Division of Humanities

Department of Social Sciences

The Effectiveness of Extension Services provided by OPIC for the production of oil palm to Smallholder growers in Hoskins, West New Britain Province.

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This thesis is presented for the Degree of Master of Philosophy in Social Science

Curtin University of Technology

July 2012

STATEMENT OF DECLARATION

This thesis contains no materials which have been accepted for the award of my other degree or diploma in any university. To the best of my knowledge and belief, this thesis contains no materials previously published by any other person except where due acknowledgement had been made.

Candidate.....

Senny Kapia-Mendano

Date...../...../.....

ACKNOWLEDGEMENT

This dissertation would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

First and foremost, my utmost gratitude to all oil palm growers who have shared their knowledge, ideas and experience with me. I am grateful and honoured to have experience being part of the oil palm community in West New Britain and I would like to express my gratitude for their assistance. I thank the Anias and Kalaivi families for their hospitality for two months including Regina Anias at Daliavu Plantation for housing me for two weeks prior to my field work. I thank David Naon, Hossaiah Sule, Carl Tuoro, Aisolie, Evelyn and Elizabeth Rava, Leah Anias, and Joan Vilang for assisting me during my field work. I acknowledge Pauline Hoare and the staff of PNGOPRA for material support and for transport from DAMI to Kimbe every Friday. I will never forget Samuel Kapia for his assistance and inspiration as I overcame the obstacles in the completion the fieldwork on the time scheduled.

I am grateful to my supervisors, Professor George Curry and Dr Gina Koczberski for attending to my needs and for their unselfish and unfailing support. I sincerely appreciate their encouragement and advice during the process of writing the thesis and for comments on the draft chapters. I am thankful to Dr Gina Koczberski for her patience, motivation and inspiration she gave and the task of guiding me through the research work.

Not least of all, I am grateful to my family in PNG for their support through their prayers and their desire to see me progress in life. Also I acknowledge Jamie and her dad for their love, patience and the unfailing support throughout the course of my study.

I would like to thank friends who have helped me one way or the other whose names I do not mention.

This research project was undertaken with the financial support of a Curtin Strategic International Research Scholarship (CSIRS) funded by Curtin University through the Research and Development office. I thank the staff for their support. Also, I would like to thank the Scott Kimpton research grant for the fieldwork grant I received.

Above all, I thank the source, God Almighty for wisdom, knowledge and understanding. In Him all things were made possible.

Senny Kapia-Mendano
July 2012

ABSTRACT

In Papua New Guinea, oil palm is regarded as a crop with great economic importance and is now the dominant export cash crop in terms of export revenue. It is grown in six provinces in PNG which are Hoskins and Bialla in West New Britain Province, Popondetta in Oro Province, Higaturu in Milne Bay Province, Poliamba in New Ireland Province and Ramu in Madang Province. The study examined the effectiveness of OPIC extension services provided to smallholder oil palm growers in Hoskins. The research included growers in the Hoskins land settlement scheme (LSS) and village oil palm (VOP) growers in the Hoskins project area. The LSS subdivision studied was Buvussi and the VOP subdivisions were Bubu and Lilimo. The main purpose of the study was to identify the factors hindering smallholders' productivity on oil palm as their production (tonnes per hectare) was considerably below the estate plantations managed by the company. To investigate smallholder production, factors such as smallholder block population, education levels of grower families, leaseholder status, type of production strategy, adoption rate of extension messages and productivity were investigated. The study used both qualitative and quantitative methods to investigate these aspects of smallholder production and extension.

The findings of the study indicate that there was low extension contact between the extension officers and smallholders with most visits because of sexava infestations. The low ratio of extension officers to blockholders was a factor in limiting OPIC (the extension agency) capacity for block visits. The majority of blockholders received their extension information through their visits to the OPIC office. However, the study revealed that the majority of blockholders were knowledgeable about oil palm and had excellent management skills on oil palm production. The study revealed that the education level of children in secondary households was adversely affected as priority was given to children in primary households.

Due to population and income pressures, the single household block has been replaced with multiple household blocks and this has led to changes in the production strategies pursued on blocks. The harvesting strategy has shifted from the traditional

harvesting method (*wok bung*) to *makim mun, skelim hecta* and some blocks practising a mixture of all three strategies. However, *wok bung* was found to be the most productive method of harvesting in terms of tonnes/ha/year. The study also found that population and income pressures have influenced blockholders' decision-making process to adopt extension messages on fertilizer and replanting, thus there was low adoption levels. The low level of fertilizer application was due to increases in fertilizer prices over the last five years and also was due to disputes over block management which has led to falling productivity. The *makim mun* strategy of harvesting was also found to have an influence on adoption. However, reluctance to replant was because most blockholders were ferarful of debt accumulation and financial constraints due to loss of income after replanting.

Therefore, the study recognised that smallholders' low production was not due to lack of knowledge and skills on oil palm but was due to stresses associated with rising population pressures, together with the ineffectiveness of extension services provided by OPIC to smallholders.

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ABBREVIATIONS

ADB	Agricultural Development Bank
CIC	Coffee Industry Corporation
CBO	Community-Based Organisation
DAL	Department of Agriculture and Livestock
DASF	Department of Agriculture Stock and Fisheries
DPI	Department of Primary Industry
ENBP	East New Britain Province
ESP	East Sepik Province
FFS	Farmer Field School
FPDA	Fresh Produce Development Agency
FTC	Farmer Training Centre
IATP	Integrated Agricultural Training Program
IPM	Integrated Pest Management
LLG	Local Level Government
LSS	Land Settlement Scheme
NBPOL	New Britain Palm Oil Limited
NGO	Non-Government Organisation
OPIC	Oil Palm Industry Corporation
OPRA	Oil Palm Research Association
PAR	Participatory Action Research
PNG	Papua New Guinea
PNGCCEA	Papua New Guinea Cocoa and Copra Extension Agency

PRAP	Participatory Rural Appraisal Planning
PTD	Participatory Technology Development
RSPO	Roundtable Sustainable Oil Palm
SPSS	Statistical Package for Social Science
SSSPP	Smallholder Support Service Pilot Project
T&V	Training and Visit
VEW	Village Extension Worker
VOP	Village Oil Palm
WNBP	West New Britain Province

GLOSSARY

Agricultural extension services	Describes the services that provide rural people with the access to knowledge and information they need to increase productivity and sustainability of their production system and improve their quality of their life and livelihoods. It includes, but is not limited to the transfer of knowledge generated by agricultural research.
OPIC	Is the statuary body under the Oil Palm Industry Act, created in 1992 to provide extension services to smallholder oil palm growers. The vision of OPIC is to achieve a; prosperous, secure, healthy, educated and empowered communities, participating in PNG's success as a world leader in the production of sustainable oil palm. Also with a mission increase the productivity, production, profitability and sustainability of oil palm in PNG. OPIC is financed by smallholder crop levy of K3.50/tonne which is matched by oil palm companies. International aid funding also provided significant support for the organisation
PNGOPRA	Papua New Guinea Oil Palm Research Association is a research arm of oil palm industry in PNG. It began in 1967 when Dami oil palm research station in WNBP, when Dami oil palm research station was established by Harrison and Crosfields. Due to the expansion of the industry, OPRA was formed between the government, the plantations and the smallholder sector. It is financed by smallholder crop levy and plantation crop levy, government funding and its research projects are funded by external donors. The aim area of

	research includes agronomy, entomology, socio-economic studies and plant pathology. The primary aim of the research is to develop appropriate techniques and provide extension interventions that improves oil palm productivity in order to strengthen the economic and social well-being if the smallholder household.
RSPO	Roundtable Sustainable Palm Oil is a not-for-profit association with the objective of promoting the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders from seven sectors of the palm oil industry. These are oil palm producers, oil palm processors or traders, consumer goods manufacturers, retailers, banks and investors, environmental or nature conservation NGO and social or development NGO.

CHAPTER ONE

INTRODUCTION

1.0 Overview of the chapter

There are two distinct economies operating side-by-side in Papua New Guinea, the traditional and cash economies. The traditional sector, mainly subsistence and semi-subsistence farming, provides incomes and livelihoods to 81% of PNG's rural population in the range of K1,000-K1,200 per household/year (Bourke, 2012). In the period 1800-1920s, 90% of PNG exports were agricultural products such as copra and cocoa. In the 1950s, copra still accounted almost for 70% of all exports but declined in the mid 1970s, primarily due the collapse of the world copra market and to the expansion of cocoa and coffee and the mineral industry. Since the 1970s, agricultural commodity production has continued to decline as production of coffee, cocoa and copra shifted from plantation to smallholder production and further declined as the expansion of mineral and energy exports became a major source of overall export growth. In 2009, agricultural crops contributed 18% by value of PNG exports with minerals (gold, copper and crude oil) accounting for 74% of the value of PNG exports (Bourke, 2012). At a national level, oil palm has become the most significant export commodity crop in PNG. Oil palm is the only major agricultural export tree crop that has experienced continued growth since the 1980s (Bourke and Harwood, 2009).

This thesis is based on research conducted among oil palm smallholders in the Hoskins area of West New Britain Province (Figure 1.1) and examines the factors hindering the adoption by smallholders of agricultural extension, training and advice. In particular, the thesis evaluates the extension strategies used by the Oil Palm Industry Cooperation (OPIC) to increase the incomes and productivity of smallholders. OPIC was formed in 1992 as a quasi-government agency and is in charge of providing extension services to smallholder oil palm growers with the aim to increase production. It is financed by a smallholder crop levy of K3.00/tonne, which is voluntarily matched by the oil palm milling companies.

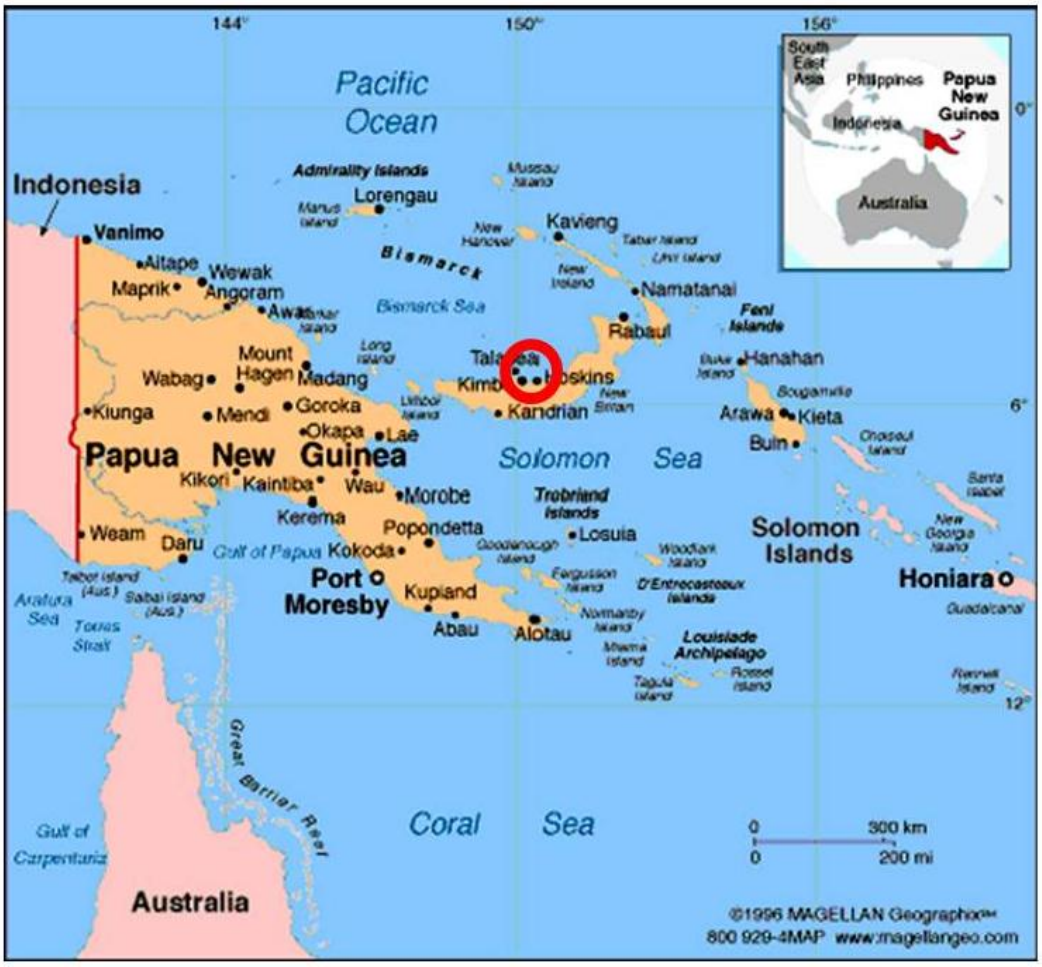

Figure 1.1 Map of Papua New Guinea showing the study site.
Source: (www.mapsofworld.com/papua-new-guinea**)**

In terms of oil palm production, there is great variation in the productivity among smallholders at Hoskins. There is a range of socio-economic and agronomic reasons for these differences including the abandonment of oil palm blocks, poor farm management, insufficient household labour, and inter-generational and family conflicts due to increasing population and economic pressure on blocks (Koczberski *et al*., 2001). Soil nutrient deficiencies, senile palms and pest and diseases are also factors implicated in low smallholder production. What is not known are the factors affecting the diffusion and uptake of extension and new technologies by oil palm farmers and its impact on production. This thesis aims to address this gap in our knowledge by examining the factors influencing smallholder uptake of extension advice and training. This chapter briefly presents a background of the oil palm industry in Papua New Guinea, the economic importance of oil palm to the economy and an overview of oil palm in West New Britain Province (WNBP), where the study

was located. The chapter also discusses the importance of extension services to smallholders and the factors limiting the effectiveness of extension. Finally, the thesis organisation is outlined.

Establishment of the Land Settlement Schemes (LSS) and Village Oil Palm (VOP) in WNBP

The LSS at Hoskins was established in 1968 following the acquisition of customary land and its conversion to state land for agricultural purposes (Koczberski and Curry, 2005). Settlers were recruited from the mainland of PNG and allocated 99 year agricultural state leases over blocks of 6-6.5 ha of land. When the LSSs were established, it was recommended 4 ha be planted to oil palm and the remaining land be reserved for gardening (Koczberski and Curry, 2005). The aim of the LSS was to resettle people from other parts of Papua New Guinea and to shift them from traditional subsistence farming to cash crop farming with the motive to increase export crop production. The establishment of the LSS at Hoskins was based on a nucleus estate model whereby the LSS was located next to a private nucleus plantation. The advantage of the nucleus estate model was such that the nucleus company supply smallholders with all necessary equipment essential for the production for oil palm. This included planting material, harvesting tools, fertilizer and the transportation of harvested oil palm to mills for crude oil extraction. Since the establishment of the LSS at Hoskins, the population of settlers has dramatically increased from an average of 8.6 persons per block in 1990 to 13.3 in 2000 (Koczberski *et al.*, 2001). The early settlers had high hopes and believed that if relocated to WNPB, they would live a happy life with their children having access to quality education, health services and possibilities of becoming wealthy growing oil palm.

As the Hoskins LSS became a success achieving its production targets soon after its development, it encouraged the government to establish a similar oil palm nucleus estate-smallholder scheme at Bialla. The Bialla LSS was established in 1972. An agreement was signed by the government and the Belgium/United Kingdom Company, Hargy oil palm (Koczberski and Curry, 2005). After the LSS was established at Bialla, the VOP scheme started and by the mid 1980s, 900 LSS and

110 VOP blocks had been established. This figure has increased to a total of 3,649 smallholders including both LSS and VOP as of December 2008 (Orrell, 2009).

Despite increasing population pressure on the LSS, the productivity of oil palm smallholders is low relative to the plantations. The company plantations have all the necessary management techniques and inputs required to maximise productivity. However, smallholders, rely largely on family labour, and are dependent on OPIC for extension training and advice (Koczberski and Curry, 2005). Extension services for smallholders were initially provided by Department of Primary Industry (DPI) and later was mandated to OPIC in 1992 (OPIC, 2009; Orrell, 2009). OPIC's vision is of prosperous, secure, healthy, educated and empowered smallholder communities all participating in PNG's success as world leaders in the production of palm oil. Its mission is to increase the productivity, production, profitability and sustainability of oil palm through direct communication with smallholders in delivering extension messages effectively (OPIC, 1992). Some of the main strategies to increase smallholder production are to improve block management and soil fertility through fertilizer application, and to provide training, and learning to promote integrated pest management.

1.1 Background to oil palm in Papua New Guinea

Oil palm is grown in six project areas in Papua New Guinea namely, Hoskins and Bialla in West New Britain Province, Popondetta in Oro Province, Milne Bay in Milne Bay Province, New Ireland in New Ireland Province and Ramu in Madang Province. All six projects are operated on a nucleus estate-smallholder model, whereby smallholders growing oil palm supply oil palm fruit to mills operated by estate companies. In WNB and Oro Provinces, smallholder oil palm production is located on state leased land on land settlement schemes (LSS) and on customary land in villages known as village oil palm (VOP).

The VOPs were established after the LSSs and were purposely established to encourage more involvement of the local villagers in the oil palm industry. Milne Bay, New Ireland and Ramu do not have LSSs, only VOP (Koczberski *et al.*, 2001). Presently, the total area under oil palm cultivation in PNG is 134,240 ha with 77,430

ha cultivated by estate plantations (Table 1.1). In 2009 plantations in PNG produced 67% of the total FFB while the remaining 36% was produced by LSS and VOP smallholders.

1.2 Economic importance of oil palm in Papua New Guinea

Oil palm has become one of PNG's most successful agricultural crops and is now the dominant export cash crop in terms of export revenue. The total value of palm oil exported rose from K142.2 million in 1995 to K305.2 million in 2000 (data from DAL, 2001, cited by Bourke and Harwood, 2009). Then production rose to an average of K420 million per year from 2004 to 2006 comprising 30% of the total value of agricultural commodities (Bank of PNG data, 1984-2007, cited in Bourke and Harwood, 2009). Oil palm's performance in terms of economic status was further boasted in 2008, when the oil palm exported recorded 50% of the total value of agricultural exports.

Table 1.1 Estimated areas planted to oil palm and the amount of FFB produced in 2008 in all six projects areas in Papua New Guinea

Projects areas							
Project	**Hoskins**	**Bialla**	**Popondetta**	**Milne Bay**	**New Ireland**	**Ramu**	**Total**
Plantation (ha)	34,783	9,800	8,984	11,629	5,689	6,546	**77,430**
Smallholder (ha)	25,223	12,698	14,285	1,837	2,533	234	**56,810**
Total (ha)	**60,006**	**22,494**	**23,269**	**13,466**	**8,222**	**6,7780**	**134,240**
Plantation (tonnes)	751,481	168,293	136,638	190,675	101,634	32,264	**1,380,885**
Smallholder (tonnes)	379,498	62,767	158,661	11,833	18,999	0	**731,759**
Total (tonnes)	**1,130,980**	**331,061**	**295,299**	**202,404**	**120,633**	**32,264**	**2,112,645**

(Source: PNGOPRA, 2008)

1.3 Overview of oil palm in West New Britain Province (WNBP)

In WNBP oil palm covers an area of 82,500 ha of which 37,921 ha are cultivated by smallholders residing on LSSs and by villagers under the village oil palm (VOP) scheme (Table 1.1). At both Hoskins and Bialla, the areas under VOP have grown significantly over the past few decades. Currently there are 7,181 smallholder oil palm blocks occupied by both LSS and VOP in Hoskins (Orrell, 2009). There are a total of 6,349 smallholder blocks in Bialla. Oil palm production in WNBP, contributed 71.2% of the total FFB produced in PNG. The majority of this

production was produced by New Britain Palm Oil (NBPOL). Smallholders' contributed 32% to the total production in WNB in 2008 (Orrell, 2009).

1.4 Significance of extension services and factors limiting effective extension

Most agricultural extension messages aim to assist the farmer to address their needs and problems and to raise production and incomes (Ray, 2003). In the case of OPIC, it is a top-down approach in which training and advice given to smallholders are based largely on research conducted by the Oil Palm Research Association (OPRA). A successful diffusion and adoption of a particular message or technical information depends to a large extent on the effectiveness of the extension services. Research undertaken in several developing countries has also revealed that certain limiting factors can hinder the effectiveness of extension (Fernando, 1988; Strauss *et al*. 1991). For example, lack of competence in technical knowledge by the extension officers was identified as a major problem affecting extension effectiveness. To motivate and provide good information to the farmer, technical knowledge on the subject of increasing production and other vital information must first be fully understood by the extension officers themselves before delivering it to farmers (Hulme, 1983; Fernando, 1988). Communication skills between the researcher, government department and extension officers also play an important role in transferring information and messages to smallholders. Also for the message to be adopted it must be simple and easy to understand (Chaudhry and Al-Haj, 1985).

In addition, qualifications and technical expertise of extension officers are also essential for successful and effective dissemination of information to farmers. Extension officers must be well trained in order to identify and solve problems faced by the smallholders (Onazi, 1982). In the context of effective extension, research from Nigeria has discovered that farmers' contact with extension officers has had a positive impact on production. Progressive farmers with the highest productivity were the farmers with the highest frequency of contact with the extension officers. The same research also concluded that low extension contact was also the result of a high ratio of farmers to extension officers which created productivity differences amongst smallholder farms (Sofranko *et al.,* 1988).

Other studies have found that the process of diffusion and adoption of extension messages is greatly influenced by the socio-economic and personality characteristics of farmers as well as by their education level and knowledge (Kebede *et al*., 1990). Research in Nigeria showed that socio-economic factors such as income, wealth, farm size, family size, education and experience of the farmer affect the diffusion and adoption of innovations (Kebede *et al*., 1990). Similarly, the adoption of soybeans by farmers in West Brazil and the adoption of other new crops by farmers in other developing countries showed that the education level of the farmer influences the adoption rate of new technologies and innovations (Jamison and Moock, 1984).

In PNG, there has been no comprehensive research done to verify whether the range of the extension strategies and framework used by OPIC has an impact on smallholder productivity. Apart from some research done by Koczberski *et al*., (2001) that examined smallholder production issues, very little is known regarding the effectiveness of agricultural extension services to oil palm growers. Hence, this study fills an important gap in the understanding of the effectiveness of the extension services in oil palm. Given that smallholder production comprises almost 32% of the total production, then individual smallholder block production plays an important part in oil palm production in Papua New Guinea. The findings of this research will be useful to OPIC to improve existing extension training and advice to growers and will be relevant to other export cash crop sectors, such as coffee and cocoa where production is dominated by smallholders and where smallholders' productivity is in decline.

1.5 Objectives of thesis

To date there has been very little attention given to the effectiveness of extension in the commodity crop sector in PNG. Thus, the aim of the research is to determine the effectiveness of the extension services provided by OPIC. The study has the following objectives:

1) Evaluate the effectiveness and appropriateness of the main extension approaches and strategies used by OPIC to improve the production and incomes of smallholder farmers and their families.

2) Identify the key factors hindering and/or fostering the adoption and implementation of extension messages among smallholders.

3) Identify any relationships between demographic and socio-economic characteristics of smallholders and their level of adoption of extension advice; their attitudes to extension services; their economic and social problems; and block productivity.

1.6 Thesis organisation

Chapter 2 begins by briefly outlining the range of extension approaches used across the world and then briefly presents the history of agricultural extension in PNG. This latter section of the chapter describes the different types of extension services and extension models used to date. Finally, the chapter provides an overview of the factors hindering the effectiveness of extension in PNG.

Chapter 3 provides an outline of the study site and methodology. This chapter provides an explanation to why a mixed method research approach was used in the study. The chapter also presents the type of sampling method used and the type of statistical analysis used in analysing the data.

Chapter 4 presents the findings from the Hoskins Land Settlement Scheme (LSS). The discussion includes outcomes on the effectiveness of the extension services provided by OPIC and the socio-economic and demographic characteristics of the smallholders selected for the study. The main socio-economic characteristics discussed are: age, average education levels of all household members and the blockholder block population, number of secondary households on the block, and leaseholders' status. Other factors considered include, harvesting strategy, farmer aspirations and their experience of oil palm production, work experience and their level of contact with extension services.

Chapter 5 offers results and findings on knowledge and skills on fertilizer and replanting on LSS blocks. It also provides results and discussion on blockholders' level of adoption of the two extension approaches provided by extension officers.

Chapter 6 presents findings and discussion from the Village Oil Palm (VOP). The discussion includes similar outcomes on that was discussed under LSS except that VOP growers have yet to replant their blocks given that they have been established more recently.

Chapter 7 presents the conclusions and the recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview of the chapter

This chapter has several aims. First, to review the main agricultural extension approaches that have been used across the globe over the last four to five decades. Second, to provide a brief history of agricultural extension in PNG and to examine critically the different extension approaches that have been used and are currently implemented in PNG. Third, the chapter aims to demonstrate the factors limiting the effectiveness of agricultural extension and the adoption of extension innovation in rural farming communities.

2.1 Agricultural extension approaches used in the world

Extension is well known and accepted by people involved in extension services. However, it is not fully understood by the farming community. With no definite single meaning to extension, this section will review different views used to describe extension and then examine the various agricultural extension approaches. The word extension is derived from a Latin root 'ex' meaning 'out' and tension meaning 'stretching'. Agricultural extension originated in England in 1866 with the system of university extension which was taken up by Cambridge and Oxford Universities. Extension education was described as an educational innovation with the objective of extending university teaching to ordinary people (Ray, 2003). Extension is a type of education which can be spread out to people in the rural areas, beyond the limits of the education institution to which the formal type of education is usually confined (Ray, 2003).

Agricultural education is a complex knowledge sub-system, linked to wider rural knowledge and learning. As a discipline it is concerned with education both for and about agriculture. Unlike formal education, extension education includes various kinds of agricultural extension services such as: short-term training for farmers, for farm families and workers in the industry, a wide range of rural organizations and

groups; integrated programmes for agricultural and rural development and various kinds of distance education aimed at rural audiences (Wallace, 1992).

Extension can be explained in many ways. For instance, the Dutch use the word *voorlichting*, meaning extension as light, lighting the pathway ahead to help people find their way. Whereas in Indonesia, instead of using the term extension, *perkembang* is used which means lighting the way ahead with a torch. However, agricultural extension is the involvement, using communication information to help people formulate sound opinions that could help them make better decisions (van den Ban and Hawkins, 1985).

Agricultural extension approaches refer to the procedures or steps within the extension system. The extension approach embodies the philosophy of the system and it is the framework that controls the structure, programme, methods and the technology to be used. Extension approaches vary among different countries depending on certain circumstances. The type of extension approach adopted by an organisation depends on the organisational structure of the bureaucracy, financial resources, personnel and equipment, program goals of the extension service, the type of leadership within the bureaucracy and its linkages with other organisations (Axinn, 1988). The main types of extension approaches are:

1. The general agricultural extension approach.
2. The commodity specialized approach.
3. The training and visit approach.
4. The agricultural extension participatory approach.
5. The project approach.
6. The cost sharing approach, and
7. The education institution approach.

1) The general agricultural extension approach

The general agricultural extension approach is commonly found in government organisations where the extension is the responsibility of the agricultural department. It has been practised in many economically developed nations and has been the

dominant approach in the last decade. In this approach, the Ministry of Agriculture has several departments in which extension is one of them. The primary aim of the approach is the transfer of technology from government research scientists to farmers. The general agricultural extension approach was also commonly used during the colonial era. The establishment of agricultural units by colonial governments generated and transferred technology largely focusing on export crops with the purpose to increase production of a particular crop at the national level. The approach was based on an assumption that the ministry and administrative personnel know farming better than the farmers.

Extension planning was controlled by the government and implementation was done by field staff, employed and paid by the government. Extension messages were usually relayed by plot demonstration, radio broadcast and posters. This approach had both advantages and disadvantages. The two main advantages were, the approach had national coverage, and extension messages interpreted the national government policies and procedures to rural people, purposely to increase production. However, the disadvantage was, there was no means of a two-way communication between the farmer and the extension personnel and so farmers' problems and needs were not known. With farmers specified in growing few crops and livestock, variations in soil, microclimate and farmers capacities to access resources were limited. In addition, in this extension approach, extension officers were used by the government to perform non-extension duties like conducting census surveys in rural communities. These factors have limited outreach to farmers and have reduced the benefits and impact of extension (Anderson *et al*., 2006). Also, there was a tendency for only progressive farmers with higher status and wealth to have contact with extension agents. Moreover it was a top-down planning system that did not meet the perceived needs of the farmer. The approach was also perceived by some donors as being fragmented, and conducted by poorly trained personnel (Farrington, 1995). Thus, the approach was often ineffective and expensive (Axinn, 1988; Farrington, 1995).

2) The commodity specialized approach

In this extension approach, extension concentrates solely on a particular crop, such as cocoa, coffee, sugarcane and tobacco. The main purpose of this approach was to

increase production of the particular commodity crop. This approach was coupled with other organisations such as those involved with research, input supply, marketing and providing credit. It was a less complex extension approach compared with the general agricultural extension approach. Programme planning in this approach was controlled by a commodity organisation and the goal, aim and the type of message to be broadcast to farmers was also controlled by the commodity organisation. The implementation of the programme was given by extension personnel to farmers through face-to-face communication or farmer meetings. For educated farmers, printed instruction was often issued. In this approach, success was measured by the total increase in production of a particular crop. An advantage of this approach was that the technology promoted matched the production problems of the farmers (Axinn 1988).

As extension was concentrated on one particular crop, extension messages were also more likely to meet the needs of farmers than the general extension approach. Furthermore, supply inputs, research and marketing of produce were coordinated by commodity organisations and therefore extension activities tended to be efficient and effective. This assisted in messages being delivered in a timely manner to farmers. Yet, regardless of the advantages of this approach, there were two main disadvantages. First, when farmers were confronted with other situations which they thought were more important to extension, they often redirected their interest from extension. Second, this approach did not provide an advisory service for other aspects of farming other than the crop the commodity organisation prioritized (Axinn, 1988). Thus, other agricultural, social or cultural factors affecting commodity production were ignored in this approach. For most commercial crops, commodity based extension was successful as private companies provided extension and processing facilities (Hanyani-Mlambo, 2002).

3) The Training and visit approach

The training and visit (T&V) approach was introduced by Benor and Harrison in 1977 with the main objective to increase the quality of extension advice and make extension information known widely to farmers through the contact farmer theory (Hussain *et al*., 1994). The T&V approach spread rapidly in the mid 1980s. The basic assumption to this approach was similar to the general agricultural extension

model. This approach recognised that extension personnel were poorly trained, not up-to-date on the latest innovations or knowledge in agriculture, and rarely visited farmers on farms. The training and visit approach was purposely designed to overcome these problems and also to establish a two-way communication channel between research specialist and extension organisations and between extension personnel and farmers.

T&V was characterised by a single line command approach, in which extension was focused on contact farmers intended to spread the extension messages and advice to other farmers. T&V operated on a disciplined programme with fixed time scheduled activities to visit and train farmers who later became village level workers with the main role of disseminating information to other farmers. Subject matter specialists visited contact farmers on a fortnightly basis to train and teach them with research specialists conducting field demonstration on farmers' fields regularly. In a two week routine, typically one week was for training contact farmers and the other week was for information dissemination (farmer visits) and evaluation. The subject matter specialist was the link between extension and research, establishing a close relationship between research and extension (Farrington, 1995; Anderson *et al*., 2006).

