Muresk Institute

A Study of Agribusiness Supply Chain Systems for Small Farmers in Dryland Areas of Lombok Island - Indonesia A Pluralistic Approach

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

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Abstract

Despite the contribution that agriculture makes to the Indonesian Gross Domestic Product, the income of small subsistence farmers continues to fall. While many development activities and policies have been implemented to reduce the gap in income between farmers and non-farmers, the situation remains unchanged. In part this is because the majority of research has focused on improving production rather than addressing the social and economic aspects of farming and its supply chains. Very few approaches have adopted a holistic systems approach. This study examines holistically the agri-food supply chains of dryland farmers of Lombok, in eastern Indonesia, using a pluralistic approach. The objective of this study was to investigate the utility of developing a pluralistic model which combined the benefits of SSM with hard systems approaches like statistical and technical efficiency analyses and test this approach on the agri-food supply chains of dryland farmers of Lombok, in eastern Indonesia.

Agribusiness is a complex social system both to understand and to manage but is also driven heavily by the need to produce efficiently for a market. This means that solving problems within such systems requires the melding of both the qualitative and quantitative aspects in a pluralistic way. The research presented here combines an interpretative research approach the Soft Systems Methodology (SSM) with hard systems tools like descriptive and inferential statistical analyses, and technical efficiency analysis.

The SSM analysis was successful in identifying a feasible pathway for change for the agri-food supply chains studied. The key benefits of adopting this approach was its ability to produce realistic and feasible solutions in a culturally acceptable way and to unconsciously help the supply chain members to understand, look at, think, analyse and solve their problems through collaborative action. It is however, a complex tool to use and there is a need to develop a simplified SSM approach which significantly reduces the sophisticated systems jargon and technical terms that have been developed by the SSM research community if it is to be adopted more widely for use in solving agri-food supply chain problems in developing countries
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The farm productivity analysis found significant variations in the technical efficiency of the farms analyzed; from 47.6 to 94.5 per cent, indicating that there is still significant opportunity for improvements in production practices. Age and education were found to significantly affect farm-specific technical efficiency suggesting that programs that educated the rural young generally, but more specifically in new innovations and farm management practices, would show production efficiency benefits.

An analysis of the marketing system revealed that a number of market intermediaries were involved in the marketing and distribution of agricultural commodities. Market intermediaries arrange for the collection, consolidation and subsequent transport of the product and to varying degrees, with the sorting, grading and packing of the product to better fulfill downstream customers' needs. Quality at the farm gate was problematic, for much of the product is sold under the *tebasan* system where there are few incentives for quality and farmers face difficulties in disposing of product which fails to meet customers' expectations. As the quality of the product

deteriorates as it moves down the supply chain, the marketing margin increases to cover the increasing losses, and the uncertainty of price inherent in highly volatile commodity markets. In order to reduce risk, farmers and downstream market intermediaries prefer to transact with those exchange partners with whom they have developed long-term relationships. However, in the absence of reliable market information and the propensity for actors to sell to whichever market intermediary offers the highest price, little trust is evident in the exchange. As the geographic distance between actors increase, relationships down the supply chain become increasingly less personal and more businesslike.

This study resulted in a new pluralistic model for analyzing the agribusiness supply chain of Lombok referred to as the Lombok Method (LM). This pluralistic approach was found to be a more effective way to analyse and design solutions than SSM alone for the following reasons. First, the inclusion of hard system analysis enhanced the robustness of the model produced which in turn means it can be validated and challenged. Secondly, hard systems approaches were used to verify the findings of the SSM and also provide feedback into the SSM. Finally, the SSM was able to bring the experience of the participants to the interpretation of the hard system analysis.

While the model was successful in providing some solutions to the problems experienced in the supply chains, the research also highlighted the need to do further studies that 1) identify the nature and scale of market failure, 2) apply optimization techniques to supply chain systems and 3) identify a means of including external variables like climate in the model. There may also be a role for modeling the relationships between supply chain participants using structural equation modeling (SEM) or causal loop diagrams (CLD). With a focus on SSM there is a need to develop a simplified approach for use in developing countries and establishing standards for the conduct of human interaction in the SSM process.

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Chapter One

INTRODUCTION

1.1. Introduction and Background

In Indonesia, agriculture is still considered the cornerstone of economic development. Two indicators of the importance of the agricultural sector to Indonesia's economic are its contribution to the Gross Domestic Product (GDP) and its role in providing livelihood for the population (Table 1.1).

Table 1.1. Contribution of Agriculture to GDP and Total Employment in Indonesia

Year	Agricultural GDP (%)	Employment in Agriculture (%)
1961[a]	51.8	71.8
1971[a]	34.1	64.2
1978	23.0	59.4
1980[a]	24.4	55.9
1990[ab]	19.6	49.3
1992[d]	18.7	n.a
1997[c]	16.1	48.5
1998 [c]	18.1	49.4
1999 [c]	19.6	49.4
2000 [c]	17.0	48.4[e]
2001[cd]	17.0	43.8
2002[d]	17.5	n.a

Source: [a]Cited in Kasryno and Suryana (1992); [b]Cited from Anderson and Pangestu (1995); [c]Cited from Hafsah (2003); and [d]Cited from Indonesia at a Glance (http://lnweb18.worldbank.org/eap/eap.nsf/Attachments/IndAtAGlance/$File/INdAtAGlance.pdf); [e] Cited from Manikmas *et al*. (2003)

In terms of contribution to GDP, the agricultural sector in 1961 contributed more than half of total national GDP and this reduced annually until reaching a low of 16% in 1997. In 1998 and 1999 the contribution increased slightly because of the economic crisis that hit other sectors such as the manufacturing industry, trading and services, mining and energy, and tourism. Despite the contribution to the GDP reducing, the reduced absorption of the labour force was not very significant. Until 1980, this sector employed over 50% of the national labour force and this slightly decreased until 2001.

Sudaryanto *et al.* (1992) and Rosegrant and Hazell (2001), showed that the agricultural sector in Indonesia is a major source of economic growth, providing employment, foreign exchange earnings, a source of food supply and raw materials for the manufacturing industry. Similarly, Kasryno and Suryana (1992), Booth (1994) and Anderson and Pangestu (1995) found that this sector was a major contributor to GDP and a major source of employment for the population. Tambunan (1998) also reported that agriculture in this country played a leading role in providing millions of low-skilled or non-skilled labour with employment. Saragih (2002) predicted that the agriculture sector would still play an important role in the economic growth in Indonesia. The author based his prediction on several reasons, one of which is the ability of this sector to provide employment for a large proportion of the population and make a significant contribution to GDP.

Saragih and Krisnamurthi (1993) predicted that the structure of economic development in Indonesia could be changed from an emphasis on the agricultural sector to an industrial base that is supported by a significant improvement of the agricultural sector. This means that Indonesia can move to an industrial-led economy after it has developed a strong foundation in the agricultural sector. Similarly, De Rosa (1995) stated that even though Indonesia provides continuous support to industrialisation and has significant reserves of mineral fuel and ores, its economic development is still heavily dependent on agricultural-based activities such as cultivation and exporting large amounts of tropical agricultural commodities and related products. In short, the most suitable development strategy for this country is still based on agriculture.

One of the main targets of agricultural development in Indonesia is to maximise the potential of dryland areas to increase farmers' income and improve labour absorption in the agricultural sector. In Indonesia, dryland areas are mostly situated in the eastern islands including Lombok Island which is characterised by a harsh environment and the existence of large dryland areas which make up more than two thirds of its agricultural land. Therefore most farmers in Lombok are engaged in dryland agriculture.

Dryland areas in Lombok Island can only be cropped once or twice a year and the range of options open to farmers is considerably less when compared with irrigated land. Hence, poverty is rife among dryland farmers. Although some efforts have been done to alleviate poverty, farmers' conditions generally remain unchanged (Parman, 2005; Tim Kompas, 2005; Suhartiningsih, 2004; Masnun, 2006).

Most of the government's poverty reduction efforts for these farmers have focussed on increasing production (Adjid, 1994; Soekartawi, 1997; Lokollo, 2002). Furthermore, several studies have also been conducted to improve the situation. Kasryno (2000) examined growth and productivity of rural agro-industries and found that the growth and productivity in this sector was lower than other economic sectors. Other studies have found that most Lombok farmers have tended to follow traditional farming practices and have therefore not optimised the application of their farming resources (Wathoni, 1999; Wathoni *et al.*, 2000). There have been few studies focused on marketing problems of agricultural products in Lombok. Idrus and Rosmilawati (1991) studied the effect of socio-economic factors on the supply of soybean in central Lombok. However, none of these studies were focused on dryland farming in Lombok or investigated supply chain (SC) management issues in the context of an agricultural system.

A systematic understanding of the supply chain and its relationship to the agricultural production system is important because it is not concerned about individual parts of the process but rather on the supply chain as a whole. A supply chain is a network of several activities that function to procure materials, transform this material into products, and distribute these products through various chain participants to the end consumers (Ellram, 1991; Lee and Billington, 1995; Trienekens, 1999; Muckstadt *et al.*, 2001). A supply chain ideally contains all activities related to material and product flows from supplier to end-users and vice versa (Yoshida, 1999) and supply chain analysis can reveal improvements to the situation not only for farmers but also for other participants along the supply chain.

Naturally every firm will do everything it can to ensure its survival. A company cannot survive without following the changes to its environment especially those relating to its customers and suppliers. This means that a company endeavours to create a harmonic relationship with its suppliers and customers to improve its returns and efficiency of operation. In addition, the modern business paradigm requires businesses to understand competition between supply chains rather than just within chains (Christopher, 1998; Fearne *et al.*, 2001). Therefore, cooperation within chains rather than confrontation is needed to underpin the efficient operation of supply chains and the winners of competition are those who can manage their supply chain efficiently. Dyer *et al* (1998) and Lancioni (2000) have noted that within the last decade there has been increasing attention paid to supply chain management (SCM) as a tool to achieve competitive advantages in markets.

Typically the activities observed in a supply chain involve one or more of the following: procuring raw materials, producing (intermediate and/or finished) products and delivering the products to retailers and even to consumers. Traditionally, each activity along the supply chain such as planning, procuring, manufacturing, warehousing and marketing have operated independently of each chain participant with each often having their own sets of objectives that may be in conflict with other chain participants. Research and practice have shown that integration of these different objectives and functions through supply chain management (SCM) is now critical because if a business gets SCM right, it can optimise its own (and the chain's) delivery of material and information flows meaning it can prosper as a business (Gencoglu *et al.*, 2001, 2002).

The objective of SCM is to get better coordination along the supply chain in order to ensure the optimisation of the delivery of materials and information flows. This has led many writers to define SCM based on concepts of logistic management. But SCM is wider in scope than just logistics. SCM has been seen as a collaborative-based strategy (Bowersox *et al.*, 1999) or management philosophy (Mentzer *et al.*, 2001) that links inter-organisational business operations to achieve a shared market opportunity that create unique and individualised sources of customer value, leading to customer satisfaction. The importance of relationships and information sharing in this process has been highlighted by a number of authors (Christhoper, 1998; Fearne *et al.,* 2001).

The goal of SCM is therefore to eliminate the barriers between supply chain participants with the objective of soften the flow of goods, cash and information within the supply chain. The two major drivers are to enhance end-customer value (Bowersox *et al.,* 2000) and to increase cost-efficiency throughout the whole supply chain (Christhopher, 1998). When dealing with agricultural products the complexity increases as the products are seasonal, bulky and perishable therefore need to be handled with special attention to time and place. This has led a number of writers (Castano 2002; Cadilhon *et al.,* 2003; Zylbersztajn and Filho, 2003) to suggest that applying system's thinking to SCM is the appropriate way of capturing this complexity.

Metz (1998) argued that the most important contribution to supply chain thinking is the increasing reliance on system's thinking. However, adoption of system's thinking in one part of the supply chain doesn't maximise the benefits to the chain as a whole. To achieve this, the approach must be adopted by all firms and across all areas in the chain (Holmberg, 2000). Prussia and Shewfelt (1993) stated that over the past 50 years several systems approaches have been developed, ranging from formalised mathematical procedures for optimising a system to broad guidelines for thinking about situations involving both technical and human components. They also argued that systems approaches became more necessary as designed systems became more complex and as our understanding of natural systems expanded.

Clearly, a supply chain almost always involves several actors and activities linked in often complex networks (Lazarini *et al.*, 2001). As a system, the actors in a supply chain are not only the participants who work directly along the chain but also some indirect participants such as the government (Er, 2005), non-Government organisations NGOs (Wei *et al.*, 2004) and the media (Arryman and Indrayadi, 2005; Pujawan, 2005).

Similar to the theory of supply chain in general, the concept of agribusiness supply chain (ASC) refers to the activities of procurement, order fulfilment, product design and development, distribution, delivery, shipping and customer service executed by two or more separate organisations in the agribusiness industry to fulfil customer orders (Folinas *et al.*, 2003). Spinosa (1999) stressed the role of actors of ASC and stated that ASC consist of small and medium size enterprises such as farmers and raw materials producers, supplier of agricultural inputs, processors of agricultural outputs, farmers cooperatives, brokers, suppliers, distributors, wholesalers and retailers, that either tend to operate independently or cooperate, mainly in the last stage of the supply chain (wholesalers/retailers to consumers).

In agribusiness supply chains in developing countries such as Indonesia, the government through the Department of Agriculture, the Department of Co-operative and Small Enterprise Affairs, National Logistics Board and state-owned Banks play important roles. The Department of Agriculture is mostly involved in the mechanism of farm input supply; the Department of Co-operative and Small Enterprise Affairs is assigned to assist farmers in supplying farm inputs and marketing farm products; the National Logistics Board mandates over the marketing system specifically for staple food; and State owned banks support supply chain participants at any level (mostly farmers and collector agents) in financing their business.

Due to its nature, a supply chain can be viewed as a system. Wilding (1998) stated that since the 1950s, the systems approach has been used internally within supply chains which led to oscillation in demand inventory as orders passed through the system. As a system, all participants and activities in the supply chain should be viewed as part of an integrated system. This means that changes (both negative and positive) in one part of the supply chain may affect the supply chain itself as a whole. Forrester (1958) showed that in an industrial production-distribution system, a minor change in a system input could lead to oscillation behaviour for the whole system. Whilst Lee *et al*. (1997) found that distorted information from one end of the supply chain to the other can create significant effects on the whole system leading to excessive inventory investments, poor customer service, lost revenues, misguided capacity plans, ineffective transportation and missed production schedules.

Holmberg (2000) used the systems thinking approach to measure the performance of supply chains. He argued that one could not conclude that if a firm shows a high degree of adoption of systems thinking in one part of the supply chain or in one area, it automatically means that this kind of thinking has been consistently adopted across all firms or across all areas. Hence, it is suitable to reveal the importance of analysing the performance of agribusiness supply chains as a system (McGregor, 1997; Said and Intan, 2001).

In the ASC for dryland farming products in Lombok Island, participants who are involved have significant differences in their capabilities. Farmers and village intermediaries (collector agents) have very low levels of education, while wholesalers have medium levels and inter-island traders and government personnel have high levels of education with some having university degrees. Inter-island traders, wholesalers and government personnel may adopt systems thinking in their organisation, but farmers and collector agents may not necessarily do so. If inter-island traders and wholesalers who may understand systems thinking want to apply it in managing the whole supply chain but farmers and collector agents do not, the application will not work well. Considering that an ASC process involves several participants with many interactions among them, a systems approach should accommodate all the interests of all participants along the supply chain.

Based on the above, systems thinking is therefore relevant approach to developing an understanding of agribusiness supply chains. Systems thinking is a scientific approach to study problems holistically that have various relations that are relevant, complementary and reliable (Brocklesby and Cummings, 1995; Eriyatno, 1998).

A systems approach starts from the identification of a situation to obtain as much input as possible to build an operational and effective systems model. Two types of study apply to a systems approach: 1) identifying and gathering information on as many affected factors as possible involved in the problem situation, and 2) designing a model (quantitative and/or qualitative) to assist in understanding the problem to improve the situation. By adopting an interdisciplinary systems approach it is possible to study comprehensively complex problems.

Checkland (1981) divided systems approach into “hard” and “soft” systems analysis. Hard systems analysis works with definite objectives and structured data and is the mainstream of operations research. Soft systems methodology is a learning cycle focused on the improvement of ill-structures (or messy) situation problems usually found in social systems. The question now is which of those two methods is appropriate to analyse the agribusiness supply chain (ASC) for dryland farming in Lombok, Indonesia, or is there a better method that combines aspects of both?

ASC is categorised as a complex system because it has a basic compatibility interest. Participants’ values and beliefs diverge to some extent, often having different ends and means. However, the possibility for compromise around agreed objectives or compatible interests (Yoshida, 1999) means that ASC is suitable for analysis using a soft systems methodology (SSM).

However, during the development of SSM some people revealed the limitation of SSM when it applies alone (see Section 3.6.3). This system methodology does not offer a standard against which different perspectives from different people can be confusing. Interpretation of the SSM result may lead to the domination of more powerful people. When some standard measurements involve in the process of application of SSM, the interpretation of the result can be more robust.

Moreover, ASC consists of at least three kinds of activities: supplying, manufacturing or producing and delivering or distributing. All these activities contain structured and quantitative aspects. Structured, because the pattern or stages within each activity can be described clearly in a sequential order and quantitative because everything can be expressed in the form of a number or value such as transaction costs, input and output value, demand, supply etc. Therefore, fixed problem questions can be defined and be solved through quantitative analysis. Lazarini *et al*. (2001) suggested three core sources of value in supply chain analysis (SCA) – 1) optimisation of production and operation, 2) reduction of transaction cost and 3) value captured from joint innovation using complementary assets. Besides application of mathematical programming, some aspects of supply chain analysis can also be analysed with statistical and econometric tools. For example, Batt (2003) analysed the factors influencing the relationship between buyers and sellers along the agribusiness supply chain in Vietnam using factor analysis. Moreover, aspects like demand, supply, firm efficiency and profit margin can be analysed with financial tools. This is also supported by Chopra and Meindl (2001) and Beamon (1999) who concluded that the performance of supply chains can be measured quantitatively on the basis of cost, resource and flexibility. Therefore, ASC can also be analysed using hard systems analysis.

It is clear that the base characteristics of ASC mean they can be studied using both hard systems and soft systems methodology. It can also be argued that applying both hard systems and soft systems methodology would be appropriate in analysing ASC problems thoroughly. The starting point of this thesis is to develop a framework for a systems approach for agribusiness supply chains in Lombok that incorporates the analysis of farm level technical efficiency and the analysis of buyer seller relationship in marketing process to address the limitation of SSM. Application of more than one approach for a particular research problem has been referred to as a pluralistic approach (Blancarte and Azeka, 1992; McGregor *et al*, 2001; Batt, 2003a).

1.2. Problem Statement

Dryland farming is one of the main foci of agricultural development in Indonesia because more than 50 per cent of agricultural land in this country is dryland. Moreover, most dryland farmers live below the poverty line (Indriyati, 1992; Tim Kompas, 2005; Departemen Kehutanan, 1999; Marwah, 2005). Many policies have been introduced to increase the usage of potential dryland areas such as the *gora* system for rice cultivation, artificial rain, ground water pump schemes, construction of simple rain water irrigation systems called *embung* and farm input subsidies. Policies include not only the construction of physical infrastructure, but also some rural development programs such as *Inpres Desa Tertinggal* (IDT) which is a government program directly under presidential instruction to develop under-developed villages which are mostly agriculture-based and the P4K research project for small scale farmer development. Despite these programs most farmers still live in poverty (Heile and Dendi, 2004; Mubyarto, 2004; Manikmas *et al*., 2003; Soekartawi, 1997).

One potential area for development is the development of agribusiness supply chains (ASC). Farmers as well as other participants in the supply chain will benefit if the supply chain is managed efficiently because competition in this era is no longer simply business-to-business but rather, supply chain-to-supply chain (Christopher, 1992; Fearne *et al*., 2000). This is true especially for agrifood supply chain due to the shelf life constraints of food products and of increasing consumer attention for save production methods. Furthermore, a competitive advantage of firms can be maximised when all members along the supply chain work together to serve the end consumers (Towill, 1997).

Therefore, an analysis of the agribusiness supply chain as a whole is considered more and more important. Given the significant number of dryland farms in Indonesia and the important role of supply chains in the agribusiness system, this study examined the supply chains of important agricultural commodities such as maize, cassava, peanuts and paddy under dryland farming in Lombok Island. The key theoretical issue investigated was the need to develop a pluralistic framework that can best analyse the complex nature of the agribusiness system in Lombok. The research questions for this study are therefore as follows:

1. What kinds of supply chains are applied by the agribusiness actors for dryland farming products in Lombok and what is the rationale for this?
2. What are the key factors that influence the supply chains of dryland farming products in Lombok?
3. Is the pluralistic approach suitable to analyse agribusiness supply chain in Lombok?
4. What is the best framework that can be used to analyse the complex nature of the agribusiness supply chains in Lombok?
5. How can the supply chain models of dryland farming products in Lombok be analysed to improve the situation?

1.3. Research Objectives

The overall objective of this study is to determine an appropriate analysis framework for analysing agribusiness supply chains for dryland farming products in Lombok Island. Specifically, this study aims to:

1. Better understand the current agribusiness supply chain systems of dryland farming in Lombok;
2. Identify and describe the key factors that influence agribusiness supply chain systems associated with dryland farming in Lombok;
3. Apply a pluralistic approach in analysing how to improve the efficiency of agribusiness supply chain systems for major agricultural products in dryland areas in Lombok; and
4. Assess the effectiveness and limitations of a pluralistic approach in developing improvements in agribusiness supply chain systems for dryland farming in Lombok.

1.4. Thesis Organisation

This thesis consists of eight chapters. The structure of this study is described in Figure 1.1. Chapter 1 is an introduction to the thesis and covers the background of the study to provide general information on the problem specification including the research objectives. The second chapter describes the research site, Lombok Island, in general and more specifically, the two villages sampled in the study.

Chapter 3 presents a literature review on the analysis of agribusiness systems. It covers relevant theories and concepts for this study. In particular, the chapter includes a summary of agribusiness concepts, some examples of analysis of agribusiness systems, and the logic behind the pluralistic approach as an analytical method for agribusiness system analysis. Chapter 4 will provide a detailed methodology of the approach taken and the various analytical tools employed to analyse the results.

Chapters 5, 6 and 7 are devoted to the application of soft systems and hard systems analysis. Chapter 5 focuses on soft systems methodology (SSM) commencing with a background on the application of SSM through to suggestions on how to improve on the results of SSM.

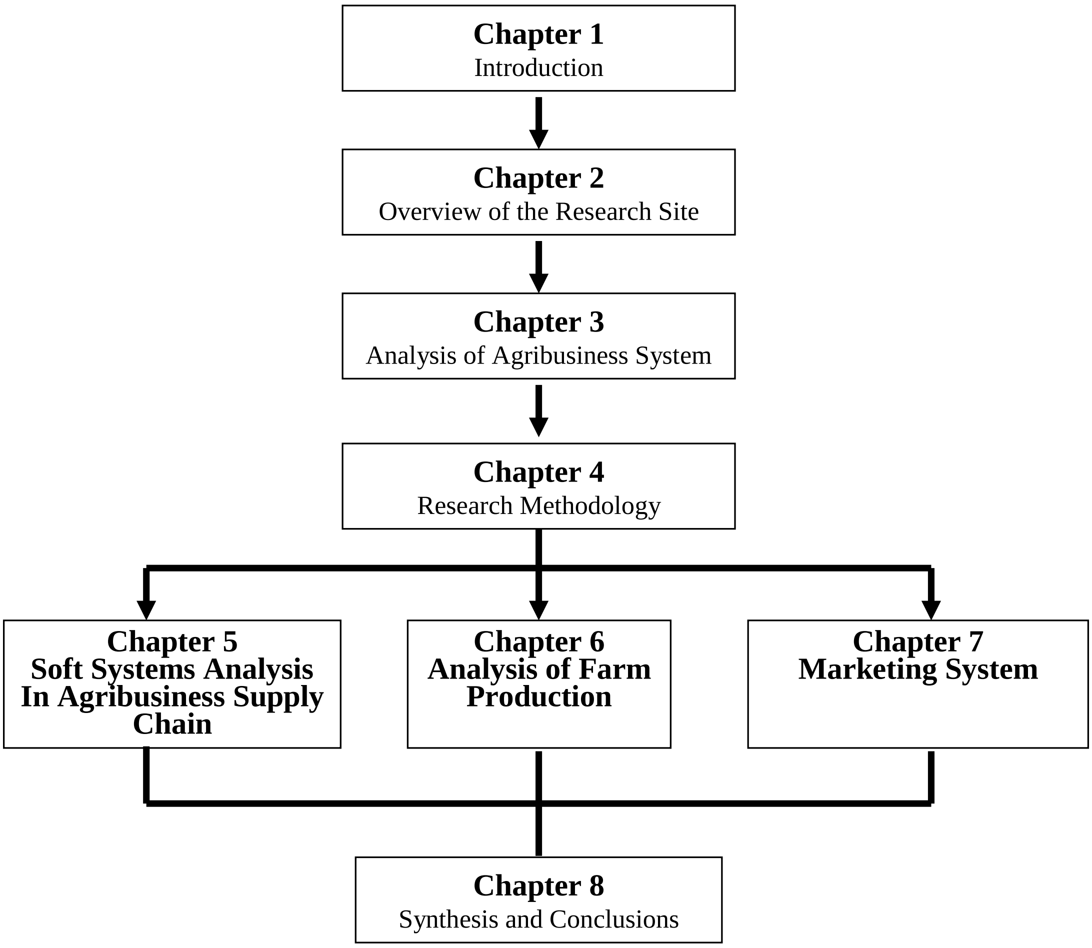

Figure 1.1: Structure of the Study

Chapter 6 is concerned with the analysis of farm-specific technical efficiency of agricultural producers. This chapter also includes factors that determine technical efficiency. Chapter 7 is about marketing system analysis which consists of the analysis of marketing margins, gaps between supplier capability and buyer expectation and relationship patterns between suppliers and buyers. The last chapter discusses the synthesis of the pluralistic approach and suggests an ideal analytical model for agribusiness supply chain analysis in Lombok Island and for agribusiness supply chain analysis in general, revisits the aims and objectives presented in Chapter 1, and discusses both the managerial and theoretical implications.

Chapter Two

OVERVIEW OF THE RESEARCH SITE

2.1 Introduction

This chapter provides an overview of the history of agricultural development in Lombok Island, Indonesia and general information on the factors associated with agricultural practices and farm product supply chain on the island of Lombok. Most of the discussion in this chapter is based on secondary data that was obtained from village offices and village unit cooperatives as well as the district and sub-district offices of the Departments of Agriculture; Trading and Industry; and Cooperative and Small-Medium Enterprise

This chapter is organised into seven sections that starts with an overview of the features of Lombok Island (Section 2.2) including a description of the geographic position, population and sources of income for people, and topography and climate. This is followed by a brief description of the history of Lombok (Section 2.3) and Section 2.4 describes the changes in the agricultural sector from Soekarno era to the reformation regime with a focus on land tenure and farming systems impacts. The agricultural market and transportation systems are discussed in Section 2.5 and the key formal and informal institutions impacting on agribusiness supply chains are described in Section 2.6. The last section (Section 2.7) highlights the factors that have constrained the development of the agriculture sector in Lombok.

2.2 Description of Lombok Island

2.2.1 Geographic Position of Lombok

Lombok Island is one of the two main islands in the province of West Nusa Tenggara. The island lies between Latitude 8° 12′ and 8° 55′ South and Longitude 115° 46′ and 116° 28′ East and is bordered by the Java Sea in the North, Alas Strait in the East, the Indian Ocean in the South and Lombok Strait in the West (Figure 2.1). It covers an area of 4,738 square kilometres and has a maximum length of 80 km and width of 60 km. Administratively Lombok is divided into three districts and one municipality. Those are West Lombok (1612.55 km^2), Central Lombok (1208.40 km^2), East Lombok (1783.43 km^2), and Mataram Municipality (133.62 km^2).

Figure 2.1: Map of Lombok (Central Bureau of Statistic of NTB, 2000)

2.2.2 Population and Source of Income

All statistical data in this section are derived from Central Bureau of Statistic of NTB (2002) unless otherwise stated. Lombok's population in 2001 was 2,615,217 made up of 53 percent males and 47 percent females living in 623,107 households comprising on average four people. This population is distributed almost evenly in every district. The population density is 242 people per km^2 and is increasing in the fertile areas compared with the dryland areas. The highest density is found in Labuapi Subdistrict (Mataram Municipality) with 1636 people per km^2 and the lowest is in Bayan Subdistrict (West Lombok) with only 124 people per km^2. *Dinas Kesehatan NTB* (2001) reported that the population growth in the period 1990-2000 was 2.02 per cent per annum, which was a decrease on the previous 10 year period (1980-1990) when it was 2.25 per cent.

This reduction is due to the success of family planning programs that have been in place since 1980.

Agriculture provides the main source of income (78%) for Lombok inhabitants followed by *perajin*[1] (7.5%), traders (5.8%), services (4.4%), and others (3.9%). There are two main reasons for agriculture being the main source of income. The first is that the majority of people live in rural areas and secondly unskilled and uneducated people can take part in agricultural production without significant amounts of money.

The majority of people are from the Sasaknese ethnic group (87%) with the remainder made up of Bimanese, Sumbawanese, Javanese, Balinese, Buginese, Malay, Arabic and Chinese. While each has its own language, communication across ethnic groups is via Bahasa Indonesia. Ethnic groups tend to congregate together in their own *kampungs*. Therefore in Lombok there are Kampung Jawa (for Javanese), Kampung Arab (for Arabic), Kampung Bugis (for Buginese), Kampung Melayu (for Malay), and Kampung Lawata (for Bimanese and Sumbawanese). The Balinese are different as they mainly live in the urban area of the Mataram in "*karang*" kampong. The Balinese ethnic group are Hindu's unlike the majority of the population who are Muslim.

2.2.3 Topography and Climate

The topography and climate of the island is best explained by focusing on the three areas - southern, central and northern. The topography varies from flat areas to mountainous areas as high as 3700 metre above sea level (asl).

There are some steep mountains in the south with the most highest being Mt. Mareje but most other parts of the south are mainly flat with no access to irrigation. On the western peninsula, hills rise steeply to a height of between 40 to 60 m asl which merge with the Mt. Mareje complex to the northeast. Mt. Mareje descends steeply to the east towards the eastern peninsula to form a hilly belt approximately eight kilometres wide. The southern slopes of the Mareje complex descend gently towards the Indian Ocean coast and the northern slopes descend steeply to the flat area.

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[1] Perajin is someone whose main job is producing handicrafts like carving, pottery, foot mats, etc.

The central part of the island is mostly a fertile plateau intersected by two large rivers (Babak and Jangkuk Rivers) which are used to irrigate rice. This area contains the majority of Lombok's population and extends from east to west for for approximately 56 km and is about 25 km wide. In a south-easterly direction the plain rises gently to approximately 100 m asl in the vicinity of Desa Mujur before descending again in a very gentle slope towards the east coast (Labuhan Lombok). Two soil regions are found in this region (*Balai Penelitian Tanaman Pangan Malang*, 1991). The smaller western central area is fertile and well irrigated from both the Babak and Jangkuk Rivers and has four major springs (Lingsar, Narmada, Sesaot and Sarasutha). The larger eastern part is less well-watered and less fertile.

The northern area of the island is mainly rolling hills and forest with only a small amount of flat land with no irrigation. This area is dominated by an impressive volcanic mountain complex which culminates in Mt. Rinjani (3,718 m asl). The slopes of Mt. Rinjani gradually descend about halfway to the east coast where it is interrupted by a hill complex, the highest point being Mt. Nangi (2,316 m asl). Similarly, the slopes to the west are interrupted by Mt. Punikan (1,481 m asl). The northern slopes descend gently through the northern plains area to the coast, while the southern slopes merge gradually with the central plateau.

The main winds that impact on agricultural production are the wet westerly and the dry south-easterlies. Lombok has five wet months (November/December to March/April) in the central part of the island but in the north and south this is usually restricted to four months. Temperatures range between 24° C and 34° C with between 1,000 to 2,000 mm of rainfall per annum with maximum monthly rainfall being 445 mm and the minimum 0.3 mm (Table 2.1).

The highest rainfall occurs in the central area where the soils are a heavy loam, very fertile for agricultural purposes and very stable for the erection of buildings. As a result this area is more densely settled and well supplied with community facilities (like schools), government offices and trading centres. However, the lower rainfall areas to the north and the south are markedly different in terms of both their ecology and agricultural potential. In the north, the soil is rocky, sandy and slightly leached and production is restricted to one crop per year. A number of groundwater schemes were established in this area but these have fallen into disrepair since the water price subsidy was stopped in 1997. As a consequence, farmers are again dependent purely on rainfall for water. In the south, the soils are hard when it is dry and sticky when wet. The biggest dam in Lombok is found in the south but it can only irrigate a small part of the area and can be unreliable depending on the nature of the rainy season. Some farmers stock rainwater in small man-made ponds or micro-dams called "*embung*" which allow them to get a second crop. The government has not established groundwater schemes in this area because it is viewed as technically infeasible.

Table 2.1. Average Temperature, Rainfall and Humidity in Lombok Island by Month in 2001

Month	Rainy days	Rainfall (mm)	Temperature (°C)	Humidity (%)
January	15.5	215.7	27.2	81
February	15.5	285.9	27.1	74
March	18.9	445.0	27.2	79
April	7.8	100.8	26.9	74
May	0.7	2.8	25.1	71
June	0.3	1.3	24.6	74
July	0.3	0.3	24.0	71
August	0.3	1.1	26.1	67
September	0.5	2.5	27.0	66
October	2.2	17.4	30.8	69
November	10.4	120.6	31.5	76
December	15.7	275.4	30.8	75

Source: Central Bureau of Statistics Regional Office of West Nusa Tenggara (2002)

2.3 Brief History of Lombok

Lombok came under the influence of the Javanese when the island was claimed as part of Majapahit Kingdom of Java in the 15th century although there are no clear indications that there has ever been any direct control over the island from Java. However, there are number of indications that this was a possibility because Lombok is stated in *Negarakertagama* as belonging to an empire of Majapahit. The *Negarakertagama* is a historical manuscript that is believed as a national governance of Majapahit. Secondly, there are a group of people in Sembalun Lawang (a small village in the vicinity of Mt. Rinjani) who claim to be descendants of Hindu Javanese. Another indicator is that the major religion practised is Muslim. However the *Babad Lombok*[2] states that Sunan Prapen of Java came to Lombok to Islamise the people after the fall of Majapahit Kindom in 1479 and the Javanese influenced the people of Lombok until the 16th century.

In the 17th century, the mainly Hindu practicing Balinese people started to migrate from Bali to the west coast of Lombok and the Islamic Macassarese from Sumbawa Island[3] started to influence some of eastern Lombok. The indication of these two influences is the establishment of the Balinese hamlets such as Pagutan, Pelangan, Rencung, Lilin and Celuk Gedang in West Lombok and similarly Macassarese hamlet called *Kampung Bugis* in the east.

From the beginning of the 18th century there was a consolidation of the Balinese political control over the people of Lombok. The eastern Balinese empire, *Karangasem*, controlled the island after they defeated the Macassarese in a number of skirmishes. In the early part of this century, the Balinese Kingdom called *Mataram* was established. This kingdom then moved the capital city and erected a palace in *Cakranegara*. Both *Mataram* and *Cakranegara* are now the largest cities in Lombok. *Mataram* is a civic and education centre and *Cakranegara* is a trading and entertainment centre. The *Cakranegara* Palace is also now a major tourism destination. The Balinese have influenced much of the Lombok peoples' culture and are credited with introducing *sasaknese* which formed the basis of the management of crops and animals as well as the production of items such as bricks, and agricultural and kitchen tools.

The Dutch defeated Mataram Kingdom which had been in control since the 16th century and colonised Lombok in the late 19th century, holding power for less than 40 years before Indonesian independence in 1945.

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[2] *Babad Lombok* is a history book of Lombok compiled by the regional government that is translated from some historical manuscripts

[3] Lombok is geographically located between Bali in the west and Sumbawa in the east.

2.4 Agriculture in Lombok Island

2.4.1 Development of Agricultural Sector

The history of agricultural development in Lombok is aligned directly with the Indonesian national policy direction. There are three key phases which have relevance to this research: 1) the Soekarno administration from 1945 to 1967 which was characterized by policy stagnation with respect to agriculture; 2) the Soeharto administration (from 1967 to 1997) which implemented major agricultural policies focused on developing the sector systematically; and 3) the post-Soeharto era from 1998 to present.

In the post-independence period (1945-1967) the major focus of policy was on nation building. During this period the major agricultural policy was the establishment of ‘paddy centres’ which were focused on improving rice production through the development and expansion of simple irrigation systems, establishment of upland research centres, and the promotion of soil and water conservation (Lokollo, 2002). The impact of this policy in Lombok was the shift of land use from crop cultivation to paddy. The growth in rice production between 1950 and 1965 was due to the increase of area producing rice rather than an increase in yield; in fact rice yields stagnated at 2 ton/ha over this period (Jatileksono, 1987). The government and its agencies did not pay much attention to crops other than paddy and the agricultural production system was characterized by the continued use of traditional farming methods. This meant that many people living in the dryland areas of Lombok suffered from famine.

The Soeharto era was a boom period for agricultural development policy. A key component of the policy was the *Bimas* program which was aimed at educating farmers about modern rice cultivation linked to the provision of credit. The impact in Lombok was similar to the Asian “green revolution” and resulted in production agriculture generating surpluses which in turn triggered growth in the rural economy, creating a significant multiplier effect, with a large part of the value added retained at village level. This program was also successful in educating farmers about improved cultivation methods linked with the use of modern inputs and a trickle-down effect was noted as farmers who did not use the credit component of the policy also intensified their production systems. In response to this trickle-down effect the government of West Nusa Tenggara Province promoted a mass intensification program called *Bimas*/*Inmas* which provided subsidised inputs like the *Bimas* scheme but this was not tied to the need to access credit.

In 1970 this program was extended to cover a larger area under the banner "*wilud (wilayah unit desa)*". This extended the *Bimas* for each *wilud* by providing 1) a field extension worker, 2) a village level bank to provide credit, and 3) village level cooperative to supply farm inputs and to market farm products. These changes saw the rapid expansion of intensification of farming systems and ware significant in that there was a move to reduce the role of government and to increase the role of public in developing the intensification.

In 1979, the provincial government launched *Insus* (*Intensifikasi Khusus* Special Intensification) as a new intensification program which was based on a group farming approach where a group of farmers developed a collective farm plan and credit application in order to conduct intensification in an area of about 50 ha. The government organised an annual competition among farmer groups (*Kelompok Tani*) at a range of levels, from village to provincial, to motivate farmers.

One year later in 1980, the government introduced the *gora* system cultivation for rice in dryland areas. This system initially applied to South Lombok but was later expanded to cover the whole island. The *gora* system is a rice cultivation system involving direct seeded rice followed by flooding with land preparation done under dry conditions. It is usually found in low-land rain-fed areas without additional water sources and has a number of different variations depending on rainfall and numbers of rain days experienced.

The government role in this transformation was significant. It provided considerable amounts of money to establish irrigation facilities such as dams, micro dams, irrigation and drainage canals as well as subsidising farm inputs such as certified rice seed and fertilizers. In total 51 cooperatives were established in

Lombok to distribute subsidized inputs and to assist farmers market their rice and a large number of agricultural extension workers were funded.

There is no doubt that the policies worked and the agricultural sector in the province of West Nusa Tenggara grew by 3.48 percent per annum during 1970s and 1980s and in early 1982 the Governor was able to declare that '*no people in Lombok sleep with empty stomach*' (Parman, 1992). As further consequence, Pasandaran *et al*., (2003) reported that Indonesia achieved self sufficiency in rice production in 1984 and the process of poverty reduction was also accelerated (Timmer, 2002). However, despite this success there were still some underlying problems that needed addressing. The policy was costly and based on high level of subsidies on capital infrastructure, farm inputs and government marketing systems particularly for rice whilst other commodities remained unsubsidised. A further problem was the poor recovery on loans.

To increase rice production simultaneously and to maintain self-sufficiency the government developed a new intensification program called *Supra Insus*. One of the significant differences between the old *Insus* and the new program was the manner by which credit was provided. In *Supra Insus*, the credit was provided not to an individual farmer but to a group of farmers with the repayment under *tanggung renteng* method. This meant that the individual group member was a debtor to the group organization and the group in turn was a debtor to the credit provider. In practice this meant that groups would not relend to members who didn't repay their previous debts. This program was instituted across all farmers in Lombok.

After achieving rice self sufficiency in 1984, the government paid serious attention to non-rice cultivation specifically for export commodities such as rubber, palm oil, cocoa, cashew nut, vanilla, lobsters and pearls to diversify agricultural production. In Lombok, there was a focus of investment on cashew nuts, cocoa in the dryland areas and pearls and sea weed in coastal areas. In livestock sector, there was also a program for cultivating *lamtoro* (*Leuceana leucepala*) called *lamtoronisasi* to increase the supply of fodder for cattle. To support this, the provincial government also lent farmers some cattle to be fattened. These programs were also combined with multiple cropping for cash crops like maize, peanut and bean for domestic consumption. Therefore, the agricultural development strategy was shifting to diversification (and rehabilitation) as well as intensification.

In this decade, the government also paid attention to the development of agricultural research and development. Since 1995, the government has established an Assessment Institute of Agricultural Technology (AIAT) or *Badan Pengkajian Teknologi Pertanian* in each province. An AIAT comprised both researchers and extension specialists in an attempt to shorten the introduction and dissemination of technology from scientist to the farmers.

In the third era (post Soeharto), agricultural development in Lombok underwent great reform. This period started with the economic crisis that hit Indonesia. Since this time, food prices have risen dramatically and adequate quantities of food are often out of the reach of approximately the bottom quarter of the population. It is estimated that as many as 700,000 people have an income below the poverty line. The economic crisis also hit the farm input and marketing sectors with some closing down and others focusing solely on a limited number of cash crops.

To cope with this national problem, the government has undertaken some policy reforms in agriculture, including: 1) eliminating the National Logistic Board's (*Badan Urusan Logistik)* import monopoly over all commodities but rice, 2) reducing tariff rates on all food items to a maximum of 5 percent and abolishing local content regulations, 3) removing restrictive trade and marketing arrangements for a number of commodities including local content requirement, and 4) deregulating trade for agricultural products across district and provincial boundaries. These reforms were developed to benefit smallholder producers and in turn to reduce the incidence of poverty.

2.4.2 Land Usage and Tenure System in Lombok

The land use by region is shown in Table 2.1. Forest takes up the largest area followed by rice fields and plantation agriculture. Most of the rice (73%) is grown in the rain-fed dryland areas.

The current system of land tenure was formally initiated when the Balinese controlled the island. Before Balinese control, most land was owned by landlords and cultivated by peasants who were required to take all production to the landlord and in return they received a small share as wages. The Balinese king (called the *raja*) took control of all farmland and then distributed it evenly, based on land productivity, to every peasant's family. In return the *raja* asked the peasant to send some farm product or provide cash or in-kind to the kingdom (called *pajegan*). The *raja* used a two layer cell system to handle agriculture. First layer was the *pekasih* who directly controlled all peasant activity. Some *pekasih* were controlled by one *punggawa* as a second layer and this *punggawa* could directly meet the *raja* in the palace.

Table 2.2. Land Use in Lombok Island in 2001

Type of Land Use	West Lombok and Mataram (ha)	Central Lombok (ha)	East Lombok (ha)
Settlement	4233	4295	3548
Upland	32411	7576	19095
Plantation	30892	10151	12586
Fishpond	283	109	428
"Embung"	-	1076.5	10
Forest	72649	25430	56713
Shrub	2566	11365	5640
Imperata sp	8448	2115	760
Grass	4914	4754	11640
Pond	931	839	523
Swamp	379	1165	-
Unusable land	46	-	331
Rice fields	25964	51964	47154

Source: Land Use Plan, Bappeda NTB (2000)

At present three categories of land holdings are found in Lombok. First, *tanah wakaf* which means land belonging to social organisations like the mosque (*wakaf mesjid*), temple (*wakaf pelabe pure*), Islamic school (*wakaf pesantren*), and orphanage (*wakaf panti asuhan*). Such land can be donated to social organisations but cannot be owned privately although the president or chief of the organisation may request someone to manage this land based on share-farming agreement. There can be problems with this form of land control when land that has not been used for a couple of years is then occupied by another party. In some cases the occupant will ask for compensation when the land is taken back by the social organisation. The second category of land control is land owned by the government (*tanah negara)*. This land can be used with the approval of the local government either at the district or province level. Most of forest and coastal areas is *tanah negara*. The final category is privately owned land (*tanah pribadi)* which covers the majority of rice fields, plantation lands and the plots on which the houses stand.

Most farm land in Lombok is privately owned. Sidik *et al.* (1995) reported that there are three systems of managing farmland in Lombok. First is when the owner directly manages the land to cultivate plant and animals (*petani pemilik*). The second system is when the farmer manages the farmland that is belonged to other either privately owned or government or *wakaf* based on an agreed sharing of the product produced. This farmer is called *penyakap* or *penggarap*. The last system is the farmer leases land from either a private owner, government or *wakaf.* This farmer is called *penyewa*, *penggadai* or *penanggap*. In the dryland areas almost all farmers own their land. This is because the dryland farmers in northern zone are the transmigrants and under the local transmigration program, each farmer who moved into this area was given 2 hectares of sloping land if they settled in the hilly area and 1 hectare of land for those who settled in plateau areas. In the southern zone, the dryland farmers also own their land privately.

2.4.3 Farming Systems in Lombok

Lombok has four main agricultural sectors: food crops, tree crops, livestock and fisheries. Each will be discussed below.

2.4.3.1 Food Crops

The main food crop in Lombok is paddy grown mainly on irrigated land but also under dryland conditions in the southern zone, and maize in the dryland areas. The production systems utilised are very traditional. The cropping pattern for food crops on irrigated land differs between regions and is determined by water availability. For those adopting a three crop per annum cycle the first cropping period (PS1) is December to March, followed by PS2 between April and July, and

PS3 which takes in August to December. For those farmers with technical[4] irrigation the rotation is paddy-paddy-second crops or paddy-second crops-second crops. Those who farm semi-technical irrigated land have a rotation of paddy-second crops-second crops and paddy-second crops-fallow. Dryland farmers normally follow a rotation of paddy-second crops-fallow, paddy-fallow-fallow and second crops-fallow-fallow (*Dinas Pertanian Nusa Tenggara Barat*, 1996).

The farming system adopted in the southern dryland zone is highly influenced by the annual rainfall which means that only one crop of paddy can be grown each year. *Dinas Pertanian Nusa Tenggara Barat* (1996) reported that the cropping pattern of food crops in the southern zone rain-fed areas is paddy – second crops – fallow, paddy – fallow – fallow, and second crop – fallow – fallow.

The seven steps involved in the cultivation of paddy from nursery to harvest are nursery, soil tillage, planting, fertilising, pesticide spraying, weeding, harvesting. Soil tillage, weeding and harvesting are the most costly steps in the process of growing paddy. In the rain-fed areas of the south the soils are a heavy clay that is very sticky in wet season and very hard in dry season, which means they require a lot of work in the tillage phase which is very costly compared to land preparation costs for irrigated land. Land preparation in the rain-fed areas is usually done with cows and human labour with low levels of mechanisation used. After the Soeharto era, the wages of labourers increased faster than the price received for paddy which meant that some dryland farmers changed their land-use to second crops like soybean, maize or green beans even when the government continuously promoted paddy production by increasing the floor price for unhulled rice. This was a change for farmers who had during the new era period (1967–1997) been required by government regulation to grow paddy in the first season of their rotation.

[4] There are three categories of irrigation used by the Department of Infrastructure. *Irrigasi non teknis* (Non technical irrigation) is irrigation using traditional channels (dikes) without bricked banks and without dams; *irrigasi semi teknis* (semi technical irrigation) that uses bricked bank dikes but has no dams; and *irrigasi teknis* (technical irrigation) which uses bricked bank dikes with dams as a water reservoir.

The cropping pattern for dryland farming in the northern zone is different. Farmers who can plant crop twice a year adopt a rotation of second crop – second crop – fallow, but those who can only crop once a year have a rotation of second crop – fallow – fallow (*Dinas Pertanian Nusa Tenggara Barat*, 1996).

Wathoni (2000) reported that farmers in the northern zone of Lombok prefer to plant second crop because the soil structure is so loamy making it unsuitable for holding water during paddy production. The main crops grown in this area are maize, peanut and cassava while a few farmers grow hot chillies and onions. Because production is so difficult the bulk of the food produced is used to fulfil basic food needs during the year with maize being the staple food. However, some rich farmers still have rice as their staple food.

In this area alley cropping systems, typical of shifting cultivation, have been adopted to minimise the risk of crop failure (Suyamto *et al*., 2003). The authors reported this system was used with the main crop (maize) which is planted in the first week of the rainy season with no application of fertiliser. In between two rows of maize, the alley crop (soybean or peanut) is planted a week later. Weeding activities are then conducted manually two or three times during the growing period. Adoption of this system has been found to deliver farmers with at least one crop per annum.

2.4.3.2 Tree Crops

Tree crops, coconuts and cashews, are grown around the coast and coffee is grown in the hilly and forest areas. Coconuts have been cultivated since before the Balinese came to the island and now occupy about one third of total tree crop area in West Nusa Tenggara (32%) producing 72,062 tonnes in 2004 (*Dinas Perkebunan NTB*, 2005).

Robusta coffee was also a traditional cash crop but has moved into third place behind cashews since the latter were introduced in 1982. Coffee production is concentrated in the hilly complex of the central zone in Sesaot, Montang, and Santong. *Dinas Perkebunan NTB* (2005) reported that coffee occupied 6,458 hectares producing 3,006 tonnes in 2004.

Cashew nuts have become a popular tree crop and now occupy 42,317 hectares and produce 7,025 tonnes fresh annually (*Dinas Perkebunan NTB*, 2005). In the 1980s, the state government of West Nusa Tenggara promoted the production of cashew nuts by providing huge areas of land to investors to develop estates both on Lombok and Sumbawa Islands. At the same time the government together with the investors recruited high school graduates to be trained as specialist extension workers who were assigned to develop cashew nut plantations for small farmers bordering the estates. The cashew nut product from the small farms was purchased by the investor company which in turn marketed the product.

Other tree crops that are also cultivated in Lombok include cloves, vanilla, cocoa, and tobacco.

2.4.3.3 Livestock

Livestock play an important role in the dryland farming system. The major livestock categories in order of importance are Bali cattle, caribou, goat, pigs and chickens (*Dinas Peternakan NTB*, 2003). Most cattle farmers in Lombok are subsistence farmers and run 2 to 5 head of cattle (Yohanes *et al.*, 2003) for breeding and meat production.

The traditional livestock production system in Lombok involved the management of freely roaming livestock grazing on native grasses with no supplements (Sarwono, 1996; Martojo, 2002). The livestock grazed on communal areas but also were fed on the by-products of the cropping systems.

Small livestock such as pigs and goats are popular with farmers in Lombok. Goats are raised as they play an important role culturally as a sacrifice on the Holy pilgrimage day and as a core part of the main menu at weddings and circumcision ceremony (Abidin, 2002). Pig production systems are usually traditional with two or three pigs being kept in pens and fed *kankung*, banana stems, food scraps from the household, by-products of tofu, rice milling and coconut milk (Arka *et al.*, 2002.

Almost every farm household have chickens which usually forage freely around the farm yards and some are supplemented with husk rice or crushed corn when being confined at night. Chickens are raised for household use and cash income.

2.4.3.4 Fishery

The fisheries sector is based on three kinds of fishery: ocean marine, fresh water and brackish water fisheries. To date there has been no development of mariculture, however, *Badan Pusat Statistik NTB* (2005) reported that 37 types of fish had good prospects for mariculture including *Tongkol, Lemuru, Selar, Merah Bambangan, Kembung* and Prawn. Other marine fisheries include the harvesting of pearls, sea weed and lobsters.

Fresh water fisheries are normally based on the river systems although some farmers grow fish as part of their irrigated rice systems. *Dinas Perikanan NTB* (2005) reported three methods of fresh water fish production namely *keramba*, fish pond and *mina kangkung* and six types of fish are grown - *Nila, Mas, Tawes, Mujair, Gurame* and Cat Fish.

A fishery based on brackish water in ponds (*tambak*) growing prawns and milkfish is showing potential especially along the southern coast of Lombok (*Dinas Perikanan NTB*, 2005). Although the fishery is currently focused on local markets it has the potential for development as an export industry (*Dinas Perdagangan dan Industri NTB*, 2006).

2.5 Market and Transportation

The majority of farmers in Lombok are subsistence farmers which mean they are usually focused on increasing production to meet the family needs rather than on value adding. Any excess production is sold in traditional wets markets (*pasar)*. These markets are widespread but not every village has one. Most of these markets are open once a week and only some (8 in the suburbs and 12 in the Mataram Municipality) are open daily. Two big markets Sweta (groceries) and Ampenan (retailers) operate as central markets for the island and there also one fresh food supermarket operated by Hero in Mataram city.

Most people normally shop in the traditional markets for their food and clothing needs. These markets also sell a few handmade goods such as woodcarvings, bamboo baskets and traditional kitchen utensils, based on raw materials that are taken from the island’s forests.

Local markets serve an important function in addition to selling food and goods. They are a focus of social activities in terms of spreading news and often the village heads use the market day as the day to announce important issues for the villagers (Ridwan, 2005) such as information on immunisation programs, general elections or campaign schedules.

In general, there two systems utilised for marketing farm produce: the *tebasan* and weight based system (Tanaya, 1997; Efendy, 2000; Idrus and Rosmilawati, 2000). The *tebasan* system involves the farmer selling his production before harvest. This system is different from the *ijon* system where the product is sold in advance of it ripening. This system has higher risk and returns a lower price; as a result this system is declining in use (Sidik *et al.*, 1997).

The weight based system is the marketing system where the farmers sell their farm products based on the weight at the farm gate. Suparmin (2004) reported that most farmers sell their farm products using this system with some doing some value adding such as drying and cleaning. Idrus and Rosmilawati (2000) and Sari (2006) found that the two main reasons why farmers use the weight based system is to reduce the risks associated with quality reduction and the immediate need for cash.

The main problem farmers' face is asymmetry of market information (Efendy, 2000; Idrus and Rosmilawati, 2000). The farmers have little access to market information prior to selling which means they are weak in the negotiating process with middlemen who have access to a wider range of market information. Based on this information and their economic power, the middlemen create a monopsonistic or oligopsonistic market situation where the farmer is forced to be a price taker.

Another area where there is a possibility for farmers to be exploited is in the supply of farm inputs. Many of the key farm inputs such as certified seed and fertilisers, are sold through a limited number of companies determined by the government (Sutrisno, 2004). Having the government determine who and how many companies can sell subsidised inputs means the government has control over the process but limiting the number of suppliers reduces competition and could lead to higher costs. At the village level, the institution that has been given the legal status to handle subsidised farm input distribution is usually the village cooperative or *Koperasi Unit Desa* (KUD) although famers could source inputs direct from non-subsidised sources. Tanaya (1997) and Santoso (2002) reported that the KUD had problems with low quality staff, lacked good management systems and were an arm of governmental policies.

The process of farm input marketing from the farm-gate to the plate of consumers is highly dependent on the transportation infrastructure like roads, bridges, shipping and vehicles. Indonesia has three kinds of road based on their quality. The highest level is the Federal roads (*jalan negara*) which are built and managed federally and normally connect two provincial capitals. The second level is a Provincial road (*jalan propinsi*) which is built and managed by the state government and connects two district capital towns. The last, is a District road (*jalan kabupaten*) which is built and managed by the district government and connects two subdistrict major towns. Roads at the next level down that connect villages are usually in very poor condition, unless they are in a municipal area.

Public transport on Lombok is run by private operators but the government sets the prices and controls the routing. Intra-district capitals are served with buses; intra-subdistrict capitals are served by minivans; and for intra- or inter-villages routes by horse carts (*cidomo*) and motorcycles (*ojek*). Taxis are only available in the city.

2.6 Institutions in Lombok

The government realises that the agricultural sector plays a very important role in national economic development and has established a range of institutions to support the sector's development. This is a tiered arrangement with a minister at the top and at the provincial and district levels the governor has a person assigned to manage the policies relevant to the sector. For example at the federal level there is a Ministry of Agriculture and at the provincial and district level the parallel institutions are the *Dinas Pertanian Propinsi* and *Dinas Pertanian Kabupaten* respectively. A similar structure is in place for the marketing and supply chain issues with the Ministry of Trading and Industry at the federal level in Jakarta and in the provincial (*Dinas Perdagangan dan Industri Propinsi)* and district levels *(Dinas Perdagangan dan Industri Kabupaten)*. The cooperative sector is not supervised by the Ministry of Trading but by a special ministry called Ministry of Cooperative and Small-Medium Enterprise.

At the village level there are another group of institutions such as the farmer groups (*kelompok tani*) which coordinate agricultural production; the farmer cooperative (KUD) which is in charge of supplying farm inputs and distributing farm products; and a village office which coordinates all synergetic activities for these two institution especially related to the conduct of governmental policies like the subsidised farm input and farmer's credit schemes. There is also an organisation at the village level considered important to dryland agriculture. The association of dryland farmers who used ground water as main source of irrigation, *Persatuan Petani Pemakai Air Tanah (P3AT),* coordinates the use of ground water pump to irrigate farmers' land.

Two formal organisations act at the village level and are coordinated by the village chairman. The first is the *Lembaga Musyawarah Desa* (LMD) which functions as the village-level government. All village constitutions or *Peraturan Desa* (Perdes[5]) must be approved by this institution. The second is the *Lembaga Ketahanan Masyarakat Desa* (LKMD) which functions as planning and advisory board at the village-level. The annual working plan of the village office must be approved by this institution and once the plan is implemented this board monitors its execution. Other informal village organisations that are lightly related to agricultural and supply chain activities are the village women's organisation, *Pembinaan Kesejahteraan Keluarga* (PKK), and the integrated health service post, *Posyandu (Pos Pelayanan Terpadu).*

2.7 Constrains of Agricultural Development

The productivity of the agricultural sector in Lombok is still very low compared to other regions in West Indonesia. Mustadjab (1998) and Idriati (2003) reported that dryland farmers in Malang, East Java produced rice and soybean yields of 5.4

[5] Perdes is a formal administrative rule that issued and ratified by head of village after approving by village parliamentary board and recognized only by the people who live in the village where the perdes issued.

tonnes and 2.5 tonnes per hectare compared with only 4.6 tonnes and 1.7 tonnes per hectare respectively in Lombok. This is not only due to the unfavourable agro-climatic and edaphic conditions experienced in Lombok but also the prevailing socio-economic and cultural conditions. The difference is also due to the area experiencing a drier climate with more dry months within a year and unpredictable weather patterns; a poor irrigation infrastructure for the dryland part of the island; poor supporting transport infrastructure; a sense of isolation; and a lack of base resources to develop an industrial base thereby restricting the opportunities for households to develop non-farm incomes. Finally, the last major constraint is the absence of well functioning and reliable financial institutions like village banking, cooperatives and village microfinance bodies providing affordable funds for farmers.

Chapter Three

ANALYSIS OF AGRIBUSINESS SYSTEMS

3.1 Introduction

The term 'agribusiness' was first used by Goldberg in the early 1950's. Since then, the term has been used extensively to describe everything from the production of food through to complete food and fibre supply chains. The meaning given is often coloured by the author's interests or discipline background. For instance, some people describe agribusiness as everything that happens beyond the farm gate. Others include both inputs and outputs of the production business. Others refer to agribusiness as a supply chain. Another way of looking at agribusiness is through the lenses of disciplines such as agricultural science, business and economics and social science. Each discipline area defines the term in a slightly different way. This chapter discusses the concept of agribusiness and explores the links between agribusiness and systems analysis to develop the concept of an agribusiness system.

The chapter is organised into eight sections. The second section discusses the concept of agribusiness (3.2) and the third section (3.3) looks at the term as applied in a developing country like Indonesia. The next section (3.4) widens the discussion to link agribusiness with systems analysis and Section 3.5 discusses how agribusiness systems can be analysed. The next three sections discuss each of tools used to analysis agribusiness system in this study. Section 3.6 discusses the Soft System Methodology. Section 3.7 and 3.8 discuss the farm production system and the marketing system respectively.

3.2 The Concept of Agribusiness

The term agribusiness was born at Harvard University in 1952 when the university opened a joint program in agriculture and business. They realised that there were close relationships between agriculture and the industries that supplied farm inputs, processed farm produce and distributed and retailed farm products.

This was accurately described by Drillon (1971:p18) who stated that *"…sectorally agribusiness encompasses all of the agricultural sectors including fishery and forestry and that portion of the industrial sector which contains the sources of farm supplies or the processors of farm products"*. He illustrated this by showing agribusiness as the interface between the agricultural (production) sector and the industrial sector (see Figure 3.1).

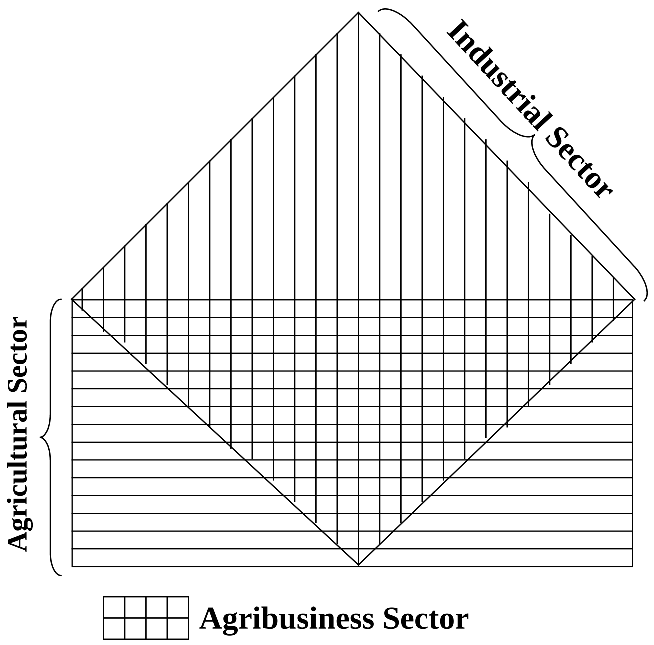

Figure 3.1: The Agribusiness Sector is The Whole of the Agricultural Sector Plus A Good Portion of The Industrial Sector (Drillon, 1971:p18).

The now famous definition of Davis and Goldberg (1957:p2) stated that agribusiness was *"…the sum total of all operations involved in the manufacture and distribution of farm supplies, production operations on the farm, and the storage, processing and distribution of farm commodities and items made from them"*. As noted earlier the term is now interpreted widely and often to suit the individual's or organisation's own interest. A key element in all definitions is determining the point at which the boundary is drawn and what is deemed to be inside and outside the agribusiness sector. For example, Drillon (1971) described agribusiness as the structure of vertical activities that involved farm suppliers, farmers, processors, wholesalers, retailers and consumers as the main actors assisted by government officers, managers, educators and researchers whereas Soehardjo (1991; 1997) excluded the supporting functions.

Others such as Downey and Ericson (1987) suggested a three-way split: the input, farm and output sectors, while Wills (1979) excluded the farm production sector and added those businesses that provided services to the agricultural sector such as credit, insurance, electricity, etc. The introduction of a split between the production and agro-industrial activities of supply chains has been suggested by authors such as Saragih (1997) and Kadarsan (1997). At this level, the split can simply be upstream and downstream of the farming operation or a more detailed split differentiating the supply chain into the primary sector that handles farm outputs, a secondary sector that transforms those products, and the tertiary sector that provides services such as transportation and distribution.

The one thing that the majority of authors agree on is that agribusiness has a major role in coordinating product flow along the food and fibre supply chain and to a lesser extent information (Roy, 1973). In the past decade, there has been a significant shift towards a more holistic or systems view of agribusiness which links the elements discussed above (see McGregor, 1997; Soemardjo, 1999; and Soekartawi, 2002). By viewing agribusiness as a system, it is possible to integrate all the elements of the definitions already discussed, but also introduce the concept that there are factors that impact externally on the system such as socio-economic and political factors as well as positive and negative impacts associated with the agro-climatic and ecological environment in which the agribusiness system operates.

3.3 Characteristics of Agribusiness

Agriculture is considered the oldest economic activity involving human intervention and natural resources. Thus, a major characteristic of agribusinesses is the significant influence natural environmental processes such as climate, vegetation, fauna, and water, exert on production and both the quantity and quality of the products produced. Downey and Ericson (1992:p24) noted the following important factors that differentiate agribusinesses from other kinds of business:

1. The agribusiness sector contains a wide range of business sizes which encompass global companies such as Nestlé and Conagra through to subsistence level farmers. Business functions range from farmers to shippers, intermediaries, wholesalers, processors, packers, warehousing, transportation, financial institutions, retailers, food companies, restaurants.
2. The whole agribusiness sector involves millions of different individual firms that are coordinated en route from producers through to retailers and final consumers.
3. Agribusiness, unlike many other businesses, is closely located to its raw material base (farms). This does vary depending on whether the focus is local supply or export.
4. Competition levels are very high and the sector is characterised by a large number of sellers and few buyers. Competition at the producer level can be between small-scale farm businesses and large farming enterprises which generate economies of scale.
5. The sector has been very traditional and slow to adapt to the changing world around it, but this criticism is now fading as agribusiness becomes truly global.
6. A significant number of agribusinesses are owned and managed by family enterprises where family members participate in decision making for the business.
7. Agribusiness tends to be communal because the location is often in small towns or rural areas where interpersonal relationships are very important. Often these relationships have been developed over several generations.
8. Agribusiness is highly influenced by natural forces particularly seasonal weather patterns and pest and diseases that impact significantly on the quality and supply of raw materials.
9. Most agribusiness commodities are directly affected by government policy, like quarantine, tariffs, input support, price policies and agrarian policies.

Howard *et al.* (1990) studied the characteristics required for the successful management of agribusiness firms in three different countries – US, Canada and Australia – and concluded that of the skills needed, personal qualities and communication skills were the most important, followed by business and economic skills. Experience was ranked lowest. Moreover Drillon (1971:p21) stated that there were four important dimensions to agribusiness. Firstly, agribusiness is multi-faceted. By this Drillon meant that supply chains are complex vertical structures which link a series of independent business, all of which rely on others in the chain. Decisions at any level within the chain will impact on the overall chain efficiency and profitability.

Secondly, successful decision-making at the firm level in the private sector or at government policy or program level will develop where the decision makers are well informed about the structure of the entire agribusiness supply chain and are able to take this understanding into account in their decision making. Drillon (1971) stated that a thorough understanding the whole of chain will strengthen the operation of the chain, while haphazard decision making bring temporary success, it will usually lead to failure.

1. The third dimension is that the long term viability of the industry is derived from the viability of the firms that form the industry. The industry can be expanded and move forward only if the firms operating within it are able to do so. The industry's posture is shaped by the strength or weakness, and by the life or death, of firms in the industry.
2. Finally, agribusiness by its nature is market oriented.

Agribusiness' importance is also felt away from the immediate supply chain and its environment. Saragih (1998) argued that agribusiness is an appropriate driver for the Indonesian economy because it has high multiplier effects both downstream and upstream; it absorbs a large amount of labour (60 per cent of the value-added from agro-industry is in the form of wages while in other industries it is only 30 per cent); and it uses very low levels of imported inputs (only 17 per cent, while the machinery and metal industry use 62 per cent and the chemical industry uses 71 per cent). Soekartawi (2002) also noted that the fortunes of the agribusiness sector are crucial to the whole Indonesian economy. Indonesia's economy is heavily dependent on agriculture and the population is largely agrarian. There is also significant potential to develop agriculture by utilising land, especially outside Java, that has not been intensively used for agricultural purposes. In addition, the country has a strategic advantage in the region because unlike its neighbours, the Philippines, Japan, Taiwan and Bangladesh, it is not ravaged by typhoons. It's position on and around the equator means that it has a stable rainfall, sunlight, temperature and humidity, which means that subject to soil quality and aspect, crops can be cultivated all year round.

Finally, there is a strong political will to make this sector work. In terms of priorities the government consistently ranks agriculture in the top three alongside public infrastructure and education.

However, Soekartawi (2002) also noted several challenges. The population is growing at a high rate and the challenge is to improve agribusiness performance to match this growth. There are a decreasing number of people available to the agricultural sector as more people move from rural to urban areas. New agricultural land opened up under the transmigration and rehabilitation programs has not proportionally replaced the loss of productive agricultural land to manufacturing and urban expansion.

A shortage of capital to develop agribusinesses, has meant that most firms are currently small scale, high risk and require long payback periods.

In addition, the dissemination of new and improved technologies to the agribusiness sector has been very slow compared to other industrial sectors.

3.4 Agribusiness Systems

Davis (1956) noted that agricultural production has high levels of interdependency between pre and post farm-gate businesses. Consequently often strong partnerships and relationships developed between every activity along the whole supply chain and the performance of the chain, as a whole, is determined by the quality of these links (Anwar, 1995). Ziggers and Trienekens (1999) formulated a model of successful partnership that was determined by the context in which the partnership operated, the interdependencies which existed among actors and the behaviour of those actors. This high degree of integration aligns with the concept of an integrated agricultural industry proposed by Soekarto (1997) that links and incorporates the concept of agribusiness and agro-industry into one sustainable system.

Krisnamurthi and Saragih (1992) Soehardjo (1997) and Saragih (1998) described agribusiness as a system that consists of five sequential subsystems that each exert influence on each other. The system begins with the farm input production or the upstream subsystem which includes activities related to the procurement and distribution of farm inputs. This subsystem consists of seed industries not only for crops but also for cattle, poultry and fish; agrochemical industries that produce fertilisers, pesticides, growth stimulant, vaccines, and agro-automotive industries that produced tractors, seeders, trashers and millers.

This is followed by farm production or the on-farm subsystem that produces primary agricultural products such as rice, horticultural products, livestock, fish, estate crops and timber and other by-products.

Next is the processing or the downstream subsystem that transforms the primary products from the farm sector into either intermediate or finished products. For example, food, drink and fibre industries, bio-pharmacies and agro-tourism. The marketing subsystem that distributes primary and secondary products from producers to consumers either in country or overseas comes next. This subsystem includes promotion, market intelligence, market research and price information.

Finally, the supporting institutional subsystem includes activities that provide services to all the other four subsystems. For example, insurance, transport, banking, communication.

Saragih (1998) depicted the relationship among all five subsystems as Figure 3.2 demonstrates.

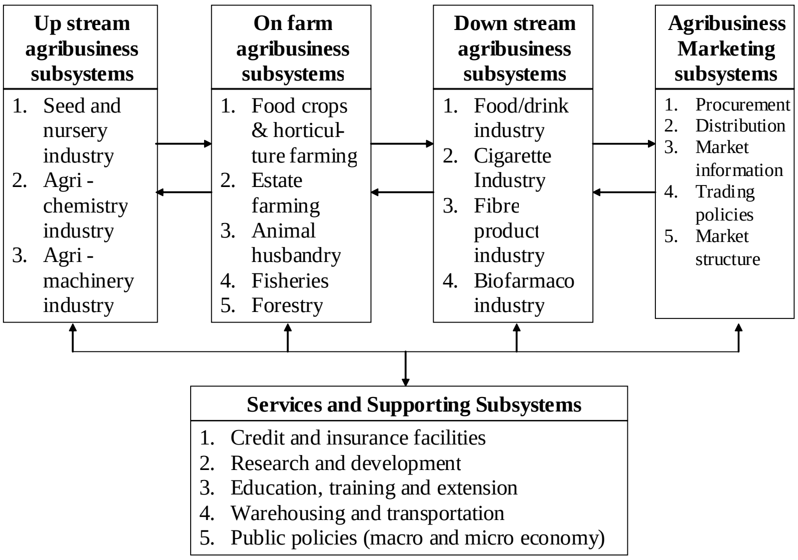

Figure 3.2: Relationship Between Subsystems Within an Agribusiness System (Saragih, 1998)

Soekartawi (2002) developed this concept to one that was more specific to the Indonesian situation (Figure 3.3).

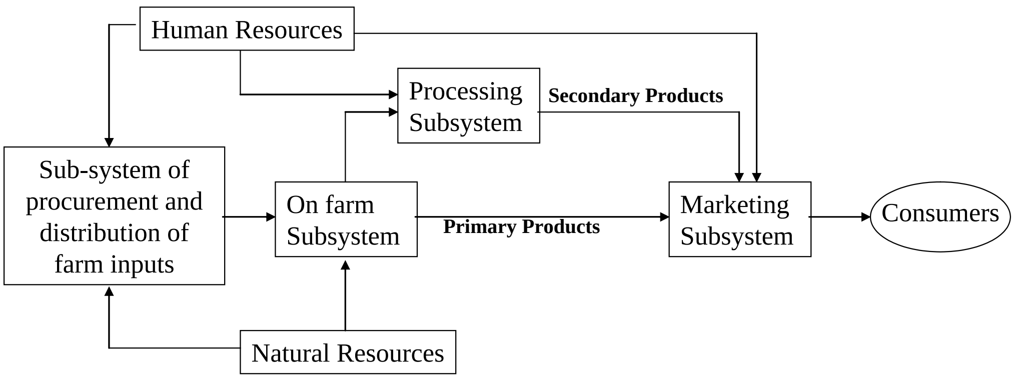

Figure 3.3: Agribusiness System (Soekartawi, 2002)

Like McGregor (2002), Soekartawi recognised that systems are sensitive to the environment in which they exist. However, unlike McGregor, Soekartawi included the socio-economic, political and agro-climatic and ecological environment as exogenous subsystems which he named human and natural resources respectively. By doing so, Soekartawi failed to recognise that there is an interaction between these exogenous factors and the endogenous agribusiness supply chain. In agribusiness systems, the supply chain itself is impacted by external factors such as the socio-economic status of consumers, as well as the political, agro-climatic and ecological environments within which it operates. An analysis of both the endogenous and exogenous variables is important in order to develop and maintain agribusiness systems which are profitable, resilient, sustainable, stable and match the available system component parts.

3.5 Analysis of Agribusiness Systems

Agribusiness research has evolved along two parallel levels of analysis (Cook and Chaddad, 2000). The first has been the study of coordination between vertical and horizontal participants within the food chain, known as agribusiness economics, and the second has been the study of decision making within the alternative food chain governance structures, known as agribusiness management (Figure 3.4).

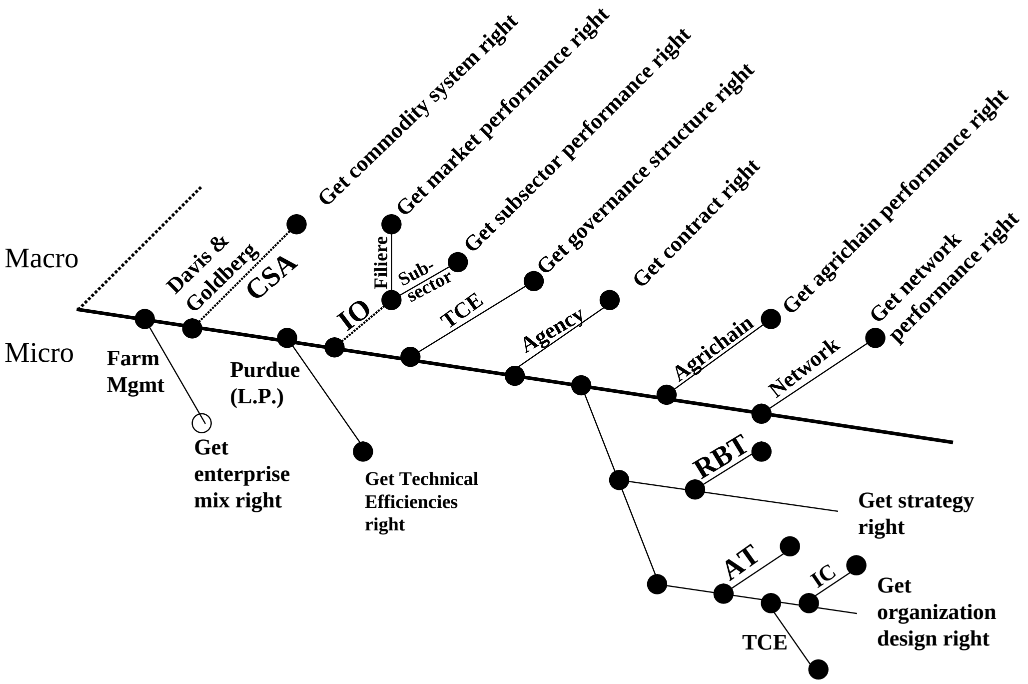

Figure 3.4: The Evolution of Analysis In Agribusiness Research (Cook and Chaddad, 2000)

Branches on the upper side of the centre line in Figure 3.4 represent the evolution of macro-analyses or agribusiness economics methods through time. These commenced with the Commodity Systems Approach (CSA) which continued to the Bainsian industrial organisation model (IO), which further developed into the French *filiere* concept and 'sub-sector analysis' approach in America. The next phase was Coasian-Williamsonian transaction cost economics (TCE) which in turn was followed by the contract-oriented approach for agro-industrialisation.

CSA focused attention on harmonic coordination of vertical agri-food system relationships with the objective that this would reduce per unit costs, and increase output, profit and responsiveness to market demand. The Industrial Organisation (IO) model concentrated on a market structure approach and agricultural industrialisation with the intention of improving market performance as a whole and industrial sub-sector performance.

The TCE approach focused on developing a set of tools and concepts to address the increasing importance of relationship specific investment in the process of agricultural industrialisation with the aim of minimising transaction costs along a chain. Milgrom and Roberts (1992) defined transaction costs as all the coordination and motivation costs involved in the economic organisation of the chain. Empirically, Frank and Henderson (1992), Hobbs (1996, 1997), Hobbs *et al.* (1998), Ghosh and John (1999), Standford *et al.* (1999) identified the importance of transaction costs as major points of change in vertically coordinated agribusiness supply chains.

In the 1990s, a new analysis method, supply chain management (SCM) evolved that viewed a supply chain as a network of firms between which, the materials and information needed to derive final consumer products flow. Since then the increasing liberalisation of market policies, the advent and embedding of globalisation, and significant developments in both information and biotechnologies have added to the complexity surrounding the agribusiness system and hence the analysis methods used. The current focus is on getting the network performance right.

The branches on the lower side of the centre line in Figure 3.4 represent micro-analysis or agribusiness management methods. These were initiated from farm management approaches like cost and efficiency studies that then evolved into optimising technical efficiency through the use of mathematical programming, particularly Linear Programming. More recently, the emphasis has moved to methods such as resource based theory (RBT) which emphasises getting the strategy right and methods that focus on getting the organisational structure right by using plural approaches which link Agency Theory (AT) with Transaction Cost Analysis (TCE) and Incomplete Contracts (IC) analysis.

Said and Intan (2001) proposed a split between macro- and micro-analysis methods for studying agribusiness systems. They argued that macro-analysis viewed agribusiness as a set of industrial systems related to commodities that formed a regional or national economic sector (Figure 3.5).

However, a micro-analyses approach views agribusiness as an industrial unit that covered one or more subsystems for one or more commodities (Figure 3.6). For example, a mango estate is one subsystem (production) and one commodity (mango), while a Palm Oil Company involves more than one subsystem (production and processing) and one commodity (palm oil).

Each analysis has its own focus and orientation. Micro-analysis places greater emphasises on efficiency measures (Jahnukainen and Lahti, 1999; Li and O'Brien, 1999; Abdulai and Eberlin, 2001; Schiefer, 2002; Chen *et al.*, 2003; Alvares and Arias, 2004; Cho and Gerchak, 2005); optimisation of resource allocation (Bredstrom *et al.*, 2004; Lamothe *et al.*, 2005; Mo *et al.*, 2005); profit maximisation (Bhattacharjee and Ramesh, 2000); and firm organisation (Ugarte and Oren, 2000). Macro-analysis analyses the agribusiness units within the context of the whole agribusiness system, including government, researchers, exporters and others. Wilk and Fensterseifer (2003:p100) stated that "… *agribusiness analysis requires an interdisciplinary approach, a dynamic and systemic, rather than a static and local, view of investment in order to achieve a long term dynamic optimisation of the system as a whole*".

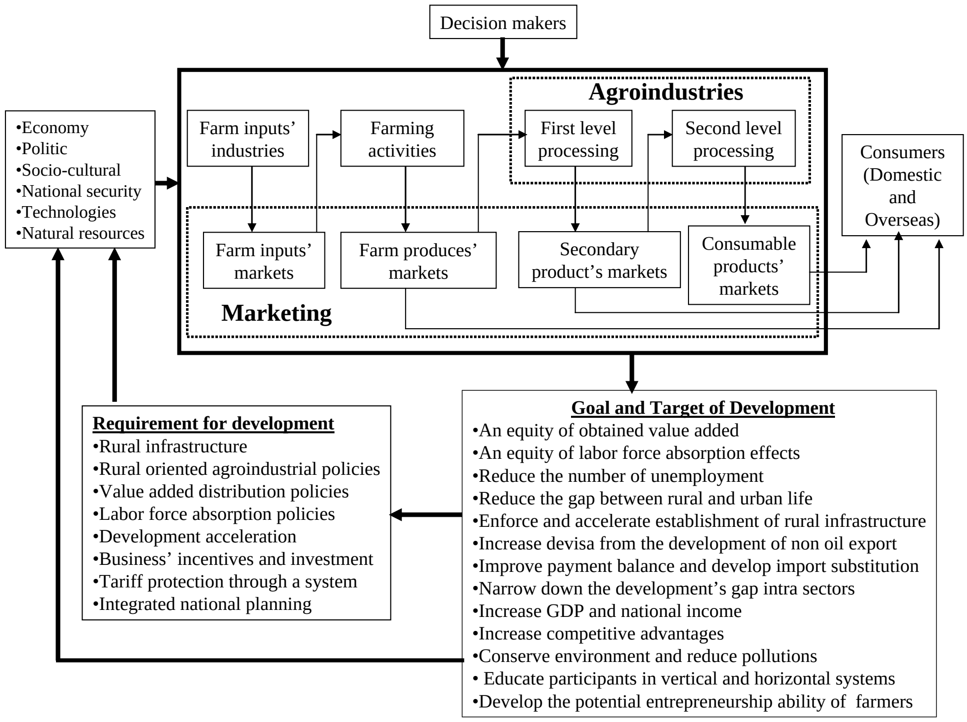

Figure 3.5: A Framework of Macro-analysis of Agribusiness System (Said and Intan, 2001)

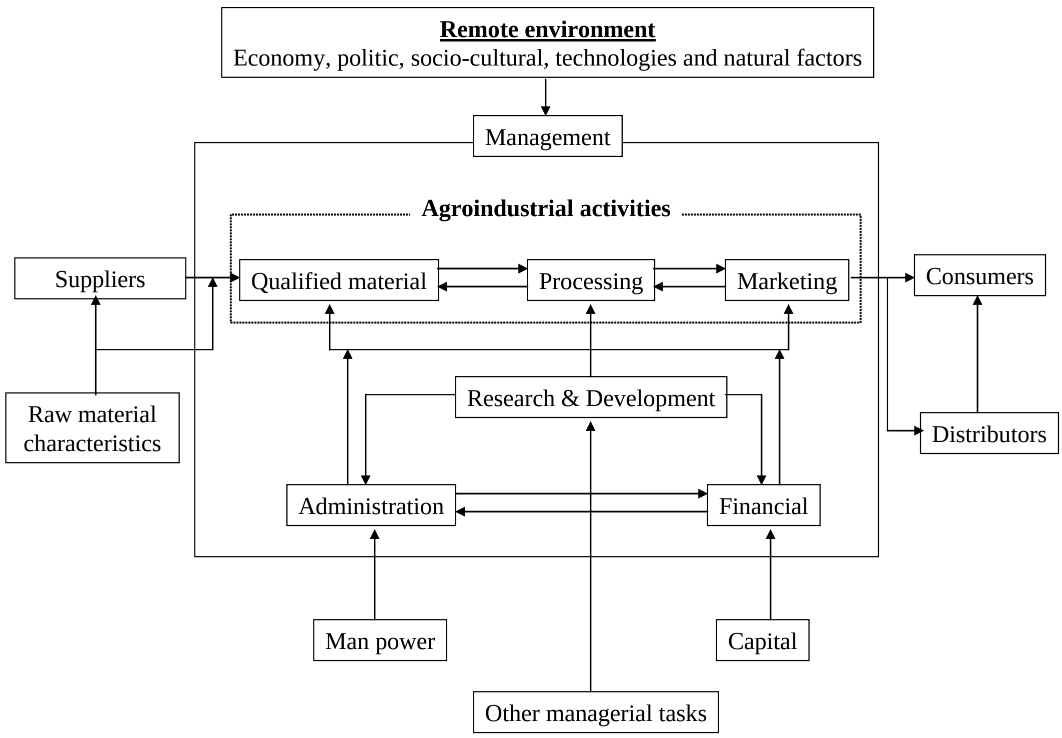

Figure 3.6: A Framework of Micro-Analysis of Agribusiness System (Said and Intan, 2001)

It has long been realised that the central issue of agribusiness studies is integrating the supply chain both vertically and horizontally (Davis and Goldberg, 1957). Young and Hobbs (2000) suggested that a continuum of vertical integration can be viewed as supply chain management. In the 1990s, agribusiness scholars adopted the concept of SCM as the flow of goods forward and market information backward along the chain as the basis of analysis (Cook and Chaddad, 2000; McGregor, 2002). van Dallen (1997) stated that the term ‘chain’ is a metaphor to express a set of inter-linked activities to achieve a predefined goal. More specifically, Omta *et al.* (2001) expressed that the ‘chain’ is the process that links suppliers and user companies from initial raw material to finished products. A supply chain is more than a process involving a flow of products, but also involves the sharing of information in both directions along the chain (Thomas and Griffin, 1996; Cooper *et al.*, 1997; Beers *et al.*, 1998; Christopher, 1998; Trienekens, 1999; Handfield and Nichols, 1999; Muckstadt *et al.*, 2001; McGregor, 2002).

When considering relationships within a supply chain, it is more appropriate to view the chain as a network rather than as a sequential chain (Ellram, 1991; Davis, 1993; Lee and Billington, 1995; Beers *et al.*, 1998; Christopher, 1998; Trienekens, 1999). A network is a finite set of actors who work together in definite interdependent relations (Wasserman and Fraust, 1994). Specifically, Lazarini *et al.* (2001), based on Thomson’s opinion, stated that there were three types of interdependency among actors in supply chains or supply networks. These were:

1. Pooled interdependence – which refers to discrete relationships by loosely networked parties in the chain. An example of the application of pooled interdependence is the business-to-business (B2B) networks that have been established in a number of agri-food supply chains.

2. Sequential interdependence – this refers to the linear buyer-seller relationships between parties in the agri-food chain. These relationships sequentially link the chain and are interested in optimising product flows and have an emphasis on reducing transaction costs and developing appropriate contractual relationships.

3. Reciprocal interdependence – in this situation, parties in the chain are mutually dependent on each other and as a result they are tightly linked. Failure by one could lead to failure by others in the chain.

Lazarini *et al*. (2001) have adopted the term netchain (Figure 3.7) to capture both the vertical and horizontal integration as well as the associated relationships. Lazarini *et al*. (2001:p7) defined a netchain as "*a set of networks comprised of horizontal ties between firms within a particular industry or group, such that these networks or layers are sequentially arranged based on the vertical ties between firms in different layers*".

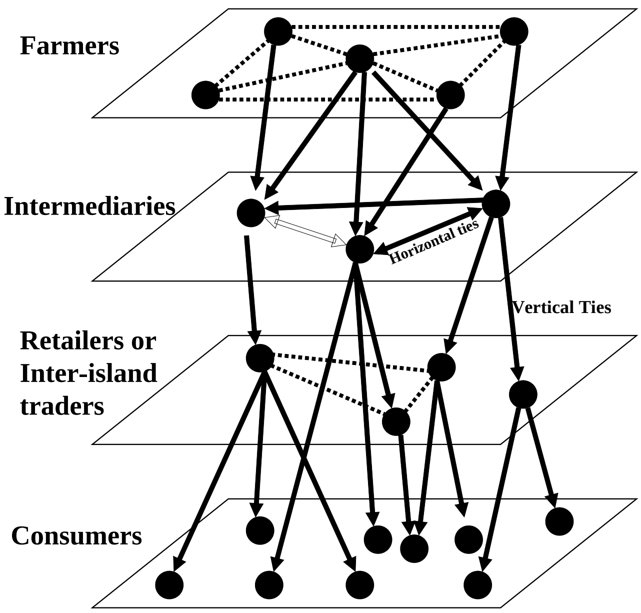

Figure 3.7: A Description of A Netchain (modified from Lazarini *et al*., 2001)

The analysis frameworks for an agribusiness netchain involve the integration of both supply chain and network analysis (Figure 3.8). The methodologies used in each type of analysis differ in their focus. Lazarini *et al*. (2001:p9) argued that supply chain analysis is a broadly defined field focusing on successive stages of value creation and capture in a vertically organised set of firms with three core sources of value such as optimisation of production and operations, reductions of transaction cost and appropriation of property rights. The micro-analysis techniques shown in Figure 3.4 have a role to play here.

Network analysis however, is a broad field commonly associated with sociology with three sources of value such as: social structure, learning and network externalities. Network analysis focuses on studying an object holistically. This means that system approaches such as soft systems analysis are considered appropriate to identify and resolve problems involving the human activity system. More detail of the soft system methodology is presented in Section 3.6.2.

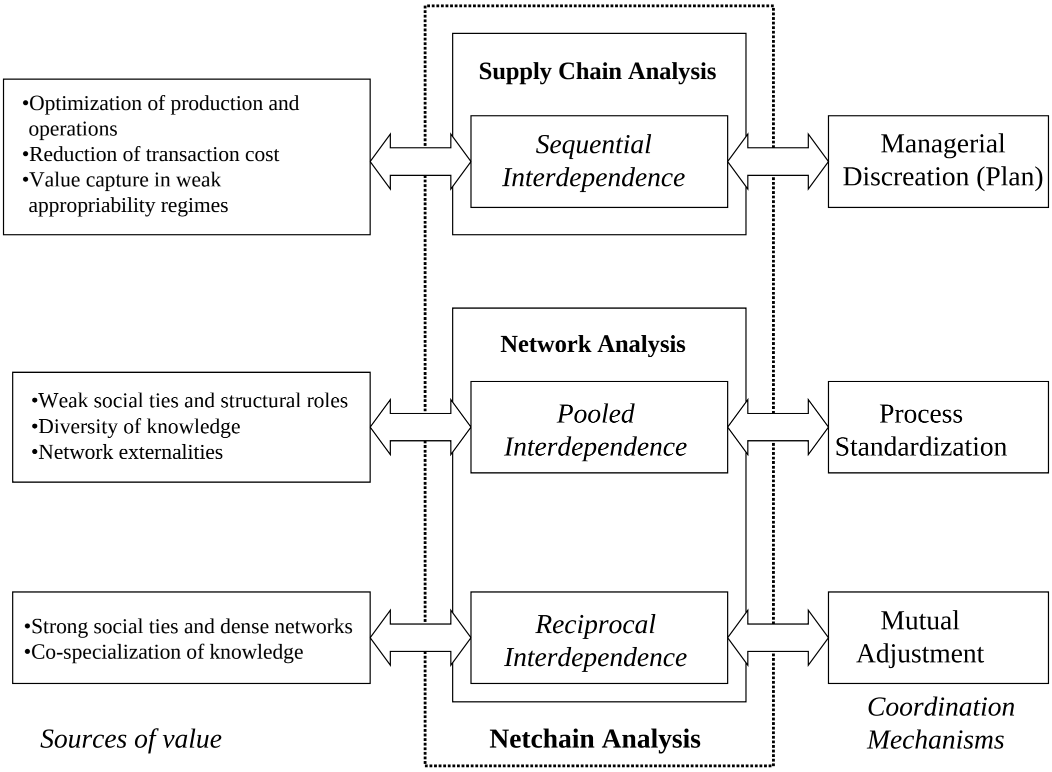

Figure 3.8: A Map of Netchain Analysis (Lazarini *et al.,* 2001)

In summary the agribusiness system consists of a number of individual firms who locally want to achieve a set of goals they have identified, but they are also part of a much larger system which is defined by the supply chain(s) they are a component of. The analysis of agribusiness systems can thus be categorised into four levels. The first focuses on each individual subsystem (or firm); the second on the agribusiness system as a whole (or supply chain); the third concentrates on the physical and social links between the supply chain actors (or subsystems) and the final level deals with the relationships between external influences on the defined system and its impact on external factors. Therefore, the analysis of agribusiness supply chain systems must involve 1) whole system analysis, 2) individual business subsystem analysis, and 3) relationship marketing system analysis.

3.6 Holistic System Analysis

The purpose of this section is to review the development of soft systems methodology (SSM) as a suitable means to analyse holistic systems and to justify the use of SSM in agri-food supply chain problems. In doing so, this section will initially discuss the systems approach or systems thinking and conclude by discussing the application of SSM in action research.

3.6.1 Systems and Systems Thinking

There are many definitions of systems, but all agree that a system is composed of a set of inter-related elements within a defined boundary that react to their surrounding environment to form a unified whole in order to achieve a specific objective (Flood and Jackson, 1991; Eriyatno, 1998; Aminullah and Muhammadi, 2001). A system also takes an input and transforms it into an output (see Figure 3.9). Ossimitz (1998) also noted that systems often have a dynamic behaviour over time that is often related to the aim of the system and they are hierarchical such that, individual system elements might be considered as whole sub-systems or a system might be a single element of a larger system.

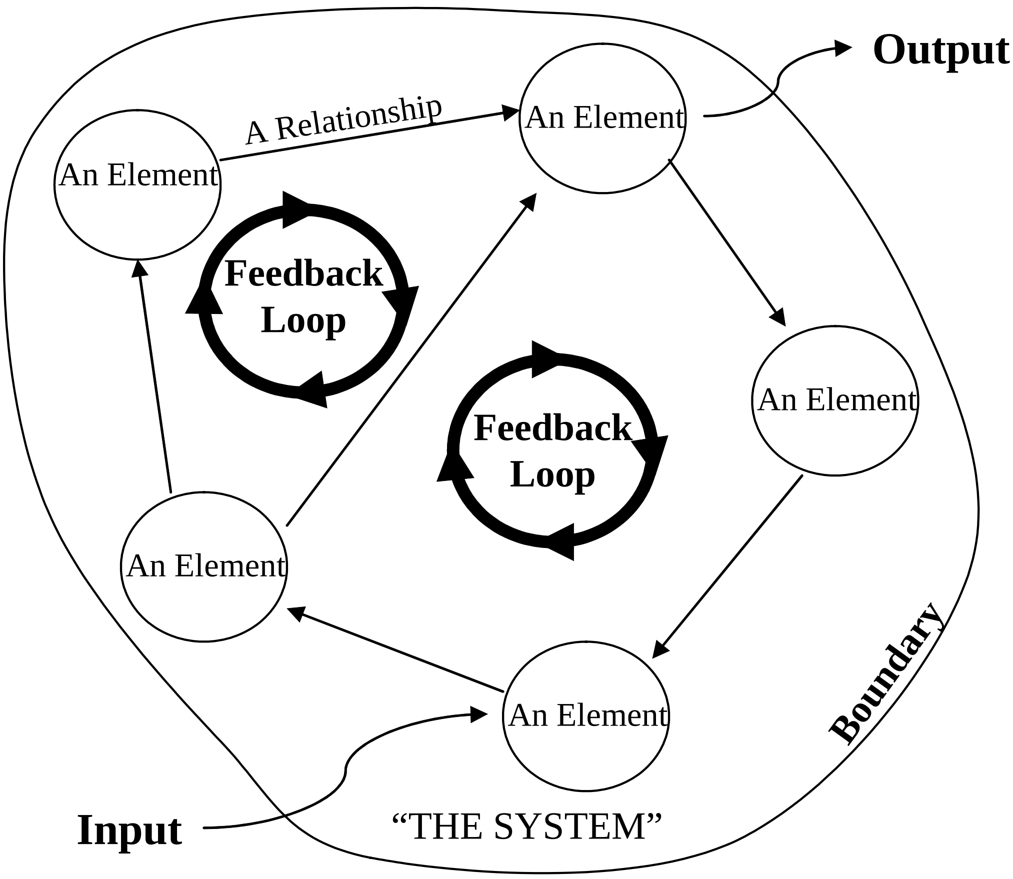

Figure 3.9: A General Conception of A System (Flood and Jackson, 1991:p6)

Checkland (1993) categorised the universe into five different systems: natural systems, designed physical systems, designed abstract systems, human activity systems and transcendental systems (Figure 3.10). He believed that anything in this world can be described as a system and will belong to one, or some combination of the five systems. While Checkland considered natural systems as those that originate from the universe, Petheram (1994) considered natural systems as closed systems in the sense that they are considered to be in balance, despite complex interactions occurring within them. Checkland (1993:p113) expressed the properties of natural systems as systems that "*… evolution made, irreducible wholes which an observer can observe and describe as such, being made up of other entities having mutual relationship. …they maintain themselves in a changing environment, create themselves in response to the challenge of the* *environment, and are coordinating interfaces in nature's hierarchy"*. Human activity systems and designed systems (both physical and abstract) were seen as fundamentally different from natural systems. *"The difference lies in the fact that such systems could be very different from how they are, whereas natural systems, without human intervention, could not. And the origin of this difference is the special characteristics which distinguish the human being from other natural systems*".

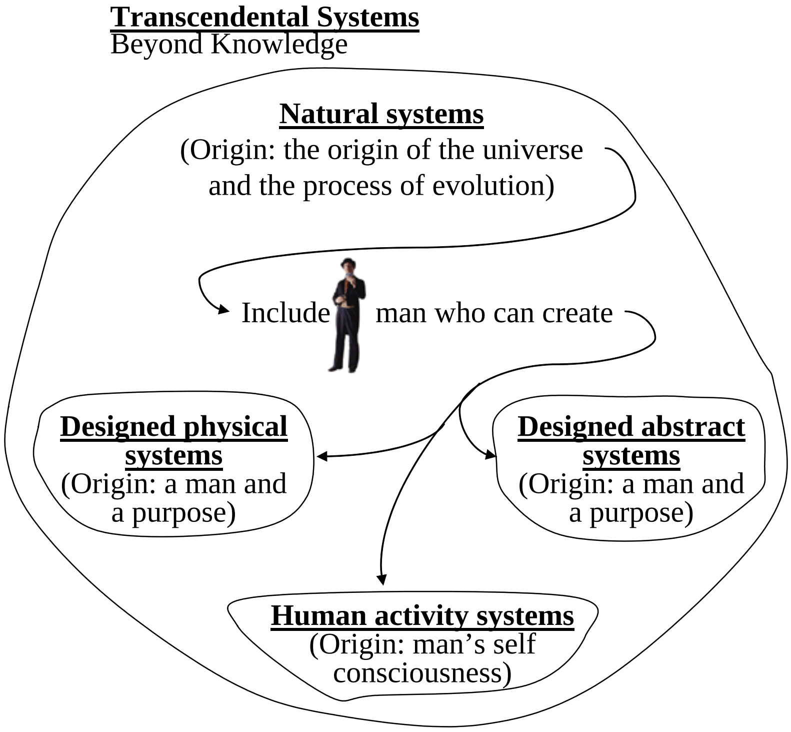

Figure 3.10: Basic Classification of Systems (Checkland, 1993:p112)

Hong *et al* (1998) and Simatupang (1995) described systems by their degree of openness. Closed systems were described as focusing on internal components such as variables of size, technology, location, ownership, managerial strategies and leadership style. Open systems were defined as a system of interdependent activities, that is a system with neither a formal structure nor an organic entity. However, Robbins and Barnwell (1994) criticised the open-closed dichotomy of systems and suggested this should be considered as a range rather than separate categorisations.

Other authors including Dunham and Pierce (1989) have related system thinking to the management of an organisation and its environment. They argued that organisations need to create different management systems for different environmental characteristics. Similarly Robbins and Barnwell (1994) claimed that the value of system thinking was that it provided a framework for managers to conceptualise organisations and to enable them to see the organisation as a unified whole.

Systems thinking emerged in the first half of the 20th century and was pioneered by three major scientific areas: biology, psychology and ecology, and later physics, specifically through quantum theory (Capra, 1994). However, systems thinking faced numerous obstacles because it was, and still is, not seen as an academic discipline like physics (Naughton, 1985).

The analysis of systems, or systems thinking, is distinctive from traditional reductionist paradigms which break the problem into components and study each part in isolation then draw conclusions about the whole (Senge, 1990). Systems thinking, on the other hand, directly studies the whole as a complex problem (Larsen *et al.,* 1996) in which the world is seen as a complex interaction of variables and actors (Bishop, 2002). Systems thinking expands its view to take into account larger and larger numbers of interactions related to the issue being studied (Aronson, 1996). In fact, systems thinking looks at as many of the influencing factors as it can, including past, present, and future conditions that influence thinking and decisions (Great Circle Learning, 2001). In other words, it looks beyond the immediate context of the problem situation to consider the larger picture.

Senge (1990) defined the essence of systems thinking as a mind-shift to seeing interrelationships rather than linear cause-effect chains, and seeing processes of change rather than snapshots, while at the same time also focusing on detail, not dynamic complexity. He described systems thinking as the "fifth discipline" which involved shared vision, personal mastery, mental models and team learning.

Methodologically, systems thinking has been broadly categorised into hard and soft systems (Checkland, 1993). Couprie *et al.* (2001) defined hard systems problems as those problems in systems design which can be well-defined. The assumption is that there is a definite solution and that a number of specific goals which must be accomplished. In essence, with regard to hard system problems, it is possible to define the end product prior to commencing to implement the solution; the 'what' and the 'how' of a hard problem can be determined early in the methodology.

Soft problems in contrast, are described as difficult to define. They contain a large social (organizational culture) and political (organizational power) structure components. These problems are not expressed as 'problems', as such, but as 'problem situations' for things are not working in the way the problem owners want them to. They want to find out why and to see if there is anything they can do to rectify the situation. It is the classic situation of not being a 'problem' but an 'opportunity'. Flood and Carson (1993:p98) stated that "*Soft problems are more usefully discussed as problematic situations in which the "same" problem may be perceived differently by various people".*

Naughton (1985) argued that the differences between the approaches basically emerge from their historical development. Naughton noted that the hard systems approaches evolved first and developed rapidly to meet the needs of modern engineering and industrial systems. For instance, the early mathematical programming work was based on the need to get arms, ammunitions and supplies across the Atlantic during the 2nd World War. Soft systems on the other hand, evolved partly from the failure of hard systems approaches to solve complex problems because the problems were complex as a result of the social context within which they were embedded. Checkland and Scholes (1990:p22) summarised this well - "*Hard system engineers tackle rather well-defined problems, while soft systems methodologies address messy, ill-structured problem situations. …hard systems thinking assumes that the perceived world contains holons; soft systems thinking takes the stance that the methodology, the process of inquiry, can itself be created as a holon*". Checkland (1999) described these differences diagrammatically in a simple and easily understood illustration (Figure 3.11).

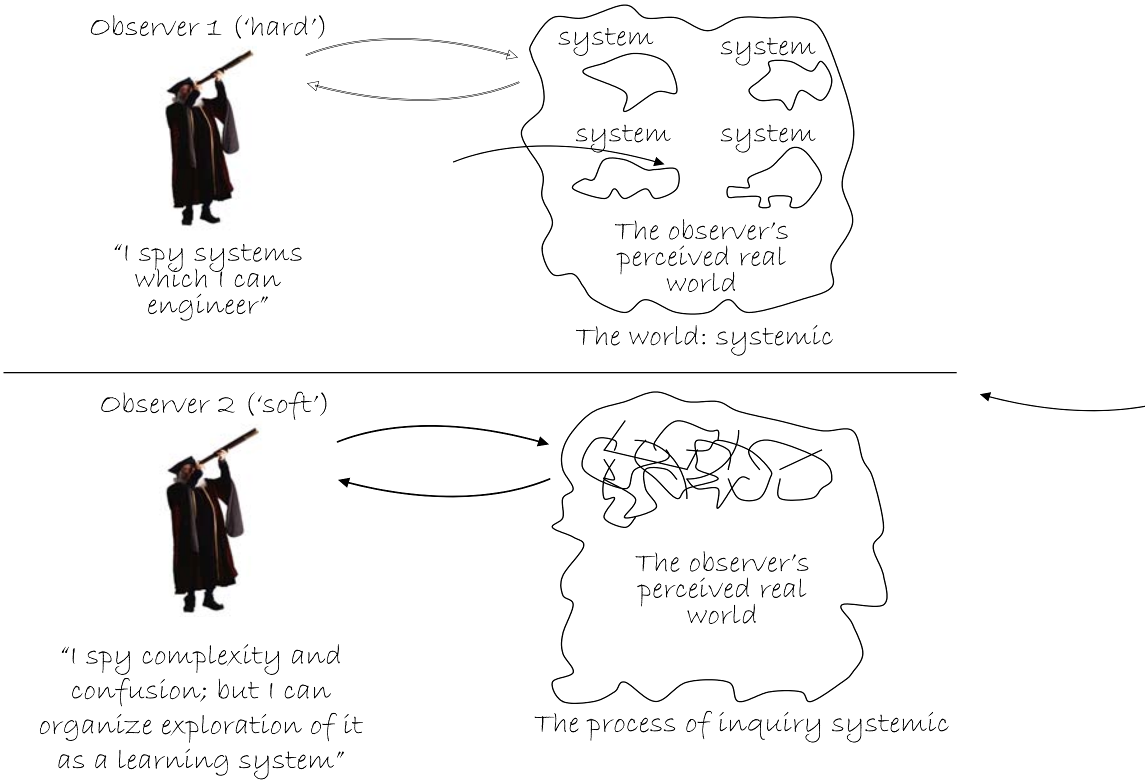

Figure 3.11: The Hard and Soft Systems Stances (Checkland, 1999:pA11)

While the previous discussion has suggested a distinct difference between the approaches, Wilson and Moren (1994) found similarities. They noted that both approaches recognised that systems models consisted of a recognizable boundary, inputs, outputs and essential transportation and performance measurements. Other writers have argued that both approaches are firmly rooted in a pragmatic tradition which values real-world applicability rather than theoretical development, are geared towards largely practical ends, and are classically technological in their orientation (Naughton, 1985).

Despite there being many apparent differences between hard and soft systems thinking, there is room to apply them together for improving the same situation. Platt and Warwick (1995) stated that soft and hard systems are often viewed as approaches that compete with each other, but a number of writers (McGregor *et al.*, 2001; Engel *et al.*, 2000; Rees, 2000) have suggested that a pluralistic methodology (the focus of this thesis) should be preferred as it allows an understanding of systems from a synergistic viewpoint, thereby combining the best of each approach. The next sub-section looks at soft systems methodology in more detail.

3.6.2 Soft Systems Methodology

Soft Systems Methodology (SSM) was developed over 30 years ago at Lancaster University by Checkland to deal with ill-structured or 'messy' problem contexts (Checkland and Scholes, 1990; Checkland, 1993, 1999). The methodology accepts that real life consists of unstructured multiple realities with their own interaction and interdependency. Checkland (1999:pA7) described four key thoughts, which dictated the development and direction of SSM. The first was that there was a need to build "*purposeful human activity systems models*" to repair or improve real world systems. Secondly, such models needed to be able to capture and explain a world view for its relevance and content. Thirdly, the models developed should be treated as an organised learning system within which emerging questions could be debated in order to find desirable and feasible changes. Finally, the model of purposeful activity should provide an entry to work on information flows which are less than ideal in all real world situations.

The basic principle behind SSM is that human beings are always eager to fill out the world where they live with meaning. SSM is therefore initiated from the 'world views' (*weltanschaungeen*) of individuals or groups of individuals who are part of the system under evaluation. Checkland and Scholes (1990:p2) stated it as follows:

> *"Given the creation of an interpreted, not merely an experience world, we can form intentions, we can decide to do one thing rather than another, in the light of how we are interpreting our situation".*

This means people will react to a problem situation based on how ***they*** interpret the situation. The authors term this as a "*purposeful action" which is a "deliberate, decided, willed action, whether by an individual or by a group and taken in response to experience of the world to which humans cannot help but attribute meaning*" (Checkland and Scholes, 1990:p2).

After deciding on and implementing an action, the problem owners will have had a new experience that is normally added to past experiences and used in their consideration of how to react in the future. This should lead to further improvement of problem situations. Checkland and Scholes (1990:p2) clearly describe this natural learning activity as a repetition called the experience-action cycle (see Figure 3.12).

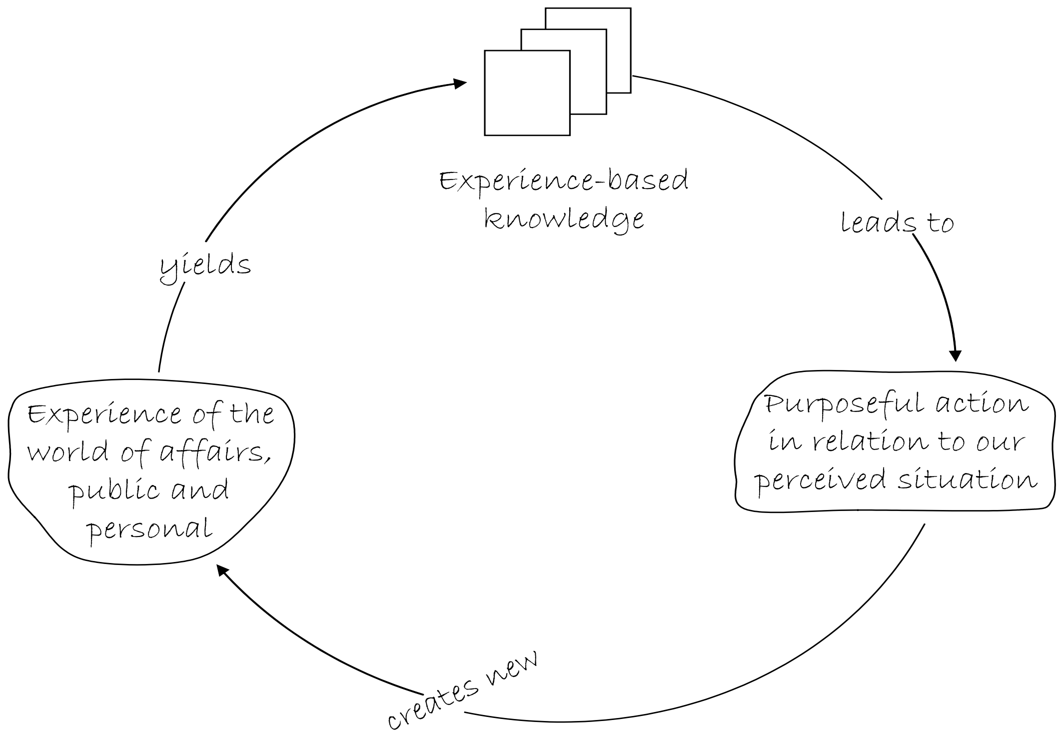

Figure 3.12: The Experience–Learning Cycle (Checkland and Scholes, 1990:p3)

The experience-action cycle shows the way a person responds to an interpreted situation, which creates for them a new experience that in turn becomes knowledge for that person or the interpreter. This knowledge is termed experience-based knowledge that leads people to do better following purposeful actions. The social sciences tell us that human knowledge can easily be increased with experience and experiential learning can be thought of as a system (Checkland and Scholes, 1990; Wilson and Moren, 1994). Soft Systems Methodology has been developed to operate along the lines of this endless cycle, from experience to purposeful action. The basic shape of SSM is actually the development of the problem owner's or interpreter's cycle (see Figure 3.13).

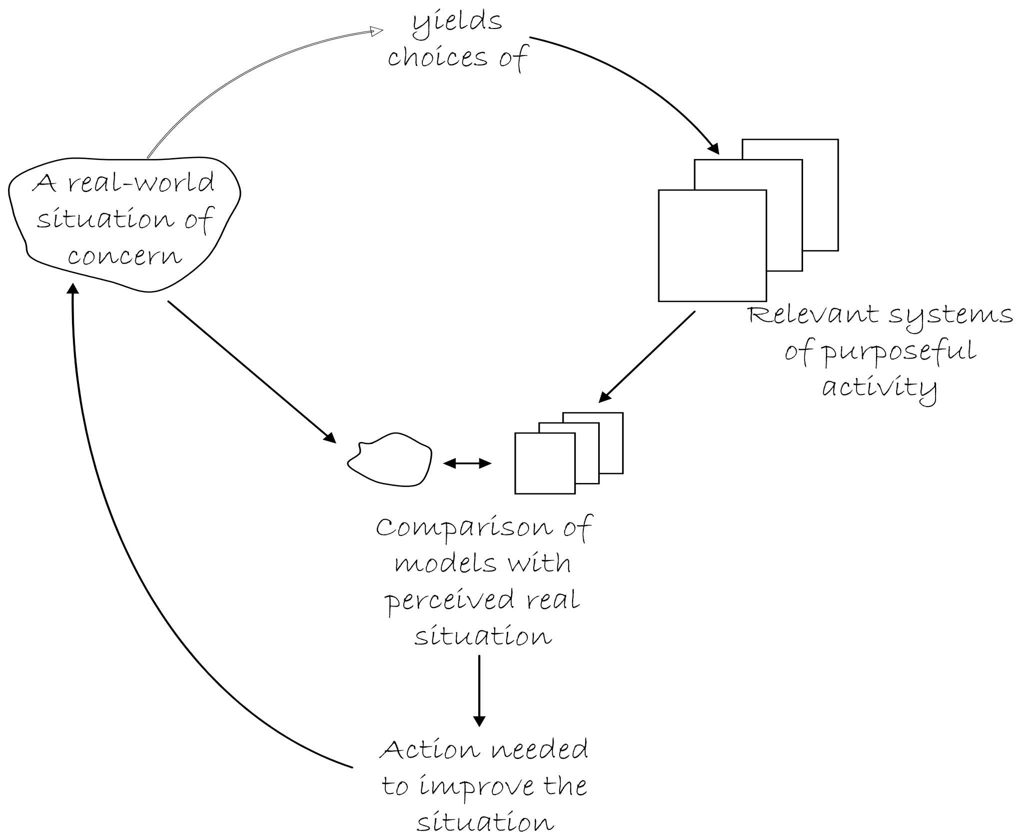

Figure 3.13: The Basic Shape of SSM (Checkland and Scholes, 1990:p7)

SSM starts with the notion that the world and their various subsystems can be described as 'holons' and can be changed as a result of purposeful or goal-directed action. It is a systemic process of enquiry which uses systems approaches (models) to improve real-world situations (Checkland, 1993). Like other methodologies, SSM has evolved through three experiential cycles.

3.6.2.1 SSM Mode 1

The first SSM mode 1 is represented as a seven-stage process (Figure 3.14) which is described in more detail in Appendix 2. In this mode of SSM, the separation of real world and the systems thinking of the real world are aligned. The real world division is the place where the problem situations occur and human activities take place (ontological aspects of SSM). The systems thinking about the real world is the analysis context where the information and data from the real world is scrutinised, dissected and analysed thoroughly within the process of problem solving. In the real world, involvement of people in the problem situation is required. In systems thinking, involvement of people in the problem situation depends on the circumstances of the study (Checkland, 1993).

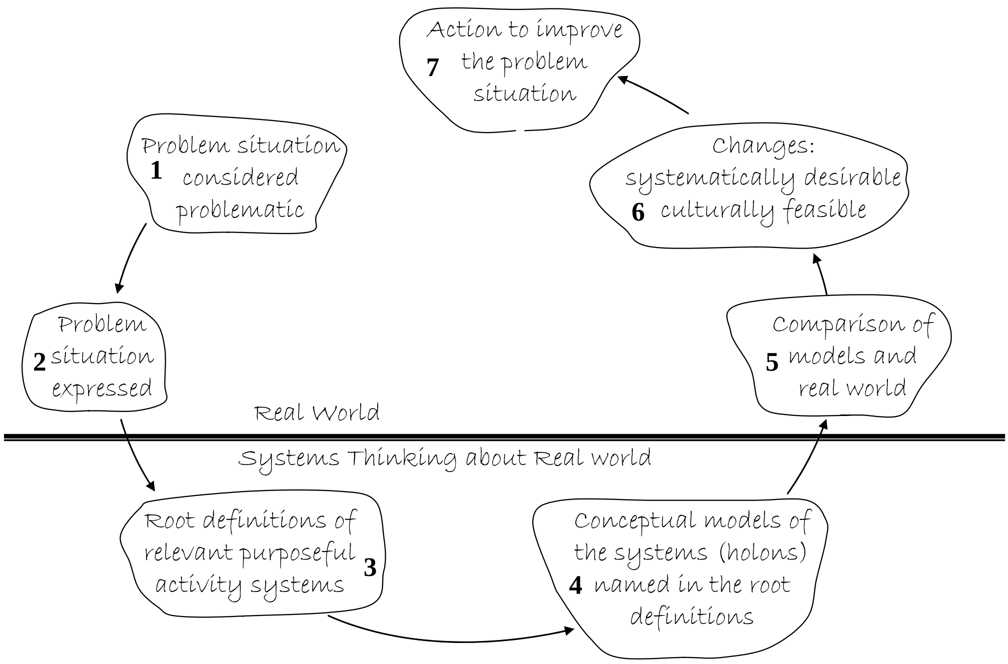

Figure 3.14: The Seven Steps of SSM Mode 1(Checkland and Scholes, 1990:p27)

It is important to note that when using the SSM mode 1, the analyst doesn't blindly follow all the stages shown in the cycle. It is possible to repeat and iterate through stages as necessary because the problems that occur may encourage the removal of the model altogether to avoid misinterpretation (Checkland, 1999). Woodburn (1991) has also argued that the seven stages can be condensed to three general phases: 1) building "rich pictures" of the problem situation (stages 1 & 2); 2) developing models of relevant human activity systems (stages 3 & 4); and 3) using those models to stimulate thinking about organizational change (stages 5, 6 & 7).

3.6.2.2 SSM Mode 2

Experience with the application of SSM mode 1 in a variety of situations led to a refinement of the seven-stage model in SSM mode 2. Checkland and Scholes (1990) argued that the seven-stage process did not necessarily have to be worked in sequential order. Hence, the seven stage model was enriched by making a division between what they termed a 'stream of cultural analysis' and a 'logic-based stream of analysis' (Checkland, 1988:p27). This approach is shown in Figure 3.15. A major difference between the mode 1 and 2 approaches was the removal of the separation between the 'real' and the 'systems thinking' worlds, which was described as 'heuristic rather than theory-based' and implied a 'false dualism' (Tsouvalis and Checkland, 1996).

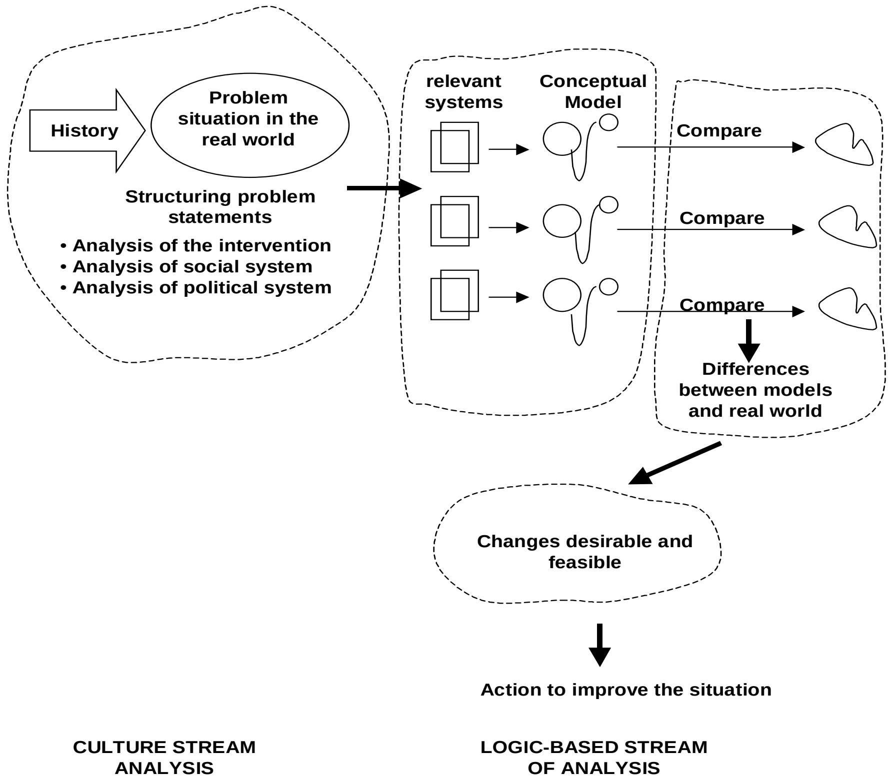

Figure 3.15: Outline of SSM Mode 2

The stream of cultural enquiry consists of three examinations of the problem situation. The first focuses on the roles of the problem owners, problem solvers, and clients within the area of the problem situation. The second examines the social and cultural interrelationships along with the roles of norms and values within the system. The last is a political analysis which examines power structures and their expression in the problem situation. However, the idea of the separation still exists with the use of terms such as ‘real world’, ‘compare’, ‘real situation’, and ‘differences’ in the logic-based stream of analysis. The mode 2 approach still appears sequential and retains the appearance of mode 1 in that there is still an obvious delineation between the systems thinking and real worlds.

The basis of the five step learning cycle used in the mode 2 approach is shown in Figure 3.16. The first step perceives the real world as involving complex sets of relationships. The second explores these relationships via models of purposeful activity based on explicit world-views. The third step structures the inquiry by questioning the perceived situation using a model as a source of questions. Step four involves the taking of action to improve the problem situation based on finding accommodations or versions of the situation which conflicting interests can live with. The last step suggested that the inquiry in principle is never-ending and cyclic.

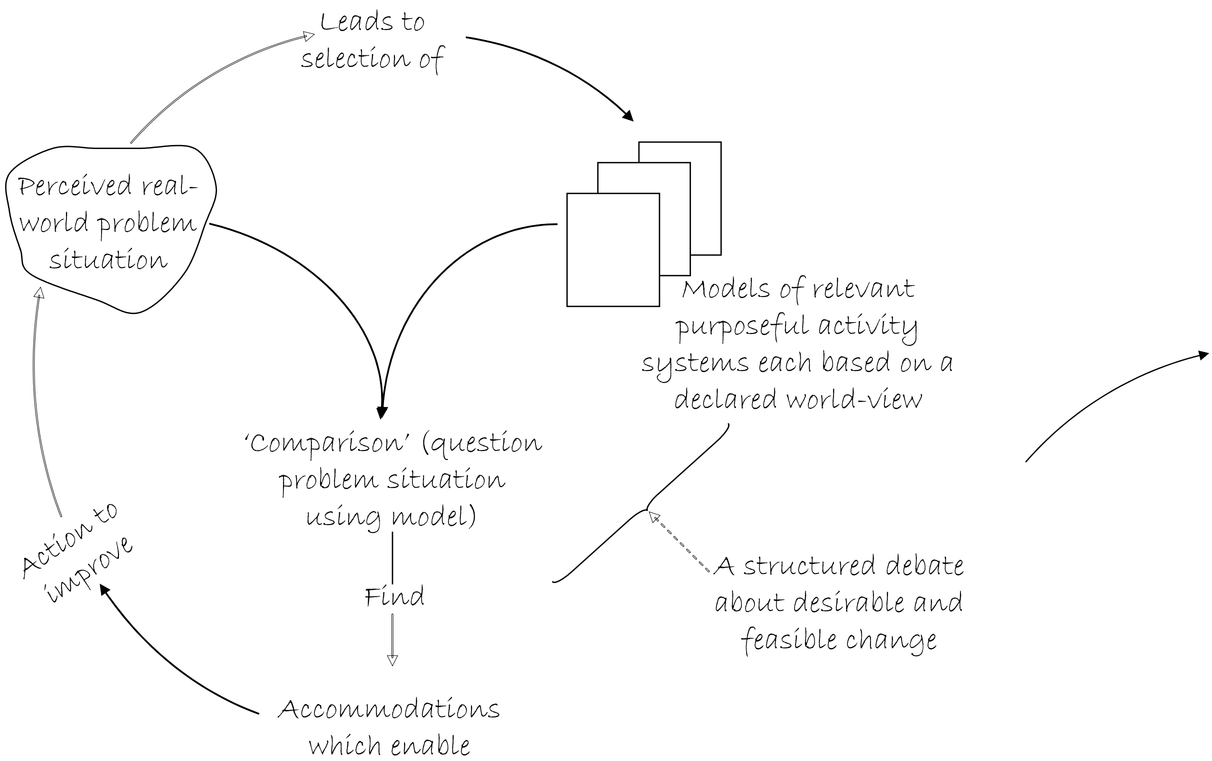

Figure 3.16: The Learning Cycle of SSM Mode 2 (Checkland, 1999:pA9)

A comparison of the differences between the SSM modes 1 and 2 is shown in Table 3.1.

Table 3.1. The Differences Between SSM Mode 1 and SSM Mode 2

Mode 1	**Mode 2**
Using SSM to do a study	Doing work using SSM
Intervention	Interaction
Mentally starting from SSM	Mentally starting inside the flux[δ], providing a coherent way of describing or making sense of it
Stage by stage; logic-driven stream and cultural stream of analysis	SSM as a thinking mode, used in internalised form takes SSM itself as a framework; meta-level[§] use of SSM compared with mode 1
SSM as an external recipe	SSM as an internalised model

Source: Kreher (1994:p1300) based on Checkland (1999:pA36)

[δ]That is, starting with a problematic situation and using SSM techniques and tools as appropriate to organize observation and understanding, and to generate debate about it. More emphasis is placed on understanding the situation, than on prescriptive application of the methodology.

[§]Use of the approach as a set of guiding principles within which tools and techniques are not prescribed.

3.6.2.3 SSM Mode 3

The latest development of SSM completely removes the distinction between systems thinking and the real world although the social and political elements are retained when describing the problem situation. This formulation is depicted in Figure 3.17 (Checkland and Howell, 1998).

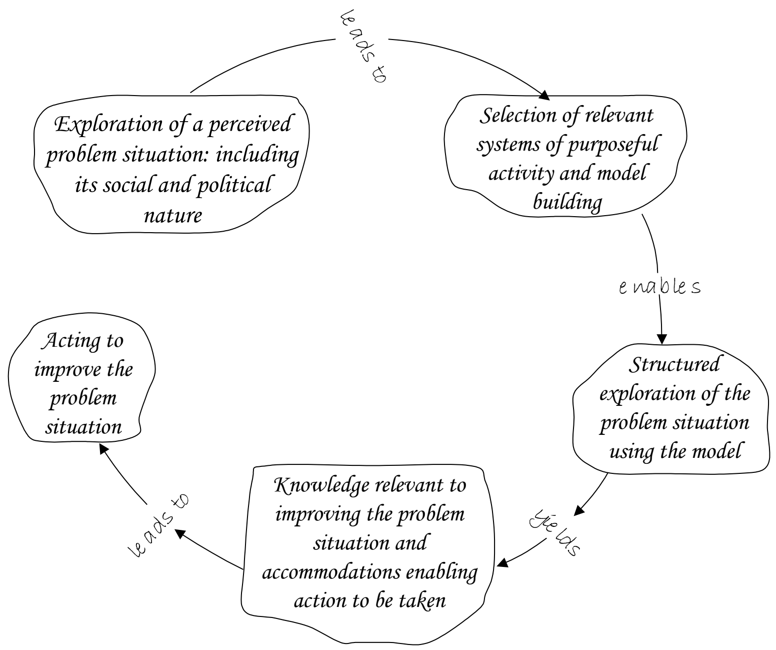

Figure 3.17: Outline of SSM Mode 3 (Checkland and Howell, 1998)

3.6.3 Criticism of SSM

A number of writers (Mingers, 1984; Ivanov, 1991; Jackson, 1991) have criticised SSM on the basis that it lacks an objective standard and can be very easily influenced or biased by the point of view of the user(s). This criticism is based on the nature of SSM as described by Checkland (1993:p173,p181) that "*it is absolutely not the intention of the SSM to diminish the freedom of actual human activity*"…nor "*to force real life into more rational form*" …but " *to portray the real life itself as being open and participatory*". Jackson (1991) questioned whether it is really possible to find problem situations in which an open and participatory approach would work, because in most situations there is a fundamental conflict of interests between the groups or participants who often have unequal power resources. Jackson's criticism led to the inclusion in Mode 2 of an analysis of the intervention itself as well as the power relationships in the social and political analysis. Houghton and Ledington (2002) have argued that the original concept of SSM was to 'solve' hard to define problems in the real world but now the focus had shifted from improvement to one of learning. It is worth noting that criticisms such as these have led to experiential development of SSM.

3.6.4 Applicability of SSM in Agri-food Supply Chain Analysis

Many of the problem situations experienced in agri-food supply chains have characteristics which make them '*wicked and ill structured*' (Westbrook, 2004) and therefore suitable for analysis with SSM. The application of SSM approaches in agri-food supply chains have not been widely reported in the literature. Yoshida (1999) described the methodologies that could be applied to improve the effectiveness of supply chains and in particular focused on the need to incorporate the human-to-human and human-to-chain interactions. Based on the Total Systems Intervention approach of Flood and Jackson (1991), he considered the supply chain on two planes. The first was based on the relative complexity of the context, (or the 'system' dimension), and secondly on the relationship between the individuals or parties who stand to gain or lose from a system intervention, (or the 'participant' dimension). Based on this approach Yoshida (1999) found that supply chains could be classified as being "… *complex dynamic systems that behave in a probabilistic manner because they have many attributes that cannot be predetermined; and have interactions among the elements that are loosely organised*".

The participant dimension was characterised by Yoshida as having many participants who share a basic compatibility of interest, but whose values and beliefs may diverge to some extent. The participants may also have different goals, objectives and decision-making flexibility that may be compromised when interacting with other businesses in the supply chain. This highlights the need to widen the analysis framework from the analysis of the 'systems' dimension alone to one that integrates that dimension with the 'participant' dimension. This led Nonaka and Takeuchi (1995) to conclude that Soft Systems Methodologies were suitable for analysing supply chain multi-dimensionality. More specifically, Dimyati (2004) noted that agri-food supply chain management (SCM) can be integrated with Soft Systems Methodology (SSM) because he realised that the nature of the agri-food supply chain in developing countries like Indonesia is very complex and involved participants from several sectors including the government.

3.6.5 SSM and Action Research

The basic tenant of Soft Systems Methodology (SSM) is the need for the direct involvement of the researcher in the process. The researcher takes a number of roles including facilitator, analyst and sometimes mediator. The methodology adopted therefore needs to provide room for the researcher to do action and participatory research.

Lewin's research in the 1940s that investigated the changing social systems for American housewives regarding their diet can be considered as the first work that applied action research (Lewin, 1943). Lewin described action research as a cyclical process of planning, executing and fact-finding to learn about and change the situation. More specifically, it can be seen as a process that cycles (or spirals) between action and critical reflection (Dick, 1999), or as Baskerville (1999) states, a diagnostic and therapeutic stage. Susman and Evered (1978) described a five-stage cycle which included diagnosis, action planning, taking action, evaluation and identification of the lessons that have been learned from the process, which are used as inputs for the next cycle.

Hult and Lennung (1980) and Altricher *et al*. (1990) noted that action research had the following characteristics:

1) It aims to increase the researchers understanding of the social situation along with the complex nature of its setting by applying self-reflection, self-evaluation and self-management by autonomous and responsible persons and groups.
2) Always assists practical problem solving and expands scientific knowledge with highly interpretive assumptions about the observations made by the researcher who is embedded in the problem setting.

3) Data gathering by participants themselves or with the help of others in relation to their own questions.
4) Enhances collaboration and the competencies of the actors involved; researchers and the researched. This means that participation and collaboration among members of the group as a critical community (in problem-posing and in answering questions) in decision-making.
5) Is extremely suitable for gaining an understanding of the change processes in play in social systems including power sharing and the relative suspension of hierarchical ways of working.
6) Learning progressively or publicly by doing and by making mistakes in a self-reflective spiral of planning, acting, observing, reflecting, replanning, etc. Reflection that supports the idea of the self-reflective practitioner.

In action research, both researcher and the researched work as co-investigators and co-learners to think about the research problem, conducting the research and communicating the results. From the nature of the process, it is clear that action research is active (not passive), value-filled, seeks feasible and desirable change, which does not just explain the phenomena but researches it. In other words, action research by its nature is interpretive and participative (Descombe, 1998), is heavily concerned with change and self-development (Baskerville and Wood-Harper, 1996) and has a purpose which is to facilitate social change or attain a political-social goal (Neuman, 2000). In problem situations involving social changes, action research cannot make a massive change for it only focuses on one or two aspects with a high level of detail (Descombe, 1998).

Realising that the key activity of action research is participation, Fals-Borda (1992, 1987) referred to it as participatory action research, but Brown and Tandon (1983:pp290-291) make a clear distinction between action research and participatory research as follows:

> "*Action research strategies will be appropriately employed when the distribution of resources and authority are accepted as legitimate, when the relevant parties accept research as credible, and when rewards are available for integrating problem solving and research. Participatory research strategies will be appropriately employed when the legitimacy of power and resource distribution is questioned,*

> *when client groups are aware and mobilised to influence their situation and when resources are ideologically committed to social transformation*".

Yet they also noted that action and participatory research have the same values and employ similar methodologies. A number of writers have preferred to concentrate on the similarities rather than the differences and combined the terminology to describe the approach as participatory action research (Whyte, 1991; Ortiz, 1991; Ruano, 1991).

There are close links between action research and Critical Systems Thinking with both involving the following modes of operation (Grundy, 1990; Levin, 1994; Zuber-Skerritt, 1996):

1) *Technical action research* that aims to improve effectiveness of educational or managerial practice. In this mode, the researcher acts as a facilitator.
2) *Practical action research* which aims to promote and expand mutual understanding among the individuals and groups participating in the social systems of interest. In this case the researcher encourages practical deliberation and self-reflection of practitioners.
3) *Emancipatory action research* which aims not only at technical and practical improvement, but also at changing the system itself to remove those conditions that impede the desired improvement in the system/organisation.

Minger (cited by Fairtlough, 1991) noted a similarity between CST and SSM and stated that they both focus on the human activity system, they react in similar ways to the inadequacy of hard system thinking, and they aim to develop a rational approach to communicative interaction that allows people to find their own solutions for their problems. It is clear that action-oriented research approaches are the most appropriate when researching issues that are considered systemic in nature and involve human activity systems.

3.7 Farm Production System Analysis

Farm production is an important subsystem of the whole agribusiness supply chain. The farm production subsystem considers the interaction between farmers and their farm, farm inputs, the product and the environment. The role of the farm household in deciding which farm inputs to use and which farm products to produce is the main concern of the farm production activity. This is closely related to the efficiency in using farm resources including land, labour and capital. Farm production analysis using frontier production function is one of the more popular methods used to analyse farm efficiency. However, given that the farm production process is highly influenced by uncontrollable factors like weather, risk and uncertainty must be considered in this subsystem.

3.7.1 Farm Household

In most countries, the family farm remains the dominant form of ownership in rural communities. This means that there is a strong link between a farm household and the farm business. Based on neo-classical economic theory, under quite restrictive assumptions, households may act as if they were individuals. Samuelson (1956) and Becker (1991) explain how under certain conditions, a household acts to maximise a single utility function subject to a budget constraint. However, household decisions can also be an outcome of interactions between household members who may have different preferences and resources. Gordon (1993) stated that the personal value system of an individual influences the decision making process within the household. The importance of household members in farm decision making was recognised by Errington and Gasson (1994), Corcoran and Dent (1994), Bryden (1994), and Bollman *et al.* (1995). Intra-household interactions mostly relate to the collection and allocation of resources in the household. Lundberg and Pollak (1993) stated that it is very difficult to decide who does what for whom within the household. Udry (1995) modelled the interaction within farm households using a pareto efficiency model to analyse the relationship between gender and agricultural production within the household.

Matlon (1988) and Fresco and Westphal (1988) defined the farm household as the smallest group of persons usually, but not exclusively kin-related who form a more or less independent production and consumption unit during the cropping season. Dillon *et al.* (1978) stated that the term ‘farmer’ may mean more than a single person or decision maker like the family, the household or management organisation. Fleisher and Robinson (1983) considered the farmer as the unique actor in the process of decision-making. Dillon and Hardaker (1993) view a farm household as a system which consists of three subsystems: the household as a decision making unit, the farm as the production element, and the off-farm component involving one or more of work, market and social relationships.

Farm households in developing countries consist of the farm's nucleus family but more often than not, the extended family, some number of more or less permanent domestics, farm workers and miscellaneous dependants (McConnell and Dillon, 1997). Farm households are both resource managers and system beneficiaries (McConnell and Dillon, 1997). Moreover, Aksoy and Kaynak (1993) noted that most farm households in developing countries could be categorised as owning small farms with small land holdings, operating under traditional cultivation methods, and constrained by lack of capital and knowledge. In Indonesia, Soerojo *et al.* (1991) found that average farms sizes are between 0.2 ha and 5 ha.

Dillon and Hardaker (1993) view the important characteristics of the farm household system as:1) Complex, due to the multiple objectives of the decision-makers involved, 2) dependent on the indigenous knowledge developed over long periods of time, 3) flexible, due to the rational disposition of farmers in the face of the compelling need for change, and 4) employing a high proportion of family labour in the total labour input, as well as a high percentage of subsistence consumption relative to total output.

For economic analysis, farm households can be treated as an enterprise unit. Rola-Rubzen and Hardaker (1999) argued that the farm-household is a complex system of interactions between and among a variety of endogenous and exogenous variables. They discussed the importance of intra-household considerations and described the farm household as a system consisting of three subsystems: the household, the farm and the off-farm component. In the household, there are consumption and production activities. In context of the agri-food supply chains, the farm household is considered as an actor for commodity production along the chain. This means that farm household activities are assumed to be oriented toward technical efficiency that can be either output-augmenting or input-conserving in producing farm products.

3.7.2 Background of Efficiency Measurement

Cobb and Douglas (1928) can perhaps be considered as one of the originators of efficiency analysis. They used ordinary regression analysis using least squares statistical methodology to estimate production functions. However, for the purpose of efficiency analysis, the average function may be problematic because the concept of an average production function is inconsistent with the notion of maximizing behaviour (Soekartawi, 2001). Furthermore, the focus of efficiency analysis is on maximizing product or minimizing cost.

An alternative approach to analysing efficiency is through frontier production analysis. The literature on frontier production and cost functions and the calculation of efficiency began with Farrell (1957). Farrell (1957) was the first to propose that useful measures of efficiency could be derived from a production frontier isoquant, combining the theory of production functions and economic efficiency. Burley (1994) stated that Farrell developed the essentials of multi-factor production productivity at the empirical level and provided an elegant and fundamentally simple solution.

Farrell's work was essentially inspired by the work of Koopmans (1951) and Debreu (1951) who introduced a rigorous analytical approach to the measurement of efficiency in production. Koopmans (1951: p60) originally provided a formal definition of technical efficiency. According to Koopmans (1951) a producer is technically inefficient if he could produce the same outputs with less of at least one input, or could use the same inputs to produce more of at least one output. However, whilst Koopmans (1951) provided a fundamental framework for differentiating between efficient and inefficient states, he failed to offer guidance concerning either the degree of inefficiency or the identification of an inefficient vector or combination of efficient vectors with which to compare an inefficient vector (Färe *et al.*, 1994).

This limitation was addressed by Debreu (1951), who formalised a "coefficient of resource utilisation" model for the macro-economy. Debreu's coefficient *p* indicated the quantity of resources which could be saved in more efficient production, holding utility levels constant and provided a standard measure of inefficient production, $0 \leq p \leq 1$, whereby increases in p are pareto optimal. More importantly, Debreu (1951) provided measures of technical efficiency that is, efficiency in terms of an equi-proportionate reduction in all inputs, or the equi-proportionate expansion of all outputs. Debreu's (1951) approach stood in stark contrast to existing partial measures of efficiency, such as maximisation of output per unit of labour or input.

Farrell (1957) incorporated both of these approaches, acknowledging the similarity of his measure of 'technical efficiency' and Debreu's 'coefficient of resource utilisation'. Moreover, Farrell (1957) extended the work of Koopmans and Debreu by noting that production efficiency may be decomposed further into a measure that takes account of a firm's ability to select the appropriate combination of inputs and outputs (technical efficiency).

3.7.3 Production Function and Efficiency

The word efficiency has a relative meaning. Simply put, efficiency can be defined as the effort to use as little input as possible to obtain as much output as possible. Those who have limited inputs available will try to organise their resources to minimise the cost of inputs to produce a certain amount of output (cost minimisation approach). In contrast, those who do not have a problem with input provision will try to maximise the profit from the production process (profit maximisation approach). Both approaches are geared towards reaching productive efficiency.

There are three types of efficiency; technical efficiency, allocative (price) efficiency and economic efficiency. Due to the limitation of data availability, this study will focus on the analysis of technical efficiency. All three kinds of efficiency have a mathematical relationship. Farrell (1957) showed that economic efficiency (EE) is equal to the product of technical efficiency (TE) and allocative efficiency (AE). These can be clearly explained using production function analysis. To explain the relationship between technical, allocative (price) and economic efficiency, consider Figure 3.18.

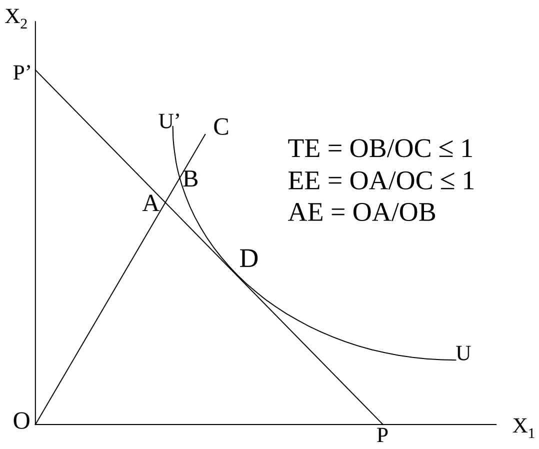

Figure 3.18: Measurement of Efficiency (Farrel, 1957)

In Figure 3.18, U'U is an isoquant curve which describes the least combination of X_1X_2 to produce a certain level of output. The line P'P is called an isocost line which is all combinations of inputs or resources the firm uses for a given total cost. Here two inputs X_1 and X_2 are used to produce a single output y, so the production frontier function is $y = f(X_1, X_2)$. In the assumption of constant return to scale (CRS) then $f(X_1/y, X_2/y) = 1$. The isoquant of fully efficient firm U'U permits the measurement of the value of technical efficiency. Given that a firm may use a certain amount of inputs (X_1*, X_2*) defined by point C to produce some amount of output (y*), then the level of technical efficiency can be defined as the ratio of OB/OC. Thus, 1- (OB/OC) can be stated as the firm's technical inefficiency. This means that the proportion of (X_1*, X_2*) can be reduced (keeping the input ratio X_1/X_2 constant) without reducing output. This also means the possibility of reducing costs by producing y*. Point B is technically efficient because it already lies on the isoquant line.

When the input price ratio P'P is known, the ability of the firm to use these inputs in optimal proportion (allocative efficiency), given the price at point C, is the ratio of OA/OB. Thus the allocative inefficiency is 1 – (OA/OB). The distance between A and B is the reduction of production cost if the firm wants to reach point D where the firm is technically and allocatively efficient (overall efficiency).

Point B is a position where the firm is technically efficient but allocatively inefficient. Therefore the total economic efficiency (overall efficiency) is the ratio of OA/OC and total economic inefficiency is 1 – (OA/OC) which is the possible reduction in cost from moving from C to D. Hence, the cost reduction achievable is the distance of AC.

3.7.4 Frontier Function and the Efficiency Measurement

Lau and Yotopoulus (1971) used the unit output price (OUP) profit function which specifies the following conditions: (1) the technical and price efficiency components have been included; (2) the capability to facilitate the differences in resource endowment and environmental factors in the short-run; (3) there is the possibility that each firm faces different sets of market prices or imperfect markets; (4) the condition of maximising profit may vary among firms; and (5) there is no statistical problem such as simultaneous equations bias and inconsistency.

While this approach has the advantage of considering both price and allocative efficiencies, this technique however, is estimated by Ordinary Least Square (OLS), therefore the result is relative and average in nature (Supranto, 2000). In addition, this method does not provide pure technical inefficiency because it includes random variability. Bravo-Ureta and Pinheiro (1997) showed that the OLS method provided estimates of the "average" production function, while the maximum likelihood (ML) method yields estimates of the production frontier. The frontier function is a function that indicates the maximum possibility of output that can be reached from a given combination of inputs using available technology. The frontier function is designed to respond to the problem encountered in OLS by introducing the error term to represent an inefficiency measurement. The frontier can also be used to estimate the minimum cost that can be reached in the production process.

The focus of recent developments in efficiency measurement has been on the evocative term *frontier*. Interest is now placed upon extreme values and bounding functions, rather than those of central tendency and best fit (Lovell, 1993). This is a logical extension because frontier performance comparisons flow directly from the definition of the production function itself. If production is a process of physical transformation whereby inputs are translated into outputs, then the production function should be interpreted as a purely technical relationship which defines efficient transformation possibilities, given the available technology. Specified rates of output thereby correspond to given factor inputs and they may be said to represent solutions to a technical maximisation problem.

The frontier function approach is a method to measure productive inefficiency of individual producers. Inefficiency is measured by the deviation from the frontier, which represents a best-practice technology among all observed farms. Farrell (1957) presents computational measures for productive inefficiency based on Debreu (1951) and Koopmans (1951).

Coelli (1995a) suggested that there were two advantages of frontier functions compared to average functions which are commonly estimated under the ordinary least square (OLS) method (1) the frontier model is suitable to the theory of production which tends to move toward the optimisation process; and (2) it provides a measurement of efficiency for each firm or farm.

3.7.4.1 Parametric and Non Parametric Approaches

In the process of measuring technical efficiency, a fundamental distinction is necessary between the parametric and non parametric approaches. These approaches may also be related to econometric and mathematical programming. The econometric approach represents a significant modification to conventional econometrics, while the mathematical programming approach is an inherently bounding technique which requires little or no modification in the analysis of production frontiers. Each of these two different techniques makes different accommodations for random noise. All other things being equal, the econometric approach is *stochastic*, attempting to distinguish the effects of random noise from the effect of inefficiency. A parametric approach combines the effects of a mis-specified functional form with inefficiency.

The non-parametric technique constructs frontiers and measures efficiency relative to the constructed frontiers using linear programming techniques. The approach frequently goes by the descriptive title of *data envelopment analysis* (DEA) (Ali and Seiford, 1993; Charnes *et al*., 1995; Lovell, 1993, 1994; Seiford, 1996 and Seiford and Thrall, 1990). The non-parametric approach can be categorized according to the type of data available (cross-sectional or panel), and according to the type of variables available (quantities only, or quantities and prices). With quantities only, technical efficiency can be calculated, while allocative efficiency requires both quantities and prices.

The two approaches differ in many ways, but the essential differences can be reduced to two characteristics. One is that the non-parametric approach typically does not take statistical noise into account, which consequently provides inaccurate efficiency measures, while the parametric approach with stochastic frontier specification can accommodate statistical noise. The other is that the non-parametric approach does not require specific functional forms to be imposed on the data while the parametric approach is subject to potential specification error since estimated frontiers and efficiency measures are conditional on the functional form chosen. Hence, the selection of an appropriate functional form is a vital factor in the parametric approach.

Farrell (1957) measured technical efficiency and allocative efficiency in terms of a non-parametric and deterministic production function, with assumptions of 1) constant returns to scale (CRS) and 2) the frontier technology was characterised by the unit-isoquant. However Erwidodo (1990, 1992a, 1992b) stated that this approach has two weaknesses, 1) the assumption of CRS is restrictive and its extension to non-CRS is not practically applied and cumbersome and 2) the production frontier function is computed from a supporting subset of observations from the sample and therefore it is susceptible to extreme observations and measurement error.

Considering the weaknesses of the non-parametric approach, Farrell (1957) himself proposed a deterministic parametric frontier by computing a parametric convex hull of the observed input-output ratio using a simple mathematical form. The parametric approach constructs a frontier function and measures efficiency with econometric techniques. There are two main differences between non-parametric and parametric approaches. The non-parametric approach does not account for statistical noise therefore the measurement of efficiency is likely to be inaccurate, while the parametric approach accommodates it.

3.7.4.2 Deterministic and Stochastic Model

The parametric technique forms the frontier through employing econometric estimations. Frontier functions are estimated with either a deterministic or stochastic specification, which are presented, respectively, as:

$$y_i = f(x_i, \beta) - u_i, \qquad i = 1 \dots N \tag{3.1}$$

$$y_i = f(x_i, \beta) - u_i + v_i, \qquad i = 1 \dots N \tag{3.2}$$

where i indexes producers; $y_i \geq 0$ is an output scalar; $x_i = (1, x_{i1}, \dots, x_{iN}) \geq 0$ is a vector consisting of inputs and an intercept; $\beta = (\beta_1, \beta_2, \dots, \beta_N)$ is a vector of coefficient estimates; $u_i \sim \text{iid } N^+(\mu, \sigma_u^2)$ is a random variable representing technical inefficiency associated with production of farm i; and $v_i \sim \text{iid } N(0, \sigma_v^2)$ is a stochastic error term.

As seen in equation (3.2), the stochastic frontier specification involves a stochastic error term, v_i, which is added to the deterministic specification in equation (3.1). The stochastic frontier specification was simultaneously introduced by Meeusen and van den Broeck (1977) and Aigner et al. (1977).

The stochastic frontier specification has been more widely used than the deterministic specification since the former can handle statistical noise, resulting in more accurate specification. A more complete specification is essential for accurate efficiency measures since the estimated frontier is conditional on the functional form. One common criticism of the stochastic frontier method is that there is no *a priori* justification for the selection of any particular distributional form for the technical inefficiency term, u_i.

There are two objectives in stochastic frontier analysis (Kumbhakar and Lovell, 2000). The first is the estimation of a stochastic frontier function which serves as a benchmark against which to estimate technical (or allocative) efficiency of producers (Battese and Coelli, 1988; Kumbhakar *et al.*, 1989; Green, 1990, and Atkinson *et al.*, 2001). The second objective is the incorporation of exogenous variables, that are neither inputs to the production process nor outputs of it, but which nonetheless affect producer performance with the intent of identifying the determinants of efficiency (Pitt and Lee, 1981; Kalirajan, 1981; Battese and Coelli, 1995; Ali and Flinn, 1989).

Aigner and Chu (1968) applied a homogeneous Cobb-Douglass production function as the frontier and required all observations to be on or under the frontier. The formula is as follows:

$$\ln Y = a_0 + \sum_i a_i \ln X_i + \mu, \mu \leq 0 \tag{3.3}$$

Where Y is the amount of output, X_i is the amount of i^{th} input used to produce Y and μ is an error term, where μ is less than or equal to 0.

Once the parameters are estimated, the technical inefficiency for each firm can be computed directly from the residual. This method can accommodate non-CRS conditions.

In a deterministic model, the variation in farm performance ignores the possibility of variation due to factors not under the control of farmers such as weather variation, machine breakdowns and luck, which usually adds statistical noise (Soekartawi 2003). This noise needs to be calculated separately from the controllable factors that indicate inefficiency. The model in this case is not deterministic but stochastic. Aigner *et al.* (1977) and Meeusen and van den Broek (1977) developed a model in response to this limitation. Moreover, Schmidt and Lovell (1979) stated that where the condition $\mu \geq 0$, then the production can occur beneath the stochastic production frontier. The model can be written as follows:

$$\mathrm{y}_i = f(x_i; \beta) + e_i \tag{3.4}$$

Where y_i is the maximum amount of output obtainable from x_i; x_i is a vector of non-stochastic productive inputs of the i^{th} farm, and β is a vector of unknown parameters to be estimated. In addition

$$e_i = v_i - u_i \tag{3.5}$$

where v_i is the error component representing random noise which is assumed to be distributed normally with zero mean and variance of σ_v^2 or N(0, σ_v^2), while u_i, is the non-negative error component representing technical efficiency, assumed to be distributed either with a half normal density or with an exponential density, both with mode at $u = 0$. It is obvious that the stochastic frontier model involves a statistical error term (v_i) which is added in a deterministic function. Hence, stochastic frontier model provides a more complete specification that is essential in measuring accurate efficiency levels.

The problem with the stochastic frontier model is that it is not possible to decompose individual residuals into their two components. Jondrow and others (1982) provided a mathematical analysis to separate the two components. One can estimate the average inefficiency over the sample and its variance using this formula (Jondrow *et al.*, 1982).

$$E(u) = \bar{u} = \sigma_u \sqrt{2/\pi} \tag{3.6}$$

Jondrow *et al.* (1982) also demonstrated how individual or farm-specific estimates of inefficiency might be calculated. Considering that the definition of technical efficiency (TE) is the ratio of actual output and potential yield, the formula of TE can be derived from the stochastic production frontier model as follows (Battese and Coelli, 1988).

$$\mathrm{y}_i = f(x_i;\beta)\exp(v_i - u_i) \tag{3.7}$$

$$TE = \frac{y_i}{f(x_i;\beta)\exp(v_i)} = \exp(u_i) \tag{3.8}$$

Where all symbols in equation 3.7 and 3.8 are as previously defined.

3.7.5 Cobb-Douglass Production Function

A production function shows the physical relationship between inputs and output in a production process. In applying inputs to produce certain amounts of output, the manager or farmer will face not only controllable factors but also uncontrollable ones such as weather, flood and luck. This is why there is risk and uncertainty in a production process.

The degree of uncertainty will affect the degree of risk faced by farmers. If a farmer has difficulty in knowing when a disaster will hit his/her farm then this means that the farmer is running the business with uncertainty. Therefore, the production function for the farm under this situation should consider incorporating risk. When the uncertainty considered does not affect the farm significantly, one may apply a deterministic production function.

A function will provide relatively good estimates if the conditions needed can be met. A good production function can be used to obtain important information such as appropriate input combinations in a production process and the extent of contribution every input makes to output. However, the interpretation of a production function must be done carefully because not all independent variables can be entered into the function. Issues that must be considered are as follows (Soekartawi, 2002a, 2003):

1) Estimation in the model must be known so the model will not have a highly significant bias.
2) Estimation of the production function reflects the average of observations if run using cross-sectional data (i.e., data obtained from a survey in a certain period of time.)
3) Data expressed in currency may bias the real situation because of opportunity cost. This can happen as a result of imperfect market competition for both inputs and output.
4) Each farmer has a specific business, therefore the input-output relationship for each of them is possibly very specific.

From several production functions, one that is popular is the Cobb-Douglas production function (e.g., Mythili and Shanmugam, 2000, Rao *et al*., 2003, Vu, 2003 and Arsalanbod, 2005. There are three main reasons why researchers use the Cobb-Douglas function: The mathematical solution of a Cobb-Douglas function is relatively easy to interpret compared to other functions such as the quadratic or square root polynomial functions. The estimated parameters of a Cobb-Douglas function indicate the value of the elasticity for every input used.

From the estimated parameters of a Cobb-Douglas function, the returns to scale of the production process can also be calculated.

Even though originally the Cobb-Douglas function was derived from the theory of production (Cobb and Douglas, 1928), this function is also used both as profit and cost functions. So that there is a Cobb-Douglas profit function and a Cobb-Douglas cost function. This indicates the importance of the Cobb-Douglas function in explaining crucial problems of economic phenomenon.

A Cobb-Douglas function can be written mathematically as follows (Soekartawi, 2002a, 2003).

$$Y = aX_1^{b_1} X_2^{b_2} \ldots X_i^{b_i} \ldots X_n^{b_n} e^u \qquad (3.9)$$

$$Y = a \prod_{i=1}^{n} X_i^{b_i} e^u \qquad (3.10)$$

where

Y = dependent variable

X_i = explanatory variables

a, b = parameters to be estimated

u = disturbance term

e = natural logarithm, e = 2.718

The estimation of this function can be solved by transforming this function to a multiple linear regression. The logarithm of this function is as follows.

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + \ldots + b_i \ln X_i + b_n \ln X_n + u \qquad (3.11)$$

or

$$Y^* = a^* + b_1 X_1^* + b_1 X_1^* + \ldots + b_i X_i^* + b_n X_n^* + u \qquad (3.12)$$

where,

Y^* = ln Y

X_1^* = ln X_1

X_2^* = ln X_2

X_i^* = ln X_i

X_n^* = ln X_n

Since the solution of a Cobb-Douglas function uses logarithms and is transformed to a linear regression, some conditions should be met (Soekartawi, 2003):

1) There is no observation with zero values because the logarithm of zero is infinite.
2) There is no difference in the respective technology.
3) There is perfect competition for every variable X.
4) Uncontrolled independent variables are assumed to be covered in the disturbance term (u).

In order to be suitable for economic analysis, the value of the sum of b_i should be positive and lower than 1. This means that a Cobb-Douglas function is derived from a situation where the law of diminishing returns occur for every input X.

However, Soekartawi (2003) noted some limitations of a Cobb-Douglas function:

1) Incorrect variable specifications will result to negative production elasticities or the value of the elasticities will be extremely high or extremely low. This condition can also happen when there is multicollinearity.
2) Extreme values of elasticities can also exist as a result of incorrect variable specification.
3) A Cobb-Douglas function can bias the management variable. In practice, management factors can significantly affect production. However, this variable is difficult to capture and include as an independent variable in a Cobb-Douglas function;
4) Limitation of Data. A Cobb-Douglas function needs high variations of data especially for a cross-sectional data set. However, it is sometimes difficult to get variable data on farm input prices in developing countries because prices of farm inputs in some countries are controlled by the government. In addition, a Cobb-Douglas function does not allow any data with zero or negative values.

Another type of production function commonly used in farm production analysis is the transcendental logarithmic (translog) model. This function is more flexible in nature because it has both linear and quadratic terms, with the ability of using more than two factor inputs (Christensen *et al.*, 1973; Yohanes and Handoko, 1987; Greene, 1997). For example a translog model for three farm inputs can be written as follows:

$$\begin{aligned}\ln Y = \alpha_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \frac{1}{2}\beta_{11} \ln X_1^2 + \beta_{12} \ln X_1 \ln X_2 \\ + \beta_{13} \ln X_1 \ln X_3 + \frac{1}{2}\beta_{22} \ln X_2^2 + \beta_{23} \ln X_2 \ln X_3 + \frac{1}{2}\beta_{33} \ln X_3^2 + \varepsilon\end{aligned} \tag{3.13}$$

In general this model can be specified as:

$$\ln Y_i = \alpha_0 + \sum_{k=1}^{n} \alpha_k \ln x_{ki} + \frac{1}{2}\sum_{k=1}^{n}\sum_{j=1}^{m} \alpha_{kj} \ln x_{ki} \ln x_{ji} + \varepsilon_i \tag{3.14}$$

$$\varepsilon_i = v_i - u_i \tag{3.15}$$

Where ln denotes natural logarithms, Y is farm output, x_k is the k^{th} farm input and x_j is the j^{th} farm input. Despite this model being more flexible, it needs prior testing for positivity and concavity. These tests are applied to identify conditions of non-negative marginal products and convex isoquants. However, Berndt and Christensen (1974) argued that these conditions are rarely fulfilled in global empirical studies.

Moreover, the result of estimations using translog models with more than three independent variables is more complex and difficult to interpret. When data with many variables is fitted to a Cobb-Douglas model, the result of the estimation will be easier to interpret.

Several researchers have used the Cobb-Douglas model for analysing technical efficiency. Using cross-section data, Banik (1994) applied a Cobb-Douglas production function with Maximum Likelihood Estimation for rice cultivation in Bangladesh to find that small farmers were more efficient than large farms. It was also observed that owner-tenants/tenants' farms were technically more efficient than owner farms. Rao *et al.* (2003) used a Cobb-Douglas model to compare the level of technical efficiency for three major crops (rice, groundnut and cotton) in Andhra Pradesh, India. They concluded that rice farms had the highest efficiency followed by groundnut and cotton. They also found that the level of farmer education significantly affected technical efficiency. Similarly, Shanmugam (2003) used panel data to estimate the technical efficiency for three major crops in Tamil Nadu - rice, groundnut and cotton. This study revealed that all farms had a technical efficiency values lower than 83 per cent. Farms having a high proportion of family members with above middle school education were more efficient in raising groundnut.

Some other people also analysed technical efficiency using panel data. Battese and Coelli (1995) constructed a model of a stochastic frontier production function to analyse technical efficiency and its determinants using panel data of 14 Indian paddy farmers over 10 years. Besides finding age and schooling of farmers were the significant factors influencing efficiency, they concluded that the model specification permitted the estimation of both technical change and time varying technical inefficiency. Mythili and Shanmugam (2000) applied the same method to analyse the technical efficiency (TE) of rice growers in Tamil Nadu, India and concluded that the value of TE varied widely from 46.5 per cent to 96.7 per cent. Esparon and Sturgess (1989) reported that rice farmers in West Java Indonesia were technically efficient in using the resources available.

Murova *et al.* (2004), using panel data from 1991 to 1996, analysed technical efficiency performance of Ukrainian agriculture using a Cobb-Douglas production function and concluded that the TE appeared to have improved slightly over time.

Besides a Cobb-Douglas production function, translog production functions are also applied by some researchers. Parikh and Shah (1994) analysed factors determining the TE of farm production activity in Pakistan. The authors constructed a translog production function using the value of output and costs of input and found significant factors that determine efficiency are family size, education, credit and land fragmentation.

3.8 Marketing System Analysis

The agrifood market can be viewed as a system which consists of the physical market infrastructure, the actors (buyers and sellers), the product characteristics and regulations, which all play a role in the exchange activity. This system is the cornerstone of the whole agribusiness system. Economically, the focus of the marketing system is the difference between the price paid by the consumer and that earned by the producers. Social interaction between buyers and sellers along the agrifood supply chain is also an issue. This interaction leads to an improved capability for sellers to meet the buyers' needs in terms of products quality; and the emergence of long term relationships between the buyers and sellers reduces risk and uncertainty.

3.8.1 The Marketing of Agrifood Products

Markets have various connotations. Entrepreneurs view markets as potential buyers of their products, but housewives view markets as a place to buy basic necessities. Geographers usually refer to markets as a place where commercial exchange takes place (Lutz, 1994). Market places may be viewed as an appointed place where buyers and sellers of commodities gather to transact and facilitate exchange (Hodder, 1969). Kotler (1997) describes a market as the set of all actual and potential buyers of a product.

Similar to the term 'market', people view 'marketing' in different ways. Kotler (2000) views marketing as a social process by which groups and individuals obtain what they need and want through creating, offering and freely exchanging products and services of value with others. Morris (1982) argued that marketing was comprised of three major elements: 1) fulfilling customer satisfaction; 2) integrating organisational functions and activities around satisfying customer needs; and 3) generating profits (from a long run perspective). In terms of agricultural products, Rhodes (1993:p16) defined agricultural marketing from the macro perspective as "*the performance of all business activities involved in the forward flow of food and fibre from farm producers to consumers*".

Beierlein and Woolverton (1991) state that marketing plays a pivotal role by providing consumers with an overwhelming assortment of food and fibre products. Marketing can help agribusiness firms compete successfully in an increasingly competitive marketplace and help to assure the overall future success of the agribusiness system.

The marketing of farm products is different from manufactured goods because of the product and the production process (Said and Intan, 2001; Soekartawi, 2002).

Agricultural products are perishable and bulky, and as production is often seasonal, there is much variation in both the quantity and quality of the product offered for sale. Consequently, the market is characterised by much price volatility and uncertainty.

The marketing system for farm products in most developing countries is characterised by a lot of small farmers producing highly perishable crops that are widely dispersed (Mendoza and Rosegrant, 1995). With very poor market and transport infrastructure, few traders are able to buy the farmers products.

In analysing the performance of marketing channels, distribution is an important issue. Stern *et al*. (1996: p1) describe the marketing channel as "the set of *interdependent organisations involved in the process of making a product or service available for use or consumption*". The marketing channel satisfies three main functions: 1) exchange functions such as buying and selling; 2) physical functions such as storage, transporting and processing; and 3) facilitating functions such as financing, risk management and managing the market (Stern *et al*., 1996; Kohls and Uhl, 1998).

The actors who exist between the producers and end consumers are described as market intermediaries. The number of market intermediaries that are involved in a marketing channel varies depending on the nature of the product and the place of production. As the distance between production areas and the ultimate point of consumption increases, more market intermediaries are required (Lele, 1981). This situation can lead to a weak bargaining position for the farmers. In a market where there are few buyers, the buyers tend to determine the price. In the main harvest season, when production is most abundant and prices the most uncertain, as traders find it more difficult to extract an adequate price margin, many withdraw from the market, leaving the farmer with fewer potential customers (Batt and Parining, 2000).

Agrifood marketing facilitates the transfer of agrifood commodities from the farm gate to end consumers through several alternative marketing channels. Kohls and Uhl (1998) argue that the marketing channels for farm products in developing countries can be described by means of the marketing exchange function.

In general, the marketing process for agricultural products in the transitional economies may be described as in Figure 3.19. These kinds of marketing channels are seen in Kenya (Dijkstra, 1997), Indonesia (Singgih and Wood, 2003, 2004; Wei *et al.*, 2004), the Philippines (Torres and Lantican, 1977), and Colombia (Janssen, 1986).

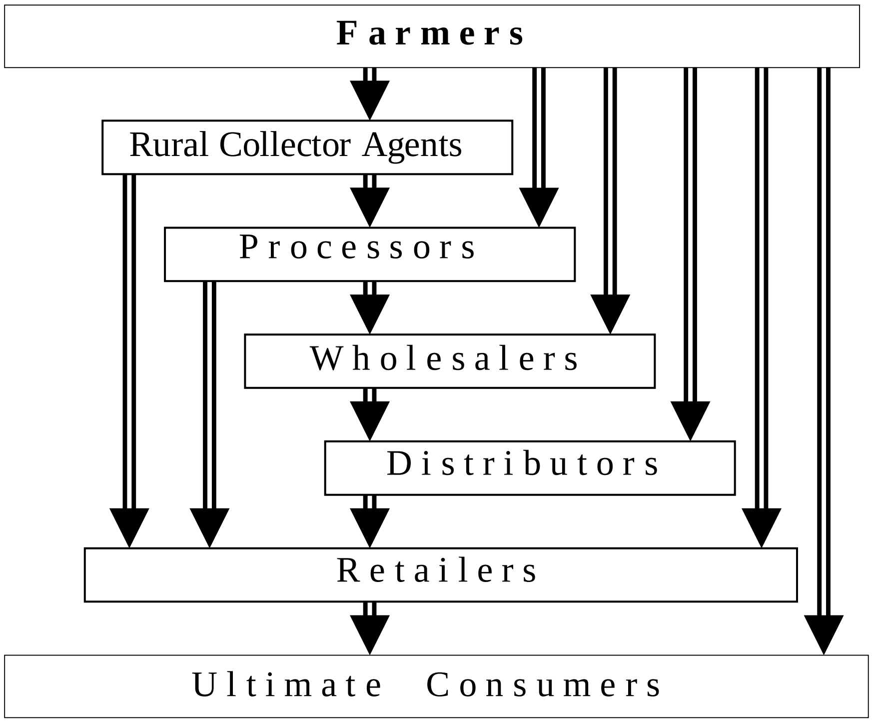

Figure 3.19: The Marketing Channel of Fresh Farm Products

The figure describes how marketing intermediaries in agricultural marketing systems purchase farm products with the intention of reselling the product to other intermediaries along the system, or to use the product as an input in the production of some higher value processed product. Until the final step, the majority of transactions occur in business-to-business markets. Business-to-business marketing has on numerous occasions been described in terms of a supply chain (Ferto and Szabo, 2002; Faria and Wensley, 2002; Frohlich and Westbrook, 2001), a value chain (McGregor, 2002; Gereffi and Memedovic, 2003; Schmitz, 2005; OECD, 2007) or a value net (Parolini, 1999; Lazzarini *et al.*, 2001; Alsakini *et al.*, 2006; Finne, 2006)

McGregor (2002) views the supply chain as a linear process where the outputs from one stage in the chain are transformed as inputs for the next stage of the chain or delivered as a final product to the consumers. As such, supply chains are sequential, vertically organised transactions that link suppliers from the initial raw materials to the ultimate consumption of the finished product (Lazzarini *et al*., 2001; Omta *et al.,* 2001). Firms need to manage and view their business activities as part of the chain if they want to maximise the value they are able to extract.

Supply chain management in agriculture has emerged and been stimulated by the need for firms to adjust in order to survive in a global business environment (van der Vorst, 2000). Even although agrifood supply chains are assumed as a subset of general supply chains, there are five characteristics that differentiate agrifood supply chains from others (Bailey *et al*., 2002): 1) the uniqueness of agrifood end consumers; 2) the specific treatment of agrifood product distribution; 3) the role of marketing in agrifood supply chain solutions; 4) the nature of agricultural products; and, 5) the continuity of material flow and availability. Effectively managing the supply chain in the food industry can improve efficiency, control cost, reduce risk, provide an appropriate response to consumer demands and satisfy consumer expectations (Boehlje *et al*., 1998; Fearne, 1998; Fearne and Hughes, 1999; White, 2000a).

As producers, farmers should consider the kind of product that is in demand in the market. Price is the mechanism most often used to determine what is to be produced when and in what quantity (Mubyarto, 2002; Soekartawi, 2002). In addition, due to the nature of agricultural products, the quality of the product will also influence the price. Sometimes, purchasing from the cheapest suppliers may have the highest overall cost because of poor product quality and unreliable delivery (Simpson *et al*., 2002). Every supplier along the value chain must understand the buyer's needs in terms of product quality to maximise the profit that can be extracted. Given the inherent variation in product quality and the risk associated in transacting with unknown and untested suppliers, in business-to-business markets, buyers prefer to transact with reliable, trusted suppliers (Batt and Parining, 2002). Similarly, in facilitating the sale of their produce to downstream, market intermediaries, farmers prefer to transact with reliable, trusted customers.

Market performance can be best evaluated using a pluralistic method that applies three different methodologies: marketing margin analysis, which examines the transaction costs (Williamson, 1979, 1985); gap analysis, which is based on industrial purchasing theory (Parasuraman, 1998); and, an analysis of the relationships between actors in the market channel. In Indonesia, previous studies of the supply chain have been conducted by Batt and Parining (2002), Morgan *et al*. (2004), Setyadjit *et al*. (2004) and Wei *et al*. (2004). However, there is no empirical evidence of any previous supply chain studies in Indonesia that have applied all three methods of analysis simultaneously.

3.8.2 Marketing Margins

Market performance has been frequently measured using the market Structure-Conduct-Performance (SCP) methodology (Soekartawi, 2002). This approach analyses market performance in terms of: 1) the consistency of marketing margins charged by various actors in the marketing system; and 2) the degree of market concentration to ensure competition, which is assumed to drive down costs.

In the developing countries, marketing margins have been most often used in evaluating the performance of supply chains because data about prices are most readily available (Golleti and Christini-Tsigas, 1995; Batt, 2004). The marketing margin is the difference between the price the customer pays and the price at which the product is resold, inclusive of all utility-adding activities and functions performed by market intermediaries (Kohls and Uhl, 1998). Harris-White (1995) argued that markets can be said to be efficient when the price paid by ultimate consumers adequately reflects storage cost, transportation cost and differences in price due to product form.

Realising that marketing margins reflect transaction costs, the analysis of marketing margins can be approached in a similar manner to transaction cost analysis (TCA). Developed primarily by Williamson (1979, 1985), transaction cost analysis assumes that various costs are associated with an exchange, including the cost of obtaining and processing information, negotiating contracts, monitoring agents and enforcing contracts. Hobbs (1996) states that transaction costs are the costs incurred in carrying out an exchange of goods through different phases of production and distribution. TCA has been used by Frank and Henderson (1992), Hobbs (1996, 1997), and Stanford *et al*. (1999) to determine the extent of vertical coordination in agricultural supply chains. In general, TCA aims to minimise cost and to maximise profit for each firm along the supply chain to increase market efficiency (Ghosh and John, 1999; Williamson, 1985).

Nevertheless analysts should exercise caution for a large marketing margin may result in little or no profit for an actor and may even result in a trading loss, depending on the buying and selling prices and the costs of marketing (Mendoza, 1995). Marketing margins will also fluctuate according to the perishability of the product, the number of actors involved in the exchange, the marketing services provided, the risk and uncertainty borne by each actor (Pomeroy and Trinidad, 1995) and the seasonality of supply (Batt and Parining, 2002).

3.8.3 Gap Analysis

Whenever the buyer purchases a product as an input for some other value-added product or with the intention to resell the product to others, the buyer will seek to purchase the product from those suppliers who are best able to deliver the desired quantity within predetermined quality specifications at an agreed price at an agreed time (Monzcka *et al*., 1998). To succeed in such markets, a supplier must understand the wants and the needs of its customers and aim to satisfy those needs more effectively than competitors (Kotler and Armstrong, 1999). The performance of the marketing system therefore, can be evaluated by the extent to which suppliers are able to meet customer's total quality requirements. The difference between what customers expect and what they actually get can be described as the service gap (Parasuraman, 1998). Understanding where the problems emerge provides an opportunity for actors to seek to make improvement. However, it is just as important to identify what constraints and impediments actors face in being unable to meet the demands of downstream customers.

In the process of buying product, when a firm has several alternative suppliers, its decision to purchase will be influenced by rational economic factors like price and quality (Hutt and Speh, 1995). Price, quality and reliable delivery are the three major criteria most firms use in evaluating potential suppliers (Cunningham and White, 1973; Lehmann and O'Shaughnessy, 1974; Dempsey, 1978; Wilson, 1994).

In defining quality, Gronroos (1990) suggested that it was necessary to differentiate between technical quality and functional quality. Technical quality related to the customer's evaluation of the physical features of the product including size, colour, freedom from pests and diseases, purity, maturity, dryness, shape etc. Batt (2004) describes functional quality as the way suppliers deliver the products to customers like production and delivery scheduling. Moreover, Parasuraman (1998) introduced a third dimension service quality, which is best described as the extra things a supplier is willing to do in order to retain the customer's loyalty. This includes variables such as technical support and advice, credit arrangements and supporting customer's special needs.

When it is easy to evaluate the product offered by several alternative suppliers, the buyer will most often choose that supplier who offers the lowest price (Hakansson *et al.*, 1977). However, when there are a number of suppliers who offer similar product characteristics, the buyer will use attributes such as supplier's reputation, financial position, communication and attitude towards the buyer (Dempsey, 1978). Anderson *et al.* (1987) suggest that buyers prefer to purchase from well known suppliers to reduce uncertainty. Given the inherent variation in the quality of most agricultural commodities, the need to reduce uncertainty takes on a number of dimensions. Batt (2003a) argued that when the decision entails a high degree of uncertainty, buyers can reduce the risk by adopting one of several alternatives strategies including trial purchasing, to purchase in smaller quantities, to use multiple sources of supply, or to purchase from preferred well-known suppliers.

However, while buyers can make estimates of product quality based on the external appearance of the product, few are able to evaluate the intangible or internal quality characteristics of the product without first consuming the product. As the manner in which the product has been harvested, stored and transported can have significant adverse effects on product quality, buyers need to be very aware. For this reason, buyers prefer to transact with preferred suppliers who have a reputation for consistently delivering superior quality products (Batt, 2003c).

Kotler and Amstrong (1999) and Monczka *et al*. (1998) describe preferred suppliers as those who are the most capable of offering quality products and services, competitive prices, reliable delivery and who behave in an honest and responsible manner.

3.8.4 Relationship Marketing

To deliver superior value to customers, the supply chain needs to be coordinated among all supply chain members. Supply chain participants should realise that maintaining relationships with upstream suppliers and downstream customers is as important as all other aspects of the marketing mix. Gaining an understanding of the buyer seller relationships that exist can therefore be used as a tool to analyse the performance of supply chains.

In long-term buyer-seller relationships, both buyers and suppliers can reduce cost because of lower search and evaluation costs (Hakansson, 1982), reduced transaction cost (Arndt, 1979; Han *et al*., 1993), and the relationship specific scale economies (Cunningham and Homse, 1982; Gundlach *et al*., 1995).

From the suppliers' side, long-term relationships provide improved access to markets and more reliable market information (Low, 1996), improved product quality and performance (Landeros and Monczka, 1989; Han *et al*., 1993), and greater customer loyalty (Evans and Laskin, 1994; Lohtia and Krapfel, 1994; Kalwani and Narayandas, 1995; Leuthesser, 1997). Moreover, for these suppliers who have long-term relationships with customers, the customer may be less sensitive to price competition (Kalwani and Narayandas, 1995) and competitors will find it more difficult to enter the market (Hakansson, 1982; Turnbull and Wilson, 1989; Heide, 1994).

Although widely used in analysing the performance of industrial markets in Europe and North America, it is only within the last decade that the study of buyer-seller relationships has penetrated agribusiness in the transitional economies. The literature has identified a range of factors that affect the establishment and maintenance of long-term buyer-seller relationships.

Dwyer *et al*. (1987) and Wilson (1995) identify commitment, trust, cooperation, mutual goals, interdependence and power, performance satisfaction, structural bonds, comparison level of alternatives, adaptation, shared technology and social bonds as the main factors of a buyer-seller relationship. Other researchers have reduced this set of variables to trust, commitment and satisfaction (Anderson and Weitz, 1992; Han *et al.*, 1993; Morgan and Hunt, 1994). However, there is increasing evidence to suggest that power-dependence (Hingley, 2005) and the willingness to make relationship specific investments (Batt, 2004), are growing in importance.

3.8.4.1 Trust

For any particular potential exchange, trust will be critical if two situational factors are present – risk and incomplete buyer information (Hawes *et al*., 1989). More specifically, trust becomes important whenever there is a high level of ambiguity, and poor product performance has a significant adverse impact on the value derived by the buyer (Singh and Sirdeshmukh, 2000).

Trust has been defined in several ways. Moorman *et al.* (1992:p315) defined trust as "*a willingness to rely on an exchange partner in whom one has confidence*". Doney *et al.* (1998:p604) described trust as the "*willingness to rely on another party and to take action in circumstances where such action makes one vulnerable to the other* party". Rousseau *et al*. (1998:p395) defined trust as "a psychological state *comprising the intention to accept vulnerability based on the positive expectation of the intention or behaviour of another*". Each of these definitions reflects reliance on the other partner and involves uncertainty and vulnerability.

On the other hand, Rotter (1980:p1) defined trust from a dispositional perspective as "*a generalised expectancy held by an individual that the word, promise, oral or written statement of another individual or group could be relied upon*". Similarly, McAllister (1995) viewed trust as the extent to which a person is confident in and willing to act on the basis of the words, action and decisions made by another. Robinson (1996:p576) defined trust as "*a person's cognitive expectation,* *assumption or beliefs about the likelihood that another's future actions will be beneficial, favourable or at least not detrimental to one's interests*".

Sociologically, trust can be defined as "*an individual's belief or common belief among a group of individuals that another individual or group: (1) makes good faith efforts to behave in accordance with any commitment both explicit or implicit; (2) is honest in whatever negotiations preceded such commitments; and, (3) does not take excessive advantage of another even when the opportunity is available*" (Cummings and Bromiley, 1996:p303). This means that trust can be viewed as a broad cultural construct or social norm rather than as an individual phenomenon. Lewis and Weigert (1985) viewed trust as a quality of the 'social fabric' that facilitates interaction.

Morgan and Hunt (1994) believe that trust exists when one party has confidence in an exchange partner's reliability and integrity. Fairholm (1994), Creed and Miles (1995), Mayer *et al.* (1995), Mishra (1996) and Laschinger *et al.* (2000) include feelings of safety, security, confidence and comfort in the relationship.

Swan *et al.* (1985) indicate that the key dimensions of trust between buyers and sellers were competence, customer orientation, honesty, dependability and likeability. Moorman *et al.* (1993) included sincerity, integrity, tactfulness, timeliness and confidentiality.

3.8.4.2 Satisfaction

Oliver (1980) argued that customer satisfaction/dissatisfaction arises from a buyer's judgement of the extent to which a supplier has met their expectations. When expectations have been met, satisfaction results, but when expectations are unfulfilled, dissatisfaction may result. Hill (1996) viewed customer satisfaction as the customer's perceptions that a supplier had already met or exceeded their expectations. Customer expectations are viewed as a belief about the likelihood that a product is associated with certain attributes, benefits or outcomes (Spreng *et al.*, 1996). If performance matches expectations, this may lead to a neutral feeling or simple confirmation (Erevelles and Leavitt, 1992). Performance above expectations will result in positive disconfirmation or customer satisfaction, and performance below expectations will result in negative disconfirmation or customer dissatisfaction (Cadotte *et al.*, 1987).

Satisfaction between marketing channel members has been defined as a positive affective state resulting from an appraisal of all aspects of a firm's working relationship with another (Frazier *et al.*, 1989). Homburg and Giering (2001) confirm that satisfaction results from an evaluation between a predetermined level of performance and the actual performance perceived as a result of a transaction(s).

Customer satisfaction usually results in higher repeat purchases, referrals to other customers, positive word-of-mouth and lower transaction costs (Evans and Laskin, 1994). Similarly, Fornell (1992) stated that high customer satisfaction results in increased loyalty, reduced failure costs and an enhanced reputation for the firm. Dissatisfied customers will tell people of their dissatisfaction, possibly complain to the company, switch to another company, or totally withdraw from the market (Anderson and Sullivan, 1993; Fornell *et al.*, 1995; Oliva *et al.*, 1995).

Geyskens *et al.* (1999) proposed that satisfaction should capture both the economic and non-economic aspects of the exchange. Economic satisfaction was derived from the channel member's positive affective response to the economic rewards that flow from the relationship with its partners. Economically, performance can be viewed as the key reward and price as the key sacrifice associated with the exchange (Voss *et al.*, 1998). Social satisfaction is derived from the channel member's positive affective response to the non-economic aspects of the exchange such that the exchange is fulfilling, gratifying and easy. This means that customer satisfaction is not only affected by product quality performance and the price paid but also by other aspects such as service. Zeithaml *et al.* (1993) argued that customer satisfaction was a function of the customer's assessment of service quality, product quality and price. Similarly, Bachelet (1995) considered customer satisfaction as an emotional reaction by the customer to an experience with a product or service.

3.8.4.3 Power Dependence

Dahl (1957) viewed power in terms of the capacity of an actor to do something that the latter would not have otherwise done. Similarly, Wilson (1995) argued that power is the ability of one partner to coerce the other to do something they would not have otherwise done.

Power is closely related to the dependency among actors in the value chain. Gaