labour intensity of rice growing (in PNG) was one of the factors that influenced the farmers' decision not to adopt the technology.

A technology that is land-using has also been found to have a negative influence on farmers' decision not to adopt it. It was found that in areas where population density is very high and less land is available for gardening, farmers were more likely to adopt technologies that are land-saving, relative to those that require large-size land areas (Pender et al., 2004). Similarly, Ajayi et al., (2007) in a study on the adoption of renewable soil fertility replenishment technologies in a southern African region, supported this view. They observed that as the population growth in an area increased, the ability of farmers to adopt land-using technology was reduced and this situation influenced their decision to adopt land-saving technologies thus contributing to enhancing soil fertility.

***Risk***

The associated risks of new technology have also been seen as a major factor and a barrier to adoption (Feder & Umali, 1993; Leathers & Smale, 1992; Pannell et al., 2006). Daberkow & McBride (2003) pointed out that, when a new technology first appears, potential users are generally uncertain about its effectiveness and they tend to view its use as experimental. Therefore, any new technology or practices that are perceived as relatively risky will be less likely to be adopted by farmers (Stanley et al., 2000). Many studies have found that the perceived risk or uncertainty associated with a technology declines with learning and experience, thus inducing more risk-averse farmers to adopt an innovation — provided it is profitable (Feder & O'Mara, 1981, 1982; Hiebert, 1994). In the following sections, the internal factors that influence farmers' adoption decisions are reviewed.

### 3.8.2 Internal factors

Several authors (Bantel & Jackson, 1989; Deressa et al., 2009; E'Dmden et al., 2008; Knowler & Bradshar, 2006; Pannell et al., 2006; Staal et al., 2002) suggested that there are four key internal factors that influence the adoption of technology. These factors include: 1) characteristics of the farmer; 2) on-farm factors; 3) cultural factors; and 4) leadership characteristics. The following sections draw on the relevant literature to describe in detail each internal factor that can influence a farmer's adoption decision.

***Characteristics of the farmer***

The personal characteristics that may influence the adoption decision of a farmer include age, gender, education, and level of farming experience (Deressa et al., 2009; Doss & Morris,

2001). These personal factors can affect the innovativeness of an individual and thus contribute to determining the rate at which farmers' will adopt new technology (Adesina &Zinnah, 1992; Deressa et al., 2009; Spence, 1994).

The age of the farmer is often considered to be one of the factors responsible for influencing his or her decision to adopt a technology (Souza et al., 1993). Tiamiyu et al., (2009) argued that younger farmers are more likely to adopt new technologies if they are not constrained by limited cash resources, whilst older farmers are less likely to adopt new technologies if they require extra physical labour. Older farmers may be less interested because they have less need for extra income (Souza et al., 1993). However, there is conflicting evidence on this relationship with some researchers finding no significant evidence between age and adoption (Curtis et al., 2005; Guerin &Guerin, 1994; Shiferaw & Holden, 1998). For example, Adesina & Zinnah (1992), in their study on the factors affecting the adoption of rice farming in Sierra Leone found that the age of farmers had no significant relationship to their adoption decision of rice farming.

Gender issues within agricultural production and technology adoption have been investigated for a long period. Most studies show mixed evidence regarding the different roles men and women play in technology adoption. Doss & Morris (2001), in their study on factors influencing improved maize technology adoption in Ghana, and Overfield & Fleming (2001), who studied coffee production in Papua New Guinea, show no significant effect of gender on adoption. The latter study reported that efforts towards the improvement in women's working skills do not appear warranted, since their technical efficiency is estimated to be equivalent to that of males. Since adoption of a practice is guided by the utility expected from it, the effort put into adopting it is reflective of this anticipated utility. It might then be expected that the relative roles women and men play in both 'effort' and 'adoption' are similar, hence suggesting that males and females adopt practices equally (Overfield & Fleming, 2001).

The education level of farmers also or could also affect their decision to adopt or reject a technology. Evidence from various sources has indicated that a positive relationship exist between the educational level of a farmer and the adoption of improved technologies (Doss & Morris, 2001; Moser & Barrett, 2003; Tiamiyu et al., 2009). Moser & Barret (2003) in their study on factors affecting non-adoption of a system of rice intensification in Madagascar found that adopters and non-adopters who had more years of schooling adopted the rice intensification system at a higher rate than those with less education. They also found that

farmers with more years of schooling were more likely to belong to a farmer association than farmers with low level of education.

Experience is also positively related to technology adoption, through an increase in the decision maker's ability to assess whether a new technology would be profitable (Hassan & Nhemachena, 2008; Khanna, 2001; Maddison, 2006). However, variables relating to experience are found in many studies, with mixed results. For example, Lin (1991) found that experience related positively to the adoption of hybrid rice in China. On the other hand, experience may be related to age, which has often been shown to be negatively related to adoption (Polson & Spencer, 1991; Zepeda, 1987). The other important aspect of experience, which is rarely investigated but is equally important, is the past experience of the farmer with the proponents of change (the government, their agents and policies advocated) (Agarwal, 1983; Stanley et al., 2000). For example, Agarwal (1983) stated that the past experience of a farmer with the technology and its proponents can positively influence his/her decision to adopt the technology. However, in contrast, Stanley et al. (2000) found this relationship to be negative. They found that the previous experience of the potential adopters (with a previous government's failed programme) was seen as a barrier to adoption. Finlay et al., (2004), in a study examining land managers' attitude towards land management in Australia, supported this view. He found that the past experience of the land managers with government agents and their failed programme only contributed to a general feeling of distrust and animosity towards government policies and their agents (such as the extension officers). In the following section, the on-farm factors that influenced adoption decision are reviewed.

***On-farm factors***

On-farm factors include farm size, location, and land tenure (E'Dmden et al., 2008; Daberkow &Mcbride, 2003; Knowler &Bradshar, 2006; Staal et al., 2002). These factors exist within the farm environment in which farmers carry out their daily activities (Spence, 1994).

The effect of farm size on adoption has been frequently analysed in many adoption studies (Erenstein & Faroog, 2009; Daku, 2002; Doss & Morris, 2001). Evidence from various sources has indicated that there is a positive relationship between farm size and adoption (Erenstein & Faroog, 2009; Deressa et al., 2009; Kasenge, 1998). In a number of studies, it was found that those with larger farms have a greater probability of adopting an innovation

than owners of smaller sized farms (Azilah, 2007; Deressa et al., 2009). Farmers operating larger farms tend to have greater financial resources and their opportunities to obtain credit are higher compared with those with smaller farms. In Kenya for example, a study by Gabre-Madhin & Haggblade (2001) found that large commercial farmers adopted new high-yielding maize varieties more rapidly than smallholders did. However, in contrast, Hossain (1988) pointed out that smallholder farmers are more willing to adopt labour intensive technologies than larger farmers did because smallholder farmers can use family labour, which is relatively cheap compared to larger commercial farms.

The location of the farm is also an important factor, which influences the adoption of a technology. For example, Zeller et al., (1998), in a study on market access in Malawi found that farmers who had their farms located close to major markets adopted maize faster than those whose farms were located far from the market. In a developed country's context, Khanna (2001) found in the American Midwest that the farmers who had their farm's located in proximity to soil research centres adopted new soil testing technology faster than those whose farms were located far away from the research centre. Similarly, a study on the adoption of conservation tillage in Australia by D'Emden et al., (2006), found that the proximity of the farm to the adopter's home was positively related to adoption. They further stated that farms that are located closer to locations that provide the service are more likely to adopt a new technology than farms located further away.

Land ownership is widely believed to encourage the adoption of technologies linked to land (Kassie et al., 2009). For example in the Philippines, Neil & Lee (2001) found that land ownership was positively associated with hedgerow adoption. Whilst empirical studies have supported this hypothesis, the results are not unanimous and the subject has been widely debated (Feder et al., 1985; Rodriguez et al., 2008). For example, Smucker et al., (2000) found no definitive relationship between land ownership and technology adoption by peasant farmers in Haiti. Similarly, Rodriguez et al., (2008), in a study on barriers to the adoption of sustainable agricultural practices in the 13 Southern States of the USA found the relationship between land ownership and the adoption of sustainable agricultural practices to be negative. This is because the landlords who lease their land to farmers dictated what crops would be grown on this land and this led farmers to be reluctant to adopt the new technology (Rodriguez et al., 2008). This suggests that farmers working on leased land are less likely to adopt long-term technology practices because they perceive that the benefits of the adoption

will not be necessary accrue to them. In the following section, the cultural factors that influenced adoption decision are reviewed.

***Cultural factors***

Cultural factors have also been identified as having influenced adoption decisions by farmers. These factors include: 1) norms and 2) the traditions of a society (Herbig & Miller, 1991; Pannell et al., 2006; Roger, 1962; Sommers & Napier, 1993; Straub, 1994; Tiraieyar, 2009; Twati, 2008; Wejnert, 2002).

The cultural norms of a society are also an important factor that influences an adoption decision. Wejnert (2002) argued that technologies, which are not compatible with cultural norms, are adopted only by a relatively small percentage of potential, individual adopters. For example, Rogers (1962) found that the residents of Los Molino in Peru did not adopt the practice of boiling drinkable water because it conflicted with their norm of serving such water only to sick people. Similarly, in Costa Rica, the rate of adoption of fertility-control practices by married couples was low because they conflicted with their cultural values relating to optimum family size (Rosero-Bixby & Casterline, 1993; 1994).

The traditions of a society are one of the factors that play an important role in affecting farmers' decision-making, which includes the likelihood of them adopting new practices (Stanley et al., 2000). For example, Sommer & Napier (1993) found that the adoption of sustainable agriculture practices by farmers in Amish communities was influenced by their cultural traditions towards land and soil protection. However, in contrast, Wejnert (2002) stated that the cultural traditionalism associated with social inertia when adopting new practices and ideas can negatively affect the adoption of technology. Myrdal (1968) for example, pointed out that these factors applied to India's unproductive economic behaviour, where strong cultural constraints on the societal position of most people may gradually reduce incentives to adopt novel approaches to farming. Similarly, Lawrence et al., (2003) argued that society's resistance to discarding long-held traditions would lead to a strong resistance (within that society) to change the adoption of new technology. In the following section, the leadership characteristics that influenced adoption decision are discussed.

***Leadership characteristics***

Leadership characteristic is another internal factor, which has been found to influence the decision to adopt new technology (Bantel & Jackson, 1989; Damanpour & Schneider, 2008; Howell & Higgins, 1990; Levi & Witwin, 1986; Scott & Bruce, 1994; West & Anderson, 1996). Ross & Lappin (1967) referred to leadership characteristics as attitudes and behaviours of those individuals who perform leadership roles. They believe that good leaders need to possess a positive identification with their people and also with others outside their community. Based on their work on community and cooperatives in participatory development Levi & Witwin (1986), supported this view. They found that good leaders are those who know their people intimately, who share with them their problems, and who lead their people towards common goals. Onyx & Leonard (2010) further support this view, in their study on complex systems leadership in emergent community projects in Australia, Uruguay, Sweden, and Peru. They found that the five community projects studied in five different countries were successful because the leadership of these community projects was open to their members in relation to shared decision making with members, honesty with members, and committed to their communities. In contrast, however, the lack of these attitudes and behaviours in a leader would certainly lessen the group members' support for their leaders and hence this situation could lead to a community project's failure (Levi & Litwin, 1986). For example, Russell & Vidler (2000) found that the collapse of a community action-planning project in Sri-Lanka was due to the poor attitudes displayed by the leaders. They observed that the leadership of the project seemed to have put their own interests ahead of the community group's interests and moreover they accepted bribes from the people they were supposed to lead.

The other important characteristics of leaders, which influence adoption decisions, are skills and knowledge (Cernea & Meinzen-Dick, 1995). According to Cernea & Meinzen-Dick (1995), these characteristics can be further divided into two types: 1) those that are required in an organisational role; and 2) those that are required in a technical role. Ros (2010) pointed out that the organisational skills and knowledge required of a leader in relation to communal projects includes financial management, decision-making, conflict resolution, record keeping, resource mobilisation, communication, and coordination, whilst the technical role refers to specific knowledge and skills relative to the technology adopted. In contrast, however, Levi & Litwin (1986) argued that the absence of knowledge and skills by the leaders would lead to poor decision-making, which could result in the disintegration of the community group and subsequently the project's failure. For example, Russell & Vidler (2000) found that the lack

of technical knowledge (held by leaders of a community action planning project in Sri-Lanka) was one of the factors responsible for causing the project to fail. This is was because the leaders did not have the correct training needed to acquire the necessary skills and knowledge to lead a community project group. Orewa et al., (2009) in a study on technology transfer and the government's direct involvement in improved seedling production for community group farmers in Nigeria also supported this view. They found that a lack of leadership skills and knowledge by leaders of the government-supported tomato seedling project, had influenced members of the project group to abandon the project and hence, this led to the closure of the project. In the following sections, the external factors that influence the adoption decision of a new technology are reviewed.

### 3.8.3 External factors

Apart from the internal factors, the adoption decision of farmers is also influenced by external factors. Several authors such as Akpabio & Inyang (2007); Anderson & Feder (2003); Binswanger (1989); Caswell et al., (2001); Cornejo et al., (2001); D'Emden et al., (2008); Doss (2006); Fliegel (1993); Grarner & Sharp (2004); Jimenez (1995); Korten (1980); Kurlalova et al., (2006); Langyintuo & Mungoma (2008); Mansuri & Rao (2003); Saltiel et al., (1994); Sunding & Zilberman (2000); and Zeller et al., (1998) identified five main external factors to have influenced the adoption decision of farmers. These were: 1) government policy; 2) infrastructure development; 3) agro-climatic condition; 4) extension support; and 5) market access. The following sections draw on the relevant literature, in order to describe in detail how each external factor influences the adoption decision.

#### *Government policy*

Government policies can either positively or negatively influence the adoption decision of farmers. According Doss (2006), Kurlalova et al., (2006), and Sunding & Zilberman (2000), some of the government policies that influenced the adoption decisions of farmers were: 1) direct support through the provision of inputs subsidies to farmers, 2) incentive payments to farmers; and 3) the community group development approach.

The provision of input subsidies to farmers has been recorded in the literature as a factor that has an influence on the adoption decisions of farmers (Dorward, 2009; Just & Zilberman, 1986; Stoneman & David, 1986; Sunding & Zilberman, 2001). The provision of subsidised inputs increases farmers' profitability and reduces the risks perceived by farmers if they

adopt a new technology (Dorward, 2009; Just & Zilberman, 1986). Stoneman & David (1986) argued that the provision of inputs also encourages more farmer participation and a rapid adoption rate. Sunding & Zilberman (2001) observed in India that the provision of subsidised inputs to farmers led to a high adoption rate of high-yielding varieties of rice. Similarly, Harrigan (2008) in a study on a starter-pack policy in Malawi found that not only did the provision of inputs to farmers influence their adoption decisions; it also contributed to increases in the yield of farms and hence improved farmers' income. In contrast, if the providers of such inputs only pay lip service and do not deliver inputs to farmers, the adoption result can be negative. For example, Orewa et al., (2009) in a study of technology transfer and government direct involvement in improved seedling production for farmers in Nigeria supported this view. They observed that farmers discontinued the tomato seedling project initiated by the government because the government had failed to deliver inputs to farmers as they had promised. In a similar study on government intervention in the aquaculture industry in Akwa Ibom State, Nigeria, Akpabio & Inyang (2007) found a similar problem where the government's failure to deliver inputs (as promised to local farmers) had led to the collapse of the project scheme, due to the farmers withdrawing their support. In the next paragraph, incentive payment as a factor that influenced adoption decision is examined.

The literature also found that the provision of incentive payment to farmers influenced their adoption decision (Cooper & Keim, 1996; Kurlalova et al., 2006). For example, some studies in USA (in a developed country's context) investigated the use of incentive payment to farmers and found that the provision of incentive payments encourage farmers to adopt water quality protection practices and had a positive effect on the adoption rates of farmers (Cooper & Keim, 1996). Kurlalova et al., (2006) in a similar study carried out on the incentive payments made in order to increase the adoption of conservation practices in the state of Iowa in the USA also found a positive relationship between the payment of incentives and the adoption rates of farmers. However, these authors also argued that the benefits of such a programme are short-lived and farmers may quit using modern practices once the programme's benefits (subsidies) have disappeared. In the next paragraph, a discussion of community approach as a factor that influenced adoption decision is presented.

According to Korten (1980), the concept of a "community development approach" came to prominence in 1948 when the Ford Foundation funded a pilot project in the Etawah District of Pradesh, India. The project achieved impressive results by increasing agricultural

production and strengthening rural infrastructure. The achievement by this community development effort led to the initiation of similar programmes in over 60 nations throughout Asia, Africa and Latin America (Korten, 1980). To date, community-based development is amongst the fastest growing mechanisms for channeling development assistance to rural populations in developing countries (Mansuri & Rao, 2003).

The community development approach has a number of advantages which can positively influence an adoption decision. For example, Grarner & Sharp (2004) reported that the main advantage of the community group approach is its potential for pooling the abilities, expertise, and resources of extension personnel and experts in the field, in order to positively affect a community project's success. As a result, members of the group would be able to develop skills, knowledge, and attitudes, which are critical to work effectively and also to meet their future needs (Ross & Lappin, 1967; Kegler et al., 1998). Meinzen-Dick et al., (2002) in a study on natural resource management also supported this view. They found that in India, collective action by a group aimed at pursuing shared objectives for technology adoption and to ensure that resource use was efficient, equitable and sustainable, had been successful. In contrast, Botes & Van Rensburg (2000) argued that the community group approach only interferes with the way poor people choose to do things and moreover the group creates an avenue where the poor will be manipulated for the benefit of the leaders and elites in the group. Other studies by Olson (1965) and Kegler et al., (1998) have also supported this view. These authors argued that community groups run the risk of developing conflicts due to differences in opinion, personality clashes, and the hidden agendas of individuals within the group.

The other advantage of the community development approach, which might positively influence an adoption decision is workload sharing. According to Williams & Harkins (1979), workload sharing enhances the effectiveness of strategies aimed at preventing social-loafing or free-riding and therefore enhances equal participation by members of the group on a given task, which could potentially makes jobs much lighter. Behera (2009) and Poteete & Ostrom (2003) supported this view and they argued that free-riding is best overcome by the existence of a small group since it is much easier to monitor and share norms and patterns of reciprocity within such groups compelling users to consider the indirect and long-term consequences of their actions.

***Infrastructure development within an area***

Jimenez (1995) stated that infrastructure plays a key role in facilitating technology adoption. Infrastructure development includes: improvement in roading, transportation system and the processing facilities (Binswanger, 1989; Langyintuo & Mungoma, 2008). The state of road infrastructure development in an area influences the adoption decision of farmers (Feder & Umali, 1993; Peterson, 1997; Vanclay, 1992). Binswanger (1989) found that improvements in the infrastructure (a paved road) in rural India led to a significant increase in the adoption of fertiliser technology. Hintze et al., (2003) in a study on variety characteristics and maize adoption in Honduras, also supported this view. They found that a better road had increased farmers' access to a new maize variety stock and thereby increased the adoption propensity of the farmers. Quality road infrastructure also enhances farmer's access to information thereby influencing the farmers' decision to adopt a new technology. For example, farmers who have access to roads and who receive frequent visits from extension agents adopt more quickly, than those who are far away from (and have not been visited by) extension agents (D'Emden et al., 2006; Hagerstrand, 1976; Johnson & Masters, 2004; Peterson, 1997; Rahman, 2003; Ruttan, 1996; Vanclay, 1992).

In contrast, however, sub-standard road networks can lead to the damage of farm produce, thereby reducing the life span of the produce (Nzomoi et al., 2007). Sub-standard roads also prevent extension officers from visiting farmers to show them the improved technology and (as a result) the adoption of improved technology is therefore limited (Leta et al., 2004; Peterson, 1997). In these studies, sub-standard roads led to high transportation cost for transporting farm produce to the markets as well as high cost of farm inputs, thus reducing farmers' competitiveness (Omboto, 2007). Access to processing equipment is also found to have influenced farmers' decision to adopt new technology. For example, Odogola (2006) in a survey report on rice production, processing and marketing in Uganda, found that an increasing numbers of farmers have adopted rice growing because they have access to rice milling machines.

***Agro-climatic condition***

Another important external factor that influences adoption is the agro-climatic condition of the farming area. Agro-climatic factors such as soil quality, rainfall, temperature and sunshine hours have a positive relationship to the adoption of agricultural technology (D'Emden et al,. 2008; Caswell et al., 2001; Cornejo et al., 2001; Fliegel, 1993; Saltiel et al., 1994). The impact of these factors generally applies to agricultural technology because the

majority of agricultural technologies can be adopted only when they are suitable to agro-climatic conditions where farmers are located (Anderson, 2008; Ormrod, 1990; Staal et al., 2002). Many studies, which have focused on the adoption of rice in Asian countries found that the production environment and (in particular) the natural conditions such as rainfall, temperature, and sunshine hours were the most important factors which influenced the adoption of rice growing (David & Otsuka, 1990; Ramasamy et al., 1992; Upadhyaya et al., 1990). Furthermore, Griliches (1957) asserted that a more favourable environment (better soil, water, and climate) increased the expected utility of income from the use of a new technology and thus, this increased the probability that farmers would adopt the technology. On the contrary, the absence of these factors would mean that farmers would be less likely to adopt the new technologies. For example, Jansen et al., (1990) found that the non-adoption of a very profitable modern cereal variety by Indian peasants was affected by the unsuitable climatic conditions of the area.

***Extension services delivery***

Access to extension support services (whether public or privately funded) is one of the most important external factors, which has been found to have an influence on a farmer's adoption decision (Anderson & Feder, 2003). The service that the extension institution provides involves the timely provision of information to farmers, in order to influence the adoption of the intended technology. Extension agents play a very important role in the adoption process. According to Rogers (1983), these agents are the passage through which information regarding different types of technologies can be diffused to farmers. In order for this to occur, there must be two-way communication taking place between the farmers and the extension institution that developed the technology (Guerin & Guerin, 1994). Several studies have shown that farmers who have regular contacts with extension agents are more willing to adopt new technologies than those who do not have this type of contact (Anderson, 2007; Azilah, 2007; Feder et al., 1985; Feder & Umali, 1993; Kassie et al., 2009; Johnson et al., 2005; Ogunlana, 2004). In contrast, however, lack of communication between extension agents and farmers can lead to the discontinuation in the use of the technology by farmers. This situation occurred in Madagascar where farmers discontinued rice growing because the extension agent had failed to communicate with them in order to 'clear up' some of their doubts regarding the technology (Moser & Barrett, 2003).

It has also been emphasised in the literature that extension agents must possess a reasonable level of technical knowledge and skills (Anderson, 2007; Belay & Abebaw 2004; Guerin & Guerin 1994). According to Anderson & Feder (2003), this is very important because having such knowledge and skills can assist them to understand more complex situations and to diagnose problems in addition to advising farmers about the more efficient use of resources. In contrast, however, the extension agents' lack of knowledge and skills can lead to a low technology adoption rate by farmers (Guerin & Guerin, 1994). For example, Belay and Abebaw (2004) in a study of the challenges facing agriculture extension agents in Ethiopia found that the adoption of modern agricultural practices to be low due to the extension agents' lack of technical knowledge relating to the new technologies.

The extension agents need to understand the local traditions, practices, and culture and values of rural farmers (Olsen et al., 2006; Tiraieyari, 2009). This is very important because the more they learn about the culture of rural farmers, the more they will be accepted by the farmers and this information will assist the agents to introduce appropriate technologies that best meets each farmer's situation (Warrix & Bocanegra, 1998). Aside from cultural knowledge, extension agents need to build up their credibility with the farmers (Guerin & Guerin, 1994). A history of respectful relationships between extension agents and farmers has been found to positively relate to adoption through enhanced trust in the advice of the agents (Anderson, 1981; Marshall, 2005). Pannell et al., (2006) found this view to be true in the adoption of agricultural conservation practices in Australia. However, in contrast, a lack of respect and trust by farmers in extension agents can negatively influence an adoption decision. For example, Finlay et al., (2004) in a study examining land managers' attitude towards land management in Australia found that the government agents' lack of respect and their failure to live up to their promises had contributed to a general feeling of distrust towards government extension agents by farmers. Therefore, new technologies or practices driven by these agents might be viewed somewhat suspiciously by the land managers/ farmers, hence potentially reducing their rate of adoption.

A lack of government support for the extension service, coupled with low morale of extension agents due to inadequate motivation can negatively affect extension delivery (Anderson & Feder, 2004; 2007). In most developing countries, government spending on agricultural extension services has been reduced due to economic difficulties. This has sometimes led to the termination of extension projects when donor support could not be

extended (Anderson, 2004, 2007). In addition, Anderson argued that government leaders who are less committed to agricultural extension activities tend to reduce their budget allocation to extension services. In some cases, extension workers may engage themselves in other activities, which are politically motivated thereby, affecting the service in regards to information delivery and transfer of knowledge to farmers (Anderson, 2007; Feder, Willett & Zijp, 2001).

A lack of available resources and financial constraints also hinder the movement of extension officers, thereby affecting the efficiency of service delivery (Anderson, 2007; Anderson & Feder, 2004; Nagel, 1997). This situation could also hinder the timely delivery of information and the facilitation of activities such as field days and demonstrations. A lack of incentives also affects the morale of the extension agents, such as the fact that most of them tend to seek alternative income sources for their survival (Anderson & Feder, 2004; Nagel, 1997). The lack of motivation of extension agents may make it difficult for them to be committed to their duties, which may then also affect their efficiency (Anderson & Feder, 2004, 2007; Feder, Willett & Zijp, 2001).

The poor state of infrastructure development in most developing countries is also another factor that hinders the delivery of extension services (Anderson, 2004, 2007; Feder, Willett & Zijp, 2001; Peterson, 1997). According to Anderson & Feder (2007), the majority of farmers in developing countries live in geographically dispersed communities where transport links are often of low quality. These sub-standard transport links further compelled by a lack of funds to enable the extension agent to reach these dispersed areas, make it difficult to reach farmers in time to demonstrate the benefits of improved technology. As a result, this has limited the adoption of new technology by farmers (Anderson, 2007; Peterson, 1997).

***Market access***

Market access is another external factor which has been found to influence the adoption of technology (Akpabio & Inyang, 2007; Zeller et al., 1998). Ransom et al., (2003), for example, found that farmers in an area with relatively better access to markets are more willing to cultivate new maize varieties, than those living farther away from the market. In their study, Feder et al., (1985) also supported this view. They argued that farmers whose farms are located close to the markets have better access to market information and are therefore more responsive to innovation. Johnson & Masters (2004) further argued that

market access helps to increase the economic returns for farmers and this leads to greater participation and adoption by farmers. In contrast, however, the longer the distance of the farm from the market, the lower the adoption rate of technology by farmers (Zeller et al., 1998). Akpabio & Inyang (2007) made a similar finding in a study on aquaculture farming in Nigeria. They found households that are farther away from a market have a lower likelihood of adopting new technologies and participating in the fish market because of the high cost of inputs resulting from high transportation costs.

Odogola (2006), in a survey report on rice production, processing, and marketing in Uganda also found that poor access to markets, which are also characterised by long distances, limited information flows, and inadequate transportation hindered new and potential farmers from adopting rice technology. Neill & Lee (2001) on the other hand, found that easy access to a market (better quality roads) might increase the possibility of land conversion and therefore, lead to a low level of technology uptake. Despite these differences, some researchers (e.g. Akinola, 1986; Gebremedhin et al., 2009) have confirmed the importance of low-cost market access in the farmers' adoption decision-making process. The next section examines agriculture technology adoption and its impact on the food security and income of farmers.

### 3.9 Impact of agricultural technology adoption on food security and income

The adoption of new agricultural technologies is important for the promotion of agricultural productivity and for the improvement of food security (Ersado et al., 2004; Dontsop et al., 2011; Pandey, 2000; Wu et al., 2010). A productivity increase in agriculture resulting from the adoption of new technology is necessary to foster economic development and ensure food security (Dontsop et al., 2011; Pandey, 2000; Pretty et al., 2003). The results of studies conducted in several countries indicate that the pro-poor role of agricultural growth can be dramatic and much more effective than other sectors in reducing poverty and hunger in both urban and rural areas (DFID, 2003). Agricultural growth has a strong and positive impact on poverty and it is often significantly greater than that of other economic sectors (FAO, 2004). More recent studies have analysed the impact of technology adoption in developing countries such as Bangladesh (Hossain et al., 2006); Uganda (Kijima et al., 2008); Benin (Adekambi et al., 2009); China (Li et al., 2010); and more recently, Nigeria (Dontsop et al., 2011) and they have supported this view. These studies found that the adoption of new agricultural technologies has had a positive effect on raising the incomes of farm households in addition to improving the well being of households and reducing household poverty levels.

Furthermore, empirical studies have shown that gains from new agricultural technology can directly influence the poor, by raising the incomes of farm households and also indirectly, by raising the employment and wage rates of functionally landless labourers, in addition to lowering the price of food staples (Bellon et al., 2006; Byerlee et al., 2009; De Janvry & Sadout, 2002).

An increase in crops yields resulting from adopting a new technology may contribute to an abundance of food, as indicated in the successful case of the adoption of new hybrid rice in Bangladesh, Uganda, Benin, China, and Nigeria (Adekambi et al., 2009; Dontsop et al., 2011; Hossain et al., 2006; Kijima et al., 2008; Li et al., 2010). However, the more farmers tend to adopt market orientated crop varieties (such as cash crops) and focus on commercialise agriculture, the more negative will be the impact on the availability of food for domestic consumption — thus ultimately leading to food insecurity (Shaw, 1987). In a study of agriculture and poverty in South Africa, Machethe made a similar conclusion citing that as agriculture reaches some degree of commercialisation, the impact of agricultural growth on food insecurity and poverty alleviation becomes limited (Machethe, 2004). This implies that as the demand for export crops increases, farmers may produce more crops targeted at exports and thereby reduce the production of crops intended for the domestic market (Azilah, 2007).

### 3.10 Summary

Food security is a situation when all people, at all times have physical, social, and economic access to sufficient, safe, and nutritious food which meets their dietary needs and food preferences for an active and healthy life. The two strategies used in most developing countries to improve food security are: 1) increasing agricultural production through the adoption of new technologies; and 2) multiple livelihood strategy, which is based on multiple approaches including agricultural production and involvement of other complementary activities. The increasing agriculture production strategy requires the adoption of improved technologies in order to increase food production, which could lead to improve food security and reduction of poverty. Therefore, technology adoption is very important in achieving food security. There are multiple factors that interact to influence the decisions of farmers to adopt a new technology. These factors include the characteristics of the technology; internal factors, which include personal, cultural, on-farm factors, and external factors such as government policy, infrastructure, agro-climatic conditions, extension services, and market access.

# CHAPTER 4

# RESEARCH METHODOLOGY

## 4.1 Introduction

This chapter describes the methodology used in this research. It begins by discussing the choice of research strategy and the case study design process. The sampling method, data collection, and the analysis procedure used by the researcher are also described. The final section of this chapter presents the ethical considerations for this study and concludes with a summary of the chapter.

## 4.2 Research strategy

There are many research strategies available which can be used by researchers to achieve their research objectives. According to Yin (2006), the five main research strategies that can be used to solve research problems are: experiments, surveys, archival analysis, history, and case study (Table 4.1).

**Table 4.1: Relevant situations for different research strategies**

| Strategy | Forms of research questions | Requires control over behavioural events | Focuses on contemporary events |
|---|---|---|---|
| Experiment | How, Why | Yes | Yes |
| Survey | Who, What, Where, How many, How much | No | Yes |
| Archival analysis | Who, What, Where, How many, How much | No | Yes/ No |
| History | How, Why | No | No |
| Case study | How, Why | No | Yes |

**Source:** Yin, (2006)

The strategy of experiment is used for answering "how" and "why" research questions. The researcher requires control over behaviour of the research subjects and this only focuses on the contemporary events. Both the survey and archival analysis strategy address "who",

"what", "where", "how many", and "how much" research questions. The researcher does not require control over the research subjects and focuses on contemporary events. The historical strategy on the other hand, answers "how" and "why" questions and also does not require control over research subjects. However, the historical strategy does not focus on contemporary events. The final strategy suggested by Yin (2006) is the case study. This strategy is used to answer "how" and "why" question and a researcher undertaking this strategy does not require control over the research subjects (Yin, 2003).

The aim of this study is to identify why farmers in the Solomon Islands adopted or did not adopt the rice technology. As such, a case study approach (Yin 2006) was adopted because the research question was a "why" question. The focus is on a contemporary issue and the researcher did not want to have control over the research subjects. Blaikie (2003) argued that a case study strategy helps to determine the influence of multiple factors on the research subjects whilst also providing opportunities for in-depth analysis of the case under consideration.

### 4.3 Case study design

Yin (2003, 2006) identified four types of case study designs (Figure 4.1): A single-case study, multiple-case studies, the embedded case study design, and holistic design. A single-case study is used when the case represents a critical test of existing theory, rare or unique circumstances, a representative or typical case, a revelatory case, or for a longitudinal purpose (Yin, 2006). Multiple-case studies on the other hand, involve collecting and analysing data from more than one case for replication purposes (Hakim, 1987; Merriam, 1998; Yin, 2003). The embedded case study design is used when there are multiple units of analysis, whilst the holistic design is used when the focus is on a single unit of analysis (Yin, 2003).

**Figure 4.1: Basic types of design for case studies**

| | **Single-case designs** | **Multiple-case design** |
|---|---|---|
| Holistic (Single unit of analysis) | Type 1 | Type 3 |
| Embedded (multiple unit of analysis) | Type 2 | Type 4 |

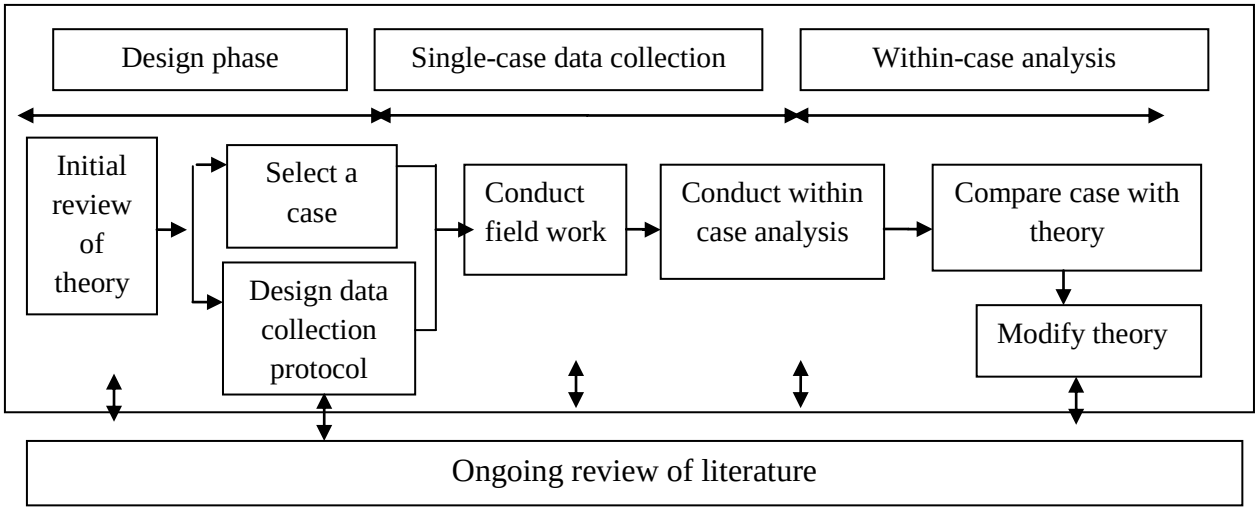
**Source:** Yin, (2003)

A single–case study approach was chosen for this research because the selected case represents a rare case. It was the only rice project out of the nine projects that were initiated in the Malaita Province of the Solomon Islands by the government in 2007 that was on-going out of the nine rice projects. The case study is a single-case embedded design because it focuses on multiple units of analysis such as: 1) the characteristics of technology that influence adoption; 2) the internal factors that influence adoption; and 3) the external factors that influence adoption.

### 4.4 Overview of the single embedded case study

According to Yin (2003), a single embedded case study is comprised of three phases: design phase, single-case data collection phase, and within-case data collection phase (Figure 4.2). During the design phase, once the research problem was clarified, an initial review of the theory or literature was undertaken to identify important concepts and relationships. This provided the basis for the design of the data collection protocol. The literature was then used to develop the criteria for the selection of the case study. During the second phase, the researcher conducted the field work and the data was collected from the case study in the form of interviews, field observations, and documents. When the data collection process was completed, the third phase began which the researcher conducted a within-case analysis. The literature review was on-going over the period of the data collection and analysis. The case findings were then compared with the theory or literature and other areas of the literature that needed to be explored and were modified accordingly to the case findings.

**Figure 4.2: Diagram of the embedded single case study method**




**Source: adapted from Yin (2003)**

### 4.5 Case selection

Malaita Province was selected for this case study out of the other eight provinces of the country because of the ease of access with respect to the existence of a weekly shipping service from the capital to the Malaita provincial capital Auki, and also given the resources, money, and time available to complete this study. Secondly, the Malaita province is one of the nine provinces of the country which received the highest number of community rice projects (nine) with the assistance from the National Rural Rice Development Programme (NRRDP) in 2007 (Table 4.2). However, eight of the projects ceased operation between 2008 and 2009. According to the provincial report from the Malaita Agriculture Division (2009), the major reason for the closure of these projects were dispute over land ownership, pest and disease attacks, lack of government support (in terms of inputs such as tractors, fertilizer, pesticides), and conflicts of interest amongst the farmers and project committees who managed these projects. The Fiu Community Rice Project was the only project operating and growing rice in 2010.

**Table 4.2: Status of the 9 rice projects in the Malaita Province**

| Community Rice Project | Farmers involved in the projects | Year established | Status of the community rice projects in 2010 |
|---|---|---|---|
| Fiu | 30 | 2007 | On-going |
| Loa | 25 | 2007 | Ceased operation in 2008 |
| Waisurione | 56 | 2007 | Ceased operation in 2009 |
| Kikiri | 24 | 2007 | Ceased operation in 2009 |
| Rufoki | 69 | 2007 | Ceased operation in 2008 |
| Siua | 73 | 2007 | Ceased operation in 2009 |
| Gwaunaru'u | 54 | 2007 | Ceased operation in 2008 |
| Marou Masike | 45 | 2007 | Ceased operation in 2009 |
| Lagefasu | 24 | 2007 | Ceased operation in 2008 |

**Source:** MAD (2009)

The Fiu Community Rice Project (FCRP) was selected as case for this study for three reasons: 1) the Fiu Community rice project was the only on-going rice project in Malaita province when the primary data collection was organised at the beginning of 2010 and that it was only when the researcher got there that it was found that the farmers had discontinued the growing of rice; 2) the Fiu community rice project was located in an area that was safe for the researcher to obtain the required information, given the resources, money and time available;

and 3) the proximity and ease of access with respect to contacts and the existence of roads and transport to the study site.

### 4.6 Sampling procedure

The government officers involved in the rice programme and the Fiu rice committee members were the first two groups of respondents identified by the researcher to be interviewed. These two groups of respondents were identified by the researcher from the secondary data provided to the researcher by the Solomon Island's Ministry of Agriculture and Livestock. They were selected because of their knowledge and experience with the case under consideration.

The farmers who adopted the rice technology were selected using a snowball sampling technique (Warren & Karner, 2005). In this case, the researcher used the Fiu project committee members as a strategic starting point for the identification of information-rich respondents. For example, the project committee members identified an information-rich respondent to the researcher for the interview and then when the researcher finished interviewing the respondent, the respondent then identified another information-rich respondent. The chain continued until the researcher felt that the information provided by the respondents had reached saturation point (Warren & Karner, 2005) where no new information seemed to be provided from additional respondents.

In the case of farmers who had not adopted the rice technology, a purposive sampling method was used where the aim was to capture a diverse range of opinions, which would adequately represent the whole Fiu community. The criteria used to select a diversity of non-adopters included education level, gender, age, experience with rice farming.

### 4.7 Sample size

A total of 24 respondents were interviewed during the data collection process (Table 4.3). The respondents included: 1) government officers (national & provincial) who were involved in the implementation and the promotion of the NRRDP in the Solomon Islands; 2) Fiu project committee members who managed the Fiu community rice project; 3) farmers in Fiu village who adopted rice technology; and 4) farmers in Fiu village who did not adopt the rice technology.

**Table 4.3: Types of respondents and sample size**

| Respondents | Sample size |
|---|---|
| Government officer (2 national, 2 provincial) | 4 |
| Fiu community rice projects committee | 2 |
| Farmers who had adopted rice technology | 10 |
| Farmers who had not adopted rice technology | 8 |
| **Total. No. of respondents** | **24** |

## 4.8 Respondents' profiles

### *4.8.1 Government officers*

Four government officers were interviewed, two were based in Honiara and the other two were based in Auki, Malaita Province. Three of the officers were male and one female. The youngest officer was 39 years old while the oldest was 55 years old. Four of these officers are married and have tertiary qualifications. In terms of agricultural training, four of these officers had completed formal training- one holds a Master of Science while the rest of the officers hold a Diploma of Agriculture. In terms of experience with rice programmes, all of the four officers have previous experience with communities who had grown rice. Their level of previous experience in rice growing ranged from four to five years.

### *4.8.2 Fiu project committee members*

The Fiu community rice-project committee had six members however, only two were available to be interviewed by the researcher. Both respondents are male and are both married. The youngest is 30 years old and the oldest 59. In terms of education, one member holds a certificate in Business Studies, whilst the other member only completed primary school education. These two committee members had both attended a one-week course on rice growing held by the Ministry of Agriculture and Livestock. Both have previous experience with rice growing.

### *4.8.3 Farmers who have adopted rice technology*

Ten farmers who adopted the rice growing technology were interviewed during the field study (Table 4.4), of whom two were female and eight were male. The youngest was 20 years

old while the oldest was 59 years old. Seven farmers were married and had children whilst three were not married. Eight of the farmers had primary school education and two farmers, the oldest ones, had no formal education. Only six out of the ten farmers had attended secondary school and one farmer had obtained a tertiary qualification. In terms of agricultural training, only two farmers' had completed formal training. Adopter one holds a certificate in organic farming while adopter five obtained a tertiary qualification in agriculture.

Nine of the rice farmers interviewed had previous experience in rice growing which ranged from three years to nine years. All had gained most of their rice growing experience when they were members of a commercial community rice project operated by the Fiu community and managed by a Japanese volunteer from 1995 to 2001. These farmers had considerable experience in the production of local staples, which ranged from 8 to 37 years.

**Table 4.4: Personal profile of the farmers who had adopted the rice technology**

| Adopters | Sex | Age | Married | No of childre n | Education | Agriculture training | Experience | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Rice | Staples |
| 1 | M | 30 | Yes | 3 | Secondary | Certificate in Organic farming | 9 years | 15 year |
| 2 | M | 50 | Yes | 6 | None | None | 9 years | 35 years |
| 3 | M | 23 | No | 0 | Secondary | None | 3 years | 9 years |
| 4 | M | 20 | Yes | 2 | Secondary | None | 4 years | 8 years |
| 5 | M | 26 | Yes | 3 | Secondary | Certificate in Agriculture | 6 years | 9 years |
| 6 | F | 40 | Yes | 4 | None | None | 9 years | 18 years |
| 7 | M | 20 | No | 0 | Primary | None | 3 years | 8 years |
| 8 | F | 27 | No | 0 | Secondary | None | None | 11 years |
| 9 | M | 30 | Yes | 2 | Secondary | None | 5 years | 14 years |
| 10 | M | 59 | Yes | 6 | Primary | None | 9 years | 37 years |

### *4.8.4 Farmers who have not adopted rice technology*

Eight non-adopters were interviewed during the study (Table 4.5). Of the eight farmers, two were female and six were male. The youngest of the non-adopters was 29 years old whilst the oldest was 62 years old. All of the eight non-adopters are married and have children except for non-adopter six who have no children. Seven of the non-adopters had a primary school education, and only two had attended secondary school. Non-adopter six had no formal education. In terms of agriculture training, only two non-adopters had attended formal

agriculture training courses. Non-adopter three holds a tertiary qualification in agriculture whereas non-adopter four had attended a six months training course in rice production at the Taiwanese Technical Mission demonstration farm in Honiara.

In terms of experience, seven of the eight non-adopters have previous experience with rice growing ranging from one week to six years, with the majority having considerable experience in this area (> three years). With regards to local staple growing, all eight non-adopter farmers have considerable experience in growing local staple crops (> 12 years).

**Table 4.5: Personal profile of the farmers who have not adopted rice technology**

| Non Adopters | Sex | Age | Married | No of childre n | Education | Agriculture training | Experience | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Rice | Staples |
| 1 | M | 35 | Yes | 3 | Primary | None | 1 week | 17 years |
| 2 | M | 35 | Yes | 2 | Primary | None | 5 years | 14 years |
| 3 | M | 29 | Yes | 3 | Secondary | Certificate in Agriculture | 3 years | 13 years |
| 4 | M | 36 | Yes | 5 | Primary | 6 Months rice training | 6 years | 15 years |
| 5 | M | 42 | Yes | 6 | Primary | None | None | 20 years |
| 6 | M | 62 | Yes | 0 | None | None | 4 years | 43 years |
| 7 | F | 30 | Yes | 2 | Primary | None | 3 years | 18 years |
| 8 | F | 29 | Yes | 4 | Secondary | None | 4 years | 15 years |

### 4.9 Design of data collection protocol

In early February 2010, letters and e-mails were sent to the government rice officers through the Permanent Secretary of the Ministry of Agriculture and Livestock and the Fiu project committee members requesting if they would be willing to discuss their involvement in the study. On arrival, a meeting was arranged with the four most senior officers in the rice section of the Ministry of Agriculture and Livestock. The aim of this meeting was to get to know the government officers and to arrange suitable interview dates and venues. It was also during this meeting that the researcher provided these officers with a copy of the data collection schedule and requested their cooperation and their consent for interviews with them to be taped.

The government officers from the rice section of the Ministry of Agriculture and Livestock and the Malaita Province Agriculture Division are very important sources of information for this research. The interviews with government rice officials were designed to collect

information relating to the aims and expected results of the government initiated National Rural Rice Development Programme (NRRDP). This included the aims and strategies of the project, the process of group formation and the implementation of the programme; the major problems and difficulties that faced the NRRDP; and their perspectives on what could be done to improve the programme. The researcher also sought their perspectives on why some farmers are adopting the technology, whilst others are not. The interview with the two senior government rice officers took approximately one week.

The researcher also sought permission from the Fiu village chief in order to stay in Fiu village to interview the Fiu project committee members. A copy of the data collection schedule was provided to the Fiu community rice project committee members and they were asked for their cooperation and consent for the interviews with them to be taped. The aim of these interviews was to collect information about how (and why) the project was established and managed; including the production and marketing of the produce. The Fiu rice committee members were also asked about their perspectives on what could be done to improve the rice policy.

The farmers who adopted the rice growing technology were another important source of data. The researchers sought their permission to be interviewed and their consent for their interviews to be taped. The interviews with these farmers were aimed at collecting information on the factors which influenced their decisions to adopt the rice technology and why they joined the project, and also if their expectations were met. The farmers who adopted the rice growing technology were also asked about their perspectives on what could be done to improve the current government rice policy.

The researcher also sought the consent of the farmers who had not adopted the rice technology for the interviews. These farmers provided different views on the subject. The interviews with these farmers were designed to collect information on the factors that influenced their decision not to adopt the rice technology. The farmers who had not adopted the rice growing technology were also asked about their perspectives on what could have been done to improve the current government rice policy.

### 4.10 Data collection

The data collection for this research was carried out between June and July 2010. Primary and secondary sources of data were used in gathering relevant information for this study. The

primary data was collected through taped semi-structured interviews with four groups of respondents. Semi-structured interviews were used because it provided an opportunity for deeper understanding of the issues from the respondents' perspectives (Ritchie & Lewis, 2003). Furthermore, it allows respondents the freedom to express their views in their own terms (Warren & Karner, 2005). The researcher also used four sets of open-ended question (Appendix 1) as a guide starting with more general questions or topics and then followed on with the main questions related to the focus of the case study. Consistent with Corbetta (2003), not all questions were designed and phrased ahead of the interviews; some of the questions were developed during the interviews, allowing both the interviewer and the interviewee the flexibility to discuss the issues or to probe further for details. The respondents were interviewed in the Solomon Islands' local Pidgin English.

Secondary information was also collected. Field notes were taken during the various interviews, in addition to field observations. The field notes were undertaken as a backup for the taped interviews, in case there is any damage to the audio recorder. The researcher also observed the former rice field and the irrigation system used by the Fiu community rice project as suggested by (Creswell, 1998). The researcher also searched and collected copies of all documents and archival records, relevant to rice growing in the Fiu community. These documents included the land lease agreement signed between the Malaita provincial government and the Fiu community rice project committee; the MOU signed between the Ministry of Agriculture and the Fiu community rice project committee; a list of farmer members of the rice project; and records of labour subsidy payment receipts (Table 4.6). In addition, the archival records collected by the researcher included the government's Rice Sector Policy and the implementation strategy relating to the National Rural Rice Development Programme.

Documentation and archival records were collected and used to triangulate with the primary data. These documents and archival records were also used by the researcher to gather information on the size of the community, and how the NRRDP was implemented in the Solomon Islands.

**Table 4.6: Documents and archival records collected and their sources**

| Documents and archival records | Sources |
|---|---|
| 1.Land lease agreement | Agriculture office, Malaita province |
| 2.Labour subsidy payments receipts | Agriculture office, Malaita province |
| 3.List of farmers and project committee members | Agriculture office, Malaita province |
| 4.MOU agreement (project & MAL) | Ministry of Agriculture and Livestock |
| 5.Rice Sector Policy | Ministry of Agriculture and Livestock |
| 6.Rice implementation strategy | Ministry of Agriculture and Livestock |

## 4.11 Data analysis

A qualitative data technique developed by Dey (1993) was used to analyse the data collected for this research. Dey described qualitative data analysis as a "deceptively simple process" which comprises an iterative process of describing, classifying and connection. The following sections describe the qualitative data analysis process used for this study.

### *4.11.1 Description*

Description is the process where the data in a transcript is summarised to provide a thorough and comprehensive account of the phenomenon of interest and the context in which it occurred (Dey, 1993; Patton, 1990). Under this process, the researcher transcribed the interviews of the respondents and later summarised the transcripts of the interviews and field notes under key important headings. Within these major headings, concepts and sub-processes were then separated out under important sub-headings. Diagrams were then used to describe the important points or sub-processes identified in the data (Dey, 1993; Strauss & Corbin, 1990). The summary was also used to identify potential categories and important relationships in the data. It also played an important role in maintaining the holism of the data (Chetty, 1996). Because the qualitative data analysis process advocated by Dey (1993) is iterative, several versions of a transcript summary may be written. The number of iterations undertaken for later interview transcripts declined because few new categories and relationships were identified.

### *4.11.2 Classification*

Classification is the process by which data in the transcript is classified into well-defined categories, sub-categories and supra-categories (Dey, 1993). The data from the audio tape summaries was manually coded and read to identify the concepts. The literature review aimed to ensure that the researcher was sensitised to the theory. A form of comparative analysis (Dey, 1993; Miles &Huberman, 1984; 1994; Straus & Corbin, 1990) was used to code the data according to where the text was broken up into "units of meaning" (Maykut & Morehouse, 1994) or data bits (Dey, 1993). These units of meaning were then compared to the category definitions provided in the literature. Similar units of meaning were then grouped under different category headings. Category definitions were obtained predominantly from the literature; however, where a data-bit differed from an existing category, but was still relevant to the study, a new category was named and defined.

Once relevant categories were identified, the structure of the category hierarchy was determined by logic (Dey, 1993). The researcher also split or sliced some categories where they could be further sub-divided or could be combined for theoretical usefulness (Dey, 1993; Straus &Corbin, 1990). For example, the leadership capacity category was split into attitudes, knowledge, and skills. The classification was an iterative process between the data and the category name, definition, and location in the category hierarchy (Dey, 1993).

### *4.11.3 Connection*

The final step in the qualitative data analysis process is connection (Dey, 1993). During connection, relationships between categories in the data were identified and defined. These connections may be explanatory, causal relationships or chronological relationships that depict a process (Dey, 1993). The data collection protocol made it relatively simple to identify the relationships between categories and develop a model of factors that influenced the farmers' decision to adopt or not to adopt the rice technology. These connections were identified in the data through linking words or conjunctions (Dey, 1993) such as: "and then", "because", "therefore", "as a result", "and after that", "as a consequence" and so on. Often these were recorded as diagrams (Miles & Huberman, 1994; Strauss &Corbin, 1990) that provided a concise overview of emerging relationships, which was useful for further analysis.

### 4.12 Ethical considerations

This research was assessed and approved as low-risk by the Massey University Human Ethics Committee. A number of ethical principles were applied during this research. Firstly, the researcher sought permission from the Permanent Secretary of the Ministry of Agriculture and Livestock to undertake interviews with government rice officers. When the permission was granted, the researcher then introduced himself and the proposed study to the ministry's rice officers and asked for their consent before the interviews took place.

At the village level, the researcher worked through the village leaders. He introduced himself and his work to the participants and asked for their informed consent before interviews were carried out. Extra care was taken by the researcher to avoid any risk of harm to any participant, in order to prevent the participants from being exposed to any pain, stress, intimidation, or embarrassment. This was achieved through the researcher allowing the participants ample time to decide on a time and suitable venue for the interview. A digital recorder was used to record interviews with the participants, but only with their consent. The researcher also explained to the government rice officials, the Fiu community rice project leaders, and the farmers that they could withdraw from the process at any time and that they could refuse to respond, if they did not feel comfortable answering a particular question.

All the interviewed participants were encouraged to express their ideas and views during the interview process. There was no deception or discrimination based on race, disability, family status, gender, religious affiliation or employment status. The rights of participants were always taken into consideration. The participants were also assured of their anonymity and confidentiality regarding the information they provided and that the tapes would be stored in the researcher's office cabinet during the data analysis process and destroyed after the final submission of the research thesis.

### 4.13 Summary

The objectives of this research were to identify why farmers in the Solomon Islands are either adopting or not adopting rice-growing technology. To best achieve these objectives, a single embedded case study design was chosen, which comprised of three phases: design, single-case data collection and within-case analysis, and interpretation. The first step in the design is to review the literature, in order to build a theoretical framework for the selection of the case and the design of the data collection protocol. Purposive sampling was used for the

government officers and the Fiu project committee members whilst snowball sampling was used for adopters and non-adopters to select respondents from within the target population. During the data collection phase, data was collected through taped semi-structured interviews with the respondents. Field notes from observations were recorded and documents and archival records were also collected in order to gather information relevant to the research. The third phase of the research process was the analysis and interpretation of the data, which was carried out after the data collection phase had been completed. During this phase, the raw data was analysed using an iterative process (describing, classifying, and connecting) in order to develop a model of factors that influenced the adoption and non-adoption of rice growing technology within Fiu community. This was written up as a case report and then compared to the existing literature. During this phase, the researcher identified a number of similarities and differences between the case results and the findings in the literature.

# CHAPTER 5

# CASE DESCRIPTION

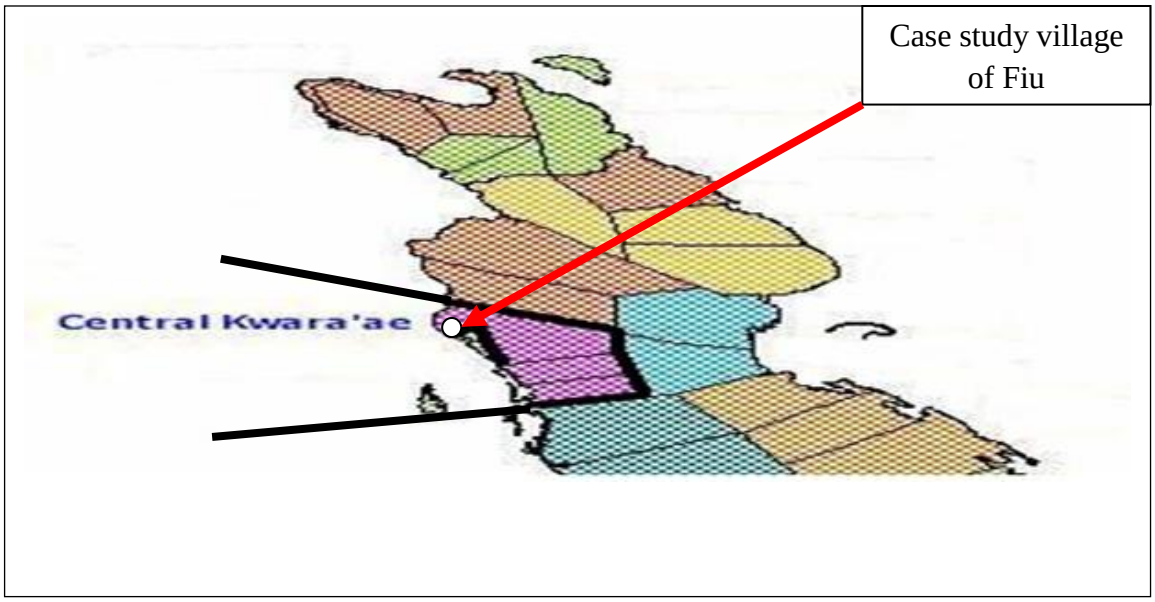
## 5.1 Introduction

The purpose of this chapter is to describe the setting in which this case study was conducted. This research focuses on the Fiu Community Rice Project (FCRP), which is located in Fiu village in the Central Kwara'ae Constituency of Malaita Province, in the Solomon Islands. In this chapter, the physical characteristics and the population of the Central Kwara'ae Constituency are first described. The characteristics of the case study village; the history of rice growing in Fiu village; the formation of the FCRP; and the decision making structure, including rice production and marketing are then outlined.

## 5.2 Central Kwara'ae Constituency (CKC)

The Central Kwara'ae Constituency is located on the central-western portion of Malaita Island (Figure 5.1). The constituency has a total land area of 207sq. kilometres comprising of two wards, Aimela and Radefasu. The Aimela ward, which is referred to in the Maliata province as Ward 2, has a total land area of 77sq.km, whereas Radefasu ward, which is referred to as Ward 29, has 130 sq. km of land (SIG, 2001). The following section will describe the population and the agro-climatic condition of the constituency.

**Figure 5.1: Map showing the Central Kwara'e Constituency in the Malaita Province**




**Source:** Census office, Honiara (2001)

### *5.2.1 Demography*

The population of the Central Kwara'ae Constituency is 21,161 (Statistic Office, 2009). This is comprised of approximately10% of Malaita province's total population. The two wards of the constituency are comprised of 114 villages, 67 of which are in Ward 29 and 47 in Ward 2. There are approximately 3,022 households in the Central Kwara'ae Constituency, of which Ward 2 has 1,340 and Ward 29 has 1,682 (Table 5.1). Ward 2 has a total population of 9,385, whereas Ward 29 has 11,776. The Kwara'ae language is spoken in all villages. In a few villages, particularly along the boundary with Auki-Langalanga Constituency, people speak both Langalanga and Kwara'ae.

**Table 5.1: The Central Kwara'ae Constituency population by ward**

| WARD | Households | Population |
|---|---|---|
| Ward 2 (Aimela) | 1,340 | 9,385 |
| Ward 29 (Radefasu) | 1,682 | 11,776 |
| **TOTAL** | 3,022 | 21,161 |

**Source:** (National Statistics Office, 2009)

### *5.2.2 Agro-climatic condition of the Central Kwara'e Constituency*

The agro-climatic condition of the constituency is suitable for farming. The average mean monthly temperature of the Central Kwara'ae Constituency ranges between 27C° to 30C°, throughout the year (Hansell &Walls, 1974; SIG, 2001). The constituency experiences two distinct rainy seasons. The major rainy season is from November to March and the minor rainy season occurs between August and October. The annual rainfall ranges from 2,500mm and 3000mm per year (Hansell & Walls, 1974; SIG, 2001). Occasionally, the rainfall pattern changes and there is continuous rain from April through to July.

## 5.3 Case study village of Fiu

### *5.3.1 Village location and structure*

Fiu village is located on the central-western part of Malaita Island. It is situated three kilometers from the provincial capital, Auki, to the south and one kilometer from Gounaru'u airport to the north. The village is comprised of one main village, usually referred to as 'Fiu'

and two outlying sub-villages: Kelokwai, and Kunu. Kelokwai is approximately one kilometre east from the main village and Kunu is approximately half a kilometre away from the western end of the main village. There are also newly established hamlets around Kelakwai and Kunu sub-villages, which are the result of an increase in the population of the community in recent years. These hamlets (and possibly the surrounding ones) were established due to a lack of space to build houses in the main village. The families living in the outlying hamlets therefore chose to leave the main village in order to secure property. The main village is comprised of four sub-villages, which are divided according to the four tribes that came to settle in the village, many years ago. According to SIG (2001), these four tribes are Gwaiuka, Otefarakau, Fa'alau, and Tafubala.

### *5.3.2 Population and migration*

The population of Fiu village has increased over the past five years. In 2009, the population was 1,152 and it had an annual rate of population growth of 2%. A total of 50 young people have migrated to Honiara from Fiu village, during the past five years and this urban drift is caused by a lack of employment opportunities. Neither the government, nor the private sector has provided adequate employment opportunities in rural areas, in order to meet the needs of an increasingly growing young workforce. During the same period, 30 people have also settled in Fiu village from another constituency of Malaita province. This has occurred primarily as a result of intermarriage.

### 5*.3.3 Village institutions*

The Church of Melanesia arrived in Fiu and established a church in the village in 1901 (SIG, 2001). They converted the locals to Christianity and also encouraged more people to move from inland areas to form settlements near the coast, in order to provide easy access to the ocean for seafood (SIG, 2001). The majority of people from Fiu village are Christians and they belong to the Church of Melanesia. They are committed Christians and they make substantial financial contributions to the church. The church plays an important role in the communal life of the Fiu village and it is the focus for village activities and communal gatherings. The church is also a provider of utilities and essential spiritual services and it promotes community cohesion. Church services are also an important venue for village announcements.

Fiu village has both a primary and secondary schools. School attendance is relatively high at both schools. The primary school covers grades one to six while the secondary school only has forms one to three. Students who want to obtain higher secondary and tertiary schooling must travel to Honiara. The facilities at these two schools are in poor condition, but recently, the school committees of both schools entered into an agreement with the Ministry of Education, through the NZAID school support programme to pay for their renovation (MED, 2007). It is estimated that approximately three-quarters of Fiu villagers receive a primary education but less than one-third go on to secondary school, and only approximately 4% receive a tertiary education.

Fiu villagers, as seen in any other village of the constituency, hold their chiefs in high regard. The village has four chiefs who represent the four tribes that originally settled in the area. These chiefs provide leadership for the community and ensure that the village by-laws are kept by the community. The legal system of justice is complemented by a customary system (SIG, 2001). The chiefs dispense justice through penalties in relation to what the community considers criminal acts. The most common crime are actually minor offences such as stealing from someone's garden; stealing money; and trespassing on reefs set aside for conservation. Serious crime cases are referred to the police in the provincial capital, Auki.

### *5.3.4 Cultural and social practices*

In Fiu village, as in many villages in the Solomon Islands, the cultural practices, such as feasting, attending tribal meetings, and customary dancing are an important part of community traditions which are passed down from generation to generation. These activities are part of the community's way of life and some celebrations may extend over an entire week. Such celebrations will involve Fiu villagers and their relatives from nearby villages. During these activities, villagers are obliged to contribute either food or money to the organisers. These are very important events in the village calendar and therefore, all village members are expected to attend.

In the village, there are strong links between families and tribal groups. The practice of sharing and caring for each other provides the safety net that most families have relied on for many years. Even with the introduction of the cash economy in rural areas, households or peoples' attitudes towards cash income revolve around the subsistence economy. Jansen et al., (2006) in a study on smallholder agriculture studies in the Solomon Islands funded by

AUSAID, supported this view. They found that in a rural village of the Solomon Islands, farmers tended to share food produce from their garden with relatives, together with their income from subsistence gardening. Wealth accumulation to improve an individual's quality of life is not a priority for most villagers.

### *5.3.5 Gender issues*

The organisation of labour within the household is determined by gender. The father usually makes the decisions concerning the tasks to be done regarding the productive aspects of the household, although sometimes the mother and the father make the decisions jointly. In a typical rural household, the mother and female children are responsible for food production, firewood collection, family chores, childcare, community work, and some income-generation activities. Their role in food production involves clearing, hoeing, planting, weeding, harvesting and cooking. Women also collect wild foods, such as ferns from waterways, nuts from forests, and marine food from coastal reefs and mangroves. The father and male children are also involved in food production, mainly doing heavy manual jobs such as felling of trees, brushing, and fishing.

### *5.3.6 Poverty level*

According to the interview with community leaders there are two levels of wealth that exist in the village: 1) the poor- those who do not have a paid job and therefore always rely on subsistence agriculture for their livelihood, and whose residential houses are made entirely of local bush materials; and 2) the rich-those who also live in the village, but generate their income from permanent paid job such as teaching in the village school, working as nurses and provincial government workers in Auki town. The residential houses of the rich are made mostly of imported housing material such as corrugated iron roofing, cements (bricks) or timbers. It is estimated that the rich accounts for only 1% of the village population whereas those that are termed as poor accounts for 99% of the population.

### *5.3.7 Vegetation, land tenure, and land use pattern*

Fiu village is situated on flat land in close proximity to the Fiu River basin. During the major rainy season from November to March, the Fiu River usually floods the farmers' food gardens resulting in food crops often being destroyed causing hunger to many families. Despite the problems associated with flooding, the land on which Fiu village is located is one

of the better areas for agriculture in Malaita province (Hansell &Walls, 1974; SIG, 2001). The land is covered with secondary forest, whilst coastal areas are covered with coconut plantations. The soil in the area is sandy, with a few deposits of alluvial soil found close to the rivers banks. Both staple root crops and local vegetables perform well in these soils.

The Fiu community holds no legal title over their residential land or their farmed land. The legal titles are held by the Church of Melanesia (COM), which bought the land from the ancestors of the four original tribes that settled in Fiu village in 1901 (SIG, 2001). The COM however, allows people in the Fiu village access to land and sea resources for their subsistence needs. For those wishing to engage in large-scale production, such as rice growing or cocoa farming, permission must be sought from the COM, before such activities can be carried out. A villager who may want to develop the land for commercial gains must provide a plan to the COM (landowner) and the provincial government. If both parties agree to the plan, the provincial authority then acquires the land from the COM and leases the land back on behalf of the COM to the individual. This occurred in Fiu village in the 1990s when a Japanese Volunteer group and the Fiu community were granted permission to farm a parcel of land leased to them for rice farming.

The land use pattern in Fiu and surrounding villages is quite intensive (SIG, 2001). The people of Fiu village grow local staples such as kumara, cassava, taro, and pana (in addition to local vegetables such as slippery cabbage) for local consumption, whilst surplus produce is usually sold at Auki market. Typically, farmers undertake two plantings before the land is fallowed. Kumara is planted in the first year, with a second planting of kumara (or sometimes cassava) planted in the second year. Detailed plot histories suggest that the land is then fallowed for periods of two to four years. The rapid increase of population growth in Fiu has resulted in the shortening of the fallow period and an extension of the cropping period with a consequent decline in soil fertility and resultant crop yields.

### *5.3.8 Livelihood strategies*

Fiu villagers grow local staple crops such as kumara, cassava, taro, pana and local vegetable (slippery cabbage) as their main livelihood source. They depend on these staples and vegetables for their food source and the surplus is sold at the markets. Apart from growing these crops, the village farmers are also engaged in supplementary activities for income. These activities include raising pigs and chickens; fishing; running local stores; selling goods

at the roadside market; and weaving of local baskets. However, in large households with grown-up children, parents usually stay at home to undertake farming activities, whilst the adult children seek work in Auki town, Honiara city, or other provincial towns. The young women typically work in large shops, whilst the young men seek work on construction sites in the building industry, in addition to the logging industry, the tuna fish cannery or the coconut plantation on Russell Island. These workers often send remittances back to their families.

### *5.3.9 Local staple crop production in Fiu village*

The main crop cultivation practice used by farmers in Fiu is shifting cultivation. Under this production system, a farmer has to clear the land, allow the cut vegetation to dry out and then burn the dry vegetation. After burning, mounds are made with a simple digging stick and local staples crops are then planted into the mounds. The process of land clearing, soil cultivation, planting and harvesting (for all local staple crops) is the same. In Fiu village, kumara is by far the most important food crop. Cassava is also an important food crop and its significance is increasing. It was observed that the average size of kumara and cassava gardens in Fiu is approximately 250m² per household. Kumara, cassava, taro, and pana are left to mature in the field and they are only harvested as required by the household for consumption or sale at the market. Taro and pana are commonly grown in the mountainous interior and in the foothills. However, these crops are cultivated in a much smaller areas of 50m², compared to that of kumara and cassava. Most of these local staple crops take six to eleven months to mature and they have limited storage capability. The main green vegetable crop grown in Fiu village is the slippery cabbage. The average size of a slippery cabbage garden size is approximately 120 m².

### *5.3.10 Infrastructure development within the area*

The road infrastructure in Fiu village is well developed. There are two feeder roads that lead from Fiu village to Auki town and farmers use both roads to transport their produce to Auki market. Some families in the village also own trucks and they provide transportation services for the villagers to Auki town. Furthermore, the village also has access to public transport and buses, which can be used to transport their produce to Auki market.

In terms of rice infrastructure, the village has an existing rice irrigation system, which was left behind by the Japanese volunteer group, who farmed rice with the Fiu community in the

1990s. This infrastructure is still in a reasonable condition. In addition to the irrigation system, the village also has rice-processing equipment, which was owned by the Asian Pacific Sustainable Development (APSD). The APSD is willing to allow the FCRP to use this processing equipment without charge.

### *5.3.11 Market access*

Domestically marketed food is a significant part of the Fiu village economy. This is due to the proximity of the village to the market in the provincial capital Auki. Auki market also provides the principal avenue for the subsistence farmers to interact with the cash economy. This market operates seven days a week, with Saturday being the busiest day. Approximately 1000–1500 farmers and fishermen sell their produce in the Auki market each week (Mcgregor, 2004). The most important items sold (by volume) are sweet potato, cassava, slippery cabbage, Chinese cabbage, cucumber, tomatoes and pawpaw. Other significant items are fish, betel nut, tobacco, cooked food made from flour, and coconuts. Both men and women sell items. Women sell mainly fresh and cooked food, whilst men sell fish.

In addition to market access, the Fiu villagers also have good access to basic health services; education; agriculture extension services; banks; and other financial institutions such as credit unions, telecommunication (i.e. phones, newspapers, radio, and air and sea transport) all of which are located in Auki.

## 5.4 History of rice growing in Fiu village

Rice was first cultivated in Fiu village in 1995 by a Japanese volunteer group and the Fiu community. This project was funded by the Japanese government through its Overseas Volunteer Group. The community rice farm was managed by a Japanese aid worker with expertise in rice production, who worked with the local community. From 1995 to 1998, this group planted approximately 20 hectares of rice annually. According to MAD (2008), approximately 85% of the people in Fiu were involved in the community rice project at that time. However, in early 1999, a disagreement in relation to the distribution of polished rice to members' households led to almost half of the community withdrawing its support for the project. In 2000, the project was further affected by social unrest and problems associated with poor law and order. As a consequence of these problems, the Japanese government recalled their farm manager back to Japan and following his departure, the farm was managed by a local farm manager during 2001. However, a lack of manpower and access to pesticides,

coupled with a lack of local knowledge about rice farming led to the collapse of the project at the end of 2001.

### 5.5 The formation of the Fiu Community Rice Project

The Fiu Community Rice Project (FCRP) was established under the National Rural Rice Development Programme (NRRDP), in 2007. The formation of the FCRP was initiated after a visit from an agriculture extension officer and the Malaita provincial rice coordinator, from the Ministry of Agriculture and Livestock. These field staff members organised multiple meetings with farmers in Fiu village aimed at discussing the purpose and benefits that could be derived from the formation of a rice project.

The extension officer also asked farmers who attended the meeting to form a community group and to select their own leaders through a transparent process. Over 60 farmers from the village attended the meeting that day and voted in the elections for the project leaders. These farmers were aware of the leadership requirements (prior to the start of the elections), as explained by the agriculture extension officer. An election was held to select a chairperson, secretary and a treasurer. The first vote was to select a chairperson. The candidate who received the highest number of votes became the chairperson, whilst those who were not elected were kept in the running for the next round, which was to select a secretary and a treasurer. Once the chairperson, treasurer, and secretary were elected, three ordinary members were appointed by the group to sit on the committee as representatives of the local farmers.

The membership of the project was open to all people within the Fiu community. At the formation stage, 60 farmer members participated at the meeting and they were also involved in the election of the committee members. However, when the project was finally approved by the Ministry of Agriculture and Livestock in 2007, membership had declined from 60 to 30 active members. The chairperson of the project reported that 30 farmers decided to withdraw from the project because they did not like the leaders who were elected during the election process.

After the committee was formed, the first immediate task was to negotiate with the COM and the Malaita Provincial authority, for the use of the land at Fiu village for rice development. The land was first acquired by the provincial authority (from the COM) and later leased on behalf of the COM, by the provincial authority to the Fiu project committee (MAD, 2008).

This process was consistent with the current law, which states that the government can acquire land for its own purposes, or it can act on behalf of landowners, when leasing land to registered companies or groups (SIG, 2001).

The process of acquiring land and organising the leasing arrangement took almost 12 months to complete. In early 2007, a land use agreement was finally signed between the provincial authority and the Fiu project committee. This allowed the committee to redevelop the former Japanese rice field for rice development. In June 2007, the Fiu community was finally selected for the project for the following reasons: (1) they had an existing paddy rice field with an excellent irrigation system in place; (2) the land had been leased to them and therefore, it was not open or subject to dispute; (3) the community group had considerable experience in rice production; and (4) the project had access to adequate roads and a rice milling machine.

The Fiu project committee received its approval letter from the Ministry of Agriculture and Livestock in July 2007. This was followed by the signing of a Memorandum of Understanding (MOU) between the Ministry of Agriculture and Livestock and the project committee. The MOU paved the way for MAL through the Rice Section to support the Fiu community project committee in their development of a 10ha rice field (SIG, 2008, 2009).

Despite the importance of a constitution to such an organisational setup, none was developed by the committee group or the agriculture extension officer — and neither did the committee set out any formal rules to guide the project's operations. However, there were a number of informal rules that were established. For example, members were verbally instructed to attend their allocated working time during the day, or they would be marked absent on the time sheet for wage payment. In addition, members were held responsible for the tools and equipment they used when working on the project. Any damage to tools or equipment (whilst in a member's possession), would mean that the particular member would be responsible for their repair, or for meeting the cost of a new item. Members had to be available and prepared to work extra hours if they were called upon to do so, undertaking tasks such as planting, weeding, and harvesting when crops are ready. A member who was sick (or needed to take a sick child to the clinic) had to report to the field manager (through his supervisor), one day earlier, or two hours before a working day begins. This was to allow the field manager ample time to find someone to replace the absent member for that day. Failure to report on time

would result in the member being marked as absent, which can impact on the member's wage.

Capacity building through training was provided to the project committee members by the Ministry of Agriculture and Livestock, through their Rice Section. However, the chairperson stated that the one-week training was too short and has limited relevance to the project. This training concentrated only on report writing and important issues such as administration management; farm management; repairs and maintenance of small machinery; and understanding the roles and responsibilities of the project leader were not covered. Farmer members who also wanted to attend the training were not given the opportunity to do so by the Ministry of Agriculture and Livestock.

### 5.6 The decision-making structure of the Fiu Community Rice Project

The decision-making structure of the FCRP comprises of a committee, which includes the chairperson, secretary, treasurer and three farmer members, who represent the other farmer members. The main role of the committee is to plan and develop a work programme in consultation with the provincial rice coordinator for project implementation. They are also responsible for the disbursement of processed rice to the farmer members. The committee members are not remunerated for their roles on the committee: but they are paid for any physical work they undertake in the field.

The chairperson is the leader of the project committee. His or her main responsibility is to liaise with the provincial rice coordinator through the regional agriculture extension officer on matters related to the payments of labour subsidies and other supplementary inputs required from time to time. The other role of the chairperson is to chair the project committee's meetings and any meetings with the rice-farming members. The secretary who is also a member of the committee is responsible for taking the minutes of meetings and also producing g monthly reports on the progress of the farm for the provincial rice coordinator in Auki, through the regional agriculture extension officer. The role of the Treasurer is to keep the project accounts and to prepare payments for the members in terms of the labour subsidy. The other three members who make up the six-committee members are ordinary members within the group who have knowledge about rice farming and who have been chosen by all the members to represent them at the committee meetings.

The field manager is responsible to the project committee and he was appointed by the committee to manage the operation of the farm based on his considerable experience on rice farming. The main role of the field manager is to implement the plan developed by the project committee and to manage the day-to-day operations in the field.

Working under the field manager are five supervisors who were also appointed by the committee to assist the field manager in implementing the work programme and to ensure that members carry out their jobs correctly and at the right times. The five supervisors are also responsible for keeping time sheets. To ensure that members have time for their other livelihood activities, the committee decided to group the 30 members into five smaller groups of six members, each controlled by a supervisor. The groups were then put into shifts whereby each group works for one day between Monday and Friday. The supervisors were selected by the project committee based on their past experiences in rice growing and their ability to motivate the members.

### 5.7 NRRDP support to the Fiu community rice project (2007-2010)

The NRRDP support to the Fiu Community Rice Project started soon after the signing of a memorandum of understanding between the Ministry of Agriculture and Livestock and the Fiu project committee in July 2007. The Malaita Provincial Rice Coordinator received inputs from the Rice Section in Honiara and then distributed these to the Fiu project committee. These inputs included a power tiller, water pump, rice seeds, fuel, and simple manual tools, such as wheelbarrows, digging forks and spades. However, far fewer inputs have been received than what had originally been promised to the project committee. Inputs not provided include a tractor, rice processing equipmens, fertilisers, pesticides, and fungicides. The lack of provision of rice processing equipment was not really a problem because the community had access to rice processing equipment owned by APSD. However, the lack of a tractor, fertilisers, pesticides, and fungicides were major contributors to the project having little area under production and low rice yields.

### 5.8 Rice cultivation and production practices

The Community Rice Project was categorised by the Rice Section as a rain-fed or paddy rice farming system (SIG, 2008). This system of farming relies heavily on irrigated water for its success. The actual land preparation for rice growing started in early August 2007 and the process involves clearing vegetation with bush knives; leaving the vegetation to dry before

ploughing; and soil leveling. Ploughing is the most labour intensive and time-consuming operation. The group relied heavily on manual tools (spades, wheelbarrows, and digging forks) for ploughing because the power tiller provided to the group was not working properly due to mechanical faults.

The system of rice growing adopted by the group begins with the soil being ploughed and leveled before the four corners of the field are raised, in order to keep the water from escaping once it is pumped into the field. After the field is filled to the required level, planting can then be undertaken. Plant spacing and the method of planting are important considerations in rice production because the planting density significantly influences the seeding rate, the optimum plant population, and eventually the crop yield. The planting operation is also time-consuming and labour intensive.

Weeding is the next most important operation after planting because weeds are one of the most serious problems in rice production. The diversity of weed species in the Solomon Islands (SIG, 2008) coupled with the limited capital for herbicides makes hand weeding the most widely used option. Hand weeding is laborious and time-consuming, thus making weed control imperfect and often delayed. Regarding the timing of weeding, weed control must begin two weeks after planting and it is repeated every two weeks. Aside from weeds, pests and diseases are also a major problem for rice production in the Solomon Islands. The major pests cited by farmers include termites, stem borers, cutworms, grasshoppers, and caterpillars. Apart from pests, the common diseases listed in order of their impacts on rice include rice blast, brown spot, and rice yellow mottle virus. Given the severe impacts that pests and diseases have on rice production, it is critical that farmers are given training on pest and diseases that affects rice, and ensure that they have knowledge on the effects of these pests and diseases on their crop — and the methods for managing them.

Harvesting is the next operation after weeding. The variety of rice grown under the project took three months to mature. Harvesting is performed by cutting the rice at the stem base with bush knives. After harvesting, the rice is immediately threshed in the field and this is undertaken by beating the harvested crop on tarpaulin. After threshing, the grain is then sun-dried. This process involves manually raking the grain several times a day in order to ensure uniformity in drying the rice. Once this operation is completed, milling can then take place. This is the only operation undertaken by machine. The basic objective of a rice milling system is to remove the husk and the bran layers, and to produce an edible white rice kernel

that is appealing to the customers. There is no need to transport the processed rice to market because it is sold in the village. The grain is stored in bags of 1kg, 5kg, and 10kg weights.

### 5.9 Rice production and marketing

The Fiu Community Rice Project (FCRP) established their first crop of 0.5 hectares in August 2007 however it failed to achieve their target of 10 hectares because it did not have a tractor to assist with ploughing the land. The actual harvesting of the field took place in December the same year. From the 0.5 hectare established, only 0.4 hectares of rice field was harvested whilst 0.1 hectare was damaged by pests and diseases. From the 0.4 hectare of rice that was harvested, a yield of 485 kg of edible rice grain was produced. Although the market price for this rice was good, the Fiu project committee decided to retain the crop for home consumption because the harvest took place during the Christmas festive season and group members needed rice. Therefore, the committee distributed the rice to members of the group as part of their Christmas present. However, the committee informed members that for their next crop, the entire harvest would be sold because the project needed money to pay for its operations.

In February 2008, the group established their second rice crop. In their second year, the group managed to plant 1.5 hectares. However, from the 1.5 hectare established, only 1.3 hectares of the field was harvested as the other 0.2 hectare was damaged by pests and diseases. The crop was harvested in early May 2008. After milling the grain, the group was able to produce a total of 1,590 kg of rice. In order to sell this rice quickly, the committee members bought plastic bags and packed the grain into three categories weighing 1Kg, 5Kg and 10kgs. The chairperson of the group stated that this packaging arrangement was preferred ahead of selling the grain in 20 kg bags, because it was more affordable for customers. The rice produced by FCRP was sold by the committee in the village at SBD$10.00/kg, which earned the FCRP group approximately SBD$15,900. There was a high demand for this rice from the Aligegeo Boarding School and even from shops in Auki town — however, the supply was not sufficient to even meet the demand for rice in the village.

In early 2009 and 2010, the group planted 1.3 and 1.4 hectares of rice respectively. However, it did not manage to harvest these crops due to crop failure resulting from attacks from pests and diseases. Therefore, in July 2010, the Fiu Project Committee decided to suspend its operations and wait for further support from the government before they can resume the project.

## 5.10 Summary

This chapter offers a thorough description of the case study village where this research was conducted. The Fiu Community Rice Project is located in Fiu village in the Central Kwara'e Constituency of the Malaita Province, Solomon Islands. The soil, temperature, and rainfall in the area are said to be suitable for rice farming. However, the farmers in the area grow local staples and vegetables as their main source of livelihood. The villagers hold no legal title over the land in Fiu however; they are allowed to cultivate the land for their subsistence needs. Rice was first cultivated in Fiu village in 1995 by a Japanese volunteer group and the local community. However, a lack of manpower, limited access to pesticides and poor knowledge about rice farming led to the collapse of the project at the end of 2001. In 2007, the Rice Section of the Ministry of Agriculture and Livestock established a new community rice project in Fiu village. The decision-making structure of this community rice project includes a committee at the highest level, who is tasked with overseeing the field manager, five supervisors, and group members.

# CHAPTER 6

# CASE STUDY RESULTS

## 6.1 Introduction

The aim of this study is to investigate why farmers in the Solomon Islands — and in particular, Fiu village in the Malaita Province adopted (or did not adopt) the rice growing technology introduced by the government through the Rice Section of the Ministry of Agriculture and Livestock. The Fiu Community Rice Project (FCRP) was established in Fiu village in 2007 under the National Rural Rice Development Programme (NRRDP), which is funded by the government of the Solomon Islands. This chapter presents the empirical result of the research in five sections. The first section presents the key factors that influenced the initial decision of farmers to adopt the rice technology. In the second section, factors that influenced farmers' decisions to discontinue the rice technology after four years of adoption are discussed. In the third section, the key factors that influenced farmers' initial decision not to adopt the rice technology are described. In the fourth section, factors that influenced the non-adopters' decision to continue with the non-adoption of the rice technology are described. Finally, suggestions made by the farmers, Fiu community rice project committee members, and the government rice officers about how to improve the government's rice policy are reported.

## 6.2 Factors that influenced the adopters' decision to adopt the rice technology

In 2007, farmers in the Fiu community were asked by the Malaita provincial rice coordinator to join a community rice-growing project initiated by the government through the Rice Section of the Ministry of Agriculture and Livestock. Some farmers decided to join the project and adopt the rice technology. The factors identified to have affected these farmers' adoption decision can be classified into three main categories: 1) the characteristics of the technology; 2) internal factors; and 3) external factors. For this study, the characteristics of the technology are defined as those attributes of the technology that affect the rate of its diffusion and adoption. The internal factors on the other hand, are those factors that are under the control of the Fiu Community Rice Project (FCRP): whilst the external factors are those that exist outside the control of the FCRP. The influence of these factors is described in the following sections.

### *6.2.1 Characteristics of the rice growing technology*

The key characteristic of the technology, which influenced the farmers' initial decision to adopt the rice growing technology, is relative advantage. Other characteristics such as complexity, compatibility, trialability, observability, and risk, were not identified by the farmers as being important in influencing their initial decision to adopt the rice technology. Five relative advantages that influenced farmers' initial decision to adopt were: 1) perceived improvement in food security; 2) high yielding and early maturing 3) perceived improvement in income; 4) palatability; and 5) convenience.

Firstly, the farmers identified perceived improvement in food security as one of the most important factor that influenced their initial decision to adopt the rice growing technology. They identified flooding as an important threat to food security in the area. During the rainy season from November to March, the Fiu River usually floods the farmers' food gardens, thus causing significant crop losses. Due to the poor storage characteristics of local staples, farmers often have limited food supplies over this period. Therefore, they stated that since rice has much better storage characteristics, it would be available as a food source during these periods of hunger.

The farmers also stated that the rice variety that was provided to them was high yielding and took only three months to mature. Therefore, with such characteristics, they would be able to grow two crops in the time it took to grow one staple crop. One of the farmers explained:

> *This rice is much better than growing local staples because with the local staples, we usually wait for about 6 to 11 months before we could harvest them and have them available for consumption and market. However, with the rice variety's ability to produce a high yield in a short period of time, we will not wait too long before we could have rice available to feed our families and have surplus rice for sale.*

Another factor identified to have influenced farmers' decisions to adopt the rice technology is the perceived improvement in farmers' income. Farmers identified two areas where the adoption of rice technology could improve their income: 1) through the sale of surplus rice; and 2) from the wages that they would receive through the labour subsidy payments that were provided by the project. One of the farmers stated:

> *The growing of rice is much better than growing local staples because you are able to earn monthly income (wages) and also another income from the sales of rice after the project ends. Unlike local staples where you waited too long (about 6 to 11 months) before you could start earning income. This will also mean that we will now be able to pay for our children's school fees and our household needs.*

The palatability or taste of rice is another factor that influenced the farmers' decisions to adopt the rice technology. They stated that rice is much more palatable than the local staple crops such as kumara and cassava. The farmers noted that their families are keen to grow rice because they prefer it to local staples. This is evident in the following statement by one of the farmers:

> *In my home, rice is an important staple that we had every day. My wife would cook rice in the morning, lunch and in the evening. Our children prefer eating rice than local staples. For example, in the village, meat or fish are always difficult to get, therefore, if we only cook local staples for dinner, the children will not eat the meal because they do not like it. However, if rice is cooked for dinner even without any meat or fish, the children would still be able to eat the meal because they prefer the taste of rice. In many cases, our children will threaten us not to attend school, if we do not pack rice for them in their lunch boxes. Rice is seen by our children as a precious food over any food you can think of.*

The final factor, which influenced the farmers' decision to adopt the rice growing technology, is convenience. Rice takes much less time to prepare and cook compared with local staples crops such as kumara and cassava. As highlighted by one of the farmers:

> *Walking long distance to food garden and coming home with a heavy bag of kumara on the back is laborious and time consuming. Further, the long preparation time involved in cooking kumara, cassava, and taro, which involved peeling, cleaning, and cooking them in a big pot over an open fire with smoke is laborious and it takes almost two hours to cook.*

For farmers without experience in rice cultivation, rice was perceived as a complex crop to grow compared to local staples. However, the farmers who had experience in rice growing identified that complexity did not affect their decision to adopt rice technology. The farmers perceive rice growing as not being compatible with their current system of farming.

However, several farmers had grown rice in the past and the irrigation infrastructure was still available to them. Because some farmers had prior experience in growing rice, there was no need to trial the rice technology. During its conception, the rice project was not designed to allow farmers to trial rice farming on a small scale. The aim was to grow a large area of rice from year one of the project.

The farmers also identified that rice-growing technology was risky, capital and variable input intensive, and labour demanding. However, they decided to adopt the rice crop because the government had promised to address these negatives aspects by providing counter-balancing factors such as: pesticides and fungicides for the control of pests and diseases, and a tractor and other manual tools such as spades, digging forks and wheelbarrows to ensure working in the rice field was much easier. It had also planned to use a community approach where labour is shared between community group members involved in the growing of rice.

### 6.2.2 Internal factors

Three internal factors that influenced the farmers' initial decision to adopt the rice-growing technology were: 1) the characteristics of the farmers, 2) on-farm factors; and 3) cultural factors. Leadership characteristic was also a factor; however, it does not influence the farmers' initial decision to adopt the rice technology. These factors are discussed in the following sections.

#### *6.2.2.1 Personal characteristics of the farmers*

The most important personal characteristic of the farmers, which influenced most of their decision to adopt the rice technology, was their previous experience with rice growing with the former Japanese funded community rice project in the 1990s. Other personal characteristics such as gender, age, education and special training in agriculture, did not influence farmers' decisions to adopt the rice technology. However, the oldest farmer (65 years) in the group adopted the rice technology because he had obtained a supervisory position in the project that did not require him to undertake arduous work.

#### *6.2.2.2 On-farm factors*

The location of the farm was the first on-farm factor that influenced the farmers' decision to adopt the rice technology. Three attributes associated with the location of the farm influenced

the farmers' decision to adopt: 1) proximity to the farmers' homes; 2) the location of the farm on land free of dispute; and 3) proximity of the FCRP farm to an available water source.

The farmers identified that the proximity of the rice field to their homes offers advantages such as saved time and energy because they did not have to walk long distances to the rice field. The oldest farmer in the adopters group stated that the proximity of the farm to his home affected his decision to adopt because at his age, he would be tired after a day working in the rice field and since the farm is located close to his home he could quickly walk home to have something to eat and relax.

Farmers also identified that the location of the farm on a piece of land free from dispute was an important factor that influenced their decision to adopt rice-growing technology. In the Solomon Islands, although everyone has equal rights to land ownership, in reality it is difficult to gain access to large plots of land. Land is increasingly becoming a subject of conflict where tribes argue with each other over which development projects they will undertake on their land. The farmers stated that this problem has led to the failure of a number of donor-funded projects in the past. One of the farmers sees the situation as follows:

> *I decided to grow rice because I knew that the land was leased to the FCRP for rice production. However, if this land was not leased I would not have made an effort to join the group and grow rice. This is because I do not want that kind of situation, where I will spend my time and effort working on the project, and then suddenly people argue over the ownership of the land, which could result in dispute and finally the closure of the project as in most project cases in the province..*

The location of the FCRP farm close to an available water source also influenced farmers' initial decision to adopt the rice technology. Farmers stated that water is an important factor of production in rice production since its availability increases production levels and eventually the expected income from growing rice. Therefore, it was an important consideration in their decision.

#### *6.2.2.3 Cultural factors*

Cultural factors associated with their community were also important internal factor that influenced the farmers' decisions to adopt the rice technology. In rural communities in the Solomon Islands, feasting, communal sharing of garden produce, and other village ceremonies are part of traditions passed on from past generations. The farmers stated that during these events (in recent years), rice has played an important part and it has now become the main staple food during these ceremonies. Resultantly, rice has become an accepted part of local culture. Farmers stated that as part of the community, they need to provide rice for cultural events and since they do not have the money to purchase rice, it is very useful to grow rice as part of a community group. Farmers further added that declining to attend or to contribute to such important events would be seen as disrespectful to the culture and traditional beliefs of the community.

Farmers pointed out that the leaders of the project had limited skills and knowledge in rice growing, community organisation, and also displayed poor attitudes toward members of the group. However, the farmers who had prior experiences in rice growing identified that these limitations did not affect their decisions to adopt the rice technology. This was because the adopters believed that with the training and input that the extension agent provided to the project leaders, these problems could be overcome and the project would be successful. The next section discussed the external factors that were identified by farmers to have influenced their decision to adopt the rice-growing technology in 2007.

### 6.2.3 External factors

The following external factors influenced the farmers' decision to adopt the rice-growing technology: 1) the government's rice policy; 2) agro-climatic condition of the area; 3) infrastructure development; 4) extension support; and 5) market access. These factors are discussed in the following sections.

#### *6.2.3.1 Government's rice policy*

Government's rice policy was identified by farmers as one of the most important factors that influenced their decisions to grow rice. According to the rice policy, the government would provide capital items such as a tractor, hand tools such as spades, forks and wheelbarrows; processing equipment, and a farm warehouse to store the rice. The farmers stated that rice growing is labour intensive especially in terms of land preparation, harvesting, and post-

harvesting activities such as threshing and milling. The provision of a tractor, spades, forks, wheelbarrows, and processing equipment would have reduced this labour requirement. Furthermore, they stated that equipment is expensive and difficult for them to purchase on their own.

Another element of the policy that influenced the farmers' decisions to adopt the technology was the provision of key variable inputs under the project such as rice seeds, fertiliser, pesticides, and fungicides. Farmers stated that rice crops do not perform well without the application of fertiliser, pesticides and fungicides. They also reported that rice requires more fertile soil than local staple crops; therefore, it requires extra fertilisers. They also stated that rice growing is risky and the crop is susceptible to pests and disease, and therefore they did not want to waste their time growing rice without these important inputs.

The labour subsidy available to the farmers was another important part of the government policy that influenced the farmers' adoption decisions. They stated that the provision of a labour subsidy was a good source of extra income. The farmers also stated that this will assist them towards paying their household needs and also in paying for their children's school fees. One of the adopters explained:

> *This provision of a labour subsidy is a good approach and is quite different from past policies. With this new NRRDP, we do the fieldwork, and then the government is paying our monthly wages as if we are working for them. Receiving a monthly wages is like someone working in town, but we think we are better than them because at the same time we earn a salary for the work done, we are also expecting a share from the sale of surplus rice at the end of cropping season.*

Another important element of the government policy that influenced the farmers' decision to adopt the rice growing technology was the use of a community group approach to rice farming. The farmers stated that rice growing is labour intensive and therefore, working in a group is seen as one way of reducing the required labour input. One of the adopters stated that:

> *To grow rice, land preparation is quiet intensive. It is not possible for an individual to prepare a hectare of land for paddy rice production. This is because rice work involves a lot of activities and it is arduous. Therefore, this idea of community group*

*work is suitable for rice growing. The tasks or activities can be delegated to members and therefore, this makes the job much lighter and completed faster.*

The other advantage that the farmers identified in relation to working in groups is that they have the opportunity to acquire new knowledge and skills from other group members and this could be useful to them in the future. For example, one of the farmers sees the situation as follows:

*Working in a community group is good because as someone who is trained in rice growing, I want to share my knowledge with the community. However, I will not force myself to teach them. An avenue like this creates the chance that I could share the essential knowledge and skills of rice growing with the members so that they too could know how to grow rice on their own. Not only would this provide farmers with the best ways to grow rice, but members also learn other crop management practices that would be useful for them in the future.*

#### *6.2.3.2 Infrastructure development in the area*

The infrastructure development in the area is another important external factor that influenced farmers' decision to adopt the rice technology. They stated that the transport infrastructure, which includes quality road system and bridges, means that truck owners come willingly to the village, in order to transport local farmers' produce to the market in Auki. This has greatly reduced the cost of transporting produce to market as explained by one of the farmers:

*In the past, when we did not have good quality roads, the transporting of farm produce to the Auki market was very difficult and expensive. This was because vehicle owners did not want to come to the village because they were afraid of risking their trucks with the bad condition of the road. However, to date, following improvements to the roads, many truck owners want to come to transport our produce to the market. The competition between different transportation owners, together with the quality of the road has contributed to the low transportation costs that we are experiencing today.*

Furthermore, some farmers also stated that the quality of the road system and the availability of the transport also allowed the FCRP committee members to visit the Rice Office in Auki to

request for advice on rice growing from the provincial rice coordinator and the regional extension officers when required.

Access to rice-processing equipment is also an important factor that influenced the farmers' decisions to adopt the rice technology. Farmers perceived that access by the FCRP to Asia for Pacific Sustainable Development rice-processing equipment would make it easier for them to process their harvested rice. They compared this situation to the 1990s, when rice from the Japanese funded rice project was harvested and sent on a passenger ship to Honiara for processing. This was an expensive exercise and it limited the returns obtained by the farmers.

#### *6.2.3.3 Agro-climatic condition*

The suitable agro-climatic conditions of the area also influenced farmers' decision to adopt the rice-growing technology. The agro-climatic conditions can be separated into four categories: 1) soil quality; 2) rainfall; 3) sunshine hours; and 4) temperature.

Farmers stated that the soil on which the rice project is located has a high level of alluvial deposits as a result of flooding in the area in recent years. Therefore, it has a lot of nutrients required to support the growth of rice. Resultantly, good rice crops were grown without the use of fertiliser. A government rice officer had this to say regarding the soil in Fiu village:

> *Fiu village sits on one of the best agricultural areas of the Malaita Province, which has alluvial soil deposits as a result of floods in the area in recent years. This is why the Ministry of Agriculture and Livestock approved the community's request for rice growing support.*

The amount of rainfall in the area was also suitable for rice growing. The farmers interviewed stated that long hours of sunshine are ideal for rice growing because it enhances the food-making process of the plant. This in turn ensured that high yields were achieved. Most of the adopters did not know exactly what photosynthesis was, however, after having learnt from the Provincial rice coordinator that their village had this advantage it played a role in influencing their decision to adopt the rice technology.

Temperature is the also an agro-climatic factor that influenced the farmers' decisions to adopt the rice growing technology. Farmers who had the opportunity to listen to the Provincial rice coordinator explaining the importance of temperature in rice production understood the role

temperature played in crop production. Therefore, this knowledge also contributed to their decision to adopt the rice technology.

#### *6.2.3.4 Access to extension services*

Access to extension support also influenced farmers' initial decision to adopt the rice growing technology. The adopters perceived that since their village is located close to the Malaita Provincial Agriculture Division in Auki, they would have good access to both the regional extension officer and the provincial rice coordinator for support and information about the rice technology.

#### *6.2.3.5 Market access*

Market access is one of the external factors that influenced farmers' decision to adopt the rice-growing technology. Farmers pointed out that the Fiu Community Rice Project is located close to three expanding markets: Fiu village, Aligegeo School, and Auki town. These markets for rice had been growing due to population growth and an increase in per capita rice consumption. According to the farmers, these markets could provide a good source of income for the community's rice project which is evident in the following:

> *It is impossible for someone who would want to grow an intensive crop such as rice if it does not have any future market prospect. We were interested to grow rice because we had seen that the demand for rice in these three markets was increasing. Therefore, we decided that if we grow rice, we could make a lot of money, and also save some of our money for other productive inputs.'*

The next section describes factors that influenced farmers' decisions to discontinue the use of rice technology after four years of adoption.

### 6.3 Factors that influenced the adopters' decision to discontinue the rice technology

In 2007, the members of the Fiu Community made a decision to join the community rice project and to grow rice. However, in June 2010 the group members decided to cease completely any involvement in growing rice. The adopters' decision to discontinue the rice technology were affected by three factors:1) the characteristics of the technology; 2) internal factors; and 3) external factors which are discussed in the following sections.

### *6.3.1 Characteristics of the rice technology*

The adopters initially perceived rice technology as: complex, incompatible with the local farming system, input and labour intensive, land-using and risky. However, they identified other counter-balancing factors that overcame these negative aspects of the technology such as the provision of capital and variable inputs by the government, a labour subsidy, and the use of community approach where labour is shared amongst group members. These counter-balancing factors overcame the negative characteristics of the technology and therefore these farmers decided to adopt the technology in 2007. However, post 2007 when the project was implemented, the government did not provide the key capital items such as tractors, or vital variable inputs such as fertiliser, pesticides, and fungicides. To further compel the situation, the community group did not function well with members failing to provide labour as initially planned. As such, the "loss" of these counter-balancing factors influenced farmers' decisions to discontinue the growing of rice in June 2010.

### 6.3.2 Internal factors

The only internal factor identified by farmers, which contributed to their decision to discontinue the growing of rice in a community group, was poor leadership.

#### *6.3.2.1 Poor leadership*

The adopters identified poor leadership as an important factor that influenced their decision to discontinue the rice technology. The adopters reported that the FCRP leadership was poor in three key areas: 1) their knowledge and skills in relation to rice growing; 2) their knowledge and skills in relation to group management; and 3) their attitudes in relation to the FCRP.

The first area where leadership was lacking was on the requisite technical knowledge and skills in rice production. The adopters observed that those leading the project lacked technical knowledge and skills in three important areas that are critical for the success of the project which are: 1) fertiliser management; 2) pest and disease management; and 3) small machinery maintenance. One of the farmers stated:

> *The leaders' lack of knowledge about pest and disease management led to a decision made in the 2008 and 2009 rice cropping season, when the chairperson refused to purchase pesticides to control the pests and diseases that finally damaged the whole*

*rice field in 2009 and 2010. Had they (the leaders) known the seriousness of the pest and disease problem and purchased the pesticides and fungicides at that time; we would not have lost our whole field. It is very sad seeing our sweat just gone in a few weeks.*

The second area where leadership was lacking was in the area of group management. The adopters observed that the project leaders failed to arrange regular meetings with group members to keep members informed of different aspects regarding the management of the project. As a result, members lacked information about the status of the project and other pertinent information that were important to inform their decision-making. The adopters also observed that their leaders were poor at motivating group members to work. This led to many of the members failing to provide labour for a range of crop production activities, which in turn contributed to the overall failure of the project.

The attitude of the leaders was also found to have influenced the adopters' decision to discontinue the rice-growing technology. The adopters' reported that even though some members had considerable experience in rice production, their leaders showed a lack of respect for group members and their experience. The leaders also practiced nepotism and put the interests of their family members ahead of other members in the group. They allocated lighter jobs to family members, whilst heavier ones were allocated to non-relatives. The leaders also put their own interests ahead of the group and misused project income for their own benefit.

### 6.3.3 External factors

The two key external factors that influenced the adopters' decision to discontinue the rice-growing technology were: 1) poor implementation of the government's rice policy; and 2) poor extension service delivery.

#### *6.3.3.1 Poor policy implementation*

The farmers stated that after four years of operation the government's failure to provide key capital inputs (such as a tractor) prevented the group from achieving their target of 10 hectares of land in rice production. Farmers explained that given the shortage of labour within the group, a tractor was required for the cultivation of the rice fields. Without the tractor, the group had to complete the cultivation using manual tools (spades, forks and wheel

burrows) and with the small number of people in the group, it was not possible to cultivate a large area (10-20 hectares) and hence meet their targets.

Another important factor was the lack of provision of key variable inputs such as fertiliser, pesticides, and fungicides by the government. The Rice Section of the Ministry of the Ministry of Agriculture and Livestock failed to deliver on its promise (to the FCRP) to provide these inputs. As a result, the rice fields suffered significantly from major pest and disease problems, which subsequently led to total crop failure in 2009 and 2010.

#### *6.3.3.2 Poor extension service delivery*

Because the Fiu community rice project is located close the Auki Agriculture Division, adopters initially perceived that it would enable them easy access to quality support and information on rice and other inputs. However, adopters identified that these officers only pay lip services to the project and did not provide the required inputs such as fertilisers, pesticides, and fungicides that the Fiu Community Rice Project need to prevent problems caused by pests and diseases that were experienced in 2008 and 2009. This contributed to these adopters losing their trust on these officers, which led to their decision to discontinue the growing of rice in 2010. In the next section, the factors that influenced the non-adopters initial and post 2007 decision not to adopt the rice growing technology are discussed.

## 6.4 Factors that influenced the non-adopters' decision not to adopt the rice growing technology

In this section, the factors that affected the farmers' decision not to adopt the technology in 2007 are described and these are grouped into: 1) the characteristics of the technology; 2) internal factors; and 3) external factors.

In order to understand the farmers' reasons for not adopting the rice growing technology in 2007, it is important to understand the nature of their decision. As a condition to grow rice, interested farmers were asked to give up time that they would normally have devoted to their own gardens (for local staple crop production) and to fishing and pig rearing so that they could participate in rice growing as members of the FCRP. As such, farmers were expected to forgo food and potential income from local staple crop production, fishing, and pig rearing. However, they would obtain food in the form of rice produced by the project, income from the sale of surplus rice, and additional revenue from a wage subsidy that would be paid to

them for the time put into the rice-growing project. This adoption decision was different from other food crop adoption decisions because the farmers were not going to substitute an area of an 'old' crop for an area with a 'new crop'. Rather, the substitution would occur through the substitution of hours of labour. The farmers had to decide if they were better off investing time into their own gardens, fishing, and pig rearing or investing their time into the community rice project.

### 6.4.1 Characteristics of the technology

The key characteristics of the technology identified to have influenced the farmers' decision not to adopt the rice technology were: relative disadvantages; compatibility; complexity; resource use characteristics (input intensive, labour intensive, and land-using) and risk. These factors are discussed in the following sections.

#### *6.4.1.1 Relative disadvantages*

The first reason the non-adopters gave was that the value of income and food received from this activity was perceived to be less than the value of the food and income they would have forgone by not growing local staple crops or fishing and rearing pigs. For example, one of the farmers stated:

> *My annual income from growing local staples, fishing and pig rearing was around US$2,600.00/year (SBD$18,000/year). Furthermore, I have a constant food supply from the garden. Therefore, if I decided to grow rice, I would forgo this income and the food supply that I used to receive from these activities.*

#### *6.4.1.2 Compatibility*

The non-adopters perceived that rice growing was not compatible with the farming practices that the community is currently using. One of the farmers had this to say regarding compatibility:

> *In our village, relatives tend to help each other in their subsistence food gardens; however, they do this at their own pace and when they feel they want to assist their relatives. Even when giving a hand in their relative's garden, the relative whom they assist does not apply strict control on them or even tell them how to do the garden work. Therefore, a community project such as the FCRP which had leaders who*

*supervise and apply strict rules on members who do the work in the rice field was seen as not compatible to the current farming practices of these farmers.*

#### *6.4.1.3 Complexity*

Rice was perceived as a complex crop to grow compared to local staples by farmers without rice experience. One of the non-adopters who have no experience in rice growing stated that:

*Rice-growing requires specialist knowledge and skills in pest and disease management, fertiliser management, and the maintenance of machinery.*

#### *6.4.1.4 Resource use characteristics*

The resource-use characteristics of the technology also influenced the farmers' decision not to adopt it. The non-adopters perceived rice growing as input intensive compared to the local staple crops. It required expensive capital inputs, such as a tractor; a farm warehouse to store the rice; water pumps; an irrigation system; small hand tools; rice processing equipment, and variable inputs such as pesticides, fertilisers, seeds, fuel and lubricants, which are difficult for them to purchase without government support. Furthermore, the variable inputs were not always readily available in the village compared to the inputs required for local staple crops. One of the farmers pointed out the following about the issue of inputs:

*Although the government had promised to provide both capital and variable inputs for the project, the farmer believe that, in the long term, government support would be withdrawn and they did not want to be exposed to this risk.*

The non-adopters also perceived rice growing as more labour intensive compared to the growing of local staple crops. They (the majority of farmers who have had previous experience with rice growing with the former Japanese funded community rice project in the 1990s) identified that it involved a large number of activities and that it was arduous and required a large labour force. The farmers also identified that they must substitute their time for doing traditional activities such as growing local staple crops, fishing, and rearing pigs that provide food and income for their families. They further stated that rice growing would have reduced their leisure time for attending social, cultural, and church related activities that are organised in the village.

The final resource-use characteristic of the technology that influenced the farmers' decision not to adopt it was that the technology was perceived as 'land-using', compared to local

staple crops. Since the rice project would utilise a large area of community land, this would have reduced the area available for individual household gardens. These farmers indicated that the area for gardening per family had been declining given the increase in population in recent years. As a result, the farmers had reduced the fallow period between planting cycles and this had resulted in a decline in the yields of local staple crops. One farmer explained:

> *Given the shortage of land in the area, it is better to stick to growing local staples and vegetables because they require less land compared to growing rice.*

#### *6.4.1.5 Risk*

The farmers perceived rice growing as being more risky than the production of local staples. The majority of these non-adopter farmers' had prior experience with rice growing under the Japanese-funded rice project in their village (during the 1990s) and they had seen the impacts of pests and diseases on rice yields. Furthermore, these farmers had considerable experience in growing local staples and they reported that these crops are relatively more resistant to pests and diseases. The few pests that do attack the local staple crops can be controlled with simple management practices, without causing any major impact on crop yield. In contrast, the farmers state that if pesticides or fungicides are not available, the rice crops in the area could be completely devastated. One of the farmers sees the situation as follows:

> *I am afraid to grow rice because it is susceptible to pests and diseases and if the pests and diseases thus attack the rice field, I will have nothing to feed my family and to get income from to pay for my households needs, such as plates, spoons, and clothing and also my children's school fees.*

The next section covers the internal factors, which influenced the farmers' decision not to adopt the rice technology.

### 6.4.2 Internal factors

The key internal factors that influenced the farmers' initial decision not to adopt the rice technology were: their personal characteristics; cultural factors; and poor leadership. These are discussed in the following sections.

#### *6.4.2.1 Personal characteristics of the farmer*

The non-adopters' previous experience with the use of rice-growing technology during the 1990s was an important factor that influenced their decision not to adopt it. These farmers mentioned that rice growing involves a lot of activities and requires specialist knowledge and skills to manage it successfully. Although the extension agents had promised to provide training and inputs to overcome the challenges that the non-adopters had previously experienced, they still did not adopt the technology because they did not trust the extension agents to deliver. These factors influenced their decisions not to adopt the technology.

The non-adopters' previous experience with community groups was also another factor that affected their decision not to adopt the rice technology. The farmers stated that their past participation in the previous Japanese-funded community rice project had taught them several lessons about community rice growing. They found that there were often conflicts within the community group (between members and the leaders). During their involvement in the Japanese funded rice project, there was also a lack of cooperation between members within the group. As a result, these farmers believe that their community could not work together on a commercial project such as the Fiu community rice project. Furthermore, in their experience while working on the Japanese funded rice community project they observed that the leaders tended to benefit most from the project. This is highlighted in the following observation by one of the farmers who stated that:

> *During the Japanese funded community rice project in 1990s, I have seen our leadership at that time was not honest and transparent, in relation to the distribution of surplus rice to member households. They appeared to distribute more surplus rice to their own households and less to the community members' households. They also misused project assets, such as spades, wheelbarrows and even fertilisers, for their own personal gardens.*

Another factor that influenced the farmers' non-adoption decision was their experience with previous government programmes. They stated that in the past, the government had made numerous promises through their agents (the agriculture extension and fisheries officers) to provide assistance to rural farmers and fisherman. However, in most cases, it failed to deliver on these promises. This has therefore led to government officers losing their credibility with most of the farmers. It also led to a general feeling of distrust and animosity amongst farmers and the general community towards government policies.

Age was also found to have influenced the farmers' non-adoption decision. One of them stated that rice growing is labour intensive and arduous; therefore, due to his age (62 years), he would not be able to complete the physical tasks associated with rice growing and therefore this influenced his initial decision not to adopt the technology. He explained:

> *I joined the Fiu community in growing rice in the 1990s and I know very well that rice growing involves a lot of activities and it is hard work. Since I am too old, I have decided not to adopt rice growing again. I think it is much better to grow local staples such as kumara and cassava which does not involve a lot of activities and they are easy to cultivate.*

#### *6.4.2.2 Cultural factors*

Cultural factors are the other internal factors that influenced farmers' decision not to adopt the rice-growing technology. The non-adopters' stated that if they had adopted the rice technology, it would have limited their attendance at cultural and traditional activities such as feasting and tribal meetings, due to the project's high labour requirements. The farmers further stated that adopting the rice technology would also mean that they would not have time to enjoy social and church activities, which are organised in the village on a daily basis.

#### *6.4.2.3 Leadership characteristics*

Due to the behaviour displayed by the leadership of the former Japanese funded community rice project, most of these farmers did not trust the current leadership of the Fiu Community Rice Project (FCRP). They particularly did not trust the chairperson and field manager of the FCRP because both had also held responsible positions in the former Japanese funded rice project. In addition, they were also part of the leadership group that managed the project after the Japanese manager returned to Japan. Therefore, this had influenced their decision not to adopt the rice-growing technology. One of the non-adopters had this to say regarding the new leadership of the FCRP:

> *I did not trust the FCRP committee members because they are the same people who wrecked the Japanese funded community rice project here in Fiu village in 2001.*

Apart from the three internal factors (personal characteristics of the farmers; cultural factors, and poor leadership) that influenced the non-adoption decision of farmers, the on-farm characteristics were all positive for adoption. However, these were overruled by negative

factors such as lack of knowledge and skills in rice production, group management and leadership attitudes by the leadership of the FCRP. The next section covers the external factors, which influenced the farmers' decision not to adopt the technology.

### 6.4.3 External factors

The external factors that influenced the non-adopters initial decision not to adopt the rice growing technology include: the state of infrastructure development within the area; accessibility to markets, and poor policy implementation.

#### *6.4.3.1 Infrastructure development in the area*

The infrastructure development in the area is the first important external factor that influenced the farmers' initial decisions not to adopt the rice technology. The non-adopters stated that the transport infrastructure, which includes a quality road system and bridges, has greatly reduced the cost of transporting produce to the market and therefore, encouraged them to continue growing local staple crops. Furthermore, they stated that the quality of the road system in the area has also meant that truck owners come willingly to the village, in order to transport local staple produce to the market in Auki. This is how one of the non-adopters sees the situation:

> *Our village's access to a quality road system and the availability of transport in the village means I do not have the difficulties as before, when I have to transport my local staple produce by carrying it on my shoulder to Auki market. Since I now have access to both roads and transport, this makes me more willing to grow more local staples for both consumption and the market.*

#### *6.4.3.2 Access to markets*

Access to markets for their local staples is the second external factor that influenced the farmers' initial decision not to adopt the rice technology. These non-adopters stated that there is a growing market for local staple crops in Auki and the surrounding villages, due to population growth in recent years. Therefore, farmers believe that this could provide a good source of income for their families in the future. One of the non-adopters had this to say in regards to markets:

> *The price offered for local staple crops at Auki market is very attractive and whilst there is a good market outlook for local staple crops, there is no need to lose this opportunity by rushing into adopting the rice technology.*

Apart from the two external factors (Infrastructure development and market access) that influenced the non-adoption decision of farmers in 2007, the agro-climatic conditions of the area were positive for adoption. However, these were cancelled out by the negative factors such the lack of trust due to the government's inability to deliver on its policy initiatives. The factors that influenced the initial non-adoption decision of farmers have been discussed. The next section covers the factors, which influenced the farmers' decision post-2007.

## 6.5 Factors that affected the non-adopters decision post-2007

Although the non-adopters made the decision not to adopt rice growing in 2007, these farmers identified three factors that influenced their decision not to adopt the technology after that point in time. Their decisions to continue with the non-adoption were observability of the rice project, poor leadership, and the government's failure to implement the rice policy at the local level. These factors are discussed in the following section.

### *6.5.1 Observability*

Observability was also an important factor that influenced farmers' subsequent decision (post the initial 2007 decision) not to adopt the rice growing technology. Since all the farmers live together in the same village, the non-adopters were able to observe the operation of the rice project from 2007 onwards and discuss it with the project members. As a result, they observed the impacts of the project on the adopters over a period of four years noting in particular that the project was not performing well and that the members' level of food security and income was less than farmers who had not adopted the rice technology. One of the farmers who had being monitoring the progress of the project during implementation stated that:

> *I have observed the farmers who joined the rice project have not received benefits, in terms of income and food that they had expected from growing rice. Furthermore, I have seen that instead, these adopters are worse off (in terms of food security) compared to us who did not adopt the rice technology.*

Observability was important, since it confirmed to the non-adopters that their reasons for rejecting the technology were correct. For example, they believed that the technology was risky; that the leaders lacked the capability to run the project, and that the government was unable to provide the inputs it had initially promised. Therefore, these farmers would only have subsequently adopted the technology, if many of their expectations about the technology had been refuted after its implementation.

### *6.5.2 Poor leadership*

The leadership of the FCRP lacked skills and knowledge in rice production, group management, and leadership attitudes. First, similar to the experiences of adopters, the non-adopters observed that the FCRP leadership did not have the technical knowledge on rice growing and in particular, they lacked knowledge and skills in pest and disease management, and fertiliser and machinery maintenance. Furthermore, the project leaders lacked the knowledge and skills to manage a community group; in particular, the farmers questioned the leaders' ability to motivate and encourage members to work. The non-adopters also identified that the leaders of the FCRP did not have the right attitude towards making the project successful. They did not put the interests of the community group ahead of their own, but instead, they placed their own interests ahead of the group. This attitude led to further distrust towards leadership by the farmers.

### *6.5.3 Poor policy implementation*

Poor policy implementation by the Rice Section of the Ministry of Agriculture and Livestock was also an important factor that influenced the farmers' subsequent decision (post the initial 2007 decision) not to adopt the rice growing technology. This also reinforced the farmers' viewpoint that they cannot trust the government. The non-adopters observed that the government had failed to provide key capital inputs such as a tractor, which it had promised the FCRP group. As a result, the FCRP group failed to achieve its target of 10 hectares of land in rice production after four years of operation. The second factor observed by the non-adopters was that the government had also failed to provide key variable inputs, such as fertilisers and pesticides to the FCRP group and this led to crop failure in 2008 and 2009. Furthermore, the non-adopters reported that the labour subsidy payments made to farmers were much lower than first promised and that delays were experienced in payments made to members.

## 6.6. Suggested improvements to the rice policy

Opinions about how the rice policy could be improved were obtained from the three groups: farmers (adopters and non-adopters); FCRP leaders; and government rice officials (provincial and national).These are provided below.

### *6.6.1 Farmers' suggestions for improvements in the rice policy*

Farmers identified three alternative approaches to improving food security within the Solomon Islands: Firstly, some farmers believed that the government should ignore rice production and instead, focus on promoting local staple production. These farmers have considerable experience in rice growing and they know that it is labour, capital, and input intensive and uses a substantial area of land. In addition, to grow rice successfully requires a high level of knowledge and skills. In contrast, the local staple crops require far less inputs (capital and variables inputs), less labour and land and in addition they are easier to grow and manage. Local staple crops are also traditionally cultivated by the majority of people in the Solomon Islands. On this basis, a number of farmers argue that the government needs to ignore rice production and instead provide more support to farmers, in order to help them improve their production of local staple. They believed that by promoting local staple crops, the country would be better able to meet its food security needs.

Secondly, other farmers suggested that the government should continue to foster rice production in the Solomon Islands, but through individual farmers rather than community groups. They pointed out that supporting individual households (who are willing to grow rice) would improve rice production. These farmers stated that they are not used to working in community groups especially where project leaders does not have the requisite skills to manage such groups effectively. Therefore, the government would be better off promoting the rice technology to individual households involved in rice farming.

Thirdly, an alternative view put forward by some farmers was that the government should continue to promote rice growing, but on commercial scale. The farmers suggested that the government should encourage overseas or local investors to invest in rice production. Those who suggested this option believe that rice production can be undertaken successfully at a commercial scale by investors who have the knowledge of rice production and has the required capital to invest in such a project. They further stated that only by encouraging private investors to invest in rice growing commercially would the country be able to attain

self-sufficiency in rice production. The farmers also cited the former Sol-Rice Commercial Company Limited, which had successfully grown 2,512 hectares of rice in the Guadalcanal plains from 1965 to 1986 and how experiences from this project can provide some lessons for the future development of rice production in the country.

### *6.6.2 The FCRP leaders' suggested improvements to the rice policy*

When the leadership of the FCRP was asked about the government's current Rice Policy, they offered the following two suggestions:

First, the government should select and train the leaders of community rice projects in the areas of rice farm management and group management. They pointed out that by training the project leaders, it would enable them to manage the community rice project more successfully in the future.

Second, the FCRP leadership also suggested that the government should prioritise the supply of inputs (capital and variable inputs) to the community groups. They further stated that rice growing is input and labour intensive, risky, and complex. In addition, rice if it is to be grown successfully requires a high level of technical knowledge and skills.. Therefore, they stated that the government needs to prioritise the supply of inputs to farmers and also ensure that these (capital and variables inputs) are appropriate and available to the rice farming community groups, when needed.

### *6.6.3 The government's rice officials suggested improvements to the rice policy*

When the government's rice officers were asked about the current Government Rice Policy, they offered three main suggestions:

Firstly, the government, through the Ministry of Finance and Treasury, should establish a separate standing account for the NRRDP within the Ministry of Agriculture and Livestock. These rice officials believe that the establishment of a separate account (purposely for NRRDP within the Ministry of Agriculture and Livestock) will ensure that the Rice Section will have direct access to the project funds, which could be used to purchase inputs (capital and variable inputs) that are badly needed by community rice projects in the provinces.

Secondly, the government should assist the Rice Section of the Ministry of Agriculture and Livestock to secure suitable land for commercial rice development through the Ministry of

Lands and Housing. The rice officials highlighted that land tenure is a major problem in the Solomon Islands, because most of the suitable land for rice development is owned by local tribes and is difficult to acquire. Therefore, if the Ministry of Land and Housing could work closely with the landowners to secure suitable land for rice development, it would increase the confidence of interested investors to invest in rice production.

Thirdly, the government should invest in improvements to roads, wharves and markets in those parts of the provinces that have limited access to important infrastructure through the Ministry of Infrastructure and Industrial Development. These developments will ensure the delivery of inputs to community rice projects in the provinces. By improving this sector, community rice projects would be able to receive their input supplies in a timely manner and hence would be able to increase their rice production.

### 6.7 Summary

The factors that influenced the farmers' decision to adopt the rice technology in 2007 were: the characteristics of the technology, internal factors and the external factors. The characteristics of technology that influenced the farmers' initial decision included the perceived improvement in food security, improvement in income, high yields and short maturity duration of rice, palatability, and convenience. The internal factors were: previous experience, strategic location of the farm, and cultural factors whereas external factors included: government policy, infrastructure development in the area, suitable agro-climatic condition of the area, access to extension service, and market. The factors that influenced the adopters' decision to discontinue the rice technology after four years of adoption were: poor leadership by the FCRP committee members and poor implementation of the rice policy by the rice section of the Ministry of Agriculture and Livestock. The factors that were identified to have influenced the initial decision of farmers not to adopt the rice technology in 2007 were: the characteristics of technology, internal factors and external factors. The characteristics of technology included: relative disadvantage, compatibility, complexity, risk, and resource use characteristics such as: input intensive, labour intensive and land using. The internal factors that influenced the farmers' initial non-adoption decision were: personal characteristics such as previous experience with community projects, past failed government programmes, and cultural factors. On the other hand, external factors included: the infrastructure development in the area and access to markets for the farmers local produce. The factors that were identified to have influenced the non-adopters decision post-2007 to

continue with the non-adoption of rice technology were: observability, poor leadership, and poor policy implementation.

# CHAPTER 7

# DISCUSSION

## 7.1 Introduction

This chapter provides a discussion of the case study results reported in Chapter 6 integrated with findings in literature in Chapter 3. It begins with the classification of the case, followed by a discussion of the food security strategy utilised by the rice programme, the dual role of local staple crops, and an overview of the adoption process. The factors that influenced the adoption of the rice technology are discussed and these are separated into three parts: the characteristics of the rice technology, internal factors, and external factors. The final section provides a summary of the chapter.

## 7.2 Classification of the case

The case under consideration was observed to have several characteristics that differentiate it from other cases in the literature. One of the relatively unique aspects of this case is the fact that the technology is adopted as part of a community group project, compared to other cases where the adoption of a technology by individual farmers is investigated. As such, the farmers had to decide not only about adopting a new crop, but also farming the selected crop in a way that is different (as a community group) from how they have traditionally farmed (as individuals).

The case is located in Fiu village. The age of farmers range between 20 to 65 years (Table 7.1). In the village, men usually make the decisions concerning the tasks to be done regarding the productive aspects of the household. For example, in term of food production, men would be involved in heavy manual work such as the felling of trees and fishing, while women do the clearing of land, hoeing, planting, weeding, harvesting and cooking. The majority of farmers had primary school education, and only a few had completed secondary school education. There is a low level of literacy amongst the farmers in the community. However, in terms of experience, most of the farmers in the village have had previous experience in growing rice as part of a community group with a Japanese funded project in the 1990s. There are four different tribes who live in Fiu village and each tribe is represented by a chief. The tribes share the same religion (Church of Melanesia). The level of wealth distribution in village varies however; the majorities of people in the community are farmers and are poor.

They rely primarily on subsistence agriculture and fishing for income whereas the more affluent members of the community generate income through professional employment as teachers or nurses, or as provincial government employees in Auki. Wealthy households account for only 1% of the village population, whereas those that are termed as poor account for the other 99% of the population.

The villagers' main source of livelihood is agriculture. Farmers grow mostly staple crops and vegetables for consumption with any surplus produced sold at the local market. For additional revenue, they are also involved in other activities such as fishing, pig rearing, and basket weaving. The Fiu Community Rice Project (FCRP) is situated close to Fiu village where most of the farmers live. The land on which the community rice project is located is owned by the Church of Melanesia (COM) and is leased to the community by the government for rice development. Because of this arrangement, tenure of land is therefore considered secure from disputes. The land area set aside for rice development is approximately 20 hectares.

**Table 7.1: Farmer and farm characteristics**

| Characteristics | Case study classification |
|---|---|
| Age of farmers (years) | 20 - 65 years |
| Gender equality | Men usually make household decisions |
| Education | The majority of farmers have predominantly primary with limited secondary education. Literacy rates are low. |
| Experience with the technology (rice growing) | The majority of farmers had some experience with rice growing within a community project |
| Homogeneity | Four different tribes with four chiefs representing each tribe. The tribes share the same religion |
| Wealth | 99% are termed as poor and only 1% is rich. |
| Livelihood situation | Subsistence agriculture and also gain income from fishing, pig rearing, and basket weaving. |
| Location of the rice farm | Close to farmers homes |
| Land tenure | The land is not in dispute |
| Farm size | 20 hectares |

The case project is a community project, which requires farmers to form a community group in order to grow rice. In this case study, the farmers had to decide whether or not they would

adopt the new crop (rice), and grow it on the leased land as part of a community project. Normally when the technology is a new crop, the farmers' decision is whether to substitute a new crop for the old crop. In this case, the decision is subtly different in that in order to grow rice; the farmers must substitute time they would use to grow their local staple crops for the time they would use to grow rice within the community project.

The establishment of the community group was facilitated by the extension officers (Table 7.2). Membership to the project group was open to community members of Fiu village and anyone could join the project at any time. The community rice project had 30 farmer members including six committee members. The main role of the committee was to plan and develop a work programme for rice production. There was no official constitution developed by the committee that set out formal rules to guide the project's operations. The decisions were made by the project committee with minimal consultation with group members. The leadership of the project lacked knowledge and skills in group management and also on the different technical aspects of rice production.

**Table 7.2: Community group characteristics**

| Characteristics | Case study classification |
|---|---|
| Nature of group | Formed by the extension officers |
| Membership | Open |
| Group size | 30 farmers |
| Written constitution | No |
| Level of participation in decision making | Decisions were made by the leadership with minimal consultation with group members |
| Leadership capacity:<br>• Group management<br>• Rice production | <br>Poor<br>Poor |

Cultural, social and church activities are important part of the village life (Table 7.3). The villagers are obliged to make substantial contributions in cash or in kind to these important village events. The agro-climatic conditions of the area selected for the project are suitable for both local crops and rice production. The infrastructure in the area in terms of roading is well developed and there is good access to local transport services. The villagers also had

access to rice processing equipment. The village is situated 3 km from the provincial capital Auki therefore; it has good access to extension services, and markets for farmers' produce.

The programme was aimed at promoting rice growing to farmers in Solomon Islands in order to reduce the growing dependence on rice imports, and also improve local food security. Its focus was on increasing the production of food through rice cultivation rather than a more general approach used in other projects targeted at improving food security. This programme has a subtle difference from other food security programmes in that it required farmers to form a community group in order to grow rice. This programme started in 2006 and has been ongoing for five years. The strategy of the rice section of the Ministry of Agriculture and Livestock has been to increase food production through the introduction of rice as a new crop. Traditionally, farmers have grown kumara, cassava, taro, and pana.

**Table 7.3: Village and programme characteristics**

| **Characteristics** | **Case study classification** |
|---|---|
| Cultural and social activities | An important component of village life |
| Suitability of agro-climatic condition | Suitable for both local staples and rice |
| ***Infra-structure*** | |
| Road & transport services in the area | Developed |
| Access to processing equipment | Yes |
| Access to markets | Good |
| ***Programme*** | |
| Reduction of rice imports and improving food security | Promotion of rice growing |
| Period of promotion | Over 5 years |
| Strategy | Food production - introducing rice growing |

Rice takes approximately three months to mature compared to local staple crops, which take 6-11 months (Table 7.4). There are a number of disadvantages associated with the rice technology. First, the rice technology requires much more land than that used for the production of local staple crops. Second, it is more capital intensive and requires more variable inputs compared to those required for local staple crop production. Third, the technology used in rice farming is also labour intensive and is more susceptible to pests and

diseases. The technology used is also complex because it requires a considerable level of specialist knowledge to manage than local staple crop production. However, rice has good storage characteristics and is more convenient in terms of preparation and cooking time. According to locals, it is also more palatable than the local staple crops. The production system for rice is also quite different from the local staple crops in that the community normally farm as individual households rather than collectively as a community. However, many of the farmers of Fiu village had worked previously in the Japanese funded community rice project that operated from 1995 until 2001. Apart from the negatives factors related to rice farming, the demand for both rice and local staples are high in the local market and has been growing over the past five years.

**Table 7.4: Characteristics of rice and local staple crops**

| Characteristics | Rice | Local staple crops |
|---|---|---|
| Growth cycle | 3 months | 6-11 months |
| Land use | High | Moderate |
| Capital requirements | High | Low |
| Variable requirements | High | Low |
| Labour requirements | High | Low |
| Risk (pest & disease) | High | Low |
| Storage characteristics | Good | Poor |
| Convenience | High | Low |
| Palatability | Good | Moderate |
| Compatibility | Low | High |
| Complexity | High | Low |
| Market demand | High and growing | High and growing |

The government provided support under the NRRDP for the Fiu community to grow rice, whereas no support has been provided to farmers to grow local staple crops (Table 7.5). The incentives that the government had planned to provide to the Fiu Community Rice Project included the provision of capital and variable inputs, a labour subsidy, and the provision of rice information and technical advice from the extension officers to the community group. The government also acquired the land for the project and leased it to the Fiu community for

rice development. However, market support or price subsidies were not provided for either rice or the local staple crops because the government believed that it would transfer income from lower-income consumers to wealthier farmers. Furthermore, price support does little to help farmers with below-average incomes because the benefits are distributed in proportion to the sales.

**Table 7.5: Government support to farmers**

| Characteristics | Rice | Local staple crops |
|---|---|---|
| Government support | • Capital inputs,<br>• Variable inputs,<br>• Labour subsidy,<br>• Extension support,<br>• Leased land to avoid land disputes. | • None provided |

### 7.3 Food security strategies

The strategy being used by the Solomon Islands government to improve food security (promoting the growing of rice) is aimed at increasing agricultural production as highlighted in the literature ( Bartel, 2009; Pretty et al., 2003; Sahn, 1998;Von Braun et al., 1992). To implement this strategy, the government of the Solomon Islands has used capital and variable input subsidies, a wage subsidy, and extension support to encourage farmers to grow rice. This was because the government believed that the provision of such incentives to farmers would encourage them to adopt the technology. In contrast, several studies by IFPRI (1992); Sijim (1997), and Stevens et al. (2001), suggested that policies for increasing food production should include: 1) the provision of input credit, 2) subsidised or free inputs, 3) research and extension, 4) capital expenditure and investment promotion, 5) land reform, and 6) price support as a means of enhancing adoption of technologies to increase food production by smallholder farmers.

Despite the government's promise to provide the above incentives, it was found that only 30 out of the 1,152 farmers in the Fiu village adopted the rice technology. However, the ones that adopted it discontinued the technology four years later because the government had

failed to provide key capital and variable inputs initially promised to the farmers. This is consistent with the finding in a study by Orewa et al., (2009), which found that the poor implementation and delivery of inputs to farmers influenced farmers in Nigeria to discontinue the use of improved tomato seedling technology initiated by the government. There is some evidence to suggest that the farmers who adopted the rice growing technology were worse off in terms of food security and livelihood security than those farmers who did not adopt it. This was because of the food and income foregone as a consequence of growing rice instead of undertaking more traditional livelihood activities. In contrast, other studies have reported that the adoption of improved rice varieties had improved the food and livelihood security of farmers in Bangladesh (Hossain et al., 2006); Uganda (Kijima et al., 2008); Benin (Adekambi et al., 2009); China (Li et al., 2010), and Nigeria (Dontsop et al., 2011). This difference highlights the danger of failing to implement food security programmes effectively in that it can have a negative impact on the local population.

### 7.4 Agricultural extension and food security

Agricultural extension has been used widely by governments in developing countries to increase agricultural production and improvement food security (Anderson & Feder, 2004; Ison & Russell, 2000; Rivera & Omar, 2003). The Fiu community rice project is an example of this approach. It was found that the Malaita Agriculture Division through its regional extension officers has played an important role in promoting awareness of the rice technology among the farmers in the Fiu village. Similarly, Azilah (2007) reported that extension officers played an important role in making farmers in Ghana aware of the new cassava technology and this influenced their decision to adopt the technology. Unlike other projects, which require the transfer of more traditional transfer of technology, the government through the extension service used a community group as the vehicle for rice technology adoption in the Solomon Islands.

However, despite the extensive effort made in providing awareness to the farmers about the rice technology, the majority of farmers in Fiu village did not join the community rice-growing group. These farmers rejected the technology even though being informed of the benefits of adopting it. This is similar to the finding of Hassinger (1959) and Phiri (2011) who argued that if farmers were exposed to innovative messages, such exposure would have little effect, unless the innovation is perceived as relevant to the individual's needs and consistent with their attitudes and beliefs. The findings in this study show that an awareness

of the technology does not guarantee adoption especially when farmers perceive that the technology is not appropriate to their needs. In the next section, the dual role of local food crops is discussed.

### 7.5 Dual role of local food crops

An important finding from this study is that the farmers in the Fiu village considered local food crops favourably not only in terms of their ability to provide food, but also as an important source of income that could be used to buy essential goods and services. This is similar to the findings of a study by Inaizumi et al., (1999) who found that farmers in Nigeria continued to grow cowpeas rather than the newly introduced maize in the dry season because of the dual role performed by the cowpea crop. It could provide both food and income for farmers in the dry season; whereas maize could not because of its poor ability to perform well under dry seasons. Rice also has some attractive attributes in relation to this dual role because it can provide high yields of a highly palatable food crop, and a good source of income. It also has the added bonus in that the farmers were paid a labour subsidy for growing it. Because of the dual role of food crops, an important factor in the decision to adopt rice growing was the advantage the new technology provided in terms of food and income relative to what they could obtain from putting the time used for growing rice into growing local staple crops, fishing, rearing pigs and making baskets. This finding is consistent with the views by Rogers (1995) who stated that prior to adoption; farmers must see an advantage or expect to obtain greater utility if they are to adopt the new technology. In the next section, an overview of adoption and the factors that influenced adoption of the rice technology are discussed.

### 7.6 An overview of adoption

In 2007, following assurances by the government to provide capital and variable inputs, a labour subsidy and the provision of extension support, thirty farmers in Fiu village were finally convinced to adopt the rice technology. However, these farmers discontinued the use of technology in the middle of 2010 because the government had failed to deliver inputs to the group as initially promised. This is similar with the experience of farmers in a study by Orewa et al., (2009) who found that the poor implementation and delivery of inputs influenced farmers in Nigeria to discontinue the use of improved tomato seedling technology initiated by the government.

Importantly, the majority of farmers in Fiu village rejected the technology when the project was implemented in 2007. They did not have faith in the government to provide the inputs necessary for successful rice production. Furthermore, farmers did not believe that the leadership of the community group had the skills, knowledge and attitudes to manage the project successfully. Furthermore, they were aware of some of the negative characteristics of the technology (capital, input and labour intensive, complex and risky) having observed the outcomes of a similar and previous community project.

### 7.7 Factors that influenced adoption decision

In 2007, farmers in the Fiu village were requested by the Malaita provincial rice coordinator to join a community rice-growing project initiated by the government through the Ministry of Agriculture and Livestock. The research findings revealed that several factors influenced the farmers' decision whether or not to adopt the technology at the inception of the project in 2007. These factors could be separated into three broad areas: 1) the characteristics of technology, 2) internal factors, and 3) external factors. These are similar to the factors identified in the literature ( Adesina & Zinnah, 1992; Aguila-Obra & Melendez, 2006; Chau & Tam, 1997; Doorman, 1991; Feder, Just & Zilberman, 1985; Rogers, 1985, 2003; Souza et al., 1993). The following sections discuss each of these three main factors in detail.

#### 7.7.1 Characteristics of the rice technology

The result of the study identified four characteristics of the technology that have influenced the farmers' decision to adopt the rice technology. These were relative advantage, compatibility, complexity and observability. These four factors are consistent with Rogers (1995, 2003) adoption model with the exception that trialability was not important in this project. This was because the rice project required 10 - 20 hectares of land to be grown immediately, and therefore trialing it in a small scale was not possible. This study also identified that the resource-use characteristics of the technology influenced the farmers' adoption decision. These resource-use characteristics included: 1) capital intensity; 2) labour intensity and 3) land using. These resource-use factors were also identified as important in the farmers' adoption decisions in several other studies (Feder et al., 1985; Gibson, 1994; Khanna, 2001; Pender et al., 2004). Furthermore, this study also identified risk to be another factor that influenced the farmers' initial adoption decision. Feder & Umali (1993), Leathers & Smale (1992), and Pannell et al., (2006) all identified the risk associated with a new

technology as an important factor that influenced the adoption decision of farmers. The following sections discuss each of these factors in detail.

***Relative advantage***

The relative advantage of rice over local staple crops was found to be an important factor that influenced farmers' initial decision to adopt in 2007. Initially the farmers adopted the rice technology in 2007 because of a perceived improvement in their food security. The study revealed that flooding is the main threat to food security in the area because during the rainy season from November to March, the Fiu River usually floods the farmers' food gardens, thus causing crop losses. Due to the poor storage characteristics of local staples, the farmers often have limited food supplies over this period. Therefore, because the rice crop had much better storage characteristics than the local staple crops, farmers decided that it would provide a reliable source of food during the period when they experience floods. This is consistent with Rogers (1995) view that farmers will adopt a technology that they perceive to be better than the practices they supersede.

A perceived improvement in relative income was another factor that influenced the farmers' initial decision to adopt the rice technology in 2007. The research identified two areas where the adoption of rice growing could improve farmers' income: 1) through the sale of surplus rice; and 2) from the wages that they could receive through the labour subsidy payments that were provided by the project. In a similar vein, Barr & Cary (1992); Carey et al., (2002) and Webb (2004) found that technology that was profitable and that would increase farmers' income was adopted faster than those that were perceived to provide less return in terms of income.

This research also revealed that the adopters decided to grow rice rather than local staple crops because it only took rice three months to reach maturity, whereas the local staple crops took approximately 6-11 months. It meant that the farmers could grow two crops of rice in the time it took to grow one staple crop. Overall, it was expected to improve both their food security and income relative to staple crops. This finding is consistent with the work of Feder, Just & Zilberman (1981) who reported that early maturity was an important characteristic that influenced farmers' decision to adopt new crop technologies.

The palatability of rice was also found to be an important factor that influenced the initial adoption-decisions of farmers in this study. Rice is much more palatable than the local staple

crops, such as kumara and cassava. Adesina & Zinnah (1992) and Sall et al., (2000) also reported that the palatability of rice was an important characteristic that influenced the adoption-decisions of farmers in Siera-Leone.

This study also identified convenience to be an important relative advantage of rice compared to the local staple crops because it is easy to prepare and it takes less time to cook it. This finding is consistent with the work of Adesina et al., (1995) who observed that in West Africa, ease of cooking was one of the factors that significantly influenced the adoption of modern mangrove rice varieties by farmers. Similarly, Masangano & Miles (2003) also found that a short cooking time was an important and desirable characteristic that influenced the adoption of Kalmia bean by farmers in Malawi.

Because the government had failed to provide capital and variable inputs, further compelled by the failure of the committee members to provide good leadership, many of the anticipated relative advantages of rice did not eventuate and after four years of crop failure, the farmers decided to discontinue the project in 2010. Akpabio & Inyang (2007) in a similar study on government intervention in the aquaculture industry in Akwa Ibom State, Nigeria, found a similar problem where the government's failure to deliver inputs (as promised to local farmers) led to the collapse of the project due to the farmers withdrawing their support. Similarly, Orewa et al., (2009) also found that a lack of leadership skills and knowledge, by leaders of the government-supported tomato seedling project in Nigeria had influenced members of the project group to abandon the project.

Evidence from this study suggests that the farmers who had joined the community rice project were worse off in terms of food security and income than those that did not adopt the rice technology. This is contrary to the finding in the studies by Adekambi et al., (2009); Hossain et al., (2006); Kijima et al., (2008) and Li et al., (2010) who argued that the adoption of new agricultural technologies has had a positive effect on raising the income levels of farm households, in addition to improving household wellbeing and reducing household poverty levels.

Despite the relative advantages of the rice technology, the non-adopters did not adopt the technology in 2007 because they believed that they would be better off in terms of food security and income by growing their traditional staples crops, and taking part in fishing, rearing pigs, and weaving of baskets. This is similar to a study by Phiri (2011) who found

that the majority of farmers in Mazabuka district in Zambia did not adopt the cassava technology because they perceived that their existing crop maize would provide them with greater food security and a higher level of income.

***Compatibility***

The study also found that the adopters' perceived rice growing to be incompatible with their traditional farming methods. Traditionally, farmers farmed as individual households rather than in a community group. However, because they had previous experience working in a community-based rice project, they decided to adopt the rice technology in 2007. This supports the view of Hassan & Nhemachena (2008); Khana (2001); Maddison (2006) who stated that previous experience with a technology is positively related to technology adoption, because the farmers are in a much better position to assess whether a new technology will be profitable.

On the other hand, the non-adopters did not adopt the technology because they perceived that rice growing was not compatible with their traditional farming system. The non-adopters tended to work their gardens as individual households where each farmer had control of his own plot of land. The farmers did not want to work in a system where the leaders would supervise them and apply strict rules about when they would work and what they should do. This supports the view of Rogers (1995, 2003) who believed that farmers would only adopt technologies perceived to be compatible with existing values, past experiences, and the needs of the potential adopters.

***Complexity***

In this study, the adopters initially perceived rice as more complex compared to their local staples crops. Despite this, thirty farmers adopted the rice technology in 2007 because they had previous experience with growing rice as a community project in the 1990s. This supports the view of Hassan & Nhemachena (2008); Khanna, (2001); Maddison (2006) who argued that the previous experience of a farmer about a technology is one of the important factors that contributes positively to their adoption decision. Furthermore, the government had promised to provide extension support to these farmers and also train the leaders of the group in rice production. This is similar to the role extension agents played in the adoption process in studies undertaken by Azilah (2007); Feder et al., (1985); Feder & Umali (1993); Johnson et al. (2005), and Ogunlana (2004). However, when the government failed to deliver

on these promises, the adopters discontinued the technology in 2010. This is consistent with the work of Oladele (2005) who found that in southern Nigeria, farmers discontinued the adoption of maize technology because the government had failed to deliver on its promise to support the farmers. The non-adopters also perceived rice growing as complex compared to local staple crops. Although this group had previous experience with rice growing, they still did not adopt the technology because they did not trust the government and the leadership of the project.

***Observability***

The result of this study revealed that observability did not influence the initial decision of farmers in 2007. However, when the project was implemented during the period from 2007 to 2010, the non-adopters observed that the project was poorly implemented and this confirmed that their initial decision not to adopt the rice technology in 2007 was the correct decision. In fact, observability influenced farmers' decision to reconsider their initial decision not to adopt. This finding confirms the view reported by Cary et al., (2002) who stated that a lack of observable outcome, a result of adopting a technology would inhibit the adoption of the technology by others. This study highlights that observability can have an important influence on the adoption decision of farmers, but it can do this in two ways depending on whether the technology is observed to be successful or not.

***Resource-use characteristics***

The resource-use characteristics of the technology had an important influence on the farmers' adoption decision. The resource-use characteristics that this study revealed as important in relation to rice production were capital and variable input intensive, labour intensive, and land-using. This is similar with the resource use factors identified in the literature (see for example Ajayi et al.,2007; Bangura, 1983; Feder et al.,1985; Floyed et al., 2003; Gibson, 1994; Khanna, 2001; Pender et al.,2004; Rogers, 2003; Zepeda, 1990). The following section discusses each of these factors in detail.

This study found that although the adopters were aware of the capital and variable intensive nature of the rice technology, these factors did not act as barriers for adoption for this group. This was because the adopters perceived that the government had put in place actions to overcome the negative characteristics of the technology. For example, they had promised to provide capital inputs such as a tractor, a warehouse for storing rice products, processing

equipment, and manual tools such as wheel burrows, spades and digging forks, and variable inputs such as fertilisers, pesticides, fungicides, and rice seeds. However, in the middle of 2010 when the government failed to deliver on the promised capital and variable inputs, the negative characteristics of the technology were important factors that influenced these adopters' decision to discontinue the rice technology in 2010. These findings are similar to the work of Orewa et al., (2009) who found that the government's failure to provide inputs to farmers in Nigeria resulted in the farmers discontinuing the use of the tomato seedling production project after they had initially adopted them.

The non-adopters' also perceived the rice technology to be capital and variable input intensive relative to staple crops. Although the government had promised to provide these capital and variable inputs, they still did not have faith in the government to deliver on this promise and therefore, this influenced their decision not to adopt the technology. This finding is consistent with those reported by Floyed et al., (2003) and Khanna (2001), who argued that agricultural technologies that are perceived as capital and variable input intensive are less likely to be adopted by farmers than those that are less-capital and variable intensive. However, other studies have not reported the influence of the interaction between farmers' trust (or lack of trust) in a government's ability to provide capital and variable inputs and the input intensive nature of a technology on farmers' adoption decisions.

The result of this study also found that in spite of the perceived labour intensity of the rice technology, this did not deter the adopters from adopting the rice technology. These farmers reported that the government had offset the labour intensity problem by promising to provide a tractor, labour subsidies, and organising the community group so that the labour input was shared across the group. However, when the government failed to deliver on a tractor to ease the labour demands of the project, compelled by the inability of the leaders to manage the community group effectively, the negative characteristics of the technology became important and this influenced adopters' decision to discontinue the rice technology in 2010. Little has been written in the literature about the impact of labour intensity on the adoption decision of farmers.

The non-adopters perceived rice growing as labour intensive compared to local staple crop production because it involves many activities, is arduous, and requires a large labour force. Although the government had promise to provide a tractor, labour subsidy, and facilitate the sharing of the workload through a community group approach to overcome the problem of

labour intensity, the group still did not adopt the technology. This was mainly due to a lack of trust in the government's ability to provide a tractor, and the project committee members' capacity to manage the community rice project successfully. This discouraged them from adopting the technology. This finding is similar to the work of Bangura (1983) who found that farmers preferred to adopt technologies that were less time and less labour demanding. Similarly, Gibson (1994) found that the labour demands of rice production was one of the factors that influenced farmers in Papua New Guinea not to adopt rice production. However, other studies did not report the interaction between policies designed to overcome the labour intensive characteristics of the technology, farmers' trust (or lack of) in a government's ability to deliver on policy, and the labour intensive nature of a technology on farmers' adoption decisions.

Another resource-use characteristics that influenced the adoption decision of farmers was that the rice technology is land using or use more land compared to staple crop production. However, one group of the farmers adopted the rice technology because the government had organised the lease of 20 hectares of land from the Church of Melanesia to provide undisputed land for the project. This meant that the farmers "investment" in the land was protected for the duration of the project. Similar findings have been reported by Juma et al., (2009) and Ouedraogo et al., (2001) who showed that the term of a lease could influence the adoption of certain technologies, particularly where the impact of the technology occur over several years. In contrast, one of the factors that influenced the non-adopters decision not to adopt the rice technology in 2007 was that the technology was land using. These non-adopters stated that because the project would utilise a large area of community land, this would reduce the area available for individual household gardens. This problem was highlighted because land availability in the village had declined over the last decade because of the rapidly expanding population. This had resulted in the farmers having less fallow time between crops and yields had begun to decline. This is similar with the work of Ajayi et al., (2007) who found in a study on the adoption of renewable soil fertility replenishment technologies in the southern African region that as the population growth in an area increased, the ability of farmers to adopt land-using technology was reduced. This situation influenced farmers' decisions to adopt land-saving technologies that would enhance soil fertility.

***Risk***

The risk associated with the production of rice was also another important factor that influenced the farmers' adoption decision. The role of risk in farmers' adoption decisions has been highlighted in other studies (Feder &Umali, 1993; Leathers & Smale, 1992; Pannell et al., 2006). Although the adopters were aware that rice was susceptible to pests and diseases, it did not deter them from adopting the rice technology. This was because the government had promised to provide counter-balancing factors (fertilisers, pesticides, and fungicides) to overcome this risk. Furthermore, the government had also promised to provide extension support to help the farmers manage this risk. However, when the government failed to provide the variable inputs, the rice crop was attacked by pests and diseases, and this in turn ultimately led to crop failure. As a result, the adopters decided to discontinue the rice technology in the middle of 2010.

The non-adopters also perceived rice growing as more risky compared to local staple crop production. The majority of these non-adopter farmers' had previous experiences with rice growing under the Japanese funded rice project in their village (during the 1990s) and they had seen the impacts of pests and diseases on rice yields- this influenced their decision not to adopt the technology in 2007. This is consistent with the literature by Feder & Umali (1993); Leathers & Smale (1992); Pannell et al., (2006) who argued that risks associated with a new technology have also been seen as a major factor and a barrier to adoption decision. Furthermore, the non-adopters did not trust the government and the extension agents to implement policies to minimise such risk. Daberkow & McBride (2003) and Stanley et al., (2000) also found that any new technology or practice that was perceived as relatively risky by farmers was less likely to be adopted. However, little has been reported in the literature about the interaction between the level of risk of a technology, the implementation of government policies to overcome such risks, and farmers' trust in the government to implement such policies. The next section discusses the internal factors that influenced the adoption decision of the farmers.

### 7.7.2 Internal factors

The result of this study identified that four internal factors influenced the farmers' initial decision to adopt the rice growing technology in 2007. These factors included: 1) the personal characteristic of the farmers, 2) on-farm factors, 3) cultural factors, and 4) the leadership characteristics of the community group. The first three factors have been reported in the literature (Bantel & Jackson, 1989; Deressa et al., 2009; E'Dmden et al., 2008;

Knowler & Bradshar, 2006; Pannell et al., 2006; Staal et al., 2002). The fourth internal factor has not been mentioned in the literature. This is because in this study the technology is adopted through a community group, which has a number of characteristics that can influence the adoption of a technology. The following sections discuss the influence of these factors in detail.

***Personal characteristics of the farmer***

The result of this study did not find age to be an important factor that influenced the adoption decision of most farmers' who adopted the rice technology. This is consistent with the literature by Curtis et al., (2005); Guerin & Guerin (1994); Shiferaw & Holden (1998) who all found no significant evidence between age and adoption. Similarly, Adesina & Zinnah (1992) in their study on the factors affecting the adoption of rice farming in Sierra Leone found that the age of farmers had no significant relationship to the adoption of rice farming in Sierra Leone.

However, an interesting finding in this research was that age influenced one farmer's decision not to adopt the rice technology in 2007. This farmer was an older farmer and he decided not to adopt rice technology because he perceived it as too labour intensive for him to cope with. This finding is in agreement with the work of Tiamiyu et al., (2009) who reported that older farmers are less likely to adopt new technologies if they know that they require extra physical labour and are arduous. Importantly, one of the adopters was of a similar age, but he overcame this constraint by obtaining a position within the community group that required minimal physical effort. As with the other factors, these results show that complex interactions influence a farmer's decision to adopt a specific technology. In this instance, an older farmer did not adopt the technology because it was too labour intensive and in the other instance, an older farmer adopted the technology after ensuring he had a position within the community group that did not require him to undertake arduous physical labour. As such, there is a complex interaction between characteristics of the technology (labour intensive), characteristics of the farmer (age), and a farmer's ability to develop strategies that overcome negative characteristics of the technology that impact on him or her. However, no mention has been made in the literature of the interaction between characteristics of the technology (labour intensity), characteristics of the farmer (age,) and strategies that would overcome the negative characteristics on technology adoption.

The result of this study did not find gender to be an important factor that influenced the adoption-decision of farmers. This was because the technology was designed for community group participation and therefore, membership to the project group was open to community members of the Fiu village and anyone could join the project at any time. However, little has been written in the literature about the community groups and the role that gender plays in technology adoption.

The education level of farmers was an important factor identified in the literature as having an influence on adoption (Doss &Morris, 2001; Moser &Barrett, 2003; Tiamiyu et al., 2009). However, this study did not find education and training to be important in the decision-making process of farmers. Unlike most other studies where individual farmers had the sole responsibility for managing a crop, the rice technology is somewhat different in that it is a community project that is managed by a project committee with intensive input from extension personnel. In this instance, farmers with less education and training could draw on the expertise of extension personnel and also from better educated and trained farmers from within the community group. A similar point was made by Grarner & Sharp, (2004) who reported that the community group approach has the potential for pooling the abilities and expertise of the farmers in order to positively affect the success of a community project.

In this study, the majority of the adopters and non-adopters had previous experience with rice growing with the former Japanese funded rice project in the 1990s. This provided them with not only experience in growing rice, but also with working in a community group. They knew that rice growing was capital, labour, and input intensive, it was risky, involved a lot of activities, and required specialist knowledge and skills to manage it successfully. From working in the community group, the farmers understood that there were often conflicts between members and the leadership and that members often failed to cooperate. However, the farmers' previous experience with the Japanese funded rice project had either a positive or a negative influence on their adoption decision.

For the farmers who adopted, their previous experience with the technology had overcome the complexity problem associated with the rice technology and this influenced their decision to adopt the technology in 2007. This is consistent with Agarwal, (1983); Hassan and Nhemachena, (2008); Khanna, (2001); Maddison, (2006); and Lin, (1991) who found that farmers' previous experiences with agricultural technologies was positively correlated with their adoption decisions. In contrast, the non-adopters' previous experiences working with the

former Japanese funded rice project in the 1990s influenced them not to adopt the technology. They knew it was resource intensive (capital, input and labour), complex, and also risky. As a result of their previous experiences with the community group, these farmers believed that their community could not work together on a commercial project. Olson (1965) and Kegler et al., (1998) argued that community groups run the risk of developing conflicts, due to differences in opinions, personality clashes, and the hidden agendas of individuals within the group.

The research also revealed that the farmers' past experience with failed government programmes also influenced their adoption decision. However, some group of farmers (adopters) decided to adopt the rice technology because they had confidence in the government's rice policy, and were convinced that the rice section through the extension agents would provide inputs and information when implementing the rice policy. However, post-2007 when the government failed to deliver on these promises; they discontinued the use of technology in 2010. This is similar to the situation that occurred in Madagascar where farmers discontinued rice growing because the extension agents had failed to communicate with them in order to 'clear up' some of their doubts regarding the technology (Moser & Barrett, 2003).

The non-adopters stated that in the past, the government has made numerous promises through their agents (the agriculture extension and fisheries officers), but they had often failed to deliver on these promises. This had led to a general feeling of distrust amongst farmers towards government policies and agents. This finding is in agreement with the work of Finlay et al., (2004) and Stanley et al., (2000) who found that past experiences with failed government programmes can negatively influence the farmers' adoption decisions.

***On-farm characteristics***

The on-farm characteristics that influenced the farmers' initial adoption decision included: 1) proximity of the rice farm to the farmers' homesteads, 2) land free from land-dispute and 3) proximity of the farm to a water source. First, the proximity of the rice field to the farmers' home influenced their decision to adopt the rice technology. This was because the farmers did not have to walk long distances to the rice field, which saved them considerable time. This has not been reported in the literature however, Azilah (2007) found that proximity of the farm to the farm homestead saved Ghanaian farmers time and energy because they did not

have to carry harvested cassava over long distances. This in turn influenced some of the farmers to adopt the new cassava variety introduced to the area by the government extension officers.

Second, access to land that is dispute-free influenced farmer's adoption decisions. In the Solomon Islands, land is increasingly becoming a subject of conflict, where tribes argue with each other over which development projects are to be undertaken on their land. This study found that the location of the farm on a piece of land free of dispute influenced the farmers' decision to adopt the rice growing technology. The literature also reported that land security or ownership encouraged the adoption of technologies that are linked to the land (Kassie et al., 2009; Neil & Lee, 2001).

Thirdly, the location of the farm close to an available water source affected the farmers' decision to adopt the rice-growing technology. This study found that farmers treasured water as an important production factor in rice production. The availability of water for rice growing increased the expected income from growing rice and therefore, it was an important consideration in their decision. This finding supports the earlier work of Griliches (1957), who asserted that a more favourable environment (better soil, water, and climate) increased the expected utility of income from the use of the new technology and thus, this increased the probability that farmers would adopt it.

Despite these positive on-farm characteristics for the adoption of rice growing, the majority of farmers did not adopt the rice technology because they knew that the leadership of FCRP lacked knowledge and skills in rice production, group management capacity, and leadership attitudes that are conducive to manage the project successfully. Furthermore, the non-adopters did not have confidence in the extension agents ability to provide inputs and effective support to make the project successful. This finding confirms the view of Guerin & Guerin (1994) who reported that a lack of credibility of extension agents resulted in farmers losing trust and respect in them and this therefore resulted in the non-adoption of the new technology.

***Cultural factors***

The study revealed that the cultural practices of the local community also influenced the farmers' decision to adopt the rice technology. The adopters mentioned that rice played an important part as the main source of food during feasting, customary ceremonies and other

traditional village activities and this influenced their decision to adopt the technology. This finding is consistent with Herbig & Miller (1991) and Stanley et al., (2000) who reported that farmers would only adopt a technology, which is compatible to their cultural practices and the norms of society. Despite the positive cultural connotations associated with the rice technology, the majority of farmers did not adopt it because it was considered labour intensive and also because it would have limited the time they had available for attending other cultural activities. Other studies by Rogers (1962) and Wejnert (2002) have reported that a technology that is not suited to the cultural norms of a society is less likely to be adopted by farmers. However, no mention has been made in the literature on the interaction between the characteristics of the technology (labour intensity), and cultural factors on technology adoption.

***Leadership characteristics***

The results of this study identified three leadership characteristics that influenced the adoption decision of farmers. These were the technical knowledge and skills of the leaders in relation to rice growing; the leaders' group management ability, and their attitudes towards members. Similar leadership characteristics were identified in the literature (Bantel & Jackson, 1989; Damanpour & Schneider, 2008; Howell & Higgins, 1990; Levi & Witwin, 1986; Russell & Vidler, 2000; Scott & Bruce, 1994; West &Anderson, 1996). The following sections discuss each of these factors in detail.

The adopters perceived that the leaders of the project had limited technical skills and knowledge in rice growing, lacked capability in group management, and poor leadership attitudes. However, some of the farmers who had previous experience with rice growing decided to adopt the rice technology because they were convinced that with the training that the extension agent would provide to the project leaders, these limitations could be overcome. This confirms the view of Anderson & Feder (2003) who stressed that extension agents play an important role in influencing the adoption decision of farmers. However, post-2007 after the project was implemented; the adopters found that there was no improvement in the technical knowledge and skills or capability of group management among the project's leadership. This was therefore instrumental in crop failure and the eventual decision by the adopters to discontinue the technology in 2010. Russell & Vidler (2000) found that the lack of technical knowledge (held by leaders of a community action planning project in Sri-Lanka) was one of the factors responsible for causing the project to fail. In this case, the

leaders did not have the correct training required to acquire the necessary skills and knowledge to lead a community project group. These findings also confirmed the views of Levi & Litwin (1986) who argued that the absence of leaderships' knowledge and skills in group management would result in poor decision-making that would ultimately lead to the disintegration of a community group.

Furthermore, this study found that the project's leadership showed a lack of respect for group members, even though some members had considerable experience in rice production. The leaders also practiced nepotism and put the interests of their family members ahead of other members in the group. They allocated lighter jobs to family members, whilst heavier jobs were assigned to non-relatives. However, little has been written in the literature about the lack of respect and nepotism and its potential impacts in relation to the adoption of technology. The study also found that the leaders also put their own interests ahead of the group and misused project income for their own benefits. This is similar with the work of Russell & Vidler (2000) who found that the collapse of a community action-planning project in Sri-Lanka was due to the poor attitudes displayed by the leadership of the project. They had apparently put their own interests ahead of the community group's interests and moreover; they accepted bribes from the people they were supposed to lead. The next section discusses the external factors that influenced the adoption-decision of the farmers.

### 7.7.3 External factors

This research identified five external factors that influenced the farmers' decision to adopt the rice-growing technology. These were: 1) government policy, 2) infrastructure development, 3) agro-climatic condition, 4) access to extension services, and 5) access to markets. Similar external factors have been identified in the literature (Akpabio & Inyang, 2007; Anderson & Feder, 2003; Binswanger, 1989; Cornejo et al., 2001; D'Emden et al., 2008; Doss, 2006; Grarner & Sharp, 2004; Jimenez, 1995; Kurlalova et al., 2006; Langyintuo & Mungoma, 2008; Mansuri & Rao, 2003; Sunding & Zilberman, 2000; Zeller et al., 1998). The following sections discuss the influence of these factors in detail.

#### *Government policy*

This study found that government policy was one of the most important factors that influenced the farmers' initial decision to grow rice. The government policy on rice production was designed to overcome some of the negative characteristics of the technology

such as complexity, resource intensive and risky. The incentives provided under the policy included: 1) the provision of capital and variable inputs, 2) the provision of a labour subsidy, and 3) the formation of a community group to grow rice. These policy initiatives are consistent with those reported in the literature (Cooper & Keim, 1996; Dorward, 2009; Grarner & Sharp, 2004); Harrigan, 2008; Just & Zilberman, 1986; Kurlalova et al., 2006; Mansuri & Rao, 2003; Stoneman & David, 1986). Other policies, such as market support or price subsidies were not provided to farmers because the government believed that price support often transfers income from low-income consumers to wealthy farmers and does little to help farmers with below-average income because its benefits are distributed in proportion to sales.

The first element of the government policy that influenced the farmers' initial decision to adopt the rice technology was the promise t to provide capital and variable inputs to farmers. This finding is consistent with the work of Dorward (2009); Harrigan (2008); Just & Zilberman (1986); Stoneman & David (1986); and Sunding & Zilberman (2001) who all reported that the provision of input subsidies to farmers increased the profitability of their operations and reduced the risks associated with the adoption of a new technology. This in turn increased the rate of adoption of the technology.

The second element of the government policy that influenced the adoption of rice growing was government's promise to provide a labour subsidy to the farmers. The farmers saw this as a source of extra income, which they could use to pay for their household needs and also assist them to pay for their children's school fees. Little has been written about the influence of labour subsidies on adoption decisions in developing countries. However, research in developed countries by Cooper & Keim (1996) & Kurlalova et al., (2006) found that incentive payments were important in influencing farmers in the USA to adopt water conservation practices.

The third element of the government policy that influenced the farmers' initial decision to adopt the rice technology in 2007 was the community group approach. The adopters perceived this approach in a positive light because they believed that it would provide them with opportunities to acquire new knowledge and skills from experts within the group. Other studies by Camion et al., (1993), Granner & Sharp, (2004); Kegler et al., (1998) and Meinzen-Dick et al., (2002) also reported that a community group approach has the potential for pooling the abilities, expertise, and resources of numerous experts in the group together.

As a result, other members could be able to develop skills, knowledge, and attitudes that may be useful to them in the future. The farmers also perceived that working in community groups would reduce their workload because they would share the work. This finding is consistent with the concept of collective action reported by (Poteete & Ostrom , 2003).

However, failure by the government to implement these policies led to the adopters decision to discontinue the use of the technology in 2010. Orewa et al., (2009) found that poor policy implementation and delivery of inputs to farmers influenced their decision to discontinue the use of improved tomato seedlings project Nigeria. Similarly, Akpabio & Inyang (2007) also found poor policy implementation and delivery of inputs to aquaculture farmers were also responsible for the collapse of an aquaculture project in Nigeria.

In this study, despite the government's promise to deliver policies that would have overcome many of the negative characteristics of the technology, the majority of farmers decided not to adopt the technology in 2007. This was because they did not trust the government to deliver such policies. Little has been reported in the literature about the impact of trust on the adoption decisions of farmers in developing countries. However, in their studies in a developed country's context Finlay et al., (2004) and Stanley et al., (2000) found that government agents' failure to live up to their promises to land managers in Australia had contributed to a general feeling of distrust towards government extension agents by these land managers. Therefore, new technologies or practices driven by these agents might be viewed somewhat suspiciously by the land managers or farmers, hence potentially reducing their likelihood of being adopted. However, post 2007 when the project was implemented, the non-adopters observed that the government had failed to implement their policies and this confirmed that their initial decision in 2007 not to adopt the rice technology was the correct one.

***Infrastructure development***

This study identified that the village had a good road network and transport system and these influenced the adopters' decision to adopt the rice growing technology in 2007. The adopters believed that they could transport rice to market at a very low cost. Similar findings were reported by Binswanger (1989); Feder & Umali (1993); Jimenez (1995); Langyintuo (2008); Peterson (1997); Rahman (2003) and Vanclay (1992) who all reported that infrastructure

development which includes good roading and transportation systems play a key role in facilitating technology adoption.

Access to processing equipment was also found to have influenced the adopters' decision to adopt the rice technology in 2007. In 2007, the village had access to local rice processing equipment. Unlike in the 1990s, the rice from the Japanese funded rice project could not be processed locally and had to be sent to another island, which was costly to the group. Odogola (2006) also found that access to rice processing equipment was one of the important factors that influenced farmers to adopt rice growing in Uganda.

Despite the availability of the infrastructure, the non-adopters still decided not to adopt the rice technology because the quality of road and the transportation system had greatly reduced the cost and difficulty of transporting traditional produce to the market. As such, the non-adopters preferred to continue to grow local staple crops. This is in contrast to the findings in studies by Binswanger (1989); Feder & Umali (1993); Jimenez (1995); Langyintuo (2008); Peterson (1997); Rahman (2003) and Vanclay (1992) who all reported that infrastructure development which includes road and transportation systems play a key role in facilitating technology adoption.

***Agro-climatic conditions***

The agro-climatic conditions of the area also influenced the farmers' decision to adopt the rice-growing technology. It was found that these favourable agro-climatic factors such as: 1) the soil quality of the area, 2) rainfall, 3) sunshine hours, and 4) temperature were perceived by farmers to contribute to high rice yields and, therefore, it was expected that this would lead to improvements in food security and income. These findings are consistent with the studies by David & Otsuka (1990); Upadhyaya et al., (1990); and Ramasamy et al., (1992) who found that the agro-climatic environment, particularly rainfall, temperature and sunshine hours were the most important factor which influenced the adoption of rice growing in most Asian countries.

The non-adopters also perceived that the area had a suitable agro-climatic condition for rice growing. However, the non-adopters who had previous experience with other past government programmes and their agents did not adopt the technology because they did not trust the government and their extension agents to deliver on their policy initiatives. This finding confirms the view of Guerin & Guerin (1994) who reported that the lack of credibility

building by extension agents with farmers could result in the farmers losing trust and respect for the extension agents, and this could result in the non-adoption of a new technology.

***Access to extension support***

Access to extension services was one of the factors that influenced the farmers' initial decision to adopt the rice growing technology. It was found that farmers perceived that since they were located close to the provincial capital Auki, they would have good access to extension support services. This finding corresponds with the work of Anderson & Feder, (2003); Azilah, (2007); Von & Blanckenburge, (1982) who all reported that access to extension support services is an important factor that influenced the adoption decision of farmers. However, post 2007, when the project was implemented, the extension agents failed to deliver on farmers' expectations. This influenced the farmers' decisions to discontinue the technology in 2010. This finding is similar to a situation that occurred in Madagascar where farmers discontinued rice growing because the extension agents had failed to communicate with them information required to 'clear up' some of their doubts regarding the technology (Moser & Barrett, 2003).

Despite the advantage of having good access to extension services, the non-adopters did not adopt the technology because they did not trust the extension agents and the government to deliver on their promises. This finding confirms the view of Guerin & Guerin (1994) who reported that a lack of credibility building by extension agents with farmers could result in the farmers losing trust and respect for the extension agents, and this could eventually result in the non-adoption of a new technology. Similarly, Finlay et al., (2004) in a study on a developed country's context found that because of government agents' failure to deliver on their promises, this contributed to a general feeling of distrust towards government extension agents by the land managers in Australia. Post 2007, the non-adopters' confirmed that their earlier perceptions about the extension service were correct.

***Market access***

In this study, market access was also found to be one of the external factors that influenced the farmers' decisions to adopt the rice growing technology in 2007. The Fiu Community Rice Project is located close to three expanding markets: Fiu village, Aligegeo School, and Auki town. It was also found that the increase in price of rice due to increasing demand from an expanding population also influenced the farmers' initial decision to adopt. These findings

are similar to others in the literature who reported that good access to markets was found to have influenced the adoption decisions of farmers (Akpabio & Inyang, 2007; Feder et al., 1985; Ransom et al., 2003; Zeller et al., 1998).

In contrast, the non-adopters identified that good market access for existing crops influenced their decision not to adopt the new technology. They made their decision even though knowing that there would also be good market access for the new crop. The farmers mentioned that there was a growing market for local staples in the area and therefore, they believed that these would provide a better source of income to their household than rice. This finding is consistent with the work of Phiri (2011) who found that good market access for the traditional maize crop was one of the factors that influenced most farmers in Mazabuka district of Zambia not to adopt the new cassava varieties introduced to the district. As such, it is not market access and demand for a new crop alone that is important, the market access and demand for existing crops is also taken into account by farmers when making decisions whether or not to adopt a new crop.

### 7.8 Summary

This chapter discussed the findings of this research relative to the existing literature concerning the factors that influenced the adoption decision of farmers. This study discusses and provides an example of an adoption decision that was discontinued after four years of adoption. Unlike the traditional adoption studies, which only looked at simple interactions, this study considered more complex interactions that occur in real life situations.

The result of the study identified that the perceived relative advantages of rice over current staple food crops that influenced the adoption decisions of farmers were: improved food security, improved income, early maturity of rice crop, improved palatability, and convenience. However, when some of these relative advantages failed to materialise, the farmers discontinued the technology in 2010. In contrast, the non-adopters did not perceive that rice would improve food security and incomes because they did not trust the government and the extension service to provide adequate support for the project to succeed. They also did not trust the leadership of the community group to manage the project successfully because they lacked the necessary skills, knowledge, and attitudes.

The study also found that despite rice being a complex crop, some of the farmers adopted it because of their previous experiences with the crop. They also expected the extension service

to provide input and train management in crop management, and group management. While the non-adopters also had experience in rice production, they did not adopt it because they did not trust the extension service to provide adequate support in terms of training required for the project to succeed.

The study also found that even though the community group approach is not compatible with the participants' normal method of farming, they adopted it because they have had prior experience with this approach. In contrast, the non-adopters did not want to adopt it because of their negative experiences with this approach. Observability was important for the non-adopter because the failure to witness any tangible benefits from the previous project convinced them not to adopt the technology post 2007.

The findings on the resource-use characteristics and the level of risk posed by the technology showed some interesting interactions. The technology has a number of negative characteristics (capital and variable intensive, labour intensive, and land using). However, the government had put in place a set of policies to overcome these constraints. Conversely, the other farmers did not adopt because they did not trust the government and the extension service to provide the support required to overcome these negative characteristics. The farmers' distrust towards various institutions (for example the government's inability to deliver effective policy, the lack of capability of the extension service to provide effective training, and the incompetence of community group leadership team to provide effective management) resulted in their decisions not to adopt the technology.

The results of the study also found that there was an interaction between farmer characteristics and the characteristics of the technology – One of the participants (of old age) did not adopt the technology because he considered it labour intensive. However, another did adopt it because he had developed a strategy that allowed him to overcome this negative aspect of the technology. Similarly, although the technology was complex and most of the farmers have a low level of education, they adopted because they had previous experience with rice growing and believed that with support from the extension service, complemented by the community group approach (where expertise would be shared), the issue of complexity could be overcome. In contrast, the non-adopters' previous experiences confirmed that they could not trust the government, extension service, and leadership to manage this complex technology effectively.

The on-farm characteristics were all positive for adoption, but these were negated by factors such as the lack of knowledge and skills in rice production, group management, and leadership attitudes by the leadership of the FCRP. Culture had a positive impact on the adopters, but for the non-adopters there was a technology characteristic interaction – the labour intensiveness of the technology was perceived in a negative light as it would have limited the time they would have available to enjoy other cultural activities.

There was an interaction between leadership attributes and support from the extension service. The adopters believed that the extension service could provide training to overcome the leadership limitations. Previous experiences ( farmers' characteristic) suggested to the non-adopters that this would not be the case. Several external factors (infrastructure, access to extension and market access) were all positive for the adoption of the technology, however, for the non-adopters, this was overcome by external factors such as poor implementation of policy by the government, the characteristics of the technology (resource use and risk), distrust of the extension service, and distrust towards the leadership team.

# CHAPTER 8

# CONCLUSION

## 8.1 Introduction

In 2006, in an effort to reduce rice imports, the Solomon Islands Government initiated the National Rural Rice Development Programme (NRRDP) implemented by the Rice Section of the Ministry of Agriculture and Livestock aimed at promoting the adoption of rice growing by farmers. This programme was designed to improve food security through a reduction in the country's dependence on rice imports. The objectives of this research were to identify and describe the factors that affected the adoption of rice growing by farmers. In this chapter, the conclusions from the study are provided. The implications of the research findings for the Ministry of Agriculture and Livestock, Provincial Agriculture Divisions, community leaders, donor agencies and local farmers are discussed. The methodology is then evaluated and areas for future research are highlighted.

## 8.2 Summary of the main research findings

The study identified that the decision related to the adoption of rice, as a new crop was notably different compared to most other studies in two distinct ways. First, the new crop was to be grown by a community group as opposed to individual farmers. This meant that issues such as the management and leadership of the community group were important-factors that are not relevant when an individual farmer grows a new crop on his own land. Second, where the adoption of a new crop is concerned, farmers tend to consider this as a substitution problem. That is, they consider if they are better off substituting a hectare of the new crop for a hectare of their old crop. In this instance, the substitution did not occur through land use, but rather through the substitution of labour. The farmers had to give up time spent on their own crops and other food and income generating activities to free up time for rice growing.

This study found that farmers in the Fiu village considered local food crops more favourably, not only in terms of their ability to provided food, but also as an important source of income that could be used to buy essential goods and services.

The factors that influenced the adoption of rice growing could be classified into technology, internal, and external factors. However, the influence of these factors on the adoption decision of the farmers was context dependent. As such, a particular factor might be important to one farmer, but irrelevant to another farmer from within the same community. Before making the decision to adopt, farmers compared the characteristics of rice to those of local staple crops, because they would substitute time growing local staple crops for time spent growing rice if they adopted.

The main characteristics of the rice technology that influenced its adoption is relative advantage. The relative advantage factors included: improvement in food security, improvement in income, early maturing of the rice crop, palatability, and convenience in terms of preparation and cooking. While technology was not compatible with the traditional farming systems used by the community, the adopters were willing to ignore these problems because of the relative advantages provided by the technology. Rice production is also complex compared to the local staple crops. However, because the majority of farmers had previous experience with community-based rice growing, this complexity was not seen as a problem by the adopters. Government's assurance in providing extension support to overcome this problem was instrumental in adoption. However, post 2007 when the government and the extension service failed to provide adequate support and the committee members failed to provide good leadership, many of the relative advantages above did not eventuate and after four years of persistent crop failure, the farmers decided to discontinue the project in late 2010.

Despite these relative advantages, the non-adopters did not adopt the rice technology in 2007 because they believed that they would be better off in terms of food security and income by growing their traditional staples crops, and being involved with fishing, rearing pigs, and weaving baskets. Furthermore, the non-adopters did not trust the government and the leadership of the project to manage the project effectively.

The resource use and risk-characteristics of the rice technology were also important factors that influenced the adoption decisions of farmers. The adopters identified that while rice is capital, input, and labour intensive, land-using, and risky, they adopted the technology in 2007 because the government had promised to provide support (provision of capital, variable inputs, a labour subsidy and community group approach, pesticides and fungicides) that

would counterbalance the negative aspects of the technology. Because the government failed to deliver much of this support, this led to crop failure from 2008 to early 2010 eventually resulting in adopters' decisions to discontinue the technology in late 2010.

The non-adopters also identified that the rice technology was capital, variable input, and labour intensive, land using, and more risky than the local staple crops. Although the government had promised to provide support to counter balance the negative aspects of the technology, the non-adopters did not trust the government to deliver on its promises. The performance of the project through the period 2007 – 2010 confirmed the non-adopters expectations.

The internal factors that influenced the farmers' initial adoption decision were: the personal characteristics of the farmer, on-farm factors, and cultural factors. The key personal characteristic that influenced the farmers' adoption decision was the farmers' previous experience with rice growing. As a result, the adopters knew how to grow rice and this influenced their decision to adopt. Furthermore, the adopters decided to adopt the rice technology because the government had promised to provide extension support in terms of training in the technology to overcome the issue of complexity.

The previous experience of the adopters had an important influence on their adoption decision. Importantly, it was their previous experience with the technology, community groups, and government agencies that influenced their decisions. In contrast, to the adopters, the non-adopters' previous experience with rice growing had a negative influence on their decision. They perceived that rice growing involved a lot of activities and required specialist knowledge and skills to manage it successfully. Although, the government through the extension agents had promise to provide training and inputs to the project to overcome these limitations, these farmers still did not have faith in the extension service to deliver on its promises. At the discontinuance of the technology in the middle of 2010, the non-adopters expectations were proved correct.

The non-adopters mentioned that their previous experience working with community groups also affected their initial decision not to adopt the rice technology in 2007. They had mentioned that there were often conflicts within the community group (between members and their leaders) when they were involved in a project during the 1990s. There was also a lack of cooperation between members within the project. As a result, these farmers believed that their community could not work together on a commercial project.

The non-adopters stated that in the past, the government has made numerous promises through their agents (the agriculture extension and fisheries officers), but they had often failed to deliver on these promises. This has led to a general feeling of distrust towards government policies and their agents such as agriculture extension officers.

Age influenced one farmer's decision not to adopt the rice technology. This study revealed that technologies that are labour intensive and require arduous physical labour are avoided by older farmers. However, one older farmer did adopt the technology, because within a community group project, he could obtain a position that did not require arduous and physical labour. This instance showed how an individual could overcome the negative characteristics of a technology through the development of a suitable strategy.

The on-farm factors that emerged as important for the adopters were: the proximity of the farm to the farmers' households, the location of the farm on land free of dispute, and the location of the farm close to a reliable water source. However, these advantages were outweighed by other disadvantages in the case of the non-adopters. The key cultural factor that influenced the adopters' decision to adopt was the role rice plays as a main food source during cultural activities such as feasting and customary ceremonies. In contrast, the non-adopters mentioned that one of their reasons for not adopting the rice technology was that rice was labour intensive, and therefore, this would limit the time they had available for attending cultural and other village-based activities.

Because the technology was adopted through a community group project, factors associated with the community group were important for the adoption decision. The farmers perceived that the leadership of the project had limited skills and knowledge in rice growing, community group management, and they displayed poor attitudes toward group members. However, the farmers who had good knowledge and skills in rice growing identified that these limitation did not affect their decision to adopt the rice technology. This was because the adopters believed that with the training and inputs that the extension agent would provide to the project leaders, these problems could be overcome and the project would be successful. However, when the project was implemented post 2007, it was found that these leaders lacked the requisite knowledge and skills in rice production and also in group management. This led the adopters' to discontinue the technology in 2010.

The non-adopters most of whom had previous experience with the previous community rice project in the 1990s perceived that the FCRP leadership lacked both technical knowledge on

rice growing and skills in community group management. They also reported that the FCRP leadership had the wrong attitudes towards the successful implementation of the project. Although the government through the extension agent had promise to provide training to the leadership of the FCRP to overcome these limitations, the farmer still did not adopt the technology because they did not believe that the government would deliver on this promise.

The external factors that were important in influencing the adoption of rice were: government policy, infrastructure development in the area, agro-climatic conditions, and access to extension services and markets. The government policy that influenced the initial decision of farmers to adopt the rice technology included: the provision of capital and variable inputs to farmers, a labour subsidy and the use of a community approach to rice production. However, the government did not provide price support to the farmers. Infrastructure, such as good quality roads, a reliable local transportation system, and access to processing equipment, were also important factors. Favourable agro-climatic condition, access to extension services and markets were three other important factors that influenced the farmers' decision to adopt the rice technology in 2007.

The poor implementation of policy by the government however, influenced the farmers who had earlier adopted the rice technology to discontinue it in 2010. This was mainly due to government's failure to deliver the capital and variable inputs it had promised.

Despite the availability of most of the external factors (government support, roads and transportation, suitable agro-climatic conditions, access to processing equipment, the extension service and markets) conducive for the adoption of rice production in 2007, the majority of the farmers in the Fiu community did not adopt it. This was primarily because the non-adopters did not trust the government to deliver inputs to the Fiu community rice project and because they did not believe the leaders of the project had the skills, knowledge and attitudes to implement the project successfully. The failure of the government to deliver inputs to the farmers over the period from 2007 to 2010 and the leaders' inability to manage the project effectively confirmed that their decision not to adopt the rice technology was the correct one. Interestingly, the quality of the roads, access to local transportation and markets were also important factors that influenced the non-adopters decision not to adopt rice. This was because these factors ensured a good source of income from the sale of their local staple crops and this was another factor that convinced them not to switch to rice production.

### 8.3 Implication of the findings

The findings from this research have implications for the Ministry of Agriculture and Livestock; Provincial Agriculture Divisions, Community project leaders, donors' agencies, NGOs, and local farmers.

The Ministry of Agriculture and Livestock should ensure that funds must be available before a national programme such as the NRRDP is implemented. This is important because the availability of fund would enable the successful implementation of such a capital and labour intensive programme. The availability of funds would also enable the ministry to purchase and distribute the needed inputs required by farmers in a timely manner. This would address the lack of confidence and trust that the farmers have in the governments' ability to deliver on its policy commitments.

This research suggested that the Ministry of Agriculture and Livestock, Provincial Agriculture Divisions, NGO, and donors should take into account the characteristics of farmers within the community when planning similar projects. Farmers are more likely to adopt technology if they are dependent on that technology for their livelihood, if the technology is compatible with their farming practices, and if it is suited to their cultural practices.

To ensure the success of community rice projects, the Ministry of Agriculture and Livestock and Provincial Agriculture Divisions in collaboration with the community should facilitate the selection of the right leaders and ensure they have the right skills, knowledge, and attitudes to implement such a project successfully.

The Ministry of Agriculture and Livestock and the Provincial Agriculture Division should provide ongoing training on the specific areas of rice production and group management. The provision of such training would help enhance the knowledge and skill of leaders to manage similar community projects successfully.

The Ministry of Agriculture and Livestock in collaboration with the regional extension agents should set up a better monitoring and evaluation system to ensure that leaderships of the community project are transparent, accountable, and fair in their dealing with members of the community project.

The Provincial Agriculture Division and the leaders of the community rice project should consider allowing time for cultural and social activities in their planning of the community

rice project work programme. Farmers value these activities and by allowing time for them to attend to these it is more likely that they will join the community group.

### 8.5 Evaluation of the methodology

A single case study approach was used to achieve the objectives of this study. This approach was selected because it was appropriate for identifying and describing the factors that have influenced rice adoption, in the Fiu village of Malaita Province. A single case study was preferred for this study because of the need for an in-depth understanding of the farmers' adoption decision process. A multiple case-study method is useful for this type of research because it allows the researcher to compare results across case studies to achieve the intended richness in information.

The Fiu Community Rice Project was selected as a case for this study because it is the only project in the Malaita province established under NRRDP that was still operating during the data design stage in 2009 and early 2010. In addition, the project was located in an area that was safe for the researcher to obtain the required information given the resources, money, and time available; and the proximity and ease of access with respect to contacts; and the existence of roads and transport to the study site.

The data collection for this research was carried out between June and July 2010, in the Malaita Province of the Solomon Islands. The researcher learnt that these months are not suitable for the collection of data because they coincided with the Solomon Games, where athletes from the eight provinces of the country come together to compete in various sports organised in the Malaita provincial capital Auki and also in the surrounding villages close to the provincial capital. The Fiu village hosted some of these games in particular rugby and soccer. This made it difficult for the researcher to find farmers at home to schedule time for interviews. It is recommended that for future studies, researchers should first of all find out if there were any farming, cultural or sporting events that would limit access to farmers before the actual collection of data takes place. It is also recommended that data collection be separated into two phases, which could allow the researcher to reflect on the data from the first series of interviews before undertaking the second. Sufficient time should also be allowed for each phase.

Primary and secondary sources of data were used in gathering relevant information for this study. This research employed semi-structured interview to collect relevant data because it is

an effective tool for collecting the data, as it allowed the respondents to express their views and perceptions clearly and freely without due influence by the researcher. Audio recording was also useful because it helped capture and store data for detailed analysis; and it is therefore highly recommended for the future research. Consent must be sought from respondents before the recording of the interviews can be done and this is recommended for future research.

The data was collected and analysed using a qualitative data analysis technique. The process the researcher used in analysing the data includes: describing, classification, and connection. This process allowed the researcher to identify new and different factors that influenced the farmers' decision either to adopt or not to adopt the rice technology.

### 8.6 Limitations of the research

The collection of data in the Solomon Islands was not easy. A number of limitations were experienced during this study. Limited secondary data was available to the researcher. Reliability of the available secondary data on Solomon Islands agriculture was an important limitation. It was also very difficult to access data from government officers as they were reluctant to give interviews and provide data required for the study. However, this limitation was minimized by the researcher being able to convince reluctant respondents and accommodating them according to their requirements. There was also limited time and money available to complete this research.

### 8.7 Future research

This research identified a number of areas which new research should focus on in the future. Future research should investigate a successful and an unsuccessful case to identify factors that are important for the successful operation of a rice-growing community group. Such a study may need to be undertaken in another country because of the challenges associated with policy implementation in the Solomon Islands.

This study investigated the complex interaction of factors that influenced adoption decision of a community group compared with the traditional adoption studies, which looked at a simple factor approach. Future research should therefore investigate individual farmers' decisions in much more depth to find out the process by which they made their decisions, and the importance of the various factors that influenced those decisions.

This research identified three leadership characteristics, which influenced the non-adoption of rice growing technology by the farmers. These three attributes were lack of knowledge and skills in rice production, group management and poor leadership attitudes. Future research should also investigate more than one case to see whether the same leadership attributes are found in other unsuccessful cases of community rice projects.

This study investigated a case of a new crop adoption through a community group in a developing country with the aim to reduce dependence on imported food (rice). Future studies should investigate cases that are more successful and to compare and contrast these with the adoption of rice where it is targeted at individual farmers.

Future research should replicate this study by investigating another case in a different province to see if similar results are found. Furthermore, if time and resources are available, future research could focus on conducting multiple cases to compare and contrast factors that influence farmers' decision either to adopt or not to adopt the rice technology.

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**APPENDIX 1: QUESTION GUIDE**

**A. QUESTIONS GUIDE FOR KEY GOVERNMENT RICE OFFICERS**

1. What is your name? : _____

2. Age Group: 20-30 Years 30-40 Years 40-50 years

50-60 years 60 over

3. Education level: Primary…… Secondary: ……. Tertiary: ……

4. Special agriculture training? _____

5. Sex: Male Female

6. a. How long have you been involved in agriculture?

b. How long have you been involved in rice industry?

7. What are your major responsibilities within MAL?

8. How long have you been involve in the NRRDP?

9. Were you involved in the formulation of the NRRDP?

10. How is the programme implemented?

11. What are the expectations of the NRRDP?

12. Are these expectation met?

13. What are the expectations for the NRRDP in 5 years time?

14. What are the expectations for the NRRDP in ten years time?

15. How do you promote the NRRDP to farmers?

16. How does a community qualify for rice project?

17. Why did NRRDP target communities farming groups?

18. Why did NRRDP not targeting individual farmers?

19. Do you think farming communities are interested? Why? / Why not?

20. What do you think are the major community problems facing growing rice in a group?

21. How close are relationship between (NRRDP staff) and the general extension officer?

22. What is the role of the provincial extension officers in the NRRDP?

23. How often do extension agents have contact with the rice farming communities?

24. What are the major problems of NRRDP progress?

25. Why do you think farmers are growing rice?

26. Why do you think farmers are not growing rice?

27. What are the major problems facing rice farmers?

28. How often did the NRRDP officers evaluate farmers' rice projects?

29. Can any improvements be made to the NRRDP programme?

30. How do you see the NRRDP now?

31. How do you see rice growing in 5 years time?

32. How do you see rice growing in 10 years time?

33. Do you think rice industry will grow if individual farmers grow rice?

34. How do you see the future of rice industry in the Solomon Islands?

a. 5 years

b. 10 years time?

35. What are the major problems facing rice industry in the Solomon Islands?

**A. QUESTIONS GUIDE FOR FARM LEADERS OF THE FIU PROJECT**

1. What is your name? : _____

2. Age Group: 20-30 Years 30-40 Years 40-50 years

50-60 years 60-70 Years

3. Education level: Primary Secondary Tertiary

4. Specify any other courses you have completed in Agriculture? _____

5. Sex: Male Female

6. Do you have any experience in Agriculture?

7. Do you have any experience in rice farming?

a. How many years?

8. How did you find out about the NRRDP?

9. How did your community know about the NRRDP?

9. Were you involved in the initial stage of applying for this rice project?

10. How did you get involved in this project? Why?

11. Why did you apply for this project?

10. Explain the steps you went through to apply for this project?

11. What were your group's strengths that convince MAL to approve your proposal?

12. Is the soil quality good for rice growing?

13. Is rainfall in your adequate for rice growing?

14. Is temperature good growing rice?

15. Do you have available water?

16. What other strengths did your group have that help convince NRRDP?

17. How many farmers are involved in the project?

18. How do you recruit farmers to join this project?

19. Tell us about your management structure?

20. Who is making the overall decisions for the project? Why?

21. How often do you have meetings with your group members?

22. How are farm activities organized between members?

23. How do you manage to keep farmers together?

24. Did you send any of your members for rice training?

25. What are the problems related to managing your members?

**Production**

1. What is your annual production target?

2. Are you achieving your target? Why? / How?

3. What production problems have you faced during your 5 years of operation? (Rank top five problems)?

4. Rice production over the five years of operation?

| Years | Rice Production in tones | | Price/kg |
|---|---|---|---|
| | Kg consumed by members | Kg sold in the markets | |
| 2006 | | | |
| 2007 | | | |
| 2008 | | | |
| 2009 | | | |
| 2010 | | | |

**Technology**

1. What capital items are provided by the NRRDO to your project? (List them)

2. How do you use these capital items?

3. How do you manage these items?

4. What production inputs are provided by the NRRDP to your project? (List them)

5. How do you use these inputs?

6. How do you manage these inputs?

7. What irrigation equipments did you received from the NRRDP? (List them)

8. Do you know how to use the irrigation equipment?

9. How did managed the irrigation system?

10. How are these assistance changes over time?

11. Do these production inputs help you accomplish your production goal?

12. How did the capital items assist you to accomplish your production goal?

13. In what ways has the technology helped create jobs for people?

**Characteristic of the rice technology**

1. What benefits did you get from growing rice?

2. How appropriate is rice farming in your traditional farming system?

3. How easy is growing rice?

4. Is it cheap for an individual farmer to grow rice?

5. What type of rice variety is grown on the farm?

6. Is it resistance to pest and disease infestation?

7. Is it high yielding?

**Social and situational factors**

1. Did your family influences your decision to grow rice?

2. How is your relationship with members of the community?

3. How effective is social networking in your community?

**Economic factors**

1. Does your access to roads influence your decision to grow rice?

2. Do you have transport to carry your rice to the market?

3. Do you have access to the market?

4. Are you happy with the current size of the rice farm?

5. How has the size of rice farm contributed to your income?

**Institutional factors**

1. Do you think the government rice policy motivates you to grow rice?

2. Have you had access to any credit facilities?

3. How often do you have contact with the provincial extension and the NRRDP staffs?

4. How good is your working relationship with the extension and the NRRDP staff?

5. How did they evaluate your project?

**Farm Finance**

1. Source of finance for the Fiu rice project.

| **Source** | **Amount (S.I $)** | **Unpaid amount** | **Purpose** | **Year** |
|---|---|---|---|---|
| Saving | | | | |
| Subsidy | | | | |
| Grant | | | | |
| Loans | | | | |
| Shares | | | | |
| Others | | | | |

2. Do you have annual budget?

3. Do you have an official accountancy record?

4. Do you think the project is making profit? Explain?

**Marketing**

1. Where did you polished your rice after harvesting?

2. How far is the distance from the farm to the polishing machine?

3. Who owns the polishing machine?

4. How far is the market from your storage facility?

5. How did you transport the product to the market?

7. How are you selling your rice product?

8. Are you doing any packaging? Explain?

9. Who do you sell your rice to?

10. What is the price for 1 kg local rice compared to 1kg imported rice?

11. How do you see the future market for locally produce rice?

**NRRDP's Future**

1. What are the major problems and difficulties the FIU rice project faced over the last few years?

2. What should the government do improve rice production in the rural area?

3. How do you see this project now, in 5 years time and in 10 years time?

4. How do you see rice farming now, in 5 years time and in 10 years time?

## B. QUESTIONS GUIDE FOR ADOPTERS

1. What is your Name: _____?

2. Age Group: 20-30 Years 30-40 Years 40-50 years

50-60 ears 60-70 Years

3. Education level: Primary Secondary Tertiary

RTC No Education

4. Specify any other courses you have completed in Agriculture? _____

5. Sex: Male Female

6. Do you have any experience in Agriculture? How many years?

7. Crops grown commercially?

| **Crops** | **Harvested area** | **Yield per harvest** | **Price /kg** |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

8. What are the major problems you have encountered while growing these crops? (List top 5)?

9. How are you dealing with these problems?

10. What was your total annual income from growing these crops?

11. Do you have any experience in rice growing? How many years?

12. How did you find out about this project?

13. How were you recruited into the project?

14. Why did you decided to adopt rice growing and join the project?

16. What is your expectation for joining this project and adopting it?

15. How long have you been involved in the project?

16. Is it difficult to grow rice?

17. Is it different from growing local staples?

18. Would you grow rice as an independent farmer? Why?

19. Do you like the taste of local rice?

20. Is it different to imported rice?

21. Which one do you prefer?

**Social and situational factors**

1. Did your family influences your decision to grow rice in group?

2. Did social networking influence your decision to grow rice?

3. How is your relationship with your project members?

4. How is your relationship with the appointed leader of the project?

5. Did access to rice seed motivate you to join the project?

6. Did access to rice fertilizers and pesticides influence you to grow rice?

7. Did access to spades, wheel barrows and digging forks motivate you to grow rice?

8. Did access to fuel and lubricant influence your decision to grow rice?

**Economic factors**

1. Did access to the market motivate you to grow rice?

2. What are the benefits from growing rice? List them

3. Does growing rice contribute to your income level?

4. Does growing rice contribute to employment of any members of your family?

**Institutional factors**

1. Did access to credits motivate your decision to grow rice?

2. Did the labour subsidies influence your decision to grow rice?

3. Did the access to information influences your to join the project?

**Projects future**

1. What are the difficulties you faced when growing rice?

3. How did you managed to cope with the difficulties you have faced until now?

4. Did your goal of joining the project achieved? Why?

5. How do you see your future participation in this project?

6. How do you see rice growing now, in 5 years time and in 10 ten years time?

**C. QUESTIONS GUIDE FOR NON-ADOPTERS**

1. What is your Name? _____

2. Age Group: 20-30 Years 30-40 Years 40-50 years

50-60 years 60-70 Years

3. Education level: Primary Secondary Tertiary

RTC No Education

4. Specify any other courses you have completed in Agriculture? _____

5. Sex: Male Female

6. Do you have any experience in Agriculture?

7. What crops do you grow for market?

| **Crop Grown** | **Area** | **Yield per harvest in kg** | **Price** |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

8. What are the major problems you have encountered while growing these crops? (List top 5)?

9. How are you dealing with the problem?

10. What was your total annual income for growing these crops?

11. Have you had experience in growing rice?

12. Why are you not interested in growing rice? (Rank top six problems?)

**Social and situational factors**

1. Did your family influences your decision not to grow rice?

2. Who assisted with labour towards growing those crops?

2. How active is your community networking?

3. Have you involved in any group that farms these other crops rather than rice?

4. How effective is your group relationship?

3. Is lack of access to information influences your decision not to grow rice?

**Economic factors**

1. Do you have access to road?

2. Do you have access to transport?

3. Do you have access to market?

4. How does rowing cocoa contribute to your level of income?

5. How does growing these crops listed above contributed to employment of family members and the community? Explain?

**Institutional factors**

1. Comments on the agriculture policy?

2. Comments on the rural rice policy?

3. What should the government do so that you start growing rice?

Environmental Factors

1. Is the soil quality in your area not good for rice growing?

2. Is climate in your area not suitable for growing rice?

3. Do have access to water in your area?

4. Do you have on irrigation system?

**Extension agents**

1. Do you meet the National and Regional rice officers?

2. Have you had any advice from them regarding the crops you grow?

   a._____

   b._____

   c._____

   d._____

3. Is there any advice on rice growing by these officers?

4. Please indicate the plant protection service you get from regional extension agents and the expense you have to incur for each crop type?

| 1. Types of service | 2. Purposes | 3. Expense/crop type (SI$) |
|---|---|---|
| a---------- | ---------- | ---------- |
| b---------- | ---------- | ---------- |
| c---------- | ---------- | ---------- |

d---------- ---------- ----------

5. Could you list the changes adopted on the farm as a result of extension agent's advice?

a.----------

b.----------

c.----------

**Farm Finance**

1. Source of finance to your farm.

| **Source** | **Amount (S.I $)** | **Unpaid amount** | **Purpose** | **Year** |
|---|---|---|---|---|
| Saving | | | | |
| Subsidy | | | | |
| Grant | | | | |
| Loans | | | | |
| Shares | | | | |
| Others | | | | |

2. Do you have annual budget?
3. Do you have an official accountancy record?
4. Do you think the farm is making profit? Explain?

**Marketing**

1. How do you sell your produce?

2. Which nearest market did you sell your produce to?

3. Distance to the biggest market from the your farm ---------- Km

4. How did you transport your produce to the market?

5. How do you see the future market for your produce?

**Future of the Farm**

1. How do you see your farm now, in 5 years and in 10 years time?

2. How do you see rice growing now, in 5 years and in 10 years time?

3. Do you consider growing rice now, in 5 years and in 10 years time?

## APPENDIX 2: Ethics Approval Letter

MASSEY UNIVERSITY

7 May 2010

Simon Bacte
Flat A
106 Linton Street
**PALMERSTON NORTH**

Dear Simon

**Re: Challenges Facing the Adoption of Rice Farming in the Solomon Islands**

Thank you for your Low Risk Notification which was received on 6 May 2010.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

**A reminder to include the following statement on all public documents:**

> *"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*
>
> *If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".*

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

J. O'Neill

John G O'Neill (Professor)
**Chair, Human Ethics Chairs' Committee and**
**Director (Research Ethics)**

cc Dr Elena Garnevska
Institute of Food, Nutrition and Human Health
**PN452**

Prof Richard Archer, HoI
Institute of Food, Nutrition and Human Health
**PN452**