T&V encouraged extension officers and village level workers to focus only on agricultural information services and not on non-extension duties. The key purpose of the training and visit approach was to motivate and stimulate the farmers to increase production. Programme planning for this approach was centralized and reflected the interaction between extension and research personnel and the agricultural ministry on the type of information, method of dissemination and when the training should be done. All this information was discussed by professionals and then the programme was delivered to the famers. Like the general extension approach, the T&V model was also a top-down extension method of communication.

For the T&V approach, programme planning and the schedule for training, visitation and supervision of farmers followed the seasonal cropping pattern of the commodity crop. The implementation of the programme with this approach was achieved by

village level extension workers visiting farmers through group farmer contact, individual or contact farmers. The T&V approach was also financed by donor funds and the method saw an increased ratio of extension personnel to farmers compared with other extension approaches both at the local and national level.

Logistic support in terms of transportation and materials for conducting extension programmes was also accessible through donor funding. The success of this approach was measured by the increase in yields on individual farms and total production of the crop in general. Success was also measured by the provision of low cost, unsophisticated technology delivered to farmers so farmers know how to make the best of available resources.

There were several advantages of the T&V approach. First, it exerted pressure on the government to reorganise small extension units into one major integrated service. Second, it placed pressure on extension personnel to leave their offices and visit farmers on their farms. With a large number of ineffective extension systems, the training and visit approach imposed discipline in the workplace which lead to more effective extension (Howell, 1982).

Third, the approach provided regular training for extension personnel on up-to-date information and technologies to meet farmers' needs. In many cases the training promoted low cost and easy technologies to farmers. In addition, availability of logistic support and instructional materials to extension personnel assisted with more efficient extension.

Although, the training and visit approach was advantageous in many ways, there were also disadvantages to this approach. First, the high long-term cost to governments of expanding the size of field extension personnel did not vastly improve the two-way communication between research specialist and extension personnel and between extension personnel and farmers. If there was poor communication between the farmers and the extension personnel, it was unlikely that the new technologies would be adopted. For example, research conducted in the Punjab region of India suggested that, although T&V had increased the quantity of

extension advice, the level of adoption by farmers remained low as the quality of extension advice and the communication method were poor and had not improved farm production with the introduction of T&V compared with traditional extension or general agricultural extension in increasing farmers' technical knowledge (Feder *et al*., 1986; Hussain *et al.*, 1994).

Second, there was a lack of continuous supply of the low cost technology which was relevant to famers. Third, the approach was not flexible from place-to-place and therefore it did not accommodate the differences in extension needs of farmers in different places. As T&V was a supply-driven, top-down extension approach that had been designed and developed by scientists, most of the research innovations and techniques developed were done without the farmer's participation which was a drawback to the approach. The lack of responsiveness to farmers' needs and circumstances meant that there was little room for farmer participation in identifying their extension needs. A good example of the failure of the T&V approach in Papua New Guinea was experienced by the Coffee Industry Cooperation (CIC). Extension techniques developed by CIC through research were not adopted by farmers as they were expensive and not suitable to farmers (Api *et al*., 2009). Those techniques were not perceived as important by farmers. Most importantly, it was a highly costly approach to agricultural extension (Howell, 1982; Axinn, 1988).

4) Participatory approach to agricultural extension

The agricultural extension participatory approach involves rural farmers in all stages of extension planning through to implementation. The participation in decision making of the overall extension programme includes the research specialist, service organisation and farmers (Chaudhry *et al.*, 2006). It combines social and technical innovation. In this approach, extension officers are not merely instructors or suppliers of information but rather facilitators (Fleischer *et al.*, 2002). It involved little or no research but included pure technology transfer, seed dissemination or on-farm validation using discovery learning (Ashby, 2009). The main assumption of the participatory approach is that farmers have much wisdom on food production and farming on their land but their living standards and farm productivity can be improved by learning more. Thus, indigenous knowledge systems are recognised

and can be improved by incorporating scientific knowledge to improve production. Effective extension is achieved when farmers are involved in the planning and implemention of extension programmes as their problems and needs can be addressed. In this approach, the main aim and goal of the extension programme is to identify needs and solve the problems of the farmers, increase production at the farm level whilst at the same time increasing household consumption and enhance the quality of life of farming households.

As farmers are involved throughout this approach, programme planning is controlled locally, often by groups such as farmer associations or research and service organisations. This local involvement contributes significantly to the success of the extension approach. Because farmers are involved, the content of the extension messages and the new technologies tend to meet the needs and interests of local people. Extension programmes are implemented through farmer meetings with both small and large farmer groups. Plot demonstrations are also carried out on farmers' plots.

Extension personnel are the key resources required to do the job, not only as non-formal agricultural educators but also as animators and catalysts. An extension officer's main task is to motivate and stimulate farmers to organise group efforts. Once that is achieved, local farmers then become the field officers for the extension organisation. The success of this approach can be measured through continuity of the local extension programme by farmers and the benefits to the farming community. Thus, the sustainability and cohesiveness of the extension farmer groups indicates the extent to which the programme has been successful (Axinn, 1988). Agricultural participatory approach can be of two types:

- Farmer Field School (FFS) and
- Farming System Research and Development (FSRD) or Farming System Research and Extension (FSRE).

Farmer Field School (FFS)

Farmer Field School, started in Java, Indonesia in 1989 by the Food and Agriculture Organisation (FAO) of the United Nation to control pests on rice and other crops (Van den Berg and Jiggins, 2007). It was purposely implemented so that farmers developed and strengthened their self-reliance and managerial capacity by learning how to carry out field observations, conduct experiments and access results relevant to their own experiences. This training enhanced farmers' ability to solve problems and to actively seek and evaluate new information (Fleischer, *et al.,* 2002). Moreover, FFSs were not viewed as an extension model but rather as a complementary educational instrument to capture the potential of agricultural modernization and identify its negative effects as research in Kenya showed that FFS facilitators tend to work more closely with wealthy farmers, and often neglected poor farmers (Davis *et a*l., 2010). Nevertheless, Van den Berg and Jiggins (2007) maintained FFS, as an educational instrument, also helped farmers identify problems encountered with agricultural practices, thus, becoming a driving force for farmers to enhance their analytic and problem solving abilities to resolve problems.

The main advantage of the participatory approach is the participation of farmers in programme planning and implementation. The key factor is that the technology fits the needs and problems faced by farmers and that the method and the content of the message are relevant to the farmers' needs and therefore can easily be adopted by farmers. Fleischer *et al.,* (2002) identified in a cost and benefit analysis in Egypt that the participatory approach had proved to cost less than other approaches such as T&V and the general extension apprpoach. Research in Punjab, Pakistan has proved that the participatory approach was effective compared with general extension and commodity based extension approaches by helping farmers with assistance regarding technology utilisation (Chaudhry *et al.,* 2006).

Farming System Research and Development (FSRD)

This approach began in 1980s and was later known as the Farming System Research and Extension approach (FSRE) (Axinn, 1988). FSRD has two parts: 1) farming system approach to infrastructure support and policy and 2) farming system research and extension approach to technology development. The first is for information generation to be used by policy makers and the latter for technology development

and dissemination for farmers (Davidson, 1987). It is also defined as a "farmer first" approach, whereby a coalition of people, networks and organisations are committed to develop, promote and share bottom-up farmer centred approaches to technology development to agriculture and was discovered to be successful (Scoones and Thompson, 2009).

Many extension systems have failed as technologies and innovations available to extension personnel have not matched the local farming system. Under the farming systems approach, with the absence of the availability of technology and essential resources required for improving the farming system, the aim is to make available these resources by generating them locally and adapting them to local conditions of the farmers (Davidson, 1987; Crittenden and Lea, 1990; Manig, 1992; Biggs, 1995; Lisson *et al.*, 2010). Moreover, the most important innovation of this approach is that it focuses specifically on farmers. Research and extension are not the exclusive priority of research stations and extension organisations, but rather more to do with the farmers and their farming systems with research conducted on farmers' fields as field trails (Hanyani-Mlambo, 2002).

The intended objective of FSR is to develop research programs that are "cost effective in generating technology appropriate to increasing the productivity of farming system within the context of a specific micro environment (Davidson, 1987, pg.70). As such the objective is not to maximise production but to develop improved systems that are conducive to each environment and appropriate to each socio-economic and cultural context (Davidson, 1987; Crittenden and Lea, 1990).

Programme planning for this approach evolves slowly. Agro-climatic factors and farm eco-systems together with the geographical settings for the location are taken into account before the extension programme is introduced. Prior to meeting, tours and demonstrations, analysis of local farming systems and households are done to provide baseline information so recommendations can be made (Axinn, 1988). The programme is controlled by local farmers, extension personnel and research specialists. Research and extension programmes conducted are diverse as each research and extension programme depends on the farming system adopted by

farmers in each location. It also differs within each location depending on the environmental factors, and the needs and interests of farmers in each location. The programme is implemented through partnerships between local farmers, and extension and research organisations.

Success is measured to the extent to which farm people adopt the technologies and continue using them. The advantage of this approach is the relevance of the technology to farmers' needs and interests. In addition, this approach establishes links between farmers and extension personnel and extension organisations and research specialists. A recent study in Bali on cattle found that the FSR approach was successful as there was continuous adoption of techniques designed to improve cattle production. This had positive social and economic impacts on farmers as there was an increase in income, meat and milk production (Lisson *et al*., 2010). However, the main advantage of this approach is its concern in understanding the farming system as a whole. In contrast, reporting and administrative control is difficult to manage as it may not fit the typical list of crops and livestock used by the ministries of agriculture (Axinn, 1988). Though successful, FSRE had dark sides to the approach. As its popularity grew, farmer participations were self-selecting which tended to favour middle class and richer farmers. With the aim of improving productivity, poor farms were neglected where research conducted was supply driven and not demand driven according to poor farmers' needs (Ashby, 2009).

Interestingly, FSRE operated in the Southern Highlands Province in Papua New Guinea, from 1976 to1986. However, it was found to be ineffective (Crittenden and Lea, 1990). The two main underlying reasons were: lack of suitable extension messages and the exclusion of farmers from program planning. Participatory approaches to identify problems and needs that would form the basis of the projects were not considered at the initial planning stage and so farmers' basic needs and problems were not fully understood. Extension officers never did field visits and demonstrations on farmers' blocks (Crittenden and Lea, 1990).

FSRE was also used as a complimentary approach to T&V in parts of Great Britain. Research was conducted to analyse the link between the two approaches. In this

case, FSRE concentrated on conducting research and developing techniques suitable for farmers while the T&V approach was used for information dissemination, plot demonstration, implementation and evaluation of the techniques developed. However, due to diverse management strategies and disparate structural organisations between the two extension approaches, FRS combined with T&V was not successful (Manig, 1992).

5) The project approach

The project approach concentrates extension efforts on either agricultural production or on the rural population. The project approach is confined to a selected location and the programme is planned and implemented for a specific time period that may run for several years. In this approach, planning is central, excluding local farmers and involving central government and donor agencies. The programme is implemented by project management staff and field workers temporarily appointed for the duration of the project. Resources required by the programme are mostly funded from outside the extension organisations. The underlying purpose of this approach is to demonstrate that results can be achieved within a given time frame and to test the appropriateness of extension approaches in different environmental settings. Often this approach is used to provide an extension component in a larger integrated rural agricultural development project (Axinn, 1988).

The effectiveness of the extension is measured by the short-term success of the project achieving its goals and objectives. The advantage to this approach is that the extension programme is focussed which enables the effectiveness for the project to be easily evaluated. Techniques and methods learnt from the project can be incorporated into larger agricultural extension programmes when the project ceases. Nevertheless, there are also disadvantages to this approach. Ideas and techniques are often not diffused to areas other than the project area and the extension programme ceases when funding ceases (Axinn, 1988).

6) The cost sharing approach

The cost sharing approach is conducted to satisfy farmers' needs, with the cost shared between outside sponsors and the local farmers. However, because farmers are usually too poor to pay for the total cost, the cost is partly paid by the central and

regional governments. For farmers cost sharing may not be in real cash money, but rather be provided when villages offer food and shelter to extension personnel during farm visits and field trips. The main purpose of this approach is to help farmers improve their agricultural practices to increase production. It is also an approach in which central and local government need to fund continuously in order to sustain it.

The programme is planned and controlled by various organisations sharing the cost but is in favour of the farmers' interest and needs in order to maintain cooperative financial management. Success in this approach is measured by farmers' willingness and ability to provide some cost sharing either individually or through their local government units. This approach is advantageous as the programmes' content and messages are delivered according to the farmers' needs and interests which often results in high adoption rates. As costs are shared by lower levels of government and by local farmers, this approach is less expensive than programmes funded by central government. However, the disadvantage of this approach is the complexity and difficulty faced when reporting financial management and administrative issues to central government (Axinn, 1988).

7) The education institution approach

This approach involves the participation of agricultural schools, colleges and universities. It is assumed that schools or colleges of agriculture have technical knowledge useful to farmers and there is a need for students and teachers to interact with farmers. While teaching farmers the scientific agricultural techniques, students and teachers learn and understand from farmers' farming practices in their local area (Axinn, 1988). Sitapai, 2012 refers to this approach as human resource development approach. A good example would be the Agriculture Department of the University of Technology in PNG, through the South Pacific Institute of Sustainable Agricultural and Rural Development (SPISARD), reaching out to rural villages, conducting training to both male and female participants to help sustain livelihoods (this example will be fully discussed later in the chapter under types of extension approaches in PNG).

The programme is planned and controlled by those who determine the curriculum of the educational institution. Programmes are implemented through non-formal instruction to groups and individuals using a range of methods and techniques. Institutions often provide in-service courses to extension personnel especially in research. In addition, institutions often support extension through mass media, pamphlets and bulletin publications and posters for farmers. The success of this approach can be measured by institutions by the participation of farmers in activities promoted by them and by the rate of adoption of techniques taught by the institution to the farmers. It can also be measured by the number of students enrolled and the number of farm visits by academics. Lastly, this approach gives academics and students an opportunity to learn more about local farming practices and provide farmers access to the scientific techniques developed by the institution that can help increase farm production. Regardless of the above advantages, extension messages from the academics may not always be useful or of importance to farmers. In addition, the participation of academics teaching farmers can also be in competition if the agricultural extension system has its own extension personnel allocated in the field for the same purpose (Axinn, 1988).

2.2 History of agricultural extension in PNG

This section of the chapter has four parts. To begin with, a brief history of agricultural extension in PNG is presented. Then, the different types of extension services provided in PNG will be discussed. As this thesis examines the effectiveness of extension services provided to oil palm smallholders, OPIC will be briefly discussed. The third part will elaborate on the current status of extension services in PNG, and finally, problems associated with the current extension services will be discussed.

In the early 1900s during the colonial period, plantations were large-scale agricultural production systems managed by expatriate managers from an industrial background to manage unskilled labourers in establishing, growing and processing commercial crops in demand on the world market (Axinn, 1986). As such, agricultural extension in Papua New Guinea began with plantation crops with the aim of eventually establishing these crops amongst village farmers. In 1927, agricultural education was created for the indigenous people where eight agricultural

instructors were appointed and given the task of promoting village copra production in lowland communities in PNG. It was the beginning of a farmer educational programme for coconut growing. This was followed in 1929 by the establishment of a native agricultural school, the Lowlands Agricultural Research Station at Kerevat, East New Britain Province, by an instructor by the name of Hopkins. The aim of the institution was to teach trainees from surrounding villages the cultural practices of economic crops. The training was designed so that trainees would return to their villages to teach fellow villagers how to plant and manage commercial coconut production (McKillop, 1974a).

From 1933 to 1937 other parts of British Papua and German New Guinea like Madang and Talasea in West New Britain were growing rice and copra respectively and at the same time, agricultural training centres were erected to train young males as trainees to go back to their villages to train their people in agricultural techniques such as rice growing. However, due to the mechanical breakdown of rice mills and other problems, these activities ceased by the end of 1941. In 1942, a general pattern of village agricultural development emerged in Papua and mandated territories. Policies were made so that native people would no longer be used as labourers on plantations and instead be involved in the production of cash crops in their own villages (McKillop, 1976).

During the Second World War, Papua and New Guinea were brought together as a single country under the Australian New Guinea Administrative Unit (ANGAU). Policies for the future development of Papua New Guinea were formulated by the Civil Affairs unit of the Australian Army Command. Few pre-war administration agricultural staff remained. In 1947, Cottrell-Dormer, an Australian agricultural research officer who previously worked on coconut plantations in British Solomon was appointed Director of Agriculture, and soon after the Department of Agriculture Stock and Fisheries (DASF) was created. The new department was divided into five divisions, each with certain responsibilities, except that one division was created to focus only on extension. Cottrell-Dormer's aim was to improve the nutrition and living standards of the indigenous people by mixed farming on individual smallholdings capable of producing adequate subsistence while growing cash crops

to obtain money to meet household needs and the payment of taxes (McKillop, 1976; Goldbold, 2005).

The adoption of an Australian structure for DASF imposed constraints on the attainment of the policy objectives. The model of organisation evolved from a technical assistance approach to extension in which the extension officers were technical assistants. The first phase of the extension under DASF was the food crop phase which began in 1947 when two extension officers were employed to conduct a nutritional survey to study the nutritional quality of the diet of the indigenous population. It was concluded that rural villagers lacked sufficient first class protein in their diets. Hence the first extension programmes were planned to improve local diets by introducing improved pig and poultry strains as protein sources (Axinn, 1986).

In some areas like Mekeo in Central Province, and in parts of Madang, East Sepik and Bougainville Provinces, rice was re-introduced. In 1951, Cottrell-Dormer resigned and moved to Mekeo to manage the rice project. However, in 1953 the commercial rice crop declined in production. Even then, a lot of extension work was already in progress in Papua New Guinea. From the 1950s to 1960s and the early 1970s, extension expanded greatly in PNG. It was during this time that coffee was promoted in the Highlands, cocoa in the lowlands and oil palm in WNBP (McKillop, 1976).

In 1951, a shift in emphasis from food crops to export cash crops began. The first major post-war efforts to promote export cash crops occurred on the Gazelle Peninsula of East New Britain where villagers were encouraged to plant cocoa and increase their coconut groves. Several extension programmes operated in the 1950s and early 1960s to promote smallholder cocoa and copra production. For example, large centralised fermentaries were erected for cocoa growers under the Tolai Cocoa Project. Cocoa soon expanded rapidly because of well-established services and infrastructure like roads. In 1953, DASF expanded coffee plantations in the Highlands and encouraged village people to grow coffee. Between 1952 and 1954, Australian settlers obtained state land for coffee plantations because of the booming

price but this practice halted in 1954. Most coffee plantations were concentrated around Kainantu in the Eastern Highlands Province (EHP) and the Waghi Valley in Western Highlands Province (WHP).

Extension training programmes were conducted in Korn Farm in Western Highlands, where selected villagers were brought to learn the various aspects of coffee cultivation. They were expected to be employed by other members of the tribal group and assist them to plant coffee. Patrols by extension staff would later contact the trainees and check on their work. Rapid expansion of village coffee was proof of the success of the extension work in the Highlands. However, concerns over future marketing problems and conflicts of interest between the expatriates and the indigenous population led to a reduced emphasis on expanding coffee. In 1961, coffee expansion by villagers was banned. By 1967, coffee became the country's most important agricultural export and smallholders share of production reached 70% (McKillop, 1976).

Apart from export cash crops, cattle production was also promoted among rural villagers. In 1959, 60 pilot villages in the Highlands were selected for cattle production. In 1959 as well, the Minister for Territories announced that agricultural extension work was to be stepped up with an additional 74 European officers recruited. There was also an increase in the number of Papua New Guinean agricultural assistants from 180 to 300 and 22 new extension centres were established, significantly boosting the capacity of agricultural extension in Papua New Guinea. The expansion of the services continued at a rapid pace throughout the 1970s, and by 1980 expenditure by the Department of Primary Industry reached K22,000,000 (US$ 28,600 00) per annum (Hulme, 1983). During this period, the agricultural extension division of DASF was very effective. The extension division was fully staffed and well managed throughout the 1960s and 1970s. However, the Organic Law in 1977, led to the creation of the 19 Provincial Governments and by then DASF was changed to the Department of Primary Industry. During that time, agricultural extension was delegated as a responsibility to each of the newly created Provincial Governments (Bakani, 1994).

In West New Britain Province, commercial planting of oil palm was established in 1967 following a recommendation by the World Bank. Afterwards the land settlement schemes (LSS) were viewed as a means of increasing agricultural export production, increasing rural incomes, and relieving population pressure in rural areas in other provinces. In terms of extension services provided to the smallholders, it was the role of the provincial DAL extension department. However, in 1992, as part of the government's corporatisation and reform policies, OPIC was formed to take over the extension role from DAL (Koczberski *et al.*, 2001).

2.3 Types of agricultural extension services in PNG

Past reviews of agricultural extension approaches in PNG have shown varying degrees of choice of methods, operating environments, and the results of intervention. To date no assessments and evaluation of the various extension methods have been undertaken in terms of their impact, sustainability (financial, human and environmental), effectiveness and efficiency. However a general conclusion drawn from these reviews shows that no one extension model will suit all purposes, and the models are appropriate to specific areas, needs, or circumstances need to be identified and promoted (Sitapai, 2012; Dekuku *et al.*,2005). The extension approaches used on PNG over the last 50 years can be grouped in four categories:

1. Technology transfer
2. Human resource development approach
3. Private sector assisted delivery
4. Participatory or farmer-demand driven approach

1) Technology transfer

This approach is perpetuated by the T&V system of delivery and has been in practice from pre-independence period to the present. Technology transfer involves a top-down approach and delivers specific recommendations to farmers about the practices they should adopt. In PNG, technology transfer mode has followed two general trends: a) Provincial and district general extension; and b) industry-driven service delivery (Sitapai, 2012).

In the former, improved crops and livestock technologies from research were disseminated with information to provincial/district extension centres for distribution. The extension centres provided extension training in livestock and husbandry practices on site as well as in village locations. The information provided was of general advice on agricultural practices. Generally, the provincial extension personnel were less qualified than those in national agencies (Sitapai, 2012). The gap between provincial and national institutions also deprived provincial extension staff of opportunities to undertake further skills training. Furthermore, the demise of the district extension centres in all provinces since the 1980s has reduced the quality and effectiveness of extension efforts nation-wide. In the latter trend, the participation of agricultural industries (crops and livestock) in the delivery of extension services to farmers gained prominence from the mid 1980s (McKillop, 1994). The industry extension model, developed initially in coffee by CIC, was later adopted in oil palm by OPIC, and in cocoa and coconuts by the CCI. Below are examples of industry extension models.

Oil Palm Industry Corporation (OPIC)

Agricultural extension services to smallholder oil palm growers were initially provided under the Department of Agriculture and Livestock (DAL). However, in 1992, under the government reform policy, the Oil Palm Industry Corporation was formed as a quasi government agency financed by a smallholder crop levy of K3.50/tonne. This levy is also matched voluntarily by the oil palm companies processing smallholder oil palm. OPIC is occasionally financed and funded by international aid donors (Koczberski *et al.*, 2001). For example, since 2010 a World Bank funded smallholder agricultural development project is providing some funding support to improve OPIC's effectiveness. The main role of OPIC is to provide extension services to smallholders. OPIC's functions are to:

- Promote and encourage increases in productivity in the oil palm industry by more efficient provision of extension services to oil palm growers especially smallholders.
- Promote the development of the oil palm industry, and in particular improving husbandry technologies, introducing effective methods of

controlling pests and diseases and the development of growers' groups amongst smallholders.

- Provide advice and disseminate information to educate smallholders regarding oil palm production methods (OPIC, 2009).
- Liaise between government, oil palm companies and other organisations involved in the industry and to enhance the wellbeing of smallholders.

To promote and facilitate OPIC's role, a local planning committee has been established in each of the five project areas. Each committee has an OPIC project manager and a representative from the local growers association, provincial government, plantation company and the Oil Palm Research Association (Koczberski *et al.*, 2001). The extension model executed by OPIC is a top-down approach in that, strategies developed to increase smallholder productivity are largely based on research by OPRA. Extension messages are then passed on to extension workers through training and it is the extension officers' role to deliver techniques and innovations to smallholders through blocks visits and field days.

Coffee Industry Cooperation (CIC)

The mission statement of CIC is to promote and support the continuing development of a soundly based coffee industry in PNG that will maximise financial returns to coffee growers, and at the same time contribute to government economic and social policy goals. Since 1986, CIC has practised two types of extension approaches, a top-down approach and a bottom-up approach (Aroga, 2009; Api *et al.*, 2009). The top-down approaches were the training and visit (T&V) approach and the Central Training Point (CTP) models. T&V was introduced to CIC in 1986 but was abandoned in 1996 due to high operational costs. CTP was later introduced in 1997 but was also abolished in 2002. In 2002, CIC introduced a new approach which was a bottom-up approach. The Farmer Demand Driven (FDD) model was introduced in 2002 by the Asian Development Bank (ADB) and the Department of Agriculture and Livestock (DAL), and subsequently two piloted projects started in Eastern Highlands Province (EHP) and Morobe Province. FDD is an example of an agricultural extension participatory approach (Api *et al.*, 2009).

In the FDD approach, CIC extension personnel were managers and facilitators rather than the exclusive deliverers of extension and developments services. Extension services were provided by contractors from non-government organisations (NGOs), and peoples' organisations (e.g. farmer and women's groups, private companies, tertiary institutions, research centres and individuals). Payment for services was made depending on performance after evaluation (Api *et al*., 2009). With a decline in funding for extension and research, only 370,000 smallholders coffee growers throughout 15 to 20 provinces in PNG were targeted under the FDD approach (Api *et al.,* 2009; Aroga, 2009).

Under this model, farmer's problems and needs were identified using the Participatory Rural Appraisal and planning approach. Using the PRAP model, Training Need Analysis (TNA) and problem identification methodologies were used as baseline studies. The TNA identified two factors that hindered growers in increasing their coffee production. These were proper knowledge of coffee agronomy and post-harvest processing. Training and workshops are conducted to tackle these problems (Aroga, 2009).

Cocoa and Copra Extension Agency (CCEA)

The cocoa extension service was initially provided by the colonial government which was known as the "push cocoa". In this extension approach, local people were commanded to plant cocoa. It was mostly supported by the semi-government private sector which created many cocoa cooperatives societies or cocoa companies throughout the country. The extension approach's aim was to enable rural households to meet basic cash needs such as purchasing cooking utensils and clothing and improving their standards of living (Lummani, 2012).

A Farmer Training Centre (FTC) was established before 1960 in the rural areas to link all cocoa cooperative societies of the cocoa farming communities. FTC was mainly used for providing extension training to early extension officers. FTC was effective because most problems and needs faced by farmers were addressed. Cocoa extension was carried out by the Department of Stock and Fisheries (DASF) from the mid-1950s to early 1960s while cocoa processing and marketing was performed by

cocoa cooperative societies. The extension approach was effective as there was less competition and good working relationships between the private and public sectors (Lummani, 2012).

After 1975, the Department of Agriculture Stock and Fisheries (DASF) was renamed Department of Primary Industry (DPI), which was in charge of extension services until 1996. Extension approaches like Smallholder Cocoa and Coconut Rehabilitation and Expansion Project (SCCREP) was established under DPI to work with cocoa farmers but after 1996, the National Cocoa and Copra Board established the Papua New Guinea Cocoa and Copra Extension Agency (PNGCCEA). PNGCCEA was established in 1997 and mandated to carry out cocoa and copra extension in PNG until 2003 when it was merged with Papua New Guinea Cocoa and Copra Research Institute (PNGCCRI), to form what is now called Industry Services Division (ISD), an extension arm of the current CCIL. Under CCIL, certain extension approaches like Training and Visit (T&V), Farmer Field School (FFS), Intergraded Agricultural Training Programme (IATP) and Training by Association (TAB) are used (Lummani, 2012).

Regardless of all these extension approaches being established and implemented for cocoa farmers, the effectiveness of agricultural services in cocoa industry has been compounded by reduced operational support cost due to inadequate national funding for agricultural research, development and extension work over the past two decades (Lummani, 2012).

2) Human resource development approach

Human resource development (HRD) approach is a model similar to early extension in developed countries, when agricultural universities gave training and conducted workshops for rural people who were too poor to attend full-time courses at agricultural schools. It is a top-down approach where teachings are employed, but participants make their own decisions about how to use the knowledge gained. This mode of extension has been recently adopted by the PNG University of Natural Resources and Environment at Vudal and PNG University of Technology in Lae (Sitapai, 2012).

PNG University of Natural Resources and Enviroment-Intergrated Agricultural Training Program (IATP)

IATP uses the community outreach extension model of reaching out to people. It started in 2002 and the extension project was funded by the Australian government. It aims to improve livelihoods of people using training delivery information and extension services. It takes a holistic approach and uses field-based problem solving methods to define livelihoods training to subjects as the medium for delivery. Currently, IATP operates in five provinces and plans to be totally self-financing by 2013, and be established country-wide by 2016 (Sitapai, 2012).

PNG University of Technology-South Pacific Institute for Sustainable Agriculture and Rural Development (SPISARD)

SPISARD is the University centre for the promotion of rural development (Dekuku *et al.*, 2009). The institute is tasked to develop location and farming system specific extension methods and approaches, and provide training and transfer of sustainable agricultural technologies related to food and cash crops, and livestock. The aim is to improve and attain sustainable integrated farming system practices suitable for subsistence and semi-subsistence farming communities. It promotes a "model village" concept, where chosen rural locations become focal points for on-farm research, training and extension with active farmer participation. This approach is unique in PNG, because the development process takes place in the farmer environment with immediate real time feedback based on the farmers perspective and satisfaction. Presently, SPISARD is working in model villages in four provinces, and will expand its program country-wide as resources permit (Sitapai, 2012).

3) Private sector assisted delivery

Fresh Produce Development Agency (FPDA)

Fresh Produce Development Agency was established in 1990. It is a non-profit organisation funded by the government and major international donor agencies. The organisation's purpose is to improve efficiency and productivity of both male and female farmers as well other stakeholders in the fresh produce value chain and ensure a commercial and economically viable horticulture industry in PNG. FPDA has the following objectives: a) improve and sustain productivity of horticultural crops; b) encourage competitive scale of production and supply; and c) provide a vibrant,

effective and an efficient marketing system for horticultural crops for farmers (Askin *et al.,* 2008).

In 1995 after five years of operation, a gender analysis and social impact assessment study of commercial vegetable marketing identified problems hindering female farmers' participation in horticultural crop production. FPDA was recommended to focus more on women in order to promote fruit and vegetables. FPDA was also recommended to set up a separate program to help women farmers in the fruit and vegetable industry, taking into consideration planning and implementing activities that addressed socio-economic issues. In 1996, a gender and youth program was established to promote and encourage women and men to increase income and employment through the development of a competitive and sustainable fruit and vegetable industry (Askin *et al.,* 2008).

In 1997, another gender analysis and social impact assessment study of commercial vegetable production was conducted and key factors hindering women's participation in vegetable production and marketing were uncovered. This led to the establishment of the village extension worker (VEW) model in 1998. With the VEW model, the objective was to support female farmers with technical information, provide them with improved technologies and plant materials and empower women in production, marketing and processing of local fruits and vegetables (Askin *et al.,* 2008).

Smallholder Support Services Pilot Project (SSSPP)

SSSPP was piloted in Morobe and Eastern highlands provinces as a national coodinating department. It was funded by the Asian Development Bank (ADB) with national government funding for five years. The loan agreement was signed in April 1999 by PNG government and ADB and projects commenced in 2000 and ended in 2007 (Lahis, 2011; Sitapai, 2012). SSSPP was a form of contracted extension services with its aim to strengthen provincial extension using mixed model of public service to smallholders. SSSPP was designed to improve the delivery of support services to smallholders through a demand-driven contracting–out process. This

included an establishment of a support service contract facility in each of the provinces (Sitapai, 2012). The project has three main components:

a) Support service contract facilities,
b) Capacity building, and
c) Project coordination.

The major role for SSSPP was to improve the linkages between Department of Agriculture and Livestock (DAL) extension activities and semi-government commodity extension activities such as provided by CIC. A further focus of the SSSP project was to promote contracting out services to smallholder farmers to make them more efficient, flexible and cost effective (Api *et al.*, 2009).

SSSPP is a farmer driven local service provider and output-based contract extension delivery system. It uses a bottom-up approach which provides an alternative delivery system to the traditional top-down extension service delivered by public servants. It is a result of a response to the reform agenda of the PNG government and is a shift from a public funded extension system to one that is public/private sector funded and delivered (Api *et al.*, 2009).

The key aspects of SSSPP are as follows:

- Interested communities are assisted to identify their priority needs and formulate action plans through participatory rural appraisal and planning (PRAP).
- A dedicated trust fund and management unit is established per province.
- A pool of interested service providers are contracted to deliver services in response to action plans.
- Farmers participate in monitoring the evaluation of implementation supported by external evaluation of contract outputs and outcomes.
- Promote public private partnership and joint ventures in service delivery and
- Ensures adequate backstopping and capacity building of service providers (Sitapai, 2012).

The quality role of service providers was a necessary prerequisite for success in this model of extension. Two important trends worth noting are; firstly, service providers' skills become more specialized as farmers demand become more specific; and secondly, community groups contracted their own village extension workers as they developed user-pay capacity (Sitapai, 2012).

The success of the service delivery depends on the establishment of a specific fund for extension contracts, in which dedicated funds are targeted to a community or a farmer organisation with more than 20 smallholder households. The contracts awarded help the recipients to be self-reliant. Being self-reliant means that all farmers groups are expected to contribute to the cost of service in cash or in-kind. Contributions made by farmers may be used to provide inputs such as printed source materials and demonstration supplies such as planting materials, pruning shears, fish fingerlings, small livestock, etc. The success also depends on the development of a cadre of local service providers and a reorientation of the public service delivery *per se* (Api *et al*., 2009).

Review of SSSPP had indicated that there was a wide scope of adoption with projects increasing access to smallholder households to agricultural support services in both provinces. All districts and local level government (LLG) participated with an increasing number of households benefiting from the project. An evaluation study conducted showed that the projects were viable and that 80% of the contracted farmers preferred the contracting of extension service approach and the delivery of service from service providers. Due to the success of the project, CIC had successfully adopted the concept after a complete reorganisation of its outreach/extension division (Lahis, 2011).

4) Participatory or farmer-demand driven extension

Since 2000, there has been a continuous reassessment and re-focusing by change agents and their organizations in how they can work with farmers more effectively. Using methods such as experiential learning and farmer-farmer exchanges, researchers and their agents have discovered that knowledge is better gained through interactive processes, and wider stakeholder participation. Farmers involved are

more committed participants because they are allowed to take decisions themselves, of the innovation options before them, and the perceived outcomes. Participatory modes of extension currently being used in PNG are: farmers field school (FFS) concept, participatory action research (PAR) or participatory technology development (PTD) (Sitapai, 2012; Api *et al.*, 2009).

FFS is being trialled by CCI to improve cocoa farm management practices in curtailing losses to cocoa pod borer. It is a group-based learning process used in several countries to promote integrated pest management (IPM) strategies. FFS brings together concepts and methods from agro-ecology, experiential education and community development. NARI is the lead advocate of PTD; an approach to learning and innovation that promotes sustainable agriculture. The approach involves collaboration between researchers and farmers in the analysis of agricultural problems and testing of alternative farming practices (Sitapai, 2012).

One of NARI's technology innovations, the integrated pest management strategy (IPMS) for taro beetle in PNG, has shown great success at the farm level when it was introduced using the PTD approach. Rural women farmers set themselves up as members of a cooperative society to commercially produce taro for export to urban markets using NARI's IPMS technology. FPDA has promoted the engagements of VEWs in vegetable and horticultural production at village level. This approach promotes indigenous technical knowledge, and recognizes the value of local expertise and traditional wisdom. The participatory approaches for farmer empowerment are not widely used, as they are recent interventions in PNG. In other developing countries, these approaches have proven to be farmer-friendly, cost-effective, and provide a sound basis for achieving sustainable smallholder agriculture. The aforementioned approaches are being promoted by NARS institutions or are project driven. While this is acceptable, it is now widely recognized that such methods are merely tools which, to be effective, need to be part of wider institutional structures, organizational procedures and financial mechanisms. These mechanisms help create a voice for the users of extension, and makes extension service providers accountable to their clients (Sitapai, 2012).

During an extension summit in Papua New Guinea at the University of Technology in 2004, various extension models being implemented in the country were identified. These included:

- The Simbu farmer's association model.
- Farmer-to-farmer concept.
- Commodity and provincial extension system. This focuses more on a one on one delivery system as practiced by Commodity Boards and Provincial and District Departments of Primary Industry.
- Cooperative association.
- Radio extension programs, and
- The AusAID funded integrated training program in East New Britain, a public-private partnership in economical development (Dekuku *et al.*, 2004).

During the extension summit it was acknowledged that all the extension organisations were productive as results from programs implemented were achieved at varying degrees. However, during their course of establishment, no evaluation and assessments were conducted in order to determine their sustainability (financial, human and environmental), effectiveness and efficiency. Therefore, it was concluded that no extension model was yet ready to be fully recommended for adoption by farmers.

To recommend a suitable extension model for the country, it is important to evaluate the various extension systems and promote only the most suitable ones in the future. In addition, it is expected that a good extension model should promote partnerships with farmers, strengthen linkages with sector agencies, promote human resources and skills development and contribute towards human, financial and environmental sustainability (Dekuku *et al.*, 2004).

2.4 Current status of agricultural extension in PNG

Agricultural extension forms a major component of the national agricultural development program and is necessary for improving productivity and production in the agricultural sector. The provision and support for agricultural extension is

largely a government responsibility. The service is offered along commodity lines using a T&V system or driven by general rural development programs. The activities are targeted at the district and village levels and the success of the program is dependent on availability and quality of resources (human and financial) (Sitapai, 2012).

However, agricultural extension has been in decline since PNG gained political independence in 1975. Since 2000, several non-government organisations (NGOs) and community-based organisations (CBOs) have also become actively involved in the delivery of agricultural services. Most of these agencies are linked to donor and financial institutions, churches and farmer groups or organisations. This is in response to the break-down of government service delivery efforts since independence past (Sitapai, 2012).

Regardless of the different types of extension approaches outlined above, the delivery of extension services to farmers remains ineffective. A good example from PNG is the traditional extension providing extension services without necessarily taking into account the sustainability of the services at a national or provincial level (Dekuku *et al.,* 2004). For example, CIC discovered that the research output resulting from T&V approach led to extension recommendations that were too expensive for farmers to implement or were directed at problems that were not important to farmers. This led farmers not to adopt new techniques (Api *et al*., 2009).

In PNG the decline, ineffectiveness and inefficiency in extension delivery at the farm level is an outcome of a range of constraints that stifle the economic growth of the nation. These include differences in extension priorities between the national and provincial authorities, too much bureaucracy, too many levels in the systems and a lack of clear direction given to field extension officers. There is also insufficient training and experience to plan, implement and monitor extension programs at various levels of the Department of Primary Industry (DPI). There is also a lack of coordination between research, extension and farmers' access to capital in terms of credit facilities, market access and other support services. In terms of human

resources, agricultural extension is staffed with a large number of unqualified and underqualified extension personnel as a result of poor selection procedures. General infrastructure to boost extension services is also degraded in many areas in PNG (Bakani, 1994).

In addition, during the 2004 agricultural extension summit, cross-cutting issues hindering extension were identified. One factor, mentioned above, was the fragmentation of extension organisations working in isolation and on an ad-hoc basis. The summit also identified that village-led and market driven extension is on the decline due to lack of resources (skilled personnel, financial and market facilities).

From past experience, lack of commercial expertise by public service agencies has also hindered effective extension delivery. Thus, seventy years on and after much was invested in research and extension, the extent of the impact of agricultural extension in PNG on farm productivity and income is limited.

2.5 Factors limiting the effectiveness of agricultural extension

The factors contributing to the ineffectiveness of extension services vary amongst developing countries. However there are common themes that help explain the ineffectiveness of extension services. Hulme (1983) identified the following:

- Farmer resistance to change farming practices.
- Low adoption of extension messages and innovations.
- Organisational and managerial constraints.
- Low quality of extension staff.
- Lack of relevant research and poor communication between research and extension.

To Hulme's list could be added:

- Declining ratio of extension officers to farmers.
- Lack of support services.

1) Farmers' resistance to change farming practices

Not all techniques and innovations are fully adopted and utilised by farmers. As farmers have traditional knowledge to cultivate their land it is often difficult to change existing farming practices. However, there are factors that contribute to farmer resistance to change. If resource poor areas are to participate in the development process, agricultural technologies developed through research need to be adaptable to the socioeconomic situation of the farmer. The success of an agricultural project depends on the ability of the technology to be adopted and used. The ability for the technology to be adopted depends on the farmers' needs.

Decisions whether to adopt or not depends entirely on the farmers. Sometimes new technologies are not appropriate for the needs of farmers because they are not suitable for the geographical and climatic conditions (von Blanckenburg, 1982; Bakani, 1994; Wadsworth, 1995). For example, low adoption of insecticides by cocoa growers resulted from farmers' inaccessibility to equipment to be used for spraying insecticides which was part of the improved techniques demonstrated to farmers (Opare, 1980). Not only does inappropriate technology create little incentives for farmers to change, but if farmers are uncertain of the ongoing costs and the inputs to be used when adopting new technologies, then it is unlikely the technology will be adopted. If the costs are low and output in production increases over traditional cultural practices that farmers were used too, then it is more likely for farmers to adopt new farming practices (Kebede *et al*., 1990).

Research done in Surinam, Indonesia in two distinctly different agricultural areas discovered that new irrigation technology was differently adopted even though field demonstrations were conducted in both areas. A well-drained drainage and irrigation system was introduced to both agricultural areas. One group of farmers believed that the techniques were too risky and insufficiently profitable for them under their existing farming conditions. However, the same technique was adopted in other parts of Surinam as farmers who have adopted the practice realised the increase in rice production (Kalshoven, 1978). Similarly, small farmers in China did not adopt improved cotton varieties after it was introduced as they were not sure if the new improved cotton variety was resistant to pests and diseases (Yang *et al*., 2005).

2) Adoption of extension messages and new innovations

The adoption rate of extension technology and innovation can be used to measure the effectiveness of an extension agency or organisation. When considering adoption, often farmers are the ones blamed for not adopting new innovations. However, research in the Philippines tells a different story. The research identified six reasons why farming innovations intended to improve sustainability of upland agriculture were not adopted by local farmers. These included the following: a) the innovation was not suitable for the geographical location and addressed the wrong problem. The problem addressed by the proposed innovation was not a major problem faced by the farmer; b) the existing farming practices were equal or better than the proposed innovation; c) the innovation did not work; d) extension failed by not correctly demonstrating the innovation to the target farmers who needed it most; e) the innovation was too costly; and f) social factors such as insecure land tenure were other reasons why the new technique was not adopted (Fujisaka, 1994).

One cannot always blame farmers for being lazy, uneducated and stubborn when it comes to adopting new techniques. Instead, farmer adoption can also be determined by the type of extension information provided by extension officers to farmers. Extension information is adopted if it is suitable to the geographical location, the local farming system and is according to farmers needs. It was evident from research done in Sri Lanka, that high yielding coconut varieties should have been only recommended for specific soil conditions and were not suitable for all smallholders. Because extension officers did not take account of local conditions before advising farmers, many of the new coconuts were distributed to areas unsuitable for the new varieties and turned out to be low yielding (Fernando, 1988).

Research in Punjab, Pakistan also has revealed that low levels of adoption resulted from extension officers not motivating farmers enough to adopt the new technology (Chaudhry *et al.*, 2006). Not only that, the decision to adopt a new idea is not an instantaneous act but rather a process of decision making. Farmers, like most other businesses, evaluate and analyse the advantages and disadvantages of any innovation before adopting (Opare, 1980). Below are some of the factors that influence farmers to adopt or not to adopt new technologies:

i) Adoption and farmers' preferences on the characteristics of new techniques introduced

Research done in Burkina Faso and Guinea in West Africa among sorghum and rice farmers had proved that decisions farmers made regarding the adoption of new agricultural technology depends on the characteristics or advantages of the new techniques. A good example is farmers adopting a new innovation in which certain desired characteristics of crops such as a high yielding variety, perception of tillering capacity and other agronomic features that increase production were factors influencing the motivations of farmers to adopt new improved techniques (Adesina and Baidu-Forson, 1995).

Farmers' level of adoption does not only depend solely on desired characteristics of new innovations. The rate and extent of adoption of innovations by farmers is also influenced by the characteristics of farmers themselves (Greiner, 2011). A good example is research done in Australia on cattle farmers which revealed that farmers chose not to adopt innovations such as the application of applying synthetic fertilizers to increase pastures. Instead farmers placed more emphasis on living in harmony with the environment rather than adopting techniques which they believed were destructive to the environment (Frank, 1997).

ii) Adoption and farmer education level margin

Education is often hypothesised to have an effect on agricultural productivity by increasing the ability of the farmer to increase output using limited resources and also by enhancing their capacity to synthesise and analyse information that is important to use (Asfaw and Admassie, 2004). Generally research has shown that low levels of education among farmers tended to foster unfavourable attitudes towards technology adoption (Obibuaku, 1974).

Nigerian research carried out at the individual farm level concluded that literate farmers were more likely to adopt new technologies to improve production than lower capital base and less literate farmers. The results suggested that extension efforts were more likely to be focused on more literate and high capital base farmers (Akinbode, 1976; Iwueke and Findlay, 1979; Jamison and Moock, 1984; Sofranko *et*

al., 1988; Strauss *et al*., 1991; Hussain *et al*., 1994; Parikh, 1994; Lapar and Ehui, 2004).

However, reviews of the education qualifications of UK farmers concluded that education does not increase profitability and productivity of farmers but only changes farmers' behaviour about new technologies. As technology becomes increasingly dominant, externally acquired knowledge takes precedence over tradition and experience (Gasson, 1998). Research in Brazil proved that adoption of new techniques depends not only on the education level of the farmers but also on their experience in farming (Strauss *et al*., 1991; Mazvimavi and Twomlow, 2009). Experienced farmers were likely to adopt new extension messages.

Adoption of a new technology depends also on the education level of all household members on the farm apart from the household head. Having a generally high level of education amongst all family members is associated with certain tasks and functions being performed with higher efficiency, and these families were more likely to adopt new technologies in a short period than uneducated people. This also explains that decision-making in adoption of new technologies is at a farm level and depends not only on the household head but on other family members as well (Chitere, 1985; Asfaw and Admassie, 2004).

iii) Adoption and farm size and availability of household labour

Research in parts of Africa and Asia has shown that farmers with a large farm size rapidly adopted new techniques as they could apply more capital goods than the farmers with small farms (Kalshoven, 1978; Kebede *et al.*, 1990; Parikh, 1994; Marenya and Barrett, 2007; Mazvimavi and Twomlow, 2009). Thus, farm size has a positive impact on the adoption of new technology which reflects the increase in both the financial and production ability of farmers (Hussain *et al*., 1994). Research has also identified that availability of household labour had positive impact on adoption of integrated natural resources management practices. Lack of family labour accompanied by inability to hire labour had seriously constrained adoption. Therefore, availability of family labour played an important role in adoption (Marenya and Barrett, 2007).

iv) Adoption and financial capital margin

Research conducted in developing countries has reported that farmers who adopt new technologies tend to have a high capital base (Nweke, 1981; Sofranko *et al.,* 1988; Parikh, 1994). However, research done in Somalia by Kebede *et al.,* (1990) revealed that the debt level of farmers had the anticipated effect of inhibiting ability to adopt new techniques if the techniques required any form of payment. In addition, research in the Philippines on the adoption on cattle forages, identified that the determining factor for farmers' adoption was their capacity to finance the cost as reflected by their income and access to external sources of income (Lapar and Ehui 2004; Mendola, 2007). Thus, farmers' probability of adopting technology depended not only on farm income but also on off-farm income (agricultural or non-agricultural) (Marenya and Barrett, 2007; Mendola, 2007).

The cost associated with new innovations to be used to increase production also determines whether farmers can adopt or not. For example, research in Kenya showed that most farmers did not apply fertilizer because it was expensive and instead replaced it with manure. Development in agriculture requires farm households to take risks. Research in Pakistan showed that risk played an important role in farmers' decisions about the allocation of resources including capital investments in agricultural production. Therefore, risk-averse farmers were less likely to finance the cost of new innovations. However, the research also discovered that farmers who had better access to credit facilities took risks in adopting new technologies (Parikh, 1994).

v) Adoption and extension contact margin

Extension contact refers to extension officers meeting with farmers through normal farm visits, demonstration and farmer training or farmers participating in extension programmes. Research in Surinam, Indonesia found that farmers who frequently visited extension officers or extension centres had experienced significant increases in rice production (Kalshoven, 1978). However, those farmers who had more frequent extension contact, tended to have better technical knowledge and were motivated to learn and adopt new techniques (Hussain *et al.*, 1994). Not only did the better educated make visits to extension offices but they also had frequent visits from extension officers. This research can be supported by research in Pakistan which

indicated that farmers who were frequently visited by extension personnel were more educated, high producers, and highly skilled and located close to the extension office.

Farmers' age and the amount of land farmed were unimportant when explaining the frequency of extension contact. Therefore, it seems that the better educated farmers and more resourced farmers were the ones who benefited most from extension. Moreover, the research showed that extension contact was low in areas where information offered to farmers was not useful, out of date, and farmers had access to information from external sources other than from extension personnel (Sofranko *et al.,* 1988).

Economic status as determined by source of income, size of farm units and the farming knowledge of farmer influences farmers' ability to achieve high productivity. Research also proves that a person with high socio-economic status has better access to public service agencies than a person with low status and will be better able to understand information provided and make effective use of extension services (Kalshoven, 1978; Chitere, 1985). Research done in Ethiopia to improve production of maize during the drought by employing two ox instead of one, revealed that wealthy farmers with higher economic status and those with a lot of cows were more likely to adopt new innovations than poorer farmers (Kebede *et al.*, 1990; Marenya and Barrett, 2007).

3) Organisational and managerial constraints

The type of organisation and administrative arrangements that an extension officer works in, determines the role, job satisfaction and effectiveness in carrying out his/her job as an extension officer (Onazi, 1982). Research in Africa, revealed that ineffectiveness and inefficiency in extension service delivery was due to factors such as an absence of departmental policy and extension objectives for the organisation, high ratio of senior staff to junior staff resulting in unqualified subject matter specialists, jobs filled by non-agricultural graduates, low budget allocation for extension and, most of all, the management and organisational structure embedded was not suitable to a non-western cultural orientation. In addition, services, employment conditions and facilities like, housing, poor salary, and lack of logistic

support like transportation were factors affecting extension services (Fortmann, 1985; Bembridge, 1987).

In the case of Papua New Guinea, organisational problems arise from the fact that more than one agricultural extension organisation is involved in the same area (McKillop, 1974b). Due to the decentralisation of extension and differences in extension priorities between national and provincial extension in PNG, extension services are bureaucratic, resulting in too many levels in the extension system with no clear objectives and direction given to field extension staff leading to ineffective extension (Bakani, 1994).

4) Quality of extension staff

The subject matter specialist is often called the extension specialist and is the central figure or the middle man whom is solely responsible for liaising between research and extension. To fulfil this role, an extension specialist must be mature, knowledgeable, well-trained and experienced in extension methodologies. Agriculturally, economic growth depends on human capital (Asfaw and Admassie, 2004). In PNG, one of the current constraints on extension is poor selection of extension personnel, resulting in large numbers of unqualified and underqualified personnel which undermines the quality and effectiveness of the extension services provided (Fortmann, 1985; Bakani, 1994).

One important factor that hinders economic and agricultural development in a developing country like PNG, is the limited number of trained scientists and management staff in extension (McKillop, 1974b; McKillop, 1994). Extension workers lack of knowledge contributes to ineffective extension service. For example, Bembridge (1987) in his research in less developed countries identified that on average less than one in four extension officers had sufficient knowledge to be effective. In addition to extension workers' knowledge, extension workers have to be knowledgeable about a wide range of farming aspects rather than on a particular crop. Fernando (1988) found that the majority of extension officers in Sri Lanka were only knowledgeable on monocropping in coconut. But when, coconuts were

intercropped with other crops, extension worker were not in a position to help farmers.

5) Ratio of extension officers to farmers

Improved crop production in Kenya has been greatly hindered due to the reduced ratio of extension workers to farmers which has resulted in low adoption of improved crops (Chitere, 1985; Fortmann, 1985). Similarly, research conducted in two different agricultural areas in Surinam, Indonesia revealed that the areas with low adoption rates were those with a low ratio of extension workers to farmers (Kalshoven, 1978). It is evident that the low number of extension personnel to farmers makes it difficult for extension agents to care for all farmers in an individual advisory role. Research done in Sri Lanka identified extension personnel in the coconut industry were burdened with non-extension work leaving little time for extension. This has also had an impact on the quality of extension personnel which limited the effectiveness of extension services in coconut production (Fernando, 1988). This problem can be minimised through more extension group work in terms of plot demonstrations, farmer meetings and field days and less individual advisory (von Blanckenburg, 1982).

6) Lack of relevant research and poor communication between research and extension

One of the major cross-cutting factors that contribute to ineffective extension and constraints on economic development in PNG is the weak linkage between research, extension, farmers and various other agencies (von Blanckenburg, 1982; Bembridge, 1987; McKillop, 1994; Dekuku *et al.*, 2004). Extension in developing countries is often similar when it comes to factors contributing to the ineffectiveness in extension delivery. It is an unquestionable fact that research in agriculture, livestock, fisheries and forestry is of little value unless the results obtained through research are put to effective use and adopted by farmers.

Research has revealed that achievements have been made in research but the application and adoption of the new technologies and practices are still lagging. This sometimes means that there is little liaison between research and extension (Onazi, 1982; Bembridge, 1987; Bakani, 1994). Moreover, research conducted in Sri Lanka

revealed that extension was not effective as there had been no interaction between research and extension and between extension and farmers (Bembridge, 1987; Fernando, 1988).

7) Lack of support services

Research done in Nigeria revealed that success in extension is measured by the number of support services provided by the government (Akinbode, 1976). Extension and agricultural technology utilisation alone to improve productivity is not enough. Farmers need credit facilities and good road, transport and marketing infrastructure for them to improve growth in the agricultural industry (von Blanckenburg, 1982; Fortmann, 1985; Bakani, 1994; Dekuku *et al.,* 2004; Iqbal *et al.*, 2006; Mazvimavi and Twomlow, 2009). However, non-availability of support services such as technical assistance, provision of credit, quality inputs and proper marketing strategies for agricultural products is a hindering factor to adoption of new techniques (Chaudhry *et al.,* 2006).

The provision of credit facilities, marketing and infrastructure are factors that can motivate farmers to adopt new techniques (Sofranko *et al.,* 1988). In order to increase and improve production, research conducted in Sri Lanka on coconut farms has highlighted the fact that lack of access to credit facilities has reduced the ability of the farmers to shift to a relatively better technology recommended by the extension services system (Fernando, 1988). In addition, other support services like transportation are vital for extension services delivery. A study in Nigeria, revealed that most extension officers never made contact with farmers due to no means of transportation (Iwueke and Findlay, 1979).

2.6 Conclusion

This chapter has shown that extension approaches vary among different countries depending on certain circumstances. It mostly depends on organisational structures of bureaucracy, financial resources and programme goals of extension services. In PNG, agricultural extension dates back to the colonial era. Traditional agricultural extension, which was the top-down approach, was used until 1975 when PNG gained its independence. Prior to independence in 1975, agricultural extension was a division of Department of Agriculture Stock and Fisheries (DASF), now Department

of Primary Industry (DPI). During that era, agricultural extension was very effective, fully staffed and well managed. It was under the Organic Law in 1977 which led to the creation of the 19 Provincial Governments, and agricultural extension was delegated to each of the newly created provincial governments. Since then, provincial agricultural extension in PNG has been on the decline.

Extension services continue to suffer from among others, lack of direction due to lack of experience, lack of finance, poor planning and inadequate organisational structure, poor information and inadequate links with research, and insufficient training. Due to the dissatisfaction with the existing extension services, a number of private companies and parastatal organisations have recently begun to provide extension services. Quasi-government agencies such as Oil Palm Industry Corporation (OPIC), self-financing corporations such as Coffee Industry Corporation (CIC) and non profitable organisation have been funded both by the government and International donor agencies like (Fresh Food Development Agency (FPDA) were formed.

CHAPTER THREE

FIELD SITE AND METHODS

3.0 Introduction

This chapter provides an overview of the study site and the research methods used in the study. The data analysis techniques and the ethical issues raised by the research are also discussed. For the data analysing techniques, Statistical Package for Social Science (SPSS) was used for variable correlations, and pivot tables using Microsoft Excel were used to calculate averages.

3.1 Study site

The research was carried out in the Hoskins area in WNB (Figure 1.1). WNB is the western portion of the island of New Britain and the provincial capital is Kimbe. The area of the province is 21,000 square kilometres, and at the 2000 census, the province had a population of 184,504. Between 1980 and 2000, WNB's annual population growth rate averaged 3.7%, making it one of the fastest growing provinces in the country. The increase in population was due to in-migration and a high rate of natural increase. Population on the LSS blocks has increased greatly from the early 1970s when the LSSs were established: from a density of 7.2 persons per LSS block in 1975 to 13.3 persons per block in 2000. The increase in population is a result of second and third generations now living on the block and benefiting from the oil palm income. Also, because most children were raised in WNB and learnt Melanesian Pidgin rather than their home language, their chances of returning home and successfully re-establishing themselves were slight (Koczberski *et al.*, 2001).

In the 1950s WNB was identified as a suitable area for oil palm cultivation. Land settlement schemes (LSS) in PNG were established between 1950 and 1962 to promote agricultural and economic sustainability and development. In 1966 the British plantation company, Harrisons and Crosfield, applied to the administration to develop an oil palm nucleus estate-smallholder project and the following year the

first nucleus estate-smallholder scheme based on oil palm was established at Hoskins as a joint venture between the government and Harrisons and Crosfield. New Britain Palm Oil Development Pty Ltd (NBPOD) was later registered as a joint venture company and oil palm was developed in the province at Nahavio in 1967 (Koczberski *et al*., 2001).

When the Hoskins LSS was initiated in 1968, smallholders were provided with an agricultural lease over 6 ha and a loan from the Papua New Guinea Development Bank (PNGDB) for expenses required for building houses, oil palm seedlings, land rent, tools and other expenses until the first harvest commenced. The agricultural leasehold blocks were advertised publicly, allowing all Papua New Guineans to apply. However, preference was given to applicants from land short areas of the country, especially in the provinces of East Sepik Province (ESP), Chimbu, Enga, and East New Britain Province (ENBP) (Koczberski and Curry, 2005).

A grouping of approximately 130-320 blocks formed a subdivision on the LSS, with each of the subdivisions having a community centre consisting of a primary school, a health centre, recreational centre, market and stores. A divisional extension office was also part of the community centre with a divisional manager, extension officers and field assistants located on each division to provide extension advice to smallholders (Koczberski *et al*., 2001). After the establishment of the LSS, customary landowners in the Hoskins area were also encouraged to plant 2-4 ha of oil palm on customary land (Koczberski *et al*., 2001; Koczberski and Curry, 2005). As of December of 2008, Hoskins had a total of 6,821 smallholder blocks (including both LSS and VOP) producing 379,498 tonnes during the same year (Orrell, 2009).

The Hoskins smallholder scheme was based on a nucleus estate-smallholder model whereby LSS are located around private company plantation and processing mills. The private oil palm company provides for necessary facilities and services such as planting materials, extension advice and importantly, transport to cart smallholder crop to the mill. The milling company also provides technical support, milling and processing of oil palm fruit, and, payment to smallholders for their fruit on a fortnightly basis. Not only do smallholders benefit from the services mentioned

above but the large plantation estates, transport services and the mills also provide additional employment opportunities for smallholders, especially on the LSS (Koczberski *et al.*, 2001).

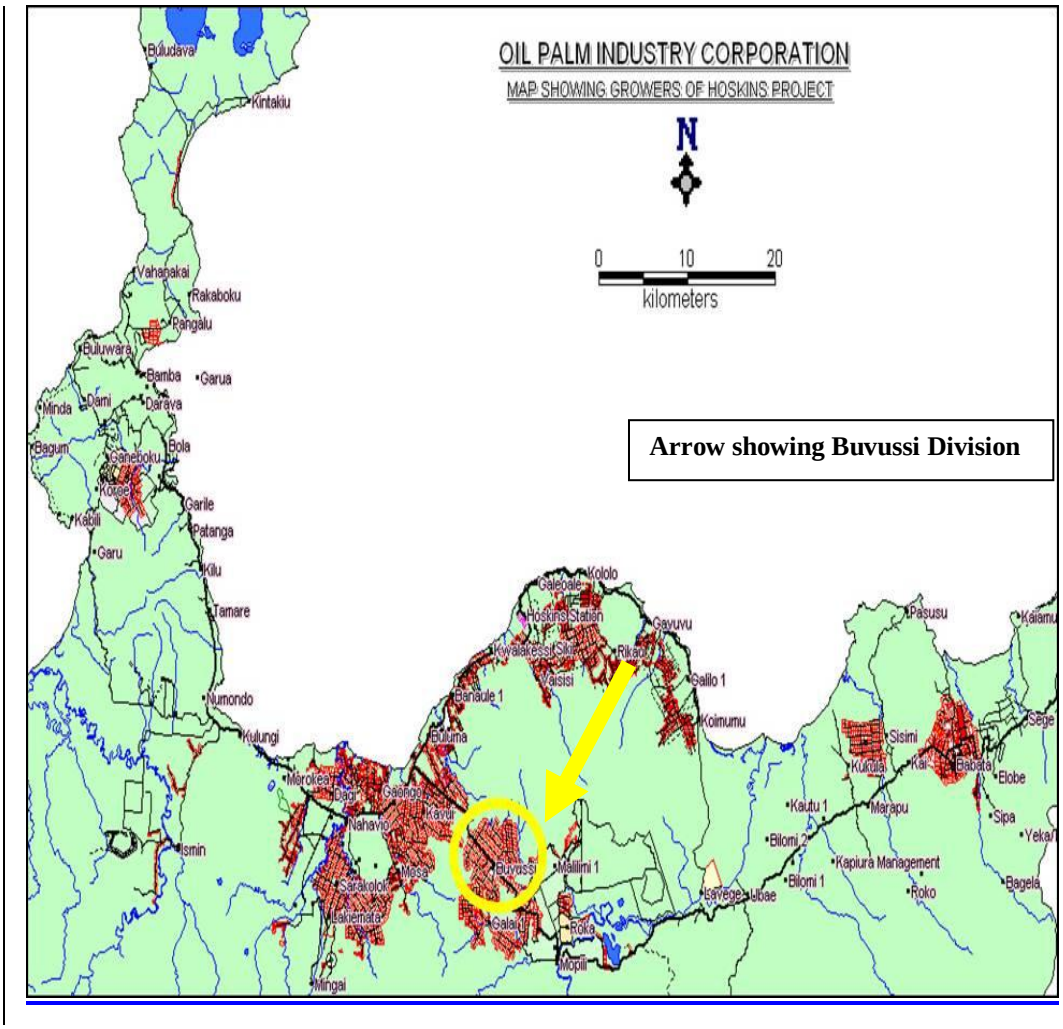

Figure 3.1 Map showing locations of LSS and VOP smallholders' subdivisions in Hoskins oil palm project. (Source: OPIC)

The research was carried out in Buvussi Division (Figure 3.1) from the 18th of July until the 10th of September 2010. Buvussi Division has 529 LSS blocks and 142 VOP blocks (Table 3.1). Of the total LSSs and VOPs at Buvussi Division, 34 LSS blocks and 15 VOP blocks in both Bubu and Lilimo were surveyed.

Table 3.1 Number of LSSs, VOPs and mini-estates blocks under Buvussi Divisions

Subdivision and total number of blocks			
LSS		VOP	
Buvussi	355	Bubu	110
Galai 1	198	Lilimo	32
Galai 2	76		
Total	**529**		**142**

3.2 Research methods

Research methods are not simply neutral tools; they are related to the ways in which social scientists make connections between different viewpoints, about the nature of social reality and how it should be examined (Bryman, 2004). Research techniques for collecting and analysing data can be categorised as quantitative, which analyses data collected using standardised instruments in numerical forms or as categories, and as qualitative data that require the analysis of text data (Creswell and Plano Clark, 2007).

For this research a mixed method approach was adopted. Mixed methods involve the combining of both qualitative and quantitative methods so that both approaches provide a better understanding of the research problem than either of them on their own could provide. The basis for employing this design can be generally described as methods to expand the scope or breadth of research to offset the weaknesses of either approach alone. Mixed methods help validate one form of data with the other form or to address different types of questions. Using this approach, a sequential mixed method of data collection strategy was used whereby data collected using close-ended or survey contributed to data collected in the next open-ended and in depth interviews. The subsequent in-depth interview consisted of individual questions intended to explore particularly interesting or ambiguous survey responses as well as a standard question intended to explore perceptions and attitudes of blockholders regarding their knowledge and understanding on oil palm production.

Quantitative approaches involve facts that have objective theories to be tested. Quantitative approaches are more scientific and experimental than qualitative approaches. When testing hypotheses, variables can be identified and relationships between variables can be examined. These variables can be measured on instruments so that numbered data can be derived which can later be analysed using formal

statistical procedures. On the other hand, qualitative research primarily seeks to explore and understand attitudes, behaviours and the experiences of individuals or groups. The process of the research takes into account question formulation, designing procedures and collecting data that are suitable to the participant settings through such methods as focus groups, participant observation and in-depth interviews.

Qualitative research techniques attempts to obtain an in-depth understanding of a particular issue or situation from participants and therefore it requires more time with each participant. Generally, fewer participants are interviewed than with techniques using quantitative research (Creswell, 2009). Qualitative researchers are mainly interested in the meanings people attach to certain things and how people make sense of their lives, experiences and their understanding of the world. Therefore, the researcher plays a key role in data collection and during fieldwork the researcher completely immerses himself or herself to live and experience the issues and the problems faced by participants in order to fully understand the situation (Berg, 2004; Creswell, 2009).

The mixed method approach, capitalises on the strengths and overcomes some of the limitations of both qualitative and quantitative approaches (Creswell and Plano Clark, 2007). In addition, a mixed method approach can provide more comprehensive answers to research questions, going beyond the limitations of a single approach as many research questions are complex and are not able to be answered using a single method.

3.2.1 Quantitative approach: questionnaire surveys

Part of my research relied on the use of a structured questionnaire survey. Each person interviewed was presented with exactly the same questions in the same order. These questions were mostly closed questions with some open-ended questions and were conducted by the interviewer rather than self-administered. A structured questionnaire was used so that differences in answers between participants could be quantified. This allowed me to detect differences in views and attributes amongst respondents which could then be explored further using qualitative methods.

A total of 36 smallholders were interviewed and surveyed. Before the questionnaire survey was administered, a consent form was read so that interviewees were aware of their rights during the process of interviewing. During the survey both husband and wife were present and on many occasions the whole family was present.

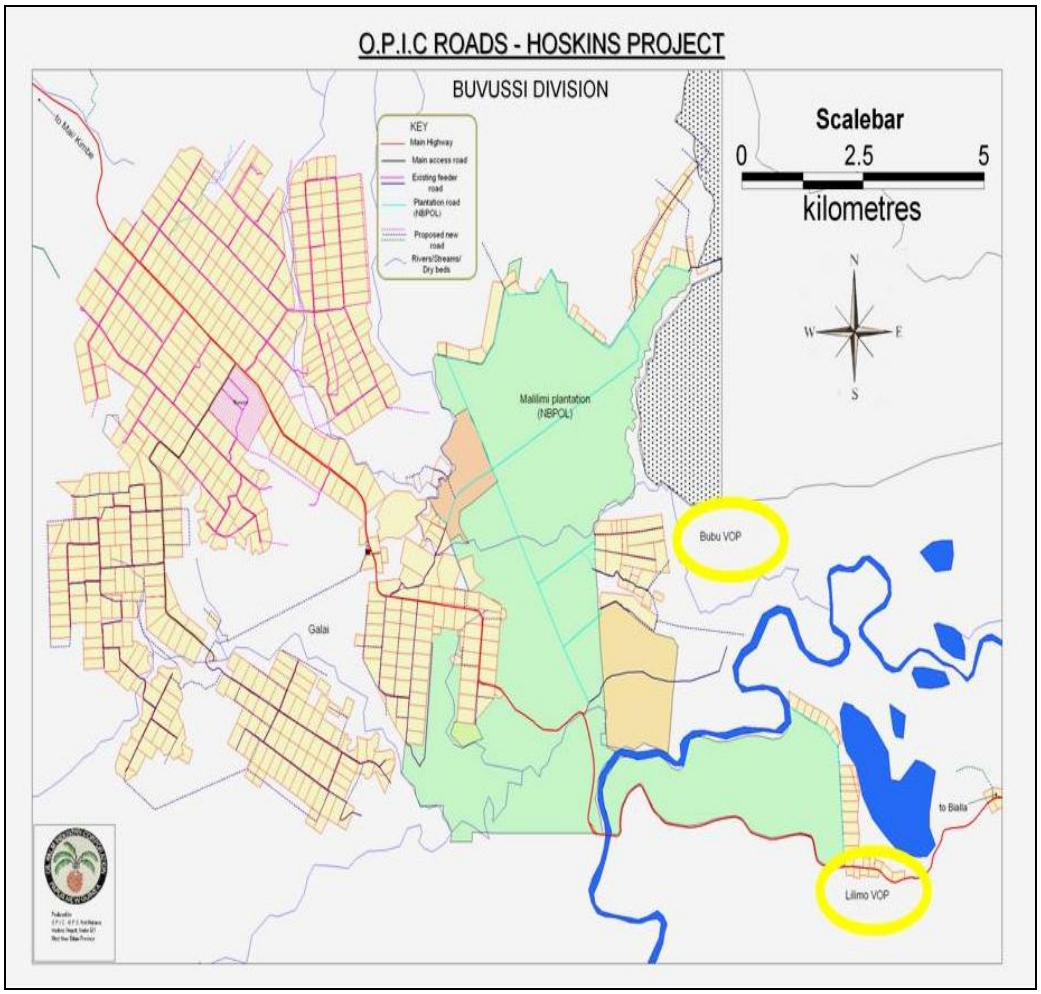

Figure 3.2 Map of Buvussi Division showing Buvussi LSS and Bubu and Lilimo VOP. (Source: OPIC)

The questionnaire used a mixture of structured (closed) and semi-structured (open-ended) questions. The open-ended questions were very useful as they permitted me to understand the world as it was seen by the smallholders. It also gave respondents the opportunity to make known their opinions and feelings without predetermining those points through prior selection of questions. The closed questions used standardised methods in which varying experiences and perspectives of people were easily fitted into predetermined response categories (Patton, 2002). The questionnaire survey was a useful tool to gather information on some of the main

variables or indicators that were used to assess extension effectiveness. The questionnaire gathered information purposely to evaluate the effectiveness of the main extension approaches used by OPIC and also to identify key factors hindering the adoption and implementation of extension messages among smallholders. The questionnaire collected data on:

- Age.
- Average education level of both primary and secondary households on each block.
- Block population and the number of families living on each block.
- Leaseholder status.
- Oil palm production strategy.
- Work experience in oil palm production.
- Extension contact with smallholders.
- Smallholders' knowledge and skills in response to extension messages.
- Level of adoption of extension messages, and
- Ways to improve the effectiveness of OPIC's extension strategies.

3.2.2 Qualitative approaches

In adopting qualitative approaches in this study I was interested in gaining a detailed understanding of the socio-economic situation of smallholders and the everyday problems they face in oil palm production. My role as researcher was aided by two main factors. First, as a Papua New Guinean I speak Melanesian Pidgin fluently and also understand very well the traditions and cultures of the people living on the oil palm blocks. I also worked as an oil palm plantation cadet with NBPOL from 2005 to 2007 and was familiar with most operations required in oil palm production. The different types of qualitative methods used in the study are listed below:

- Ethnographic techniques involving collection of observational data including living on the LSS with a smallholder family and participating in OPIC field day.
- A workshop with OPIC extension officers.
- Focus groups with farmers (about 36 blockholders).
- Formal and in-formal interviews.

- Secondary data from OPIC and milling companies for individual block productivity, and
- Attending field days.

The qualitative data were analysed inductively ascending from particular to general themes with the researcher making interpretations of the meanings of the data.

1) Ethnographic techniques

Ethnography was used as an approach to understand smallholders' opinions and viewpoints and also to enable me to be part of their everyday lives. It involved immersing myself in the day-to-day lives of the people living on the LSS and VOP and observing daily what smallholders do. I spent two months living with a family on a leasehold block at Buvussi LSS, and shared daily meals with them. I knew the family from when I worked with the milling company. The family I was living with were kind to me and that made me feel as if I had been accepted as part of their family. A good example was the celebration of my daughter's birthday on the block when they prepared a traditional feast and also contributed in cash towards the expenses while I was living on the block. Living on the LSS, enabled me to observe and learn more about smallholders' farm management practices, both on the block where I was living and on neighbouring blocks. Also, residing on a smallholder block gave me the opportunity to experience first-hand some of the problems smallholders were encountering. Good examples were poor access to clean water, limited land for gardens and scarcity of fuel wood for cooking. Being part of the community, I also experienced the daily difficulties and challenges that smallholders regularly face.

2) Workshop with extension officers

Prior to collecting data from smallholders, a half-day workshop was conducted on the 19th of July, 2010, with all agricultural extension officers at Nahavio, the OPIC base for the Hoskins oil palm project. Most of the extension officers and divisional managers attended the workshop. In total 46 extension officers and divisional managers were present at the workshop. The purpose of the workshop was to explain the objectives of the study and to find out from the perspective of extension

officers the status of the extension approach currently used and whether or not they thought it was effective. The workshop also gathered information on what officers themselves considered were the key barriers constraining their capacity to conduct effective extension to smallholders. The smallholder questionnaire survey forms were pre-tested with extension officers during the workshop and minor changes were made before commencing interviews.

3) Focus groups with farmers

A focus group is defined as comprising both an interview and an observation (Teddlie, 2009). Focus groups can also be a series of planned discussions designed to obtain perceptions of a defined area of interest in a permissive, nonthreatening environment (Krueger and Casey, 2009). Focus groups only work well when participants feel comfortable and are respected by other participants. This allows them to disclose their beliefs, opinions and perceptions (Krueger and Casey, 2009; Teddlie, 2009).

During fieldwork, a total of four focus group meetings were conducted (Plate 3.1). Two focus groups were conducted on the LSS blocks whilst the other two were conducted on two VOP blocks (Table 3.2). Prior to conducting the focus groups, participants were selected randomly from the sample. Due to the distances between blocks on the LSS, two central locations for all ten sections were chosen. Focus groups were conducted on selected blocks in an open area with 5-8 smallholders in each focus group and were arranged for times when smallholders were not harvesting oil palm or were not away collecting pay cheques.

The focus groups were considered to be a good technique for formal evaluation of the OPIC extension programs, particularly to evaluate its weaknesses and strengths and to find out the factors hindering and fostering extension services provided by OPIC. In the focus groups a lot of time was spent discussing important issues affecting production and other socio-economic problems. Also the focus groups were used to conduct a needs assessment among smallholders to identify the socio-economic and agronomic problems among smallholder households constraining block productivity.

Table 3.2 Number of focus groups conducted, their dates and locations

Number of focus groups	Date	No of attendees	Subdivision	Section	LSS/VOP
1	10/08/10	8	Buvussi	1,2,5 & 6	LSS
2	17/08/10	10	Buvussi	3,4,7,8,9&10	LSS
3	7/09/10	8	Bubu		VOP
4	8/09/10	15	Lilimo		VOP

Focus groups were conducted on a Monday each fortnight to allow smallholders time to harvest their palms for their fortnightly Friday pickup. However, for VOP blocks, focus groups were conducted on two separate blocks on Monday and Tuesday. During focus groups, I facilitated the meetings and guided the topics to be discussed (for focus groups questions refer to Appendix 3, part 5). The issues discussed by the smallholders were noted in my fieldwork journal. There was no time limit for the discussions. With a total of three topics, smallholders had plenty of time to talk and were given a chance to express their thoughts and ideas. When I facilitated the meeting, I turned to a new topic when repetition was detected during the discussion. Each focus group took between 2 and 3 hours. Refreshments were provided to participants during focus groups.

4) Formal and informal interviews

Informal interviews were conducted with smallholders from Buvussi and OPIC extension staff and several key people in the milling company**.** A total of 51 interviews were conducted. Smallholder interviews focussed on obtaining information on attitudes to extension services, knowledge gained through extension messages and smallholder perceptions of the effectiveness of OPIC extension officers. In interviews with smallholders I tried to have both husband and wife present, and usually other family members living on the block were also present and contributed to interview discussions. Interviews typically lasted from 30 minutes to 1 hour. Interview notes were recorded in my fieldwork journal and later typed into my computer. I also used a recorder as well to acquire an in-depth understanding of smallholders' role in oil palm production.

Interviews conducted with OPIC senior managers and extension officers were purposely for gathering information on the possible reasons why extension messages were not fully adopted by smallholders and alternatives they thought would be

effective for motivating smallholders to adopt extension messages in the future. In addition, an informal interview was conducted with the smallholder affairs manager from NBPOL. The purpose of the interview was to understand the aims and objectives of the smallholder affairs office and its role in oil palm production and improving smallholder production.

Plate 3.1 A group of smallholders discussing issues during a focus group at Buvussi.

5) Secondary data sources

Farm production (in tonnes) and 2008 palm census data for each of the smallholder blocks who were part of the household questionnaire survey were obtained from OPIC databases and company production records. The palm census data contained information such as the total hectares planted to oil palm, the initial year the block was planted to oil palm and it also included details of the year and hectares of oil palm replanted to oil palm since it was first settled. For verification purposes, each record was given an identification number which is similar to the block numbers the blockholders use.

The production data and the palm census data were vital to calculate production per hectare per year. Block productivity was measured by the average annual production in tonnes per ha per year. To get the average production in tonnes/hectare/year, palm census data conducted in 2008 on each block were used. The census data provided information on year of planting and replanting. Hectares planted after 1993 were converted to area of mature palm equivalent. The production data were converted to tonnes per ha for each block by dividing the production for each year by ha

equivalent of mature palms. This involved taking account of the age of the palms under cultivation and converting this into hectares of mature palm equivalent to enable productivity comparisons between blocks. Palms fully mature after 10 years were deemed to have reached their full production of 20 tonnes/ha. After calculating tonnes per hectare per year, average annual production per ha was calculated for the period of 2000 to 2009. The same was done for VOP blocks.

6) OPIC field days

OPIC conducts field days at Buvussi four times every year. I attended one field day at Niapo subdivision in order to observe and understand the type of information and messages delivered by extension officers to smallholders (Plate 3.2). While attending the field day, attendance and responses from smallholders were recorded to note whether the smallholders were interested and had understood the messages disseminated to them. Prior to the field day itself, OPIC field assistants, extension officers and senior extension officers informed all oil palm growers who were located in Niapo subdivision and the neighbouring VOPs to attend the field day.

Plate 3.2 A field officer explaining the quality of bunches to be harvested by smallholders during a field day in Niapo, Talasea.

For the growers who attended the field day, some complained that they were not notified by OPIC about the time and venue for the field day but attended because their neighbours had told them. Thirty eight male and female oil palm growers from around Niapo attended the field day, but most arrived late. During the field day, it became known that the field day had been scheduled during a harvesting week, when

growers were supposed to be harvesting, which explains the relatively low turnout of growers and why most arrived late. The field day was divided into three stations and growers were also divided equally into three groups. Twenty five minutes were allocated to each group for the extension officers to explain the extension message. After 20 minutes and before moving to the next station, growers were given the opportunity to ask questions if they wanted clarifications of any of the topics covered. Most of the growers were very responsive and had lots of questions. The three topics of the field day were:

a) Oil palm planting standards set by the inspection panel to satisfy the Roundtable Sustainable Palm Oil (RSPO) criteria [1].
b) Harvesting standards set by the New Britain Palm Oil (NBPOL) Smallholder Affairs, and
c) Fertilizer application rates derived from research conducted by the PNG Oil Palm Research Association (PNGOPRA).

3.2.3 Bennett's hierarchy

In order to identify ways to improve the effectiveness of OPIC extension strategies and to evaluate the knowledge of the smallholders acquired through time, Bennett's hierarchy which is a framework for extension program evaluation was used (Dart, 1998). Bennett's hierarchy was developed by Claude Bennett in the 1970s. The hierarchy was developed to justify the spending on extension programs and it was used to determine the effect of extension programs. Bennett's hierarchy was mostly focussed on the target outcomes of the extension programs. It also tracks progress of extension programs towards specific achievements and evaluates the degree to which programs impact on social, economic and environmental conditions. By doing so, the hierarchy also helps develop programs that can be evaluated. Thus, by evaluating, it further develops plans to initiate, modify or discontinue extension programs depending on the outcome (Bennett and Rockwell, 1995).

In the case of oil palm, strategies introduced by extension officers are targeted to increase oil palm production and improve block management. Therefore, to examine the effectiveness of the extension approach and strategies undertaken by OPIC,

Bennett's hierarchy was used to evaluate the two main extension programs undertaken by OPIC to improve smallholder production and incomes: 1) the promotion of farm management practices to improve production (nutrient management and block maintenance) through fertilizer application; and 2) the replanting of senile palms as outlined in Table 3.3.

The hierarchy helps identify whether or not the objectives of an extension program are achieved. At each level, indicators are used to measure the effectiveness of the program. Table 3.3 shows Bennett's hierarchy with examples of indicators and measures at each level that were used in my study. To fully understand the impact of the extension approaches used by OPIC and to determine whether the program has reached its end stage such as the adoption of extension messages, I used all seven levels of Bennett's hierarchy steps. By doing so, factors hindering adoption and problems associated with it can be identified.

Each level characterises different phases and dimensions of extension. During fieldwork smallholder interview questions were directed to each of the levels in the hierarchy. In doing so, the indicators in each level were used as tools to assess whether the objective of the OPIC program had been achieved.

Table 3.3 Bennett's hierarchy for evaluating extension programmes

Levels	**Indicators**	**Examples of measurement to be used in each levels**
Level 7	End result	Social, economic and individual effect of the program.
Level 6	Practice change	Adoption and application of knowledge and skills gained.
Level 5	Change in knowledge, attitude, skills and aspirations	Based on the block productivity data and general observation of the blocks, questions will be directed to smallholders to determine whether they have gained knowledge and skills.
Level 4	Smallholder opinions about extension activity carried out by OPIC	Questions directed to smallholders/extension agents as to whether or not they were satisfied with the extension program.
Level 3	Smallholder participation in extension activity	Attendance at field days, listen to radio broadcasts, availability of smallholder at block visits.
Level 2	Implementation of the program by OPIC	Field days, workshops, block visits, plot demonstration, radio broadcast etc.
Level 1	Inputs and resources used by OPIC	Extension officers, fertiliser, block maintenance information, oil palm seedlings, extension information.

Source adapted from Bennett 1977, cited by Dart, 1998

3.3 Variables and their measurement

As one of the research objectives was to identify relationships between variables, they were categorised as independent or dependent variables. An independent variable is a variable that is presumed to influence or affect a dependent variable, whereas a dependent variable is presumed to be affected or influenced by an independent variable (Teddlie, 2009). The independent variables in the study included: age of household head; education level of all individuals living on the block; block population; numbers of extended families living on the block; leasehold or land title type; production strategy used in harvesting; experience in oil palm production; level of farmers' technical knowledge; management skills of smallholders in oil palm cultivation, and smallholders' level of extension contact with extension services. Dependent variables used included block productivity in tonnes/hectare/year and level of adoption of extension information by extension officers.

3.3.1 Independent variables

1) Age

The age of household head was identified and measured in years.

2) Educational levels of all block residents

Education levels of all block residents were obtained: not only the leaseholder's educational level which is the usual case. Education is one of the factors influencing agricultural adoption decisions, so it was necessary to record the education levels of second generation co-resident household members who, alongside the leaseholder, also make management decisions on the block. Also, previous research has shown that the education levels of other household members can influence decisions made by the household head (Asfaw and Admassie, 2004).

Education levels were measured as a count of years of schooling for all individual in every household on the block. Children too young to be at school and adults who had no formal education were also recorded together with those who were still at school and those who had completed school. Using a pivot table on Excel application, average educational levels for each block were calculated.

3) Block population

Block population is the total number of individuals living on the block or those that were living elsewhere but benefitted from the income earned from oil palm.

4) *Number of households living on the block*

Apart from primary households, the number of secondary households was also counted to determine the total number of households residing on the block.

5) Leaseholder Status

Leaseholder status was categorised as follows: original leaseholder deceased and son managing the block; original leaseholder alive and, leaseholder absent and block managed by a caretaker.

6) Production strategy used in harvesting oil palm

The production and management strategy used in oil palm was the way block residents organised themselves to harvest and manage oil palm. The harvesting strategies were categorised as: working together *(wok bung);* rotational harvesting *(makim mun*); subdividing 2 ha sections on the block among different households for harvesting *(skelim hecta*); and, a mixture of the three (mixed) (see chapter 4 for more detail on each of these production and management strategies).

7) Work experience in oil palm

Work experience in oil palm was measured by the total number of years the smallholder had been living on the oil palm block. To some extent, work experience in oil palm measured the commitment of the smallholder to oil palm production.

8) Smallholders' expectations of extension services

A semi-structured questionnaire using open-ended questions was used to determine the blockholders' willingness to adopt extension messages provided by OPIC.

9) Smallholders' management skills in oil palm

A structured questionnaire with multiple choice questions was used to assess the oil palm management skills of smallholders. To fully test their skills and knowledge on oil palm production, a table outlining symptoms seen in nutrient deficient palms was presented. A total of eight symptoms were given for the smallholders to choose

from. For replanting, in order to test their skills, nominal scales were used in which a yes or no option was chosen if the smallholder had skills in replanting or not.

10) Level of extension contact by smallholders to extension services
To determine the number of times the smallholders made contact with extension services, the smallholder was asked to recall if he/she was visited on their block by an extension officer in the last 36 months.

3.3.2 Dependent variables

1) Block productivity
Detail information on the definition and the methods used in calculating block productivity is discussed earlier under the section 'secondary sources'.

2) Evaluation of extension officers' role in delivering extension advice to smallholders
To evaluate the effectiveness of the extension services provided, simple closed and open-ended questions were used. These questions were accompanied with structured questions using a Likert scale.

3) Level of adoption of extension information
The level of adoption of extension information was measured using a method in which a list of seven techniques practised in both fertilizer application and replanting of senile palms was provided. Smallholders were then asked to indicate which practices they had adopted and used in the year of study. The adoption of fertilizer focused only on the last 12 months as fertilizer was a requirement that was applied annually. Replanting was measured on a 20 year period. Smallholders are encouraged to replant when palms reach 20-25 years as palms have a productive life span of 20 years as they become too tall for effective harvesting and harvesting rates decline. Replanting information was obtained from palm census surveys undertaken by OPIC.

4) Factors hindering/fostering the adoption of extension advice provided by extension officers
To identify factors hindering adoption of extension messages, focus group discussions were conducted.

3.4 Sample size and sampling method

A sample size of 51 smallholders was drawn from the population of Buvussi LSS subdivision and Bubu and Lilimo VOPs. Of the total 51 smallholders, 15 smallholders were VOP growers. In order to conduct the study, multi-stage sampling using the cluster method was used. Cluster sampling grouped the population under study in clusters by oil palm sections and the sample was then selected for study (Kalton, 1985).

The large and dispersed population of smallholders in Hoskins LSS, together with the time needed for data collection were the prime reasons for using the cluster method for sampling. Cluster sampling is a feasible technique when dealing with a large population. It is economical and has advantages over other sampling methods. By adopting a cluster sampling technique where the blocks were located close to each other, it was easier to walk from one block to the next to interview and survey farmers. Also, if the smallholder household was absent at the time of my visit, it was easier to return to that household at a later stage (Khan and Muttlak, 2002). Another important benefit of the cluster method is that the household heads interact with each other because they are near each other. This meant that I could sometimes verify with neighbours if one blockholder did not apply fertilizer but claimed to have done so in an interview.

The three clusters of Buvussi LSS subdivision and Bubu and Lilimo VOPs were further grouped into sub-clusters. After selecting the sub-clusters for Buvussi, three to four blocks were randomly selected for study in each of the 10 sub-clusters identified. For the VOPs, 15 blocks were randomly selected from Lilimo and four blocks were selected randomly from Bubu. As Buvussi subdivision is comprised of a variety of ethnic groups, the senior extension officers and I agreed to randomly select the smallholders in Buvussi, such that all major ethnic groups were represented in the study. When randomly selecting the blocks, productive and non-productive blocks with either leaseholders alive, deceased or those blocks with caretakers were considered. This selection method was done in order to compare the productivity of blocks under different leasehold types. Fifteen growers were randomly selected from Lilimo and Bubu VOPs.

3.5 Data analysis

As mixed method research design was employed in the research, different methods were used to analyse the data. For the quantitative data, statistical analysis was used. All quantitative data were coded and entered into the computer using Microsoft Excel.

The Statistical Package for Social Science (SPSS) was used for data analysis only for variables requiring correlations to be calculated. In contrast, for the qualitative data obtained from smallholder open-ended survey questions, interviews and focus groups, a different form of analysis was used. Qualitative data were analysed to identify common themes that emerged from the data. The common themes were then coded and entered onto Excel sheets for analysis using tables and graphs from Excel. Also quotes and extracts from interview transcripts were used to illustrate particular points or themes that emerged from the data.

3.6 Ethical issues

As a protocol to do the study, ethical issues were considered before commencing my fieldwork. The privacy and confidentiality of the smallholders interviewed were preserved as very few of the smallholders personal information was collected. Names of the smallholders were recorded as well as block numbers were retrieved from OPIC databases to identify blocks. As most of the smallholders could not read and write, the consent form was read in Melanesian Pidgin and their responses were recorded. Interviews were conducted only when the smallholder agreed to participate.

Footnote

1. RSPO stands for Roundtable on Sustainable Palm Oil. It is a not-for-profit association with the objective of promoting the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders from seven sectors of the palm oil industry. These are oil palm producers, oil palm processors or traders, consumer goods manufacturers, retailers, banks and investors, environmental or nature conservation NGOs and social or development NGOs.

CHAPTER FOUR

RESULTS AND DISCUSSION ON LAND SETTLEMENT SCHEME

4.0 Introduction

This chapter presents the results and discussion of the data collected on the Hoskins Land Settlement Scheme (LSS). This chapter examines four key areas that influence smallholder production on the LSS. These are: extension contact; educational levels; leaseholder status and production strategies. Prior to discussing each of these areas, the chapter presents a summary of the variables used in the study. The chapter also sought to identify relationships between variables using Pearson's correlation test.

Extension services provided to smallholders are one of the key features discussed in this chapter with the aim to identify whether the type of extension approach used by OPIC is helpful to blockholders. The chapter also examines differences in educational levels of individuals between primary and secondary households in the context of rising population and income pressures. Then the chapter explains how the different harvesting practices used by LSS blockholders have been influenced by rising population and income pressures and describes the effect of these practices on production and on the adoption of extension messages provided by OPIC extension officers.

4.1 Summary of variable categories

1) Age

The average age of leaseholders surveyed was 55 years (Table 4.1). To find out if blockholders' age was significantly related to other variables, Pearson's correlation test was applied. The test showed that there was a significant positive relationship between the age of a blockholder and his/her knowledge of on oil palm cultivation techniques (Appendix 1 presents a correlation summary of the variables used on LSS). Research undertaken in western Kenya found that age was significantly related to production where young farmers were more likely to adopt organic manure than older farmers (Marenya and Barrett, 2007). However, in this case, blockholders

who were older tended to be more knowledgeable about oil palm compared with younger blockholders. This is because, older blockholders are more experienced due to the length of time they were exposed to extension practices on oil palm cultivation than younger blockholders.

2) Average educational level

The average years of schooling for all individuals living on the LSS block was 4.37 years. It includes education levels of the population who have completed school and those still at school.

3) Block population

Since the establishment of the LSS, the number of people living on the block has increased from 5.9 persons per block in the 1970s (Ploeg, 1972) to 13.3 persons per block in 2000 (Koczberski, *et al.*, 2001), to 14 person per block in 2010. Twenty-two per cent of the blocks surveyed had 21 or more persons living on the same block (Table 4.1). Population pressure is therefore a significant issue for many families.

4) Work experience in oil palm

Experience in oil palm was measured by the number of years a blockholder lived on the oil palm block. The average length of experience of oil palm was 41 years (Table 4.1). Using Pearson's correlation test there was no significant relationship between years of experience in oil palm and all other variables (Appendix 1). However, there was a negative and strong relationship between years of experience on oil palm and blockholders' level of extension contact. The strong negative relationship between years of experience on oil palm and the level of extension contact suggests that blockholders who spent a long time in oil palm production were visited less or not visited at all compared with new blockholders who were visited more frequently as they were new to oil palm cultivation.

This may be because blockholders were involved in oil palm production for so long and acquired skills for oil palm production, that extension officers did not need to see them as often. There is also another suggestion to explain this result and that is, extension contact with blockholders was difficult given the declining ratio of extension officer to blockholders. With fewer extension resources, extension officers

might be concentrating their efforts on progressive and less experienced farmers, that is, those newer to the industry and willing to learn.

Table 4.1 Variable categories, measurement units and summary statistics for variables used in the research (N=36)

Variable	Category	Measurement	Frequency	Percentage	Mean	SD
Blockholders' age (X1)	20-39 years	Years	5	13.9	55.14	15.44
	41-60 years		15	41.7		
	61+ years		15	41.7		
	Missing		1	2.8		
Total			36	100		
Education level for block population (X2)	Low (0-3.12)	Years of schooling	13	36.1	4.37	2.19
	Medium (3.13-6.24)		14	38.9		
	High (6.25+)		9	25		
Total			36	100		
Block population (X3)	Small (1-10)	Count of person	16	44.5	14	7.45
	Medium (11-20)		12	33.3		
	Large (21+)		8	22.2		
Total			36	100		
Work experience on oil palm (X4)		Years	1	2.8	41	11.60
			2	5.6		
			5	13.9		
			28	77.8		
Total			36	100		
Extension contact within 36 months (X5)	No visit	Count	22	61.1	0.8	1.15
	Once		8	22.2		
	More than twice		6	16.7		
Total			36	100		

5) Extension contact

Extension contact was measured by the number of times the blockholders were visited by an extension officer in the last 36 months. Sixty one per cent of the blockholders had no visits from extension officers in the last 36 months (Table 4.1).

4.2 Extension

OPIC aims to increase smallholder productivity by promoting improved farm management techniques amongst blockholders. However, smallholder productivity remains low compared with plantations, so an objective of this study was to

determine the effectiveness of OPIC's extension services. A range of factors determine the effectiveness of extension. However, in this study, two issues were considered to be key factors for evaluating extension services and were used for this evaluation. These were frequency of extension visits and the type of communication and extension method used by OPIC extension officers.

4.2.1 Frequency of visits by extension officers in the last 36 months

This question "frequency of visits in the last 36 months" quantifies the number of times an extension officer visited a grower's block over this period. It excluded blockholders' visits to the OPIC office and blockholders' participation in field days. Visits to the OPIC office and field days were not included because it was purposely decided to count only one-on-one visits to smallholders' blocks as the primary means of delivering extension to blockholders. As outlined in Table 4.2 only 14 blockholders were visited in the last 36 months. Blockholders highly value extension officers visits to their blocks (see further discussion later in the chapter).

Table 4.2 Frequency of visits to blocks in the last 36 months

Blockholder visited	**Number of blockholders visited**	**Per cent of blockholders visited**
Yes	14	39
No	22	61
Total	36	100

Table 4.3 reveals that of the 14 blockholders visited, most were visited in 2009 and 2010 because the stands of oil palm on these blocks were infested with sexava[1] (Table 4.4). Sexava strips the leaflets from palm fronds and therefore, because of poor photosynthesis, poses a major threat to fruit production with a corresponding loss in smallholder income. Also, because LSS smallholder blocks are located close to each other, infestation on one block makes it easy for the pest to spread. Therefore, it is important to control the pest as soon as it is detected.

Table 4.3 Year of visitation in the last 36 months for the visited blocks

Year	**Number of visits**
2008	1
2009	6
2010	6
No response	1
Total	14

It seems from my small survey that extension visits were limited to attending blocks when problems were encountered rather than to provide general extension.

Apart from visiting problematic blocks, extension officers were also assumed to be concentrating mostly on progressive growers only. However, the purpose of most extension visits on other blocks was problem focused, such as when pest and disease outbreaks occur as outlined in (Table 4.4).

Table 4.4.The reason for block visits by extension officers

Options	**Numbers**
Field demonstration	1
Fertilizer	2
Pest and disease (sexava)	10
RSPO	1
Total	14

One main factor explaining why smallholders were not visited by extension officers for general extension training was the low ratio of extension officers to oil palm growers of around 1:250-300 growers. At Buvussi, the ratio of extension officers to farmers, which was better than the overall average, was 1:154. This low ratio of extension officers to farmers limits the capacity of extension officers to visit individual growers on a regular basis. For example, Buvussi Division is made up of one Divisional Manager, one senior extension officer, two extension officers and two field assistants as outlined (Table 4.5). The main role of field assistants in this case was to communicate information to farmers. Field assistants play an important role in linking people with research information, new skills, new procedures and regulations through field days, individual blocks visits and through demonstrations. They also have responsibility to report to their superiors (senior extension officer) problems encountered by blockholders and issues affecting productivity. With not many field assistants to fulfil this duty, most problems and issues faced by blockholders are reported straight to the OPIC office or to Smallholders Affairs at NBPOL.

Table 4.5 The numbers and ratios of extension officers to blockholders by Buvussi subdivision

Block type	Number of blocks	Number of extension officers	Ratio of EOs to blocks
LSS			
Buvussi	355	2	1:177
Galai 1&2	274	2	1:137
VOP			
Bubu & Lilimo	142	1	1:142
Total Buvussi	**771**	**5**	**1:154**

Research amongst Surinam rice farmers revealed that extension visits to farmers were only made to farmers who had high economic status (Kalshoven, 1978). Likewise, as revealed from my interviews with blockholders and brought to my attention during focus group discussions, there is a perception among farmers that OPIC extension officers tend to favour visiting progressive farmers who are located in more accessible areas near roads. A good example was a block which was visited frequently by extension officers. The block was easily accessible being located along the main road, and it also was ranked as among the most productive of smallholder blocks. Although my small survey showed that most extension visits were to address specific problems like sexava, it appeared that some extension workers tended to concentrate their efforts on progressive farmers, thereby possibly contributing to the widening gulf in productivity between high producing blockholders and the many low producers. Such an approach by extension officers is understandable because this communication method was probably a strategy of least resistance, given that progressive growers are more likely to heed the advice of extension officers. Such farmers also have the economic means to try out new practices.

During a workshop with extension officers, they stressed that consistently low producers rarely took up extension advice and also professed that they found it very difficult to make meaningful contacts with growers who did not appear to take sufficient interest in oil palm production and did not follow advice given by the extension officers. Officers also mentioned that young men who had inherited LSS blocks did not seem to follow extension advice regarding applying fertilizer application or signing up for replanting. They said that these young men were only interested in harvesting oil palm and not investing in farm inputs. Essential block

management practices such as routine pruning of fronds and weeding of the block were also neglected. This might explain the reasons why some extension officers said that they concentrated mostly on progressive growers.

Extension officers are the link between the organisation (OPIC) they work for and the growers. As indicated above, communications between oil palm growers (whether progressive or non-progressive) and extension officers did not function efficiently and there was an absence of social relationships between individual growers and extension officers. From interviews with growers and from my observations during fieldwork, one may conclude that extension officers are portraying a static and bureaucratic image of their agency to the public at large. They tend to depict themselves more in the role of multiple workers than of a person in a distinct advisory position. Even when extension officers visited blockholders, there was no written evidence of their visit because there were no proper records kept in the office to keep track of the issues, requests or problems faced by blockholders when these blocks were visited.

4.2.2 Communication method of information dissemination

In order to further assess OPIC's extension approaches to blockholders, this section presents different approaches used by extension officers to disseminate information to blockholders. It also provides a tally of preferences on the methods most preferred by blockholders.

The method in which information is disseminated to blockholders plays an important role in the transfer of extension information. For example, research in West Africa identified a range of factors contributing to the ineffectiveness of extension services. One study found that the extension methodologies and communication approaches being used at the time were a barrier to agricultural progress and development. The problem was that the extension officers' communication strategies were ineffective because they did not involve a greater use of mass media and group methods with individual contact and were not well planned. They were generally carried out on an *ad hoc* basis, and concentrated mostly on progressive farmers (Bembridge, 1987). This same issue of the imbalance in communication was also encountered on oil

palm blocks, where extension officers were spending too much time on non-extension matters and visiting only progressive growers.

OPIC extension officers preferred blockholders to visit them at their offices rather than officers visiting blockholders. This was perhaps for two main reasons: first, because OPIC extension officers assumed most blockholders did not need further advice as they were not new to oil palm cultivation; and, secondly, because of the low ratio of extension officers to blockholders which, as discussed earlier, made visits to individual blocks difficult. Also, another factor is that low production may be more to do with social constraints rather than agronomic constraints (see Chapter 5 for further discussion under 'adoption of fertilizer').

Of the 36 blockholders interviewed, 47% said that the main way for them to acquire information was to visit the OPIC office at Nahavio (Table 4.6). However, nearly three-quarters of them argued this was an ineffective method of communication between extension officers and blockholders as they preferred extension officers to visit them individually on their blocks. However, as outlined in Table 4.6, 14% of the blockholders who acquired information from extension officers through field days mentioned it was an effective method of disseminating information to blockholders. For an extension agency to fulfil its roles and obligations, certain features that dictate their role like block visits and inspections are essential, and could be considered core methods of their approach. But in the case of OPIC, this has long been neglected, maybe due to the reasons mentioned above such as high farmer to extension officer ratio and other tasks that compete for their time. However, farmers from blocks that were visited because of pest and disease infestation (mainly sexava) acknowledged that the method of individual block visit was good. This may be because of two main reasons:

i. Block visits provided opportunities for blockholders to inform extension officers of the main issues and problems they faced on the block which could not be raised at group meetings or at farmer field days. Other sensitive issues could be discussed on a one-to-one basis, such as family problems that limited labour supply (e.g. disputes

between fathers and sons). This alone reflects the willingness of blockholders to participate in private meetings with extension officers to discuss sensitive issues.

ii. As the main purpose of individual visits to blocks by extension officers was to manage pests and diseases, blockholders contended it was a good method because of the urgency to eradicate the pest outbreak given the severe financial impacts if pests were not dealt with quickly.

Table 4.6 Communication method of information dissemination

Options	**Extension method**	**Extension method effective**	**Extension method not effective**	**Not sure**
Individual (one-to-one)	14 (39%)	14 (100)	0	0
Field day	5 (14%)	5 (100%)	0	0
Visits to OPIC office	17 (47%)	0	17 (73.9%)	0
Total	36	12	23	0

The majority of blockholders thought that OPIC extension officers should regularly visit blocks as the Department of Primary Industry (DPI) officers did prior to 1992 when there were many more extension officers employed. However, given the current low ratio of extension officers to blockholders, it is very difficult for OPIC officers to achieve this. Also, in the 1990s the frequency of individual visits and block inspections was much higher because DPI was well resourced and employed officers representing all required departments such as Lands. In addition, the LSS at that time was in its establishment phase when the population was lower and there were fewer problems like law and order issues, population and income pressures and land disputes, particularly over inheritance. When asked how extension officers could improve their performance in providing extension services, most blockholders suggested that more regular block visits by extension officers and inspections like those conducted by DPI officers two decades ago would help improve their production. Also some blockholders labelled OPIC extension officers as *"con man"* that cannot be trusted. As one blockholder replied when I asked him what they thought of the current extension services provided by OPIC.

> *....ol OPIC ya, nogat wok blon ol ya. Ol save sindaun nating nating lon office na karim motor bike go kam lon Nahavio olgeta dei. I no olsem ol DPI we save kam olgeta mornig lon sekim wel pam blok na tokim mipla lon ol samtin ol i lukim i no stret. Mipela les pinis lon ol OPIC, wok blon ol i no gutpela. Sanap lon rot tasol lon toksave lon filim form blon fertilizer tasol em ol save.... (Smallholder, Buvussi, 02-08-2010)*

> ...The OPIC extension officers have nothing to do. They only sit in the office and do nothing but get on their motor bike to travel to Nahavio every day. Compared with the DPI officers who normally did block visits and inspections every morning to check and inform the blockholders if they see anything that needs improvement, OPIC don't do that. We (the blockholders) are fed up as the OPIC officers do not perform to our expectations. We only see them when we have to sign fertilizer consent forms....

In many ways this complaint about OPIC, which mirrored the views of many blockholders, shows that blockholders have unrealistic expectations of OPIC and are not fully aware of the increasing farmer to extension officer ratio. OPIC extension officers are faced with multiple roles that are not related to agricultural extension. By doing so, extension officers take on additional duties in solving land disputes and law and order problems on blocks, and are often referred to as *"jack of all trades"*. Some of the factors highlighted during the workshop with the extension officers that are hindering extension progress are outlined in Table 4.7.

Apart from blockholders who agreed that extension officers' performance was effective, some made no comment on the performance of OPIC extension officers. By not answering such a question, it may mean that the blockholder approved of, or was happy with an extension officer's performance. However, it may also mean that they felt uncomfortable answering this question and were in fact not satisfied with extension officers' performance, or they believed that the problems they currently faced would not be solved unless there was a bureaucratic restructure that reinstated something similar to the 1990s DPI model which was what they stated in other contexts and in response to other questions. In addition, a few blockholders

suggested increasing the number of farmer field days to create more awareness of good farming strategies and management practices. However, this could be a waste of OPIC's time and money if the information provided through field days is not new to blockholders. If new information at field days was provided to blockholders on family welfare, budgeting or book keeping, then this may be of benefit to growers in that it may address some of the social constraints limiting production (see below). However, extension officers during the workshop highlighted points outlined in Table 4.7 as factors hindering their role as extension officers.

During focus group discussions blockholders said they were faced with bigger issues than solely agronomic aspects of production (e.g. social conflict and land tenure disputes to name just two which they would like to see dealt with prior to the industry focussing more on agronomic techniques to increase production (see Chapter 5 for further discussion under 'adoption of fertilizer'). Other growers believed that OPIC's performance would be improved if they responded more quickly to farmers' needs. As one grower stated:

> *....sampla taim, taim pip i bruk na mipla go tokim ol OPIC lon kisim narapela pip blon katim wel pam. Mipla save wet tripla or forpla mun nabuat. Disla pasin blon isi isi lon kisim pip, wheel barro, huk nip Na ol narapela samtin i save wastim time blon katim wel pam. Olsem Na mipla yet save go lon Mosa, small holda affairs na baim lon hap. Kain wok blon OPIC tasol, nogat nau, mipla yet save mekim.... (Smallholder, Buvussi, 24-07-2010)*

> ...Some times when harvesting tools, such as poles are broken, when reported to OPIC to replace them, we (blockholders) have to wait for at least three to four months before we get the replacement. That also applies to other harvesting tools as wheelbarrows, sickles and other necessities as well. OPIC delays in providing services has made blockholders go directly to the smallholder affairs office in Mosa [the company] to purchase the tools, which was supposed to be OPIC's role.

Table 4.7 Problems hindering extension officers' performance

Problems	Comments
Low ratio of extension officers to blockholders	Due to low ratio of extension officers to blockholders, majority of the blockholders were not visited.
Extension officers not fulfilling their role as extension officers	Increasing diversity of role for extension officers like solving social issues like conflicts which are not related directly to extension.
Land Ownership/disputes on LSS blocks	Extension officers have difficulties identifying the rightful block owner when the original leaseholder is deceased.
Absence of government services	Due to the total or near absence of other government departments like the lands officer, extension officers are expected to fill these roles such as solving land disputes.
Lack of coordination between OPIC and Smallholder Affairs Department of the milling company	The shift in responsibility of replanting and sexava treatment from OPIC to Smallholder Affairs due to RSPO introduction is delaying replanting and sexava treatment on smallholder blocks.
Lack of logistic support for extension officers	Growers in distant places cannot be reached due to absence of logistic support.

The manager of the Smallholder Affairs section of NBPOL pointed out in an interview that for OPIC to be more effective, it must restructure its role as an extension arm with the sole mandate of providing extension services to oil palm growers (G. Disley pers. comm, 14-8-2010). He added that, he felt OPIC was not doing what it was mandated to do and that, many issues that were supposed to be solved by OPIC are now being done by the Smallholder Affairs. Initially, the company Smallholders Affair's role was solely to assist growers with queries regarding crop pick up, supplying of materials and tools required for oil palm production (fertilizer, harvesting tools, herbicides, controlling pests and diseases, etc). However, now Smallholder Affairs is employing its own extension officers to service growers which they see as necessary to overcome the poor performance of OPIC. In early 2010, NBPOL took over from OPIC the role of carrying out sexava treatment. OPIC, on the other hand, is very concerned about NBPOL trying to take over some of its roles by using the argument that OPIC is ineffective. OPIC argues that the delays in tool delivery are to do with company not ordering enough in and having to wait for these to be delivered. As part of the RSPO, Smallholder Affairs now regularly visit growers, informing them when they should harvest their oil palm. Smallholder Affairs also inspects oil palm blocks thoroughly before issuing seedlings to make sure all requirements of RSPO are fulfilled by growers prior to seedling delivery.

4.3 Average education level

Because the LSS is going through a socio-economic and demographic transition over time with second generation families residing on blocks, the study was designed to determine two factors. These were:

a) If there was a statistically significant relationship between the education levels of all individuals living on the block and other variables used in the study (see Appendix 1).

b) If there were differences in the average educational levels between co-resident primary and secondary households members and between males and females.

This section also aimed to uncover if preferences were determined by household type and gender in the allocation of educational opportunities (school fees are relatively high in PNG). Also, this section was to understand the reasons underlying the decisions about which children were to be educated and which were not.

Using Pearson's correlation test, there is no statistically significant relationships between average educational levels and other variables except for number of secondary households on the block and blockholders' farm management skills. There was a strong positive relationship with blockholders' management skills on oil palm and a negative relationship with the number of secondary families on the block.

A strong positive relationship between educational level and management skills of blockholders suggested that as the average education levels of household members living on the block increased, management skills of the blockholder also increased. As the education levels of all household members were considered, the findings clearly show that intra-household members' education level is associated with blockholders' management skills. However, there was no statistical evidence to show that education levels were associated with productivity or the adoption of extension messages. It is quite possible that a larger sample may have revealed a relationship between average education levels and blockholders' management skills because management skills are generally positively associated with production.

There was a statistically negative relationship between educational levels and number of secondary households living on the block. This illustrates that as the number of secondary households on the blocks increase, the average education level of all households' member on the block decreased. This result specifically coincides with the educational data on LSS (Table 4.8 below) exemplifying the difference in educational levels between children in primary households and secondary households. The negative relationship between education levels and the number of secondary households reveals the current dilemma most blockholders face in educating the growing number of children on the blocks. Table 4.8 shows the average education levels of all block residents including both primary and secondary households, but excluding those too young to be at school. It also shows the education levels of the population who have finished school and the population who are still at school displaying the differences in average education between different household types and gender.

Several studies show the link between farmers' educational levels and their adoption of new techniques (e.g. Jamison and Moock, 1984). Research conducted in Nigeria and other developing countries on individual farms concluded that literate farmers were more likely than less literate farmers to adopt new technologies to improve production (Akinbode, 1982; Jamison and Moock, 1984; Strauss *et al*., 1991; Asfaw and Admassie, 2004). Not only does adoption depend on the household head's educational level but also on the educational levels of all household members (Asfaw and Admassie, 2004). Having a generally high level of education amongst all family members is associated with certain tasks and functions being performed with higher efficiency and these families are more likely to adopt new technologies more rapidly than farmers with lower education and literacy levels (Chitere, 1985; Asfaw and Admassie, 2004).

Table 4.8 Average education level (years of schooling)

	Primary households			**Secondary households**			**All households**		
	M	F	M&F	M	F	M&F	M	F	M&F
All population	6.22	4.78	5.55	1.98	1.69	1.81	4.79	3.34	4.04
Population excluding those too young to be at school	6.29	4.88	5.65	2.86	2.19	2.44	5.39	3.78	4.56
Population who have finished school	5.89	4.49	5.24	0.46	1.19	0.99	5.07	3.34	4.15
Population still at school	8.25	7.10	7.75	4.56	4.09	4.33	6.23	5.26	5.78

M & F=Male and Female

For 'all population', average education levels were for people living on the block and who had finished school and those who were still at school. LSS blocks now have second and third generation residents on the block, and it is important to compare the educational levels of children in primary and secondary households in order to detect if there are differences in their educational levels. This can provide an insight into how population and income pressures affect the educational outcomes of different families according to their status. Educational levels were examined at three levels. These were:

1) Primary households consisting of the original leaseholder, his wife and his children; or a caretaker, his wife and his unmarried children; or the son of a deceased leaseholder who has inherited the lease, and his wife and children.

2) Secondary households include the siblings of the original leaseholder, their wives/husbands and their children, together with other households (often relatives) residing on and benefiting from the block.

3) 'All households' is the combination of both primary and secondary households.

4.3.1 Primary households

The average educational level of males is greater than females in primary households and is also greater than both males and females in secondary households. In terms of gender equity, a study conducted in Malawi showed how cultural attitudes influenced

gender differences in education. The success or failure of girls in the educational system is influenced by the complex attitudes, beliefs and practices regarding females. Together they determine whether it is profitable to educate girls or whether sending girls to school is a wise or poor investment for the future (Cuimombo, 2005).

According to the cultural norms in PNG, there are three reasons that explain why more males were educated than females to a higher level in primary households. First, males are considered superior to females and so receive priority in disbursement of income and educational opportunities; it is viewed as a male birth right and it is their right to inherit wealth and possessions owned by the family while females are meant to leave their family on marriage to spend the rest of their lives with their husband's family. Second, parents believe that since education is often most useful for advancement in the formal sector and because girls/women often have less access to this sector than males, parents believe that schooling is not relevant to the future economic roles of their female children. Also, culturally, a young female's role is to help her mother in sibling rearing, food gardening and other household chores. Third, traditionally, most parents presumed that education investments in daughters was not worthwhile because she will move to her husband's family on marriage, and therefore returns on such educational investments (e.g. increased productivity or income) will accrue to the family of their son-in-law.

However, contrary to the argument that girls receive less education than boys, Table 4.8 shows that the average educational levels of females in primary households was considerably higher than males in secondary households. This is fascinating, given the reasons above justifying the preference given to males in education over females in PNG. The outcome may be because of the following: first, it could be due to school fees being lower in the 1980s and 1990s when the LSS was established: the cost of education in terms of school fees was not as costly as it is today. Also, more children in primary households were given the opportunity to be educated as the population on the LSS was smaller (fewer secondary households) and the income earned from oil palm was able to sustain the family. However, as the number of second and third generations living on the block grew, population and income pressure increased making it difficult to send children in secondary households to

school. Second, these results imply that priority in educational opportunities is given to children in primary households than to children in secondary households. PNG has long had a reputation as an egalitarian society, but as income and population pressures grew, families have drifted away from functioning as extended family units to more individual and stratified family units. This has led to primary household prioritising educational opportunities for their own children over the children in their extended family.

4.3.2 Secondary households

There is not a large difference in the overall educational levels of males and females in secondary households. However, what is astonishing is that the education level of females who have completed school is higher than males. Even though Papua New Guinea has a culture where males are given preference over females in terms of income opportunities and education, the results demonstrate the preferential choice given to females in secondary households in education over males was evident or should I say, more females completed their education than males. Explaining this difference is difficult; however, I suggest the following:

1) With the increasing population pressure on LSS blocks, most young males especially, have diverted their focus from education and oil palm production to other income sources. Law and order problems and alcohol abuse among young men have been on the rise, with Buvussi subdivision labelled the most notorious subdivision harbouring many criminals. Therefore, it is possible that more males in secondary households do not attend school or have dropped out of school, and some of them may be involved in criminal activities.

2) With the increasing number of males involved in unlawful activities, parents are now concentrating on educating more daughters than sons as daughters tend to take advantage of education and in most cases support their parents. This is a breakthrough in the customs and traditions of Papua New Guinea that have discriminated against females in educational opportunities. During my fieldwork a number of parents interviewed made mention of the increasing law and order problems among males who had dropped out of

school early. The parents continued by saying that it was better to educate females than males as money and resources were sometimes wasted on males because they were more likely than females to be involved in criminal activities, drug and alcohol problems during and after completing their education. This may not be a problem across all blocks but law and order issues are becoming increasingly a problem on all LSS subdivisions at Hoskins. It appears that there may be a gradual change in the attitudes of parents about investing in their daughters' education.

In terms of education and the adoption of extension messages, unlike examples of research conducted in other developing countries, Chapter 2 revealed that educated farmers tend to adopt extension messages at a higher rate than less educated farmers. As better educated farmers have greater ability to understand and evaluate the information about new products and processes, it is more likely that these farmers are more capable of adopting extension practices rapidly than less educated farmers (Obibuaku, 1974; Akinbode, 1976; Parikh, 1994; Asfaw and Admassie, 2004). Due to the lower educational levels of children in secondary households, it is likely that in the future as adults they will be less able adopt extension messages delivered by OPIC. Thus, low educational levels of secondary households may contribute to lower productivity than might have been the case with better educated residents on LSS blocks.

4.3.3 All households

Table 4.8 indicates that there was a notable difference in average educational levels between males and females and also between primary and secondary households. The proportion of people who completed school in primary households was higher than that of secondary households (Table 4.8). This may be because the increased population on LSS blocks over time means, as pointed out above, that there is not enough cash income to educate everyone, so that children from primary households are given priority over children from secondary households. As the number of multiple households residing on blocks increased over time, the way income is distributed among the various households to meet daily needs is also changing. Investing in education is becoming an increasing burden as more households share the oil palm income from the 6 ha oil palm block. If we think of the income

constraints on blockholders today with income being insufficient to cater for education, it is reasonable to say that the decline in educational opportunities of children in secondary households is understandable.

The type of production strategy whether it is the rotational system of harvesting or working together (*wok bung wantaim*) may also be one of the reasons for the changing educational opportunities between males and females and between primary and secondary households. As revealed in Table 4.8, educational levels of children in primary and secondary households on LSS blocks may have been influenced by population and income pressures. As population pressure led to an increase in the number of secondary households on LSS blocks, income pressure has led to the shift of traditional *wok bung* method to *skelim hecta* in order to minimise conflicts over income on blocks.

Given the fact that income was managed and controlled by the blockholder under the *wok bung* method, it was likely that more children had access to education as finance was made available to them unlike *makim mun* where income was rotated among families, and where it may take two to three months before the same household harvested again depending on the number of households on the block with harvesting rights. Thus, saving enough money to pay for education may not be possible under *makim mum* strategy, given the fact that most households depend heavily on oil palm income to meet their other household expenses. It is therefore possible that the switch in harvesting strategies has influenced how income is earned and distributed for educational purposes. This could be leading to marked variations in the levels of education amongst children on LSS blocks. Also, the decline in education levels for children in secondary households suggests that over time less children are completing their education today than previously.

4.4 Production strategy and leaseholder status

The purpose of identifying leasehold status was to establish whether it had an impact on smallholder productivity. Some blocks are now managed by caretakers and others have been inherited by the son/s of the original leaseholder. This section also provides arguments about the effects of the type of production strategy followed by a

block have on block productivity. It also describes problems associated with the type production strategy practiced on the block.

Koczberski *et al*., (2001) identified two main production strategies practised by smallholder households. These two strategies were: 1) *wok bung wantaim* or traditional harvesting in which individuals living on the block work together to harvest oil palm with the income distributed by the leaseholder (the father) among his family according to age and gender status. This strategy was common on the block when the original leaseholder was still alive and when the block population was low. The other strategy identified was *makim mun* or rotational harvesting by different households. Since the Koczberski *et al.,* (2001) study, two other strategies have emerged which were identified in this study. These are: *skelim hecta* that describes the system whereby different oil palm plantings are allocated (usually 2 ha) to different households; and a mixture of the three production strategies. A mixed harvesting strategy is commonly practised when cash was needed to participate in traditional ceremonies like bride price payments, funeral and school fee payments. The purpose of distinguishing production strategies and leasehold status was to see if leasehold status and harvesting strategy had an impact on productivity. Each harvesting strategy is discussed below.

The increase in the number of households on LSS blocks has forced highly populated blocks to develop new oil palm labour and harvesting strategies to minimize conflicts over labour and income distribution between households residing on the block. When the LSS was established, most blocks were single households consisting of the original leaseholder and his wife and children. The labour and production strategy used was a traditional method of harvesting known as *wok bung wantaim* where all adult family members worked together to harvest oil palm. However, over time single household blocks gave way to multiple household blocks and such methods of harvesting like *wok bung wantaim* have switched to *makim mum* (Koczberski *et al*., 2001). This will be further discussed later in this section.

Table 4.9 displays average annual production in tonnes per hectare associated with the different types of leasehold status and production strategy. Leasehold status

refers to the ownership of the block. Table 4.9 demonstrates that there is variation in productivity per hectare under each harvesting strategy and leasehold type. For instance, smallholder productivity under *wok bung* was higher compared with *makim mun.* Production for *skelim hecta* was much higher than *wok bung* or *makim mun* for blocks whose original leaseholders are still alive. However, while production might be expected to be higher under *skelim hecta* because each family would be maintaining and harvesting its own 2 ha plot, there were only two households in this category which does not allow meaningful comparisons to be made.

4.4.1 Production strategy

According to the different types of production strategies, there are also differences in productivity within each strategy depending on leasehold status. These differences are discussed below:

1) Wok bung

Multiple household blocks on the LSS are often characterised by a high level of inter-household dependence and co-operation which leads to an adequate labour supply. With multiple households working cooperatively to harvest oil palm, they tend to share the income fairly amongst the adult male and females heads of each family, though according to cultural norms which tend to mean that older men receive more income than younger men, and men more income than women. When *wok bung* is functioning well, labour shortages and disputes over income earned from oil palm rarely occur and the leadership of the block is not contested leading to complete harvesting of FFB and loose fruit. Normally, under *wok bung*, each household receives a share of income without complaining (Koczberski *et al*., 2001).

Table 4.9 shows that production in tonnes/ha/year by blocks practising *wok bung* are higher than blocks practising *makim mun* and 'mixture'. With the increasing population and income pressure currently on LSS blocks, the results suggest that the most appropriate harvesting strategy for maximising production would be *wok bung*. The production record of such blocks also signifies that extension strategies like fertilizer and replanting were more readily adopted. This is possible as all 6 ha of the block is owned and managed by one person and so it is likely that loans for fertilizer and replanting are repaid because every household on the block shares these costs,

that is, they do not fall disproportionately on any one household as under the *makim mun* strategy (see below). This may be the reason for *wok bung* blocks having higher production levels than blocks practising other production strategies apart from the *skelim hecta* that is discussed further below.

Table 4.9 also illustrates that although 25% of the original leaseholders have died, production under *wok bung* is still greater than *makim mun* or *skelim hecta* (see comment above about the problem of making valid comparisons when only two blocks in the sample practiced *skelim hecta*). The higher production indicates that production can be maximised under *wok bung* regardless if the leaseholder is alive or not. This further suggests that *wok bung* blocks reflect shared decision-making among the different households living on the block and most household members contribute to production and block maintenance. Also, given the existence of multiple households on *wok bung* blocks, the results show that such blocks can be characterised as relatively egalitarian and unified family units. Also, there is a difference in appearance between blocks practising *wok bung* and other production strategies as illustrated in Plate 4.1 and 4.2.

Table 4.9 Types of leaseholds and average productivity (tonnes/ha/year) under each harvesting strategy

Leasehold type	**Production strategies & production (tonnes/ha/year)**					
	Wok bung (n=22)	*Makim mun* (n=8)	*Skelim hecta* (n=2)	Mixed (n=4)	All categories (n=36)	% under each leasehold type
Deceased	12.92	9.17	12.51	10.28	10.80	25
Caretaker	13.87	0	0	0	13.87	8.33
Original leaseholder alive	17.22	16.48	32.64	14	17.44	66.66
All categories	16.33	13.74	22.50	12.14		

2) Makim mun

Multiple household rotation (*makim mun*) production units are predominantly found on the LSS scheme at Hoskins where up to five or six households reside on one block. Multiple household blocks may consist of the original block owner, his married sons and sometimes married daughters. In this situation population pressure is a serious problem and a total population living on a block may exceed 25 individuals (Koczberski *et al.,* 2001). *Makim mun* was introduced by blockholders

themselves as population and social conflicts increased over the distribution of oil palm income. For example, if there were three households on the blocks, each household would be given an opportunity to harvest every three months. In this example, an individual household would harvest four times in a year. Almost one-third of the blockholders interviewed were practising *makim mun*. However, as pointed out above, the production was not as high as for blocks practising *wok bung*. There were three possible explanations for this difference in production.

Firstly, during fieldwork, blocks practising *makim mun* were inspected and problems were detected. It was observed that under a rotational harvesting method, the household whose turn it was to harvest ripe bunches also harvested unripe bunches to add weight to the harvest to increase income. This practice makes it difficult for the next household in line to harvest ripe bunches during the next monthly harvesting period and in most cases, arguments and conflicts arose when less FFB is left on the palms for the following harvest round.

Secondly, it was common on LSS blocks with multiple household practising *makim mun* for conflicts and arguments to occur frequently over income distribution, causing disputes among households living on the same block. These conflicts affect production because they lead to even less cooperation in harvesting thus causing labour shortages at harvest times. With constraints on the labour supply, the household is often unable to harvest the full 6 ha. Thus, when this happens, oil palm and loose fruit are left to rot, resulting in low production. Also, when arguments arise, management practices such as fertilizer application are neglected which may further reduce production by lowering the yield potential of the palms.

Finally, another serious issue arising with this practice of *makim mun* was the tendency to shift crop from one block to another in order to avoid loan repayments for fertilizer, seedlings, tools and other farm inputs by using their neighbours' harvesting cards (primary cards) to sell their fruit to the company. This practice poses a problem for the block when it comes to requesting a loan for harvesting tools and other farm inputs. Block production is used as the primary factor to certify whether the block is eligible for obtaining a loan or not. Therefore, for a low

producing block, acquiring loans may be difficult. Also, it is common on blocks practising *makim mun*, for households to be reluctant to take out loans because if repayments fall in your harvesting month, 50% of the income can go on the loan while the brother who harvests the next month might not have to pay any deductions for farm investments like fertiliser.

A key difference in production between *wok bung* and *makim mun* is that with *makim mun*, there is less control on the block in terms of block management and income distribution. Therefore, approaches initiated to increase production are not a priority on the block anymore. As oil palm is generally the most important source of income for most households on the block, using *makim mun* as a method of harvesting reduces blockholders' incentives to adopt extension messages such as fertilizer application as income is not controlled and managed by one blockholder but rather is rotated among the different households living on the block.

Plate 4.1 Block at Buvussi where household is practising *makim mun*. Note the dry fronds that should have been removed during harvesting.

Plate 4.2 Block at Buvussi where household is practising the *wok bung wantaim*. Note how well maintained the block is with cut grass and pruned palms.

3) Skelim hecta

Even after 40 years since the LSS began, most blocks still practise *wok bung* (Koczberski *et al.,* 2001). However, one of the new strategies identified in this study was *skelim hecta* which emerged sometime after 2001 when the Koczberski *et al* (2001) study was done. *Skelim hecta* is where each 2 ha planting on the block is allocated to a different household to harvest and maintain on a regular basis. This strategy was adopted when blockholders realised the dilemma they were facing with *makim mun*. The two blocks practicing s*kelim hecta* had achieved an average of 22.58 tonnes per hectare in a year. However, the number of blocks using *skelim hecta* in the sample was too small to make any valid comparisons, and this was further complicated because these two blocks also had trade stores on their blocks and there is a possibility that harvested oil palm was shifted to these blocks in order to repay credit owed to the store owner by creditors. This is a common practice on LSS blocks where, households living on LSS blocks were permitted to acquire goods at the trade store on a credit basis with the agreement to pay back during a harvesting period by using the debtor's primary card to weigh the harvested oil palm, thereby increasing the oil palm weighed and sold on the store owner's block. To verify whether *skelim hecta* is the most productive method of harvesting would require further study to validate that claim with a larger sample size.

4) Mixture of the three production strategies

Another new strategy identified in this study was a mixture of any combination of the other three strategies. This strategy was practiced when different families living on the block decided to shift occasionally from *wok bung* to *makim mun* or to *skelim hecta* when issues such as school fees arose or when customary obligations such as bride prices must be met. This approach is not permanent but is on a temporary basis as cash is needed to participate in these activities. The difference in this harvesting strategy is such that, one or two harvesting periods are missed so that there are more bunches to harvest on the next selected period. As this is done, production is reduced as fruitlets become detached from the bunch when overripe causing a decrease in bunch weight.

4.4.2 Leasehold status

In order for a block to be productive, not only is leasehold status important, but block ownership is something that must be taken into account. Farm inputs such as the application of fertilizer and replanting, require the formal consent of the block owner. It is the block owner who decides if he/she will buy fertilizer, sign up for replanting and adopt extension advice. Therefore, block management or maintenance depends almost entirely on the decisions made by block owners. Thus, production may differ according to block ownership and leasehold type.

There are different leasehold status or block ownership types. One is deceased, for those blocks where the original leaseholder is deceased and most are now managed by the deceased's son or daughter (the original leaseholder had died on about 25% of blocks). A second type is where the original leaseholder is still alive. This can be the original settler who has inhabited the block since the establishment of the LSS, or block owners who have purchased blocks recently from the original settlers (they made up about two-thirds of my sample). In this case, block management, income and labour distribution is managed by one person as explained above. In addition, a few blocks (3%) were managed by caretakers. A caretaker[2] arrangement is typically where the caretaker is a single household consisting of the household head, spouse and children who look after the block. Blocks that have caretakers may be owned by a church whereby the caretaker is the church pastor or the caretaker is the brother or other close relative of the block owner. In the latter case, the block owner works and lives in another part of the country and his/her block is assigned to a caretaker, to manage. In this situation, the caretaker does not have a primary right to the block. It can therefore be difficult to sign up for replanting or fertilizer requests as permission must be granted by the leaseholder.

Table 4.9 illustrates the differences in production for blocks under different management types. Blocks where the original leaseholders were still alive and actively managing the block were more productive than those inherited by sons or managed by caretakers. There are various propositions that could be drawn from these results.

First, it is possible that there is less conflict over income distribution as there is constant labour supply given that households are working together and management decisions are made only by the blockholder thus reflecting a level of family unity. Also, some blocks managed by the original leaseholder have a smaller population of residents. This is perhaps because most of their children are educated and are no longer living on the block. In this situation, there is a tendency for absent children to help their parents pay for materials and resources needed to improve block production. Also, getting support from a family member in the form of cash or materials to aid production motivates growers to produce more.

Second, as production is determined by the type of production strategy, production can also be influenced by leasehold status as presented in Table 4.9. As most deceased blocks are inherited by sons, production can be low. This is likely due to population and income pressure as most blocks inherited by deceased sons are not strongly focused on block management and extension uptake but are mainly centred on short-term income benefits. Therefore, strategies requiring longer-term cash (e.g. fertiliser) and labour investments (e.g. pruning and weed control) for higher return in the longer-term tend to be sacrificed for short-term income gains as growers seek to minimise their labour inputs and loan repayments. This scenario is most likely to be increasing as the original leaseholders' age and die. Therefore, for the future generation, block productivity is likely to decrease if extension advice is neglected.

4.5 Conclusion

Due to the increase in population and income pressures, blockholders have shifted from the traditional *wok bung* method of harvesting to other harvesting strategies such as *makim mun* with the prime aim of maintaining social stability on blocks in the face of growing social problems such as conflicts over income distribution. This shift in production strategies has influenced block productivity.

The study provided an empirical base to issues raised concerning extension in Papua New Guinea as being ineffective. The evidence from the study suggests that relatively few blockholders were visited or had contact with extension officers on an individual basis. One may justifiably argue that levels of contacts exhibited in the

research are reasonable given the circumstances in which extension officers find themselves in, such as the low ratio of extension officers to blockholders. However, the low extension contact also illustrates the relatively important factor associated with the extension decision as to which groups of blockholders are selected as suitable to be visited. Given the low ratio of extension officers to blockholders, extension officers have inevitably, and necessarily established contacts with better, more productive growers and with those that need urgent help from them such as during pest and disease outbreaks.

Apart from low extension contact, blockholders are faced with an unequal distribution of educational opportunities among children living on the block. The findings demonstrate that educational levels of children in primary households were greater than children in secondary households. Results reveal that the opportunity to gain education is greatly affected and is associated with demographic characteristics of blockholders interacting with population and income pressures. The low level of education for children in secondary households suggests that fewer children are likely to complete their education. As a result, this contributes to the pool of uneducated and unemployed youths living on the block who are more likely to become involved in anti-social behaviour on the LSSs. This is now an increasing concern raised by the oil palm industry (Orrell, 2011). In addition, as education and literacy are more likely to lead to personal development and societal transition than can be achieved with an illiterate population, education is therefore an important factor that determines blockholders' decision to adopt extension messages. Thus increasing population pressure and low education levels of children in secondary households may be a hindrance to the adoption of extension information and may ultimately undermine development efforts.

In the next chapter I turn to consider the question if block productivity is influenced by the level of knowledge of oil palm production and the management skills of the blockholders. Also, the next chapter will identify the factors hindering the adoption of extension messages provided by extension officers to blockholders.

Footnotes

1. Sexava is a grass hopper-like insect that eats the leaves of the oil palm.

2. Oil palm production for caretaker blocks was not as low compared with blocks inherited by sons. However, taking into consideration the limited number of blocks under caretakers, statistically it is not possible to conclude how caretaker productivity compares with other types of management arrangements.

CHAPTER FIVE

RESULTS AND DISCUSSION OF FERTILIZER AND REPLANTING ON LSS

5.0 Chapter overview

This chapter presents the second part of the results and discussion of the LSS, and focuses mostly on two key approaches provided by OPIC extension to increase smallholder oil palm production. These are fertilizer application and replanting of senile palms. The chapter also aims to illustrate blockholders' level of knowledge on fertilizer and their skills in managing oil palm. This chapter seeks to ascertain if adoption of extension messages is associated with the knowledge and management skills of farmers or with other indirect factors such as population and income pressure.

To identify relationships between variables, Pearson's correlation test was used. The results of these correlations are presented. Before discussing the results, the summary of the variables that were used in the study and their measurement units are presented in Table 5.1.

5.1 Summary description of the variables used

1) Knowledge and skills in managing oil palm

Blockholders' knowledge was assessed by asking smallholders questions related to fertilizer application. Examples of questions asked were number of fertilizer bags required per hectare, the appropriate timing of fertilizer application, how much fertiliser should be applied per palm and the income benefits of fertilizer application to name a few. Blockholders' level of knowledge will be discussed later in the chapter. As shown in Table 5.1, the majority of blockholders had good knowledge and management skills of fertilizer application. In addition, to measuring blockholders' skills in managing oil palm, a range of symptoms associated with soil nutrient deficiency were listed to assess blockholders' skills in identifying symptoms detected on palms when soils lack nutrients.

2) Adoption level of extension information

Adoption is the decision to make full use of an innovation as the best course of action available. It is the immediate impact an extension message has on farmers, which determines the continuity of the program. The adoption level was used as an indicator to illustrate whether blockholders' adoption rate was high, low or zero, the latter meaning they would not have adopted at all.

3) Production in tonnes per hectare per year

Production measured in tonnes per hectare per year was categorised into three groups as low, medium and high. Given the standard expected 20 tonnes per ha proposed by OPIC for mature oil palm, the mean production of 15.62 tonnes per hectare was quite low. However, 64% of the blockholders were categorised as medium producers, producing 11-20 tonnes per hectare per year while 17% were categorised as low producers producing between 0-10 tonnes per hectare per year. Nonetheless, the remaining 17% of blockholders were high producers, producing more than 20 tonnes per hectare per year.

Table 5.1 Variable categories, measurement units and summary statistics for variables used in the research (N=36).

Variable	Category	Measurement	Frequency	Percentage	Mean	SD
Knowledge of fertilizer (X7)	Poor (0-10)	Score (n/14)	1	2.8	14	2.26
	Good (11-14)		35	97.2		
Total			36	100		
Management skills on fertilizer (X8)	Poor skills (0-9)	Score (n/16)	1	2.8	16	1.54
	Good skills (10-16)		35	97.2		
Total			36	100		
Adoption level on fertilizer (Y1)	Low (0-50)	Score in %	4	11.1	78.59	20.76
	High (51+)		32	88.9		
Total			36	100		
Adoption level on replanting	Low	Score in %	25	69.4	60.97	19.08
	High		11	30.6		
Total			36	100		
Production per ha/year (Y2)	Low (0-10)	Tonnes/ha per year	6	16.7	15.62	5.7
	Medium (11-20)		23	63.9		
	High(20+)		6	16.7		
	Missing		1	2.8		
Total			36	100		

5.2 Blockholders' knowledge of fertilizer

To assess blockholders' knowledge of fertilizer application, they were scored as to whether or not they understood particular aspects of fertiliser uses and benefits. A score of 1 was given to each fertilizer aspect that was known and 0 if not known. Table 5.2 below represents blockholders' level of knowledge of fertilizer application. To determine the level of knowledge, all responses from blockholders on each aspect of fertilizer management were added up and divided by 36 which was the total number of blockholders interviewed. The answer was then multiplied by 100 to obtain the percentage level of knowledge.

Table 5.2 Blockholders' level of knowledge on aspects of fertilizer management

Fertilizer aspects	**Level of blockholders' knowledge (%)**
Benefits and reasons for fertilizer application	97.22
Amount of fertilizer required per palm	87.50
Number of fertilizer bags per hectare	95.83
Fertilizer placement	97.22
Timing of fertilizer application	100
Income benefit of fertilizer application	97.22
Time taken for palms to fully utilize fertilizer	93.06

Table 5.2 reveals that almost all blockholders had excellent knowledge of all aspects of fertilizer application. The level of blockholders' knowledge in Table 5.2 measured how much information was understood and comprehended by blockholders. All smallholders knew that fertilizer must be applied during the dry season at two different times because Ammonium Chloride is in salt form and must not be applied in the wet season because it would dissolve and be washed away too quickly. Most growers had sound knowledge of other aspects of fertiliser including the productivity and income benefits of fertilizer application. When asked about the benefits of fertilizer, the following were common responses: "fertilizer increases production by increasing soil fertility" or "fertilizer increases bunch size and bunch weight". However, a few growers still had difficulties in figuring out the exact amount of fertilizer required per palm.

PNGOPRA research found that for a palm to be productive fertilizer is best applied along the frond row for mature palms and around the base of immature palms. Soil under the frond is moist, soft and the feeding roots of the palms are concentrated there. Smallholders knew exactly where fertilizer should be applied and why it

should be applied there. The time taken for palms to utilise fertilizer is 4-6 months after application and blockholders were aware of this fact too. Table 5.2 suggested that the majority of blockholders understood that each hectare of oil palm required 10 bags of Ammonium Chloride as recommended by OPIC.

The Pearson's correlation test (Refer to the Appendix 1) revealed that there was a positive relationship between the technical knowledge of blockholders on fertilizer and their management skills in oil palm. This could mean that as blockholders' management knowledge increased, their skills increased at the same time. In addition, there was a negative and strong relationship between technical knowledge of the blockholder of fertilizer and their level of extension contact. This suggested that even though there were few or no visits by extension officers to blockholders during the time the study was conducted, blockholders' knowledge of fertilizer was excellent. This is because most skills and knowledge of fertilizer application were acquired through time prior to the study and even though blockholders were not visited by extension officers within the last 36 months that did not influence their current level of knowledge.

5.3 Blockholders' skills on oil palm management

A good manager requires skills essential for improving and increasing production. In the case of oil palm production, identifying nutrient deficient symptoms on oil palm was regarded as a means to determine the level of skills blockholders have on oil palm. These symptoms appeared on oil palm leaves when the soil lacked nutrients. For every symptom detected by the blockholders as an indicator of nutrient deficiency, a score of 1 was given and 0 was given if not detected. Table 5.3 below represents blockholders' level of knowledge of fertilizer application.

Table 5.3 Blockholders' knowledge of nutrient deficient symptoms

Symptom of nutrient deficiency	**Percentage of growers who identified the nutrient deficient symptom correctly**
Low yield	100
Short light green frond	97.22
Closed canopy	98.61
Smaller bunches	100
Orange spotting on leaves	94.44
Edges of leaves shrivel and die out	93.06
Frond die back	97.22
Leaves facing the sun turns yellow	83.33

To ascertain the level of management skills the blockholders had, all responses on each symptom detected by blockholders were summed up and divided by 36 which was the total number of blockholders interviewed. The answer was then multiplied by 100 to obtain the percentage level of management skills on fertilizer. Reduction in yield and decrease in bunch sizes were widely recognised by blockholders as symptoms of nutrient deficiency. In addition, all other symptoms were also noticed by nearly all blockholders. However, blockholders' ability to spot decolouration of leaves high up the palm was quite low compared with identification of other symptoms. This was probably because the leaves were facing upwards and therefore more difficult to see.

Table 5.3 demonstrated that most blockholders were experts and were able to identify symptoms of soil nutrient deficiencies. This can lead one to conclude that low production among some smallholders was not because blockholders lacked knowledge regarding the benefits of fertilizer but was due to other underlying factors such as high fertilizer prices, high repayment rates for fertilizer loans, population pressures, and the type of production strategy practised, and confusion about how oil palm prices are calculated which will be discussed later in the chapter.

5.4 Level of adoption on fertilizer and replanting

Many extension officers think that non-adoption of extension information provided to smallholders is a barrier to increasing productivity and if the message is in the correct format adoption will occur. However, adoption of extension information is a socio-cultural process. The act of adoption is not an unthinking response to information provided by extension; rather it is a deliberate decision made by an individual farmer in response to consideration of a wide range of issues. In the case of smallholder oil palm growers on the LSS, issues such as population pressure, law and order problems and other issues that will be discussed later in this chapter are factors influencing adoption decisions. The level of adoption is shown in Table 5.4.

The results represent the practices adopted by blockholders. Discussion of adoption will be discussed in two parts under fertilizer and replanting. Smallholders' fertilizer adoption level was examined for the last 12 months while adoption for replanting

was examined for the past 20-25 years. Blockholders were considered to have adopted replanting of senile palms if they had replanted their block when oil palms reached 20 years of age, which is the recommended time when palms should be replanted.

Table 5.4 Percentage level of adoption of fertilizer and replanting of senile palms

Factors promoted by OPIC	**Per cent of smallholders' adoption (N=36)**		
	Full adoption	Patrial adoption	No adoption
Bought fertilizer	88.89 (32)	0	11.11 (4)
Required number of bags per hectare	47.22 (17)	41.67 (15)	11.11(4)
Applied the required amount per palm	47.22 (17)	41.67 (15)	11.11(4)
Signed up for replanting (only for blocks due for replanting)	30.54 (11)	0	69.44 (25)
Palms injected with glyphosphate	25 (3)	0	83.33 (8)
Replanted new seedlings	16.67 (2)	0	83.33 (9)

5.4.1 Fertilizer

Blockholders were categorised into three groups depending on their adoption of fertilizer. The first category is blockholders who have fully adopted extension messages. The second category is blockholders who have partially adopted and the third group have not adopted at all. Of the 89% (32) of blockholders who bought fertilizer, only 47% of them had fully adopted by purchasing the required amount of fertilizer (10 bags/hectare) during the year the study was conducted. The results also show that 42% (15) of the blockholders partially adopted by purchasing less than 10 bags of fertilizer per hectare while 11% (4) did not purchase fertilizer at all. Partial adopters are referred to blockholders who apply less than 10 bags per hectare per year. However, those who did not apply fertilizer for more than two years were categorised as blockholders that did not adopt at all.

Using Pearson's correlation test (Appendix 1), there was a positive relationship between the management skills of blockholders and the level of adoption of extension information. The positive relationship illustrated that, as blockholders' management skills increased, their level of adoption of extension practices increased as well. However, the results revealed in Table 5.4 show that even though most of the blockholders had excellent management skills (Table 5.3), not all blockholders adopted fully to the recommended practices. However, blockholders who fully adopted extension services were the high producers producing 20 tonnes per hectare or more or blockholders who have trade store businesses on their blocks. It may also

be that, those blockholders who have children working on off-farm jobs or have businesses on the block may be more entrepreneurial, business minded, better educated and therefore more likely to buy and apply fertilizer.

The relatively low level of adoption of blockholders not purchasing the required number of bags as outlined in Table 5.4 is likely due to various reasons such as: the high price of fertiliser; high rates of loan repayment; population and income pressures; and, the type of production strategy. These factors may influence farmers' willingness to purchase fertiliser. Prior to discussing these factors, simple revenue and costs of production in Table 5.5 illustrate some of the income pressures faced by smallholders. The two most common production strategies, *wok bung* and *makim mum,* are used to illustrate the financial difficulties facing LSS smallholders which can deter them from buying fertiliser:

- Cost of fertilizer: K65.00 per bag.
- Most smallholders have 6 ha of oil palm planted.
- Average monthly oil palm price (2010): K275.71/tonne.
- Recommended rate of fertilizer application per ha: 10 bags.
- Average production per ha/year for *wok bung*: 16.33; and
- Average production per ha/year for *makim mun*: 13.74.

For blocks practising *wok bung*, the K3,900 loans for fertiliser will take three-and-a-half months to repay at a rate of 50% deduction from gross payments and for blocks practising *makim mun,* the K3,900 will take four months to complete repayment of the fertilizer loan. Given the present and increasing population and income pressures on LSS blocks and the cost and revenue calculation shown above, many blockholders may find it difficult to purchase fertilizer or even to buy the full amount of fertilizer as required although Table 5.2 showed that they were knowledgeable of the benefits of fertiliser. For blocks practising *makim mun*, it may be more difficult for them to purchase fertilizer due to the nature of the harvesting strategy itself. Those allocated a harvest round when loan repayments are due will have a strong incentive to avoid these loan repayments, given that they might have only two or three harvest rounds each year. Some blockholders have raised concern that even before fertilizer is delivered to their blocks, loan deductions had already commenced.

Table 5.5 Cost and revenue of annual income and fertilizer payment for *wok bung* and *makim mun*

Revenue *Wok Bung*	*Makim mun*
6 ha X 16.3 tonnes/ha	6 ha X 13.74 tonnes/ha
97.8 t X K275.71	82.44t X K275.71
K2,247.04 monthly	K1,894.13 monthly
K26,964.44 annually	K22,729.53 annually
Cost	
6 ha X 10 bags/ha= 60 bags of fertilizer	
60 bags X K65= K3,900	
K2,247.04 @ 50% repayment	K1,894.13 @ 50% repayment
K2,247.04 X 50/100= K1,123.52	K1,894.13 X 50/100= K947.07

During a focus group I conducted among smallholders on some of the factors why blockholders did not order or did not apply the recommended amount of ten bags of Ammonium Chloride per hectare, growers listed the following main reasons:

- Increase in fertilizer prices over the last five years.
- Population pressure on the block.
- *Makim mun* production strategy in place.
- Still repaying fertilizer debt from the previous year.
- Blockholders are very suspicious of OPIC and the company and assume they are being exploited on oil palm prices and therefore are reluctant to order fertilizer, and
- Disputes over block ownership (no-one person taking responsibility for management decisions on the block).

These factors are explained in detail below.

1) Increase in fertilizer prices

The increase in fertilizer costs annually has been of concern to growers and has led them to resist signing up for the recommended number of fertilizer bags. As indicated in Table 5.6, with monthly/yearly fluctuations on FFB price and the annual increase in fertilizer prices, many blockholders have not purchased the full amount of fertilizer. The FFB price below is the average annual price for 2005 to 2010.

Table 5.6 Cost of fertilizer and FFB price/tonne from 2005-2010

Year	FFB price (K/tonne)	Cost of fertilizer
2005	K133.27	K48.00
2006	K132.32	K53.00
2007	K258.83	K55.00
2008	K319.36	K55.00
2009	K178.60	K65.00
2010	K275.71	K65.00

Source of data: (Smallholder Affairs, Mosa)

With many financial obligations like school fees, repayment of debts acquired from purchasing other inputs for the block, the cost of fertilizer as shown in the calculation above and the increase in fertilizer price over the years has had a negative impact on blockholders' income. Although there is potential income benefits over the medium period from increased yields, the short-term costs of fertiliser outweigh the long-term benefits for smallholders. Even though blockholders have been producing oil palm for many years and generally know how much fertiliser to apply to each palm some were applying smaller quantities for the same reason they were buying less than the recommended number of fertiliser bags. In effect, they were stretching out the use of fertiliser.

2) Population and income pressures on the block

Given the population pressures on the LSS, most oil palm blocks were supporting multiple households due to second and third generation settlers continuing to reside on the blocks and share the oil palm income. Thus, because of these pressures many blocks have not purchased the full amount of fertilizer bags and some have not purchased any fertilizer for more than two years. Like most blockohlders on LSS, Box 5.1, illustrates the impact of the cost of fertilizer.

3) Makim mun production strategy

In conversation with people during fieldwork, I realised that strategies adopted by smallholders have affected the decision-making process regarding fertilizer purchases. If the block had a *makim mum* strategy, it is very difficult to order fertilizer as harvesting is rotated amongst different households living on the block. Thus, the decision-making regarding the purchase of fertilizer is difficult as income is not managed and controlled by one person. It is therefore likely that on blocks practising *makim mum*, there is much more resistance to purchasing fertilizer.

However, under *wok bung*, where income and management is controlled by one person, decision-making regarding fertilizer purchases was not as difficult to make.

Most blocks that have applied fertilizer were blocks where the original blockholder was still alive and the blocks tended to have high average production of oil palm per year (Table 4.9, Chapter 4). Not all blocks that were inherited by sons have applied fertilizer. However, those that have applied fertilizer were blocks that were practising *wok bung*. Usually, in deceased *wok bung* blocks, the son who inherited the block was more educated than the others and therefore tended to be able to persuade other residents to keep using the *wok bung* strategy. On the other hand, the majority of smallholders who adopted the extension messages by buying fertilizer knew well and understood the importance of fertilizer application as revealed by their skills in oil palm cultivation. These blocks perhaps were better able to manage their costs and income and may have been high producers and/or had access to off-farm income. I suggest that the blocks which purchased less than the recommended amounts were blocks practising *makim mun, skelim hecta* or had disputed ownership.

4) Still repaying previous loan from the previous year of fertilizer debt

The reason why most blockholders were reluctant to purchase the required amount of fertilizer was not only the cost of fertilizer but also the high repayment rate. Some claimed they were still repaying loans attained previously from other inputs as well as from fertilizer purchased in the previous year (see Box 5.1). It appeared that financial constraints and very high potential debt levels were a major deterrent to smallholders buying the correct amount of fertilizer. Loan repayments for fertiliser are deducted at 50% of gross payments to smallholders until the full amount is recouped. If growers have a deduction of 20% for repayment, then they might not be so reluctant to buy fertilizer. The 50% rate of loan deduction by Smallholder Affairs on blockholders' income has caused a lot of additional confusion, stress, resentment and conflict as not much is left for the family to live on after loan repayments are made.

5) Blockholders assume they are being exploited by the milling company

The feeling of being exploited by the company has discouraged a lot of blockholders from purchasing fertilizer. Blockholders added that since the company established

refineries, oil was extracted from both the mesocarp and kernel. Blockholders assume that what they are paid for is only from the mesocarp. Therefore, they believe they are not receiving the full price for the oil palm sold to the company. This has created a feeling of distrust towards the company and some smallholders are not bothered to faithfully apply fertilizer. This problem can be eradicated if the milling company explains to the smallholders how the pricing formula is calculated. One may say, fertilizer is an important strategy designed to promote production but if the underlying problem leading to smallholders' neglecting to apply fertilizer such as confusion in oil palm pricing, adoption of fertilizer application will remain a problem.

6) Disputed block ownership

From the results obtained, it can be seen that being knowledgeable or skilful does not mean blockholders are capable of adopting all recommended practices and techniques promoted by OPIC to increase production. By living with them, I am confident to say that blockholders currently have many other issues to contend with that are often of higher priority than purchasing and applying fertiliser. For example, conflicts and disputes over land ownership is one of the factors hindering adoption of extension messages. The reassigning of the block title to the beneficiary though may sound simple but it is a lengthy process that blocks with deceased block owners undergo. There are constant conflicts and arguments on such blocks as to which son or daughter will take over the block. Long periods of unsettled disputes are likely to cause a drop in production as blocks are left unmanaged for long periods without any maintenance tasks being carried out including low harvesting of oil palm due to arguments.

Box 5.1 Cost of Fertilizer at Buvussi LSS, Hoskins

Anias first settled in Buvussi in 1992 on a six hectare block after leaving Kavugara. Whilst living on his block at Buvussi he recognised the loss in production when fertilizer was not applied. He also understood the importance of applying fertilizer and its income benefits. However, there was one problem. With his own large family including his extended families to support, he realised that the income earned from oil palm was insufficient to pay for the required number of fertilizer bags per hectare (10 bags/hectare) and at the same time take care of his family. He then decided to practice "skip application" which he only applied the required amount of fertilizer once every two years instead of every year, which he thinks is financially manageable. During the time the study was conducted, Anias refused to purchase fertilizer as he was still paying for the debt incurred from the previous year. He said, "even though skip application was not recommended by OPIC, his block was better off applying fertilizer once in two years than not applying at all".

5.4.2 Replanting

To maintain the productivity and the viability of oil palm, the oil palm sector has introduced replanting to smallholders in Hoskins. However, since it was introduced, the rate of poisoning and replanting was well below expectations (Koczberski *et al.*, 2001). It is a mistake to believe that only science can create knowledge that is transferrable to the public through extension. All individuals create their own knowledge from their own experiences. Innovative techniques are adopted or used by smallholders when it is consistent with their understandings and experiences. Information provided by extension officers is carefully evaluated against their own knowledge and beliefs. A good example was blockholders' resistance to replanting. As shown in Table 5.4, the level of adoption of replanting was low at 31% (11). As such, 69% (25) of the blockholders did not replant their blocks even though their oil palms were well over 20 years old.

Many growers believed that the previous variety of oil palm that was planted in the 1980s were better producers than the hybrid palms planted today. It was thought that the previous variety of oil palm did not require much fertilizer. But, the hybrid varieties of palms planted in 1990 and onwards are considered by growers as fertilizer dependent. Production was boosted only when fertilizer was applied.

Growers do not acknowledge that the oil palm varieties planted in the 1980s were planted on virgin soil. This is the likely reason why production was steady initially and then required regular applications of fertilizer to maintain production levels. These growers who believe that older varieties were less dependent on fertiliser were reluctant to replant and have stands of palms over 20 years old, the age at which palms should be replanted (they become difficult to harvest at 20 years because of their height). There are two other reasons as to why most blockholders (69%) neglected replanting:

- Blockholders' fear of debt accumulation, and
- Blockholders are reluctant to replant because of financial constraints.

Blockholders' fear of debt accumulation

On highly populated LSS blocks, replanting was delayed by the blockholder as long as oil palm bunches could be reached by lengthening the harvesting poles. By that I mean most blocks were still harvesting some oil palm fruit even though the palms were more than 20 years old and very tall. After continuously harvesting from tall palms, replanting is finally considered as a last option when yields fall significantly because a relatively high proportion of the palms are simply too tall to reach with a harvesting pole. The OPIC extension officers also reported that replanting had been stalled by smallholders reluctant to forego oil palm income during replanting, and by young male growers who show little interest in oil palm production. In most LSS subdivisions at Hoskins, reluctance to replant is likely to be caused by high population density with highly populated blocks struggling with low income per capita and, any drop on oil palm income through replanting is likely to worsen their situation (Koczberski, *et al.*, 2001). As indicated in Table 5.7, the fluctuation in FFB price and the steady increase in seedling costs over the years are factors that are influencing the decision-making of blockholders to replant their oil palm.

Due to increased seedling costs and higher fertilizer costs for immature palm, blockholders have refused the replanting option due to fear of debt accumulation. Apart from fertilizer purchasing and replanting, blockholders obtain loans for harvesting tools, such as wheelbarrows, harvest nets and other resources as well. As

50% of the total owed for fertilizer is deducted from smallholders during every payment period, Smallholder Affairs continues to deduct 50% off the blockholders' income until the replanting loan is fully repaid. When the replanting loan is completed, Smallholder Affairs then moves on to deduct 50% off the pay cheque for tools and other inputs. Also, apart from these deductions, a deduction known as "farmer payout ratio at 57%" is deducted from the blockholders' pay cheque every harvesting period to cover for FFB transport costs, sexava levy, OPIC levy and OPRA levy. This amount is deducted to cater for palm poisoning and sevava treatment to palms and also for transporting smallholders' FFB to the company mills for crude oil processing. The amount deducted per harvesting payment varies according to the oil palm tonnes harvested by the blockholders. Bear in mind, this is a separate deduction from fertilizer, tools and seedling costs if the blockholders have ordered fertilizer and have replanted his/her oil palm block. However, most blockholders have stressed that it was difficult for them to complete loan repayments in one year, and so most loan repayments are carried forward to the following year. Thus, it becomes very difficult to purchase fertilizer the next year or to replant and even order tools for block maintenance.

Table 5.7 The average FFB price per tonne and the cost per seedling

Year	**FFB Price (K/tonne)**	**Seedling cost (K)**
2005	K132.28	K3.80
2006	K132.32	K4.70
2007	K258.83	K4.70
2008	K319.36	K6.06
2009	K187.60	K6.06
2010	K275.71	K6.06

Source of data: OPIC

b) Blockholders are reluctant to replant because of financial constraints

As stated above, blockholders are reluctant to replant for several financial reasons including high potential debt levels while still repaying fertilizer loans obtained annually, potential short-term loss of income and fluctuations in FFB prices. All these reasons may lead blockholders to postpone replanting. Also, as illustrated in Table 5.8, most blockholders have refused to do timely replanting on their blocks given the income lost during the waiting period until new palms comes into production. To clarify this issue, a simple budget is done to show the amount of

income lost over the 2.5 years following replanting for blocks practising *wok bung* and *makim mun*. Assuming the average price of FFB to be the same as for 2010:

- Average production per tonne/ha/yr for *wok bung* is 16.3 and 13.75 for *makim mun*.
- Average price of FFB for 2010: K275.71.
- Replanted: 2 ha.
- 2.5 years after palms come into production.

Table 5.8 Estimated income lost per 2 hectares due to replanting for 2.5 years on *wok bung* and *makim mun* blocks

Wok Bung	*Makim mun*
2 ha X 16.3 tonnes/ha	2 ha X 13.74 tonnes/ha
32.6 t X K275.71	27.5t X K275.71
K8,988.15 annually	K7,582.05 annually
Income lost in 2.5 years	
K8,988.15 X 2.5=K22,410.37	K7,582.05 X 2.5=K18,955.13
Income lost monthly	
K22,410.37/30 months=K749.01	K18,955.13/30 months=K631.84

Some blockholders are unwilling to replant because they feel that living expenses including school fees are higher as population and income pressures are increasing on LSS blocks and so it is hard to accommodate further loans such as replanting. Also when replanting is done, blockholders can expect to wait up to 2.5 years before the new 2 ha planting matures sufficiently to generate income. However, even though palms come into production after 2.5 years, income is still low because young palms have low yields for the first six years. It is much harder for blocks practising *makim mun* to adopt replanting than *wok bung* blocks given that harvesting is rotated among different households. Either way, both types of blocks are likely to experience substantial income losses in the short-term. For blockholders, short-term loss of income is more significant than the long-term impact of increasing production through replanting. During focus groups, blockholders stressed the point that loss of income during replanting was a major deterrent to replanting for most of them as outlined in Table 5.8 and 5.9. Also, as the seedling costs and fertilizer for immature palms have increased as the simple calculation on the cost involved on replanting points out below:

- Cost of fertilizer: K65.00 per bag
- 2 ha of oil palm are replanted at a time
- Cost of seedling is K6.06

Table 5.9 Cost of replanting

Items	Cost (Kina)
Fertilizer costs after 3 months of replanting	K65.00X3=K195.00
Cost of seedlings	K6.06X120 palms/haX2ha=K1454.00
Total cost of replanting	K195.00+K1454.00=K1649.40
Repayment@50%	K1649.40=K824.70

From Table 5.9, a total of K824.70 per payment will be deducted at 30% of gross income after a 50% loan deduction for fertilizer and tools debts are paid off. There is no additional cost for palm poisoning and the labour required for poisoning as the cost involved is covered by the OPIC levy. However, seedling and transport costs are paid for by the blockholder through deductions as indicated in Table 5.9. Six months after the first application, newly replanted blocks are required to apply fertilizer to oil palm so that soil fertility is maintained until harvesting begins at 2.5-3.0 years.

Another contributing factor for hindering replanting is the price of oil palm. As the price is determined on the world market and blockholders are not aware of the FFB price the following month, blockholders begin to lose interest in oil palm replanting during periods of low oil palm prices. Thus, efforts by extension officers to motivate blockholders to replant are less likely to succeed when oil palm prices are low and whilst blockholders are struggling to maintain their livelihoods. Unlike companies where replanting can be undertaken even when prices are low as potential revenue losses are minimised, replanting options for blockholders are more viable when oil palm prices are high because they are more able to reach a minimum income at which basic needs are met (Koczberski, *et al.*, 2001).

The level of adoption of replanting by blockholders as indicated in Table 5.4 revealed that those blockholders who have actually signed up for replanting was higher than those blocks awaiting poisoning their palms. This revealed a delay in oil palm poisoning and seedling delivery. This could be due to the shifting of responsibilities from OPIC to Smallholder Affairs. Previously, palm poisoning and

seedling delivery were carried out by OPIC. However, this has now been shifted to Smallholder Affairs as New Britain Palm Oil (Estate Company) signed up to the Roundtable Sustainable Palm Oil (RSPO definition, refer to the Glossary section for certification). Since RSPO was introduced, strip lining for oil palm planting must be done in accordance with RSPO principles, prior to replanting. In this case, the delay in seedling delivery was because of the time taken by Smallholder Affairs extension officers to inspect blocks to ensure that they complied with RSPO criteria. This gives an opportunity for family members and neighbouring blocks with family ties to grow crops for consumption for some time while waiting for seedlings to be delivered. Cultivating food crops helps to control weeds, and the growing of leguminous crops like peanut and beans helps retain soil fertility until the oil palm seedlings arrive.

5.4 Conclusion

As Bennett's hierarchy was used as a tool for evaluating extension programmes as indicated in Chapter 3, the results indicate that the extension program has had a visual and immediate impact on the blockholders' knowledge and management skills. With the majority of blockholders gaining such knowledge and skills on oil palm indicates that the extension program is worthwhile and should continue. Their knowledge and skills also signifies their positive attitudes towards the approach, given most understood the importance of fertilizer application. However, the findings reveal that adoption was not influenced by excellent knowledge and those skilful blockholders who have adopted were financially capable of doing so. On the contrary, the low adoption level of blockholders on replanting and fertilizer are likely to be due to population and income pressures on highly populated blocks who are struggling already with low per capita incomes, the additional expenses of fertilizer or the loss in income due to replanting are likely to worsen their situation. In the next chapter issues faced by VOP growers that are affecting their production and adoption of extension information will be discussed.

Footnote

1 Skip application is a term used to describe the manner blockholders applies fertilizer to their block. In this process if the full recommended amount is applied the previous year, the year after is skipped therefore no fertilizer is applied.

CHAPTER SIX

RESULTS AND DISCUSSION ON VOP

6.0 Introduction

This chapter presents the results and the discussions of village oil palm smallholders' engagement with oil palm production. The chapter examines three key areas that influence smallholder production. These are: extension; education level of blockholders and their families' knowledge and adoption of extension messages. The chapter begins by outlining each of these factors and then goes on to discuss how these factors interact with smallholder adoption of extension practices and production. Prior to discussing the findings of the study, the chapter presents a summary of data collected on each of the variables used in the study (Table 6.1).

6.1 Summary of variables

1) Demographic characteristic

Table 6.1 shows that the average age of blockholders interviewed was 50 years. There was a fairly wide range of age groups of blockholders (Table 6.1). The average years of schooling was measured by the number of years an individual attended school. The average years of schooling for an individual were 4.5 years. This figure only represented those people who had completed school and those who were still at school. It excluded children who were too young to attend school. The years of schooling for VOP growers was slightly higher than that recorded among LSS growers (Chapter 4, Table 4.1). The average number of people living on each VOP block was seven. This figure was much lower than the average block population of 14 found on the LSS blocks (Chapter 4, Table 4.1). The VOP block population ranged from one to 12 persons per block.

2) Experience in oil palm and block management

The number of years a blockholder had spent cultivating and managing oil palm was used as a measure of his or her experience in oil palm and was assembled into two groups: short-term experience in oil palm and long-term experience in oil palm. The average length of experience was eight years. Most blockholders had spent more

than six years on oil palm production. However, Table 4.1 in Chapter 4 revealed that blockholders on LSS had an average of 41 years on oil palm production, which is considerably longer then VOP blockholders. This is probably because when VOP children reach their teenage years, they plant their own oil palm block which reduces the average age of the blockholders and the years of experience in oil palm. However, for LSS teenagers it is much harder to get their own oil palm blocks.

To determine the level of blockholders' knowledge, questions relating to oil palm cultivation were raised. Blockholders' knowledge of the management of fertilizer was categorised as poor or good. With the total score out of 14, the average score measuring their knowledge was 12.27, which was quite a good score. However, blockholders on LSS had a higher average score of 13.5 than VOP blockholders (Chapter 4, Table 4.1). Blockholders' management skills in oil palm were categorised into two groups as poor or good. The maximum score quantifying their level of management skills of oil palm was 16. With an average score of 15.6, the majority of the blockholders had good skills in oil palm as also identified in focus groups and interviews. This may be because of their experience working with the oil palm company.

The level of adoption of extension information was an indicator that illustrated whether or not blockholders had adopted the extension messages delivered by the extension officers. Most blockholders had adopted extension information on fertilizer application (Table 6.1) compared with LSS blockholders (Chapter 4, Table 4.1). The low adoption level of LSS blockholders compared to VOP may be due to the factors explained in Chapter 4, to do with the income pressures on highly populated LSS blocks.

Table 6.1 Variable categories, measurement units and summary statistics for variables used in the study (N=15)

Variable	Category	Measurement	Frequency	Percentage	Mean	SD
Age (N=15)	Young (20-38)	Years	5	26.3	50	16.71
	Middle Aged (39-57)		4	21.1		
	Old (58+)		6	31.6		
Total			15	100		
Average education level (N=15)	Low education (0-4)	Years of schooling	4	26.7	4.5	2.87
	High education (5+)		11	73.3		
Total			15	100		
Block population (N=15)	Small (1-7)	Count of people	9	47.4	7	3.57
	Large (8+)		6	31.6		
Total			15	100		
Experience in oil palm (N=15)	Short term (4-6 yrs)	Count of years	4	26.7	8	1.91
	Long term (6+yrs)		11	73.3		
Total			15	100		
Knowledge on fertilizer (N=15)	Poor (0-7)	Score (n/14)	1	6.7	12.3	3.63
	Good (8+)		14	93.3		
Total			15	100		
Skills in oil palm management (N=15)	Poor (0-14)	Score (n/16)	3	20	15.6	.83
	Good (15+)		12	80		
Total		15	15	100		
Level of adoption on fertilizer (N=15)	Low adoption (0-50)	Score in %	1	6.7	88.33	13.75
	High adoption (51+)		14	93.3		
Total			15	100		
Production per ha/yr	No production (0)	Tonnes of oil palm fruit/ha per year	3	20	12.89	11.62
	Low production (1-10)		3	20		
	High Production (11-20)		5	33.3		
	Very high production (21+)		4	26.7		
Total			15	100		

3) Production in tonnes per hectare per year

Production measured in tonnes per hectare per year was categorised into four groups as no production, low production, high production and very high production. With the recommended standard of 20 tonnes per hectare, the average production per hectare per year of 12.89 tonnes by VOP blockholders was considered low compared with LSS growers (Chapter 4, Table 4.1). The difference in productivity between LSS and VOP growers is explained later in the chapter.

6.2 Extension

Regardless of OPIC's determination to increase production, VOP smallholders have much lower productivity levels than LSS smallholders. This was maybe due to blockholders having limited involvement with oil palm production and missing harvesting rounds and under-harvesting (partial harvesting) when they do harvest (Koczberski *et al.,* 2010). One objective of this study was to determine the effectiveness of OPIC's extension services. A range of factors were used to determine the effectiveness of extension; however, in this study, three issues considered to be key factors for evaluating extension services were used for this evaluation. These were frequency of extension visits, the type of communication method used by OPIC extension officers, and the type of extension approach used in delivery of extension services.

6.2.1 Frequency of visits by extension officers

The information analysed for frequency of visits by extension officers included the number of times farmers were visited in the past 36 months, the location where blockholders were visited and the purpose of the visit as indicated in Table 6.2. It excluded the blockholders' visits to the extension officers and also omitted the number of times blockholders had attended field days. This was done in order to pinpoint ways to explain why extension officers were not visiting individual blockholder individually.

Table 6.2 Frequency of visits to blocks in the last 36 months

Blockholders visited	**Number of blockholders**	**Per cent of blockholders**
Yes	2	13
No	13	87
Total	15	100

Table 6.2 showed that almost 87% of blockholders were not visited by an extension officer in the last 36 months. Compared with the LSS (61%), a lot of VOP blockholders were not visited. Only two growers were visited on their blocks in 2009 purposely for sexava outbreaks which was the same reason for extension officers visiting LSS blocks as outlined in Table 6.4.

Table 6.3 Year for visitation in the last 36 months for the visited blocks

Year	**Number of visits**
2009	2
Total	2

Table 6.4 The reason for block visits by extension officers

Options	**Numbers of blocks visited**
Field demonstration	0
Fertilizer	0
Pest and Disease(Sexava)	2
RSPO	0
Total	2

The frequency of visits to VOP blocks was lower than LSS blocks (Chapter 4). Likely reasons why the majority of VOP blockholders were not visited include:

a) Low ratio of extension officers to blockholders (see Chapter 4 for further discussion).

b) Geographical dispersion of VOP blocks (costly to visit them), and

c) Smallholders have little need for block visits because they have sound knowledge of oil palm production and management despite their lower productivity.

However, the lower level of extension visits to VOP than to LSS growers suggest that even though extension officers' visits to LSS are lower than expected by the LSS blockholder themselves, it seems, more consideration was focused on LSS blocks. Since both LSS and VOP blocks were only visited because of sexava outbreaks, it may be because of the following reasons:

- Due to the recent development of the VOP, sexava infestation rates may be lower than on LSS blocks. The recent visits by extension officers to the two VOP blocks were probably because of early signs of infestation (Plates 6.1).
- LSS blocks are contiguous which means that sexava infestation can spread rapidly. VOP blocks tend to be separate from each other which slows the spread of sexava.
- Of the 15 VOP blockholders interviewed, 33% of them had previously worked for NBPOL and were more experienced. Most said during focus groups that they did not need further training on fertilizer application.

b) Geographical dispersion and accessibility of VOP blocks

Given the geographical dispersion of VOP blocks in Buvussi Division (Figure 3.2), it is more difficult for extension officers to visit VOP blocks than the LSS blocks. LSS blocks are located more contiguously and are more accessible because they are located near the main highway. Bubu VOP, for example, is situated approximately 10 km from the main highway and the unsealed road is poor and often impassable in wet weather. Smallholders in a focus group at Bubu complained that sometimes company trucks fail to collect their harvested oil palm due to the poor road condition.

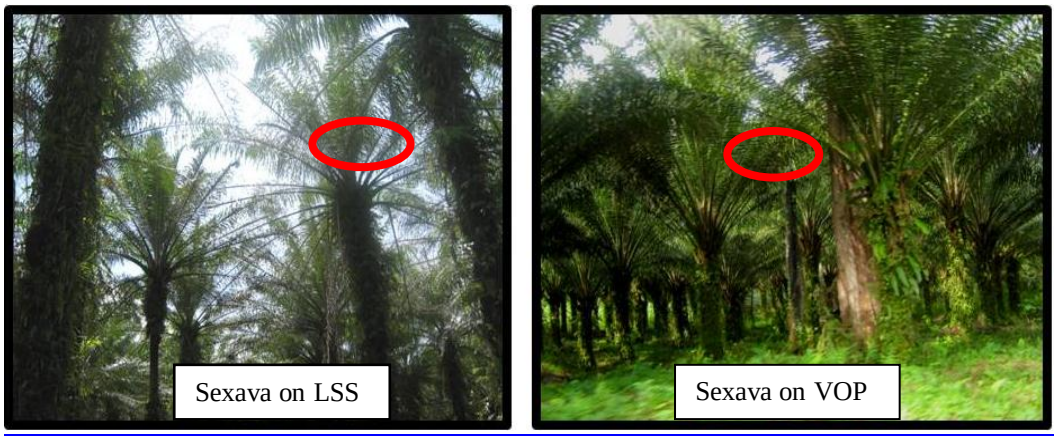

Plate 6.1 Incidence of sexava damage on an LSS and on a VOP block.

c) Level of skills and experience developed by blockholders who previously worked for the oil palm company

About 33% (5) of VOP blockholders interviewed had previously worked for NBPOL. Therefore, their level of skills and knowledge were high as most of them

showed indications of being skilful and by answering all questions confidently. A detailed explanation of blockholders' management skills is given later in the chapter.

6.2.2 Communication method of information dissemination

To further assess OPIC's extension approaches, this section presents the different approaches used by extension officers to disseminate information to blockholders as shown in Table 6.5. It also provides a tally of preferences of the methods preferred by blockholders.

Table 6.5 Communication methods preferred mostly by blockholders

Options	**Frequency of extension method (%)**	**Extension method effective (%)**	**Extension method not effective (%)**	**Not sure (%)**
Individual (one-to-one)	2 (13)	2 (100%)		
Field day	9 (60)	8 (89%)	1 (11%)	
Visits to OPIC office	4 (27)	0	4 (100%)	
Total	15	10	5	0

Even though 33% of blockholders previously worked for NBPOL, the majority of them (60%) received extension advice through field days carried out by extension officers. As blockholders in the study were located in two separate regions, all blockholders situated along the main highway (Lilimo) found field days to be an effective method of receiving information. However, Bubu growers, whose oil palm blocks are adjacent to an oil palm plantation, found field days less important to them as they claimed they had already acquired knowledge of most of the techniques and skills relating to oil palm management when they were working for NBPOL. Bubu growers also stressed that they knew about most aspects of fertilizer application and needed no further training. In contrast, blockholders in Lilimo said they were not too sure about the different types of fertilizer and their uses. Like LSS blockholders, 33% of the blockholders considered visits to OPIC office as an ineffective method of information dissemination. In other words, these blockholders prefer other methods of communication such as individual block visits. In most cases, blockholders' visits to the OPIC office were mainly enquires concerning delays in deliveries of farm equipment (tools, nets, wheelbarrows) and payment queries. However, blockholders during focus groups pointed out that most queries made to OPIC offices are often

overlooked and blockholders have no choice but to visit Smallholder Affairs office of NBPOL to address these matters.

6.3 Average educational levels

With less population and income pressures on the VOP than the LSS, as described in Table 6.1, it is to be expected that the reasons underlying decisions and preferences concerning education will be different to those found among LSS households. Given that VOP blocks consist only of primary households and are not multiple household blocks, analysis of educational opportunities will focus solely on gender differences in education within the household. To obtain the average educational level for the block, the procedure is similar to LSS where the educational levels of all members of the household were recorded.

Table 6.6 Average educational level

	Male	**Female**	**M&F**
All population	2.75	1.85	2.32
Population excluding those too young to be at school	2.95	2.05	2.53
Population who have finished school	2.75	1.55	2.16
Population still at school	3.67	4.67	4.07

M & F=Male and Female

To differentiate the educational levels of males and females, my analysis focussed on the average educational level of the population who had completed school and those who were still at school. Table 6.6 shows that for the population who had finished school, the educational level of males was higher than that of females. The higher education levels of males in this case are most likely to be explained by cultural factors. As suggested in Chapter 4 (under 'average educational level for LSS') the findings reflect Melanesian values where males are generally given priority over females in education and income opportunities. Furthermore, typically in the village situation, females often have limited opportunity to complete their education as most tend to help out in household chores and they tend to marry at a younger age than males (For a full explanation of the findings, refer to chapter 4, under 'average educational level'). In contrast, the educational levels of males in primary households on LSS are much higher than males on VOP blocks (compare Table 4.8, Chapter 4 with Table 6.6). Even the levels of education for females on LSS are

greater than males on VOP blocks. The difference in educational level between LSS and VOP may be due to the following reasons:

- With the hope of a better life and better education for people who first settled on LSS blocks and while education costs were low in the 1970s, more children especially males on LSS were given the opportunity to be educated. Also, all LSS subdivisions had schools, whereas schools were less accessible to VOP families. However, males on VOP blocks did not take education seriously because education was not a priority need at that time.

- Confined to only 6 ha of land for oil palm cultivation and limited access to land for farming and food gardening to earn income to support them in the future would have been difficult if it were not for education. Education was the only hope for earning income after completing school. In contrast, it seemed that males on VOP blocks did not take education seriously. Perhaps because they have access to more land they were not under the same pressure to educate their children.

For people still at school, Table 6.6 shows that attitudes to educating females may be changing. Currently, the educational level of females still at school is greater than that of males which illustrates that more females are attending school than males, and for longer. The increase in the years of schooling of females still at school suggests that parents may be changing their attitudes towards educating girls. As argued in Chapter 4, this shift in attitude seems to be related to the perception among some parents that females tend to take more advantage of their education than males by taking up professional roles later in life, such as being elementary teachers, nurses or secretaries. Currently, there are more technical schools for females to continue their education even if they dropped out of primary school, providing a second chance in education.

In terms of adoption of fertilizer application and education levels of VOP growers, using Pearson's correlation test (Appendix 2), there was no significant relationship between the education levels of the blockholder and household members' adoption of

extension information. However, comparing Table 4.8 in Chapter 4 and Table 5.4 in Chapter 5, LSSs education levels and adoption level of fertilizer application was higher than that of VOP blocks. Therefore, it is likely that low levels of education may have caused low adoption of extension messages and thus explain the lower oil palm productivity of VOP growers.

6.4 Blockholders' knowledge of fertilizer

To assess smallholders' knowledge of fertilizer application, a list of questions on fertilizer was given to blockholders to answer. A score of 1 was given for the correct answer and a 0 for an incorrect answer. Table 6.7 below represents blockholders' level of knowledge on fertilizer application. To determine the level of knowledge, all responses on each aspect of fertilizer for all blockholders interviewed were summed up and divided by 15 which was the total number of blockholders interviewed. The answer was than multiplied by 100 to obtain the percentage level of knowledge.

Table 6.7 Blockholders' level of knowledge of fertilizer

Fertilizer aspects	**Level of blockholders' knowledge (%)**
Benefits and reasons for fertilizer application	100
Amount of fertilizer required per palm	86
Number of fertilizer bags per hectare	93
Fertilizer placement	93
Timing of fertilizer application	94
Time taken for palms to fully utilize fertilizer	89

Table 6.7 reveals clearly that blockholders had excellent knowledge on fertilizer application, and in particular the income benefits of fertilizer application. Both, Bubu and Lilimo VOP growers were competent and very skilled in aspects of fertilizer application and most understood the function of fertilizer in increasing soil fertility to improve yields. The high level of knowledge on fertilizer reflects the specialized training blockholders received through working with NBPOL and by attending field days conducted by OPIC. A good example of that was their suggestion and concerns raised during the focus groups on the different types of fertilizer and their uses and the frequency of fertilizer application, stressing the importance of why fertilizer must be applied twice in a year rather than once. Other aspects of fertilizer application such as the required number of bags per hectare and the correct time of year for fertilizer placement (during the dry season to avoid

fertilizer being washed away during rainy season) were also well comprehended by growers. Having said that, applying fertilizer twice a year and in the recommended amount would be a waste of money as blockholders are not fully harvesting their palms.

However, some growers still had difficulty measuring the exact amount of fertilizer to apply per palm (2 kg). For VOP blockholders it may be because, most fertilizer application was executed by contractors due to labour shortages on VOP blocks.

6.5. Blockholders' skills in oil palm management

The ability of blockholders' to identify a range of symptoms of nutrient deficiencies in oil palm was used to determine their level of skills in managing and cultivating oil palm. For every symptom identified by blockholders, a score of 1 was given and 0 was given if not identified. To assess the level of management skills of blockholders, all responses on each symptom detected were added up and divided by 15 which was the total number of blockholders interviewed. The answer was than multiplied by 100 to get the percentage level of management skills on fertilizer.

Table 6.8 Blockholders' knowledge of nutrient deficient symptoms

Symptom of nutrient deficiency	**Percentage of growers who identified the nutrient deficient symptom correctly**
Low yield	100
Short light green frond	93
Closed canopy	93
Smaller bunches	100
Orange spotting on leaves	100
Edges of leaves shrivel and die out	100
Frond die back	100
Leaves facing the sun turns yellow	100

It is evident from the results shown in Table 6.8 that most growers had the necessary knowledge to identify symptoms of nutrient deficiency in oil palm. Growers clearly understood that low yields, small bunch size, orange spotting on leaves, frond die back, and leaves facing the sun turning yellow were all indicators of nutrient deficiency in palms. The most compelling explanation proposed was that most of them had knowledge of oil palm cultivation due to past experience working with NBPOL.

6.6 Level of adoption of fertilizer

Adoption is essentially a decision making process that involves steps such as:

- Observing the problems and making an analysis of it.
- Deciding the available course of action.
- Taking a course of action, and
- Accepting the consequences of the selection.

As VOP blocks were planted recently, the section on replanting of senile palms was excluded. Table 6.9 only presents findings on adoption of fertilizer.

Table 6.9 The level of adoption of fertilizer among blockholders

Fertiliser adoption	**Percentage of smallholders purchasing and applying fertiliser**		
	Full adoption	Partial adoption	No adoption
Bought fertilizer	80 (12)		20 (3)
Required number of bags per hectare	33.33 (5)	46.67(7)	20 (3)
Applied the required amount per palm	33.33(5)	46.67(7)	20 (3)

6.6.1 Fertilizer

Of the 80% of the blockholders who had purchased some fertilizer, only one-third of them fully adopted by purchasing the required 10 bags of fertilizer per hectare while 47% brought less than 10 bags per hectare. The remaining 20% did not purchase any fertilizer, therefore did not adopt at all. Table 5.4 in Chapter 5 revealed that the fertilizer adoption level of LSS blockholders was greater than VOP blockholders. Even though LSS blockholders were faced with increasing socio-economic problems such as population and income pressure, they still purchased fertilizer because LSS blockholders were more likely to harvest all of their oil palm than VOP growers. The adoption level of VOP blockholders on the other hand, demonstrated that maximising oil palm income was not a high priority for them. Koczberski *et al*., (2001) argued that income distribution was determined mostly by age, gender and kinship status and customary purposes. The low adoption levels of extension messages on fertilizer amongst VOP growers suggest that social obligations to share were particularly marked on VOP blocks making it difficult for blockholders to save income. Rather, the social demands and obligations placed on oil palm income by kin and indigenous cultural obligations were higher on the VOP, thus, reducing the incentive of growers to produce oil palm when most of that income would be lost through cultural obligations.

6.7 Conclusion

To conclude, the findings reveal that the majority of blockholders were not visited partly because of the low ratio of extension officers to blockholders, geographical dispersion of VOP blocks and poor access. However, the adoption of extension practices and production was not affected by these factors because blockholders were knowledgeable and skilful in managing their oil palm blocks through experience gained while working for NBPOL and from attendance at field days. There is no evidence to suggest the claim that the education level of household members has an impact on the adoption rate of adopt extension recommendations or productivity. However, the findings illustrate that the education levels of individuals on VOP blocks are much lower than LSS blocks. The fact that their adoption of recommended practices is low compared with LSS growers may mean that because people are bound by strict customs and traditions within their societies makes it is difficult for them to act on the importance of the extension advice received. Also, the low adoption of extension advice and low production of oil palm per hectare suggests that blockholders limited involvement with oil palm may be due to them focussing more on other activities such as customary obligations rather than on oil palm production. This is one of the key factors hindering adoption and implementation of extension messages among VOP growers.

In summary, it appears that VOP growers are less market driven producers than LSS growers. This may be because they are still located in their ancestral villages where traditions and obligations are still strong and remain a way of life, whereas LSS growers are settlers and no longer living in village settings. Village traditions and obligations are therefore much weaker in LSS. The next chapter concludes the study and provides recommendations as how to address the barriers to adoption on extension information.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATION

7.0 Introduction

This chapter summarises the findings of the study and provides recommendations for improving smallholder production and the effectiveness of extension services provided by OPIC.

It is clear from this study that improving smallholders' productivity remains a major challenge for the industry. The industry has tried to improve smallholder production by introducing innovative techniques to farmers. Among the difficulties faced in improving smallholder productivity are the many complex socio-economic factors contributing to low smallholder production and the ineffectiveness of extension services. Many of the socio-economic issues affecting the production of blockholders on the LSS and VOP are outside the traditional work domain of extension or what is commonly understood as extension work. The extension services themselves also are constrained through the declining number of extension officers.

This thesis concludes that the two main factors hindering the adoption and implementation of extension messages among smallholders include the changing socio-economic circumstances of smallholders, which are largely an outcome of population growth, and the declining number of extension officers. These issues are discussed below.

7.1 Socio-economic factors

With the aim of improving rural income, resettling people from over populated provinces to under-populated areas like WNBP, the Hoskins LSS was viewed as a major vehicle to increase agricultural export production, integrate Papua New Guineans into cash crop production and to improve rural incomes (Koczberski *et al.*, 2001). However, without realising the consequences of resettling people looking for

a better life to another province, blockholders who have settled on oil palm blocks since the establishment of the LSS now face many difficulties as the resident block population increased as second and third generation settlers remained on the block and relied on oil palm income from the 6 ha block. For most children born on LSS it would be very difficult for them to return to their home provinces as they cannot speak their parents' language fluently and would have weak claims to land and other resources which are likely now to be occupied or used by other people. Most of these demographic and income pressures now affect smallholder oil palm production and thus reduce the effectiveness of extension services provided by OPIC.

The large increase in population over time has led to increasing complexity in the structure of LSS households on blocks. The LSS block of 2010 is far more heterogeneous than the initial nuclear family that resided on the blocks in the 1970s. The findings reveal that on LSS blocks, the type of production strategy appears to be an outcome of population pressure. The shift in production strategy also influences the level of adoption of extension advice and the level of production. This socio-economic complexity is difficult for the industry to address as the growing number of people and households on LSS blocks leads to stresses which result in disputes over labour allocation and income distribution. This acts to undermine the labour cooperation found in *wok bung* strategy and leads to a block shifting from a *wok bung* to a *makim mun* strategy.

The most productive harvesting strategy identified in the study was *wok bung*. Whether the block owner was alive or deceased, *wok bung* has proved to be the most productive. The *wok bung* production strategy keeps the management and control of the block under one person. When households work together there is a degree of mutual agreement and cooperation among different households and they have respect for each other. Also, it shows family unity and indicates that these blocks have minimal conflicts over labour and income.

In addition, fertiliser adoption rates for blocks practising *makim mun* were lower than those of *wok bung*. This was mostly due to household financial constraints given the rise in fertilizer prices and the high rate of loan repayments which are harder to

service on highly populated blocks. With the increase in population and income pressure, most blocks are practising what is called the "*skip application"* where fertilizer is applied once every two years, rather than annually.

Delayed replanting of senile palms was also common on blocks practising *makim mun*. This is because harvesting is on a rotational basis and therefore income is not managed by one person and instead rotated among the different households living the block. In this case, the decision to order fertilizer or seedlings for replanting of senile palms cannot be done without all households on the block agreeing for deductions to be made for fertiliser and seedlings. Often conflicts and disputes occur amongst households when fertilizer or seedlings are purchased by the male head of the block without consulting other households. Thus with the *makim mun* blocks there are multiple managers and no longer are block management decisions centrally controlled. With several people now involved in decision making, it makes it very difficult for OPIC to encourage a block to adopt certain management practices.

Blockholders' adoption level of replanting was low compared with fertilizer adoption due to several financial reasons including high potential debt levels for seedlings while still repaying fertilizer loans obtained annually and the potential short-term loss of income from poisoning senile palms, and fluctuations in FFB prices. Given the population and income pressures on LSS blocks, most blockholders postpone replanting because of the income loss while waiting for the new palms to come into production. Most have refused replanting because of the costs associated with replanting which they see as being very high.

With *makim mun*, a further problem faced by the industry is the practice by smallholders of shifting oil palm harvests to neighbouring blocks to be weighed on the card of another block. In this case, during oil palm pickups, harvesting cards belonging to other blocks are used to weight the harvest in order to avoid deductions incurred by ordering fertilizer. However, this reduces the production record on their block which makes it very difficult for the block to obtain company loans in the future for farm inputs and other resources for block management.

Associated with the increasing population and income pressures are changes to education levels on the block. Education is broadly regarded as the route to economic prosperity and the key to scientific and technological advancement (Cuimombo, 2005). However, the current changes in household structure on the block in the way resources are distributed among co-resident households have greatly contributed to the inequalities in the education of children. The study has identified differences in the educational levels of children in primary and secondary households and also educational levels of children on VOP blocks. The large differences in educational opportunities revealed that children in primary households were more likely to be given the opportunity to be educated over children from secondary households. Surprisingly, within secondary households, the ratio of females who have completed school is higher than males. This possibly reveals a change in attitude of parents about giving preference to boys in education. This change in thinking may be due to an increasing number of males not valuing education as they engaged in unlawful activities with declining income opportunities on their blocks because of population pressure (see Chapter 4, Table 4.4).

Apart from population and income pressure leading to a drop in the educational levels of children on LSS, one may question the effect education has on the adoption of recommended practices and block productivity. As mentioned in Chapter 4 there is clear evidence to show a link between a farmer's education level and his/her adoption of extension messages. The findings of the study indicated that the average educational level of members of the household is associated with the level of management skills of blockholders. Though the study provides evidence that most blockholders were skilful and knowledgeable, it must also be appreciated that skills and knowledge accumulate and develop over time. Taking into account the education findings, it can therefore be concluded that the high productivity and adoption of extension advice earlier in the 1980s and 90s was probably influenced by education. It is therefore important to stress that the recent findings indicating the drop in educational levels of children in secondary households might have implications for the adoption of extension advice and the productivity of the block in the future.

The high level of education on LSS compared with VOP implied that most LSS blockholders were in a better position to be aware of, understand and adopt improved technologies. Blocks with a relatively high level of education have a higher probability of adopting extension messages than those with relatively little education. Regardless of this fact, is the difficulty faced by OPIC to increase smallholder yields when many of the main factors hindering production are social factors and therefore difficult for OPIC to address. Moreover, the many socio-economic issues affecting households on the LSS act as a disincentive for growers to improve production as they are more preoccupied with dealing with the issues at the family level rather than concentrating their efforts on improving production and following OPIC advice. So while smallholders have the knowledge to gain good production levels their performance is reduced because of the many pressures and conflicts in their lives.

7.2 Extension factors

Since the establishment of OPIC in 1992, the number of extension officer has declined. Prior to 1992, the industry was fully staffed and functional. However, currently the ratio of extension officers to smallholder oil palm growers is low. From the study, in Buvussi division, the extension officer ratio to smallholder was 1:154. However, in some subdivisions there are now 451 farmers for every extension officer. The low ratio is reflected in the lack of individual block visits made by OPIC extension officers to smallholder blocks for the last 36 months. Moreover, the majority of blockholders visited by an extension officer were because of reported pest and disease infestations.

Apart from pests and diseases, the study also found that extension officers tended to visit more progressive growers whom they felt were worth visiting because they were easy to deal with and were more likely to adopt extension messages than low producers. Many blockholders expected that extension officers should visit more frequently to conduct block inspections and this caused some growers to be very disgruntled and frustrated with OPIC, especially when many believed that some of the higher producers were favoured by OPIC officers. This mistrust and frustration with OPIC indicates the growing misunderstanding between blockholders and extension officers. Most blockholders who were part of this study believed the

extension services provided were ineffective and lacked coordination. Many felt that their needs and problems were not solved immediately by extension officers. However, given the low extension officer ratio to farmers and the many roles OPIC officers were expected to carry out, it is increasingly difficult for OPIC to meet the needs of growers. Thus the study revealed low fertilizer application and poor management on blocks were the result of unsolved socio-economic factors surrounding disputes within families over income distribution, ownership disputes and population and income pressures outside the domain of agricultural extension service.

7.3 Recommendations

This section provides suggestions on issues identified in the study which are the main factors affecting both the effectiveness of extension services provided by OPIC and smallholders' productivity. The section also aims to facilitate ways to improve the extension structure and also ways to help minimise the impacts caused by the rising socio-economic issues faced by smallholders. The key recommendations are to:

1. Change the way extension is carried out.
2. Introduce new fertilizer and replanting deduction schemes.
3. Encourage OPIC to liase with government departments, banks and other stakeholders to address some of the socio-economic issues on the LSS blocks; and
4. Support income diversification among growers.

There is a need for the industry to change the method in which extension officers approach blockholders and extension. Because the of the nature of the industry structure as dictated by a top-down approach where innovations and techniques are designed only to fulfil the industry's objective, it is difficult to change its approach in a significant way to better meet farmers' needs. However, it is possible for extension officers to change the method of communication to blockholders in order to improve the effectiveness of their extension messages. This can be achieved by:

- Changing the approach to block visits.

- Maintaining a diary; and
- Being more responsiveness to blockholders' need.

OPIC needs to visit not only progressive growers and those blocks affected by pests and diseases but also to focus on targeting low producing growers. More contact with low producers will motivate them, give them the opportunity to discuss problems and also help to build a rapport between extension officers and smallholders. It is not a recommendation to improve blockholders' knowledge on fertilizer. As identified in Chapter 5, Table 5.2, most blockholders were knowledgeable in fertilizer application practices and also, there was no relationship between blockholders' knowledge and extension contact. Extension officers' visits to their blocks must be done in order to improve the relationship between extension officers and blockholders. This is an important step to achieving blockholders' trust and to change their negative attitude towards extension officers as revealed in Chapter 4 where extension officers were referred to as *'con man'* which shows the mistrust blockholders have towards extension officers.

Extension officers should aim to visit at least two or three low producers each day and make it a routine for block visits every day. Coverage of all smallholders is no longer viable given the limited number of extension officers and therefore a more targeted approach with attention directed to low producers is necessary. Regular contact by an OPIC officer with the same grower will help build up trust and respect and this is likely to create incentives for the grower to respond to the efforts made by the extension officer. Maybe even separate field days targeted at low producers would be worthwhile. These field days will encourage and motivate these blockholders. Also, since the way field days have been conducted has not changed for a long time, the method of presentation needs to be modified. Instead of orally communicating, other approaches like videos, guest speakers, pamphlet distribution, plot demonstrations on both low and productive blocks and model farm blocks could be used to provide information to blockholders. The demonstration block used for fertilizer trails conducted by the agronomy section which is being used by both OPIC and OPRA should also involve low producing blocks.

It is recommended that extension officers maintain a daily work diary to improve the accountability of their roles as extension officers. A dairy is a tool to assist extension officers to fulfil their role and be more accountable to the farmers they serve. It is used to record actual work done on smallholder blocks, note comments from farmers, and list problems identified. A daily diary kept by extension officers is also a reference to the needs of blockholders and acts as a reminder because it records dates and other information that should be acted upon. This is important because many blockholders had concerns about extension officers forgetting their requests for farm inputs. This often caused lengthy delays in delivery of tools or for block maintenance which added to the feeling of mistrust and frustration some smallholder held towards OPIC extension officers.

The diary should be kept by each extension officer so that matters identified during block visits could be discussed with the divisional manager. By maintaining a daily dairy, it will help pinpoint key production issues occurring on blocks and identify ways to solve them in an efficient manner. Extension officers should also be responding to blockholders' needs by providing resources required by blockholders like harvesting tools, harvesting cards and resolving issues rapidly. The fact that most queries are directed to Smallholder Affairs after waiting for extension officers to deliver services is a sign of extension offices overlooking their responsibilities. The industry should do better than keeping growers waiting for resources important for oil palm production rather than fulfilling their role as mediators for transferring services between blockholders and other organisations promptly.

As noted above, there are problems faced by blockholders that extension officers cannot solve like population and income pressure, law and order and disputes over land and block ownership. In order to ease these problems, it is recommended that OPIC employ a "welfare officer" whose role would be to liase with relevant government departments, NGOs, banks, health department and lands department so that they could come up with solutions to overcome some of the pressing socio-economic issues on the block. For example, the health department should be part of the field days to discuss family planning, and banks could be invited to talk about savings and to advise blockholders on book keeping.

Given that many blocks face financial difficulty in purchasing fertilizer and replanting senile palms, it is recommended that the industry give consideration to introducing a system where an agreed sum be deducted from the pay cheques of smallholders to be credited as a separate payment for fertilizer and replanting. This could be used to cater for fertilizer repayments and replanting purposes. This system would move away from payment deductions for seedlings and fertiliser being made after the purchase, but rather the funds would accumulate in a smallholders' credit fund which would be used when required. In that way, blockholders will not go through the hardship of repaying at a 50% deduction of their gross income for fertilizer.

It is important for the industry to recognise that increased fertilizer adoption does not necessarily mean higher production as there remains a lot of under-harvesting, especially on VOP blocks. Therefore, further consideration must be given by OPIC and the industry as to how to increase harvesting rates amongst growers. Initiatives like the mobile card which has proved effective in increasing production on abandoned and semi-abandoned blocks should be introduced to more problem blocks (Koczberski and Curry, 2004). The purpose of mobile card was designed to facilitate labour mobility between blocks. The mobile card could be used as a payment mechanism for hired labour on any LSS and VOP block requiring labour. Because the blockholder hiring labour would pay in fruit (a share of the harvest), the reluctance or inability of blockholders to fulfil the labour contract by paying cash for the labour would be overcome. The target of such an initiative would be the large group of presently under-employed young men, many of whom are settler sons residing on highly populated blocks (Koczberski *et al.*, 2001).

Finally, in order to minimise income pressures on the block and to help address unemployment and law and order problem on LSS, it is recommended the industry should initiate schemes and projects to support income diversification among growers to help sustain household livelihoods and well-being. Industry's vision should be changed from purely focusing on oil palm production to a broader view that acknowledges the need for more diversified agricultural and non-agricultural livelihoods among smallholders. This is necessary for the viability of the

smallholder sector in the future given the population and income pressures already existing on the LSS blocks are likely to increase further. Therefore, it is recommended that youth in particular should be targeted to help them pursue income generating activities other than oil palm. A good indication of the need for income diversification is blockholders' hesitation to replant senile palms given the significant disincentive of the financial burden of poisoning old palms and purchasing new seedlings and the loss of income for 2.5-3.0 years as they wait for immature palms to come into production. Smallholders are required to go into debt at the same time as they must repay loans, and alternative income sources like the repair of wheelbarrows, nets and tools would be of great help. Another alternative is to replant 1 ha at a time instead of 2 ha. This would be financially easier for growers.

Also, smallholders should be given the opportunity to engage in small-scale enterprises that are currently managed by the milling companies. Such economic activity includes sales and deliveries of fertilizer and tools and transport businesses. In addition, given most blockholders are practising inter-planting after palm poisoning, extension support is needed to provide for the cultivation of high value market crops such as peanuts and sweet potatoes.

The study found that changing socio-economic characteristics and the increasing complexity in the structure of LSS households on blocks such as population and income pressures) have contributed greatly to the decision as to whether or not to adopt extension practises. This has led to blockholders' low level of adoption to fertilizer and replanting of senile palms. The study also identified that the education of children on LSS blocks was greatly affected as priority was given to children in primary households to be educated thus resulting in a low level of education for children in secondary households. In the case of extension services provided by OPIC extension officers, it is apparent that the ineffectiveness of the extension services was exacerbated by low extension contact with growers and the absence of a good relationship between the extension officers and growers. Thus, as identified this was due to the low ratio of extension officers to blockholders.

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APPENDIX 1: Correlation between variables used in the study on LSS

	Dependent Variable (Y)									
Independent Variable (X)	X1	X2	X3	X4	X5	X6	X7	X8	Y1	Y2
X1(age)										
X2 (education level)	.205									
X3 (block population)	.008	-.269								
X4 (number of secondary households)	-.042	**-.483****	**.754****							
X5 (work experience in oil palm)	-.023	-.302	**.363***	**.404***						
X6 (knowledge)	.**334***	.072	.028	.024	.110					
X7 (management skills)	.101	**.367***	-.108	-.110	.068	**.544****				
X8 (extension contact)	-.141	-.126	-.267	-.135	**-.494****	**-.449****	**-.582****			
Y1(adoption)	.020	.225	-.182	-.192	.092	.187	**.407***	-.006		
Y2 (production)	.125	-.024	.131	.090	-.081	.231	.086	.014	**.405***	

APPENDIX 2: Correlation results between variables used on VOP blocks

Independent Variable (X)	Dependent Variable (Y)								
	X1	X2	X3	X4	X5	X6	X7	Y1	Y2
X1(blockholders age)									
X2 (education level)	-.160								
X3 (block population)	.411	.168							
X4 (work experience in oil palm)	.228	.238	.473						
X5 (knowledge on fertilizer)	.261	-.452	.028	-.042					
X6 (management skills)	.178	.137	.048	-.289	-.057				
X7 (extension contact)	-.099	.348	-.114	-.270	-.030	-.294			
Y1(adoption level)	.610*	-.414	-.182	.263	.245	-.125	-.209		
Y2 (Production)	.209	.251	-.006	.328	-.320	.326	-.450	.085	

*** Correlation is significant at the 0.05 level (2-tailed)**

**** Correlation is significant at the 0.01 level (2-tailed)**

Summary of the variables and their measurements used in the study

Variable	Measurements
X1= Age of the blockholder	In years
X2= Average education level all individual on the block	Years of schooling
X3= Block population	Count
X4= Number of secondary households on the block	Count
X5= Work experience in oil palm	Count in years
X6= Blockholders' knowledge on fertilizer application	Level of knowledge as a %
X7 = Blockholders' management skills on oil palm	Level of skills as a %
X8= Level of extension contacts by blockholders	Number of times visited by extension officer in 36 months
Y1= Level of Adoption on extension information	Level of adoption as a %
Y2= Production	Tonnes per hectare/year

APPENDIX 3: Smallholder extension survey

Date of Survey:_____
LSS/VOP Subdivision:_____
Section Number:_____
Block Number:_____
Name of smallholder:_____

Part 1 Farmer Characteristics

1.1 What is your age?_____

1.2 Family size and education level of main household

	SEX (Male/Female)	Highest Education Level Attained		If person is employed, note their occupation & whether full time (FT) or part time (PT)	
		Currently at school, college, university (Y/N)	**If yes**, note school grade, college or university. **If no**, note highest educational achievement.	Type of work	FT or PT
Husband					
Wife					
1	M/F				
2	M/F				
3	M/F				
4	M/F				
5	M/F				
6	M/F				
7	M/F				

Household1: household head of the block
If married sons/daughters still living on the block, complete tables below.

Household 2: relationship to head of Household 1, son, daughter, brother, sister, in-law

	SEX (Male/Female)	Highest Education Level Attained		If person is employed, note their occupation & whether full time (FT) or part time (PT)	
		Currently at school, college, university (Y/N)	**If yes**, note school grade, college or university. **If no**, note highest educational achievement.	Type of work	FT or PT
Husband					
Wife					
1	M/F				
2	M/F				
3	M/F				

Block production strategy and productivity through time

1.3 What is the most common production strategy used on the block?

☐ *Wok bung*

☐ *Makim mum*

☐ Different plantings used by different family members?

☐ Mixed (specify the mix of types and state which type is most common). _____

1.4 In what year did the family settle on the block?_____

1.5 Do you think you are achieving reasonable yields of oil palm from your block given the age of the different stands? Y/N

1.6 Over the years that you have been living on this block, have yields of oil palm declined, increased or stayed about the same?

a) Declined (go to Q1.7)

b) Increased (go to Q1.7)

c) Stayed the same

1.7 What do you think might be the possible reason for the change in yields on the block?

_____

Section 2 Fertilizer Application

Fertilizer application is one of the main extension goals used to boost productivity in each smallholder block. This section is divided into two parts. The first part deals with questions that are related to the actual knowledge of the smallholder on fertilizer, while the second part is directed to extension officer's role in delivering information on fertilizer to smallholders.

Smallholders' knowledge of fertilizer application

2.1 Did you apply fertilizer on your oil palm block in the last 12 months? Y/N (If Yes, complete table) If no, why not? Go to Q2.2

Phases where fertiliser applied	In Production or not in Production (Y/N)	First application			Second application		
		Month applied	Type of fertiliser	No. of bags	Month applied	Type of fertiliser	No. of bags
Phase 1							
Phase 2							
Phase 3							
Phase 4							

2.2 Who is responsible for fertilizer application on the block? Circle the right answer
a) Household head or named individual
b) Only the men
c) Only the women
c) Both men and women
d) Contractors

2.3 Why is this person/group responsible for fertilizer application?

_____

2.4 Do you know why it is important to apply fertilizer?

_____

2.5 How often should an oil palm grower apply fertilizer each year?
a) Once
b) Twice
c) Three times
d) Four times
Why do you do that?

_____

2.6 When is the right time for fertilizer application?
a) During the peak period of harvesting
b) Immediately after circle cleaning
c) In the middle of the wet season
d) When oil palm prices are high
e) During dry season
Why do you apply fertilizer at that time?

_____

2.7 How many bags of Ammonium Chloride should be applied each round to a 2 ha phase (240 palms) of oil palm?

Planting type	Number of bags required	Amount of fertilizer required per palm
Mature Planting		
Immature Planting		
Yr 1		
Yr 2		
Yr 3		

2.8 Where should fertilizer be applied for the best yield response? Circle the right answer
a) Around the base of the palm in the weeded circle
b) Along frond row
c) Around the drip circle of the palm (directly below the tips of the fronds on the outer circle)
d) On the edge of the weeded circle

Give the main reason for your answer to the above question?

_____

2.9 Have you seen any effect on your oil palm after applying fertilizer? Y/N

2.10 How long after fertiliser is applied can you expect to see an increase in yields?
a) Immediately
b) One week
c) Four months
d) 6-12 months
e) 18 months
f) I don't know

Evaluating the extension officers' role on delivering message on fertilizer to smallholder

2.11 How many times in the past 12 months has an extension officer come to visit you on your block or a neighbour's block?_____
a) When was the last time an OPIC officer visited your block? Month _____
Year _____
b) Was this last visit on your own block or a neighbour's block?_____

2.12 What was the purpose of the last visit of an OPIC officer?

_____

2.13 What extension method do OPIC extension officers use when delivering information during block visits?
a) Individual method (one-on-one, own block without neighbouring growers attending)
b) Group method (growers from a group of neighbouring blocks meet on one block for the extension visit).
c) Mass media through radio broadcast
d) Your visit to OPIC office

2.14 Do you think the above method of communication is effective? Y/N
If yes, why

_____

If no, why

_____

2.15 Do you think you know about all aspects of fertiliser use? Y/N
If yes. Go to Q 2.15
If No, go to Q 2.17

2.16 If yes, from where did you obtain this knowledge?
a) Extension officer
b) Friends
c) Neighbouring blocks
d) Handbook for growers

2.17 If from EO, how did you learn?
a) Field/Plot demonstration
b) OPIC field day
c) Block visit
d) Radio broadcast

2.18 What type of information on fertilizer would you like to know more about?
_____

2.19 Information on fertilizer provided by OPIC has helped me realized the importance and the advantages of fertilizer application. On a scale from 1-5, select the most suitable answer.
a) Strongly disagree
b) Disagree
c) Neutral
d) Agree
e).Strongly agree
Give the reason for you answer above?
_____

2.20 Please complete the table below.

Areas of fertilizer application	Explained by EO, Y/N	If yes, did you understand?	If no, why were the explanations not clear?
The reason why fertilizer was to be applied, as to restore soil nutrients back to the soil.			
The amount of fertilizer applied per palm			
Number of fertilizer bags per hectare			
Where fertilizer can be applied whether, around the base of the palm, frond placement or drip circle			
The appropriate time for fertilizer application			
The income benefits of fertilizer application.			
The time taken for the fertilizer to be fully utilised by the palm for yields to increase			

2.21 How could the extension officers improve on their performances in delivering extension advice on fertilizer application?

_____

2.22 What were three important things you learnt from the extension officers about fertilizer application?

a) _____
b) _____
c) _____

Attitude of the smallholder towards the extension service

2.23 Do you apply fertilizer only when directed by OPIC or do you have your own judgement of when to apply fertilizer? Y/N
If yes, why

_____

If no, why not?

_____

2.24 What strategy do you use when applying fertilizer to the palm? Do you apply fertilizer to?

a) All the palms on the block
b) Only productive palms
c) Only low producing palms
d) Only the palms nearest to the road (phase1)

2.25 Why do you prefer that method of selecting which palms for fertilizer application?

_____

2.26 If you double the amount of fertilizer applied from the recommend amount of 6 bags/phase to 12 bags/phase will yields

a) Stay the same
b) Increase by a small amount
c) The yield will double

Skills of the smallholder towards the extension services

2.27 Do you recognise any of these symptoms on your palm prior to fertilizer application? Indicate yes or no

Symptoms	Y/N
Low yields	
Short light green fronds	
Open canopy	
Smaller bunches	
Orange spotting on leaves	
Edges of leaves shrivel and die out	
Frond die back (When severely deficient)	
Leave facing the sun turns yellow	
Crinkled leave and often die back	

2.28 Do you help other smallholders by giving advice on how to apply fertilizer? Y/N
If yes, why do you help?

_____

If no, why not

_____

2.29 Do you think you have a proper skills required for fertilizer application? Y/N
If Yes, why

_____

If no, why not?

_____

2.30 Do you require further training on all aspects of fertilizer application? Tick the boxes below

☐ Quantity per palm
☐ Placement of fertilizer
☐ Timing of fertilizer application
☐ Frequency of fertilizer application

Aspiration of the block holder towards extension services

2.31 As a result of the awareness given by OPIC to improve smallholder production and increase income through fertilizer application. Do you plan to apply fertilizer as recommended by OPIC on time? On a scale from 1-5, select the most suitable answer.

a) Definitely will not (1)
b) Probably will not (2)
c) Undecided (3)
d) Probably will (4)
e) Definitely will not (5

Give reason for your answer above?

_____

2.32 If it were not for the K3.00 reimbursement/bag of fertilizer applied, would you still apply fertilizer? On a scale from 1-5, select the most suitable answer.

a) Definitely will not (1)
b) Probably will not (2)
c) Undecided (3)
d) Probably will (4)
e) Definitely will not (5

Give reason for your answer above?

_____

2.33 Do you plan to adopt or utilize the techniques of fertilizer application on your block? On a scale from 1-5, select the most suitable answer.
a) Definitely will not (1)
b) Probably will not (2)
c) Undecided (3)
d) Probably will (4)
e) Definitely will not (5)
Give reason for your answer above?
_____

Section 3 Replanting of senile palms

Replanting of senile palms is also another extension goal OPIC use to deliver to smallholders. This section is divided into two parts. The first part deals with questions relating to the actual knowledge of the smallholders on replanting and the second part is directed to the extension roles in delivering information to smallholders.

Knowledge of the smallholder on replanting senile palms

3.1 Did you do replanting on your block in the last two years? Y/N
If yes go to Q3.2
If No, why not?
_____

3.2 What was the main reason for replanting? List two main reasons
a) _____
b) _____

3.3 Who decides on the block if replanting can be done?
_____
3.4 What are the steps involved in replanting?
a) _____
b) _____
c) _____
d) _____

3.5 Have you ever been consulted by OPIC to replant palms on your block? Y/N

3.6 When was the last time an OPIC officer visited your block? Month_____Year_____

3.7 What method of communication did OPIC officer use when delivering information on replanting?
a) Individual (own block without neighbouring growers attending)
b) Group method (growers from the group of neighbouring blocks meet on one block for the extension visit)
c) Mass media through radio broadcast
d) Your visit to OPIC office

3.8 Do you think the above method of communication is effective? Y/N
If yes, why

_____

If no, why not

_____

3.9 How did you learn about replanting?
a) From neighbouring blocks
b) Extension officers
c) Friends
d) Handbook for growers
e) Posters or notice at community centre

3.10 If from an extension officers, was it through
a) Field/plot demonstration
b) OPIC field day
c) Block visit
d) Your visit to the office
e) Radio broadcast

3.11 How could you rate the performance of an OPIC officer in delivering the information on replanting? On a scale from 1-5, select the most suitable answer.
1) Strongly disagree
2) Disagree
3) Neutral
4) Agree
5) Strongly agree

3.12 How could the extension officers improve their performances in delivering extension advice on replanting?

_____

3.13 Refer to the table below to determine whether all topics required for replanting as been covered by OPIC officers

Topics	Explained Y/N	If yes, did you understand?	If no, why was the explanation not clear?
The income benefits of replanting			
The time taken from poisoning senile palm to harvesting immature palm			
Income benefits of replanting			
The amount of glyphosate required to inject the trunk			
Where to inject			
The time length before felling			
Safely measures when using glyphosate			

Attitude of the smallholder towards replanting of senile palms

3.14 Do you think you are achieving reasonable yield on your block given the age of the palm? Y/N

3.15 Is the yield?
a) High as it was when you first settled on the block
b) Decreased since you first settled

3.16 What do you think would be the cause of the changes in yield over the years?
_____

3.17 If the yield of the palm is determined by the age of the palm, do you think replanting is necessary? Y/N
If yes, give reason
_____
If no, why not
_____

3.18 During harvesting, did you harvest 20m tall palm? Y/N
If yes, how do you manage to do that?
_____
If no, why not
_____

Skills of the smallholders on replanting senile palms

3.19 Do you think you have the necessary skills required of replanting senile palms? Y/N
3.20 Do you require further training on replanting senile palms? Y/N

3.21 In what areas do you require training? List them
_____
_____

Aspiration of the smallholder on replanting

3.22 Taking into consideration the yield, the height and the age of the palm together, do you plan to do replanting on your block? Y/N
If yes, why
_____
If no, why not
_____

Section 4 Level of Adoption of extension advice on fertilizer application and replanting of senile palms by smallholders

4.1 Below is the table containing the list of the extension information provided by OPIC to you, select yes if you have adopted the practice or no if not.

Extension Approach	Technique adopted (Y/N)	Applied fertilizer in the last 12 months
Fertilizer		
Bought fertilizer		
Applied the required number of bags per hectare		
Applied the required amount per palm		
Fertilizer placement at the right place as required by OPIC		
Replanting of senile palms		
Signed up for replanting		
Injected palms with Glyphosate		
Replanted senile palm on your blocks		
Adoption Index		

Part 5: Economic and Social problem fostering/hindering adoption of extension messages among smallholder using a focus group

In terms of block productivity, OPIC has used the two main approaches (fertilizer application and replanting of senile palm).The questions below relates specifically to the smallholders as to why these approaches are not adopted and their reasons for not adopting.

5.1 Do you think fertilizer application and replanting of senile palm are the only ways to increase block productivity? N/Y
Whatever your answer, give the reason for that.

_____

5.2 What are the main factors hindering adoption of these approaches and how would you solve them?

Factors hindering adoptions	Fertilizer	Replanting

5.3 Do you think the role OPIC is performing as extension agent is effective and how could it be improved?

_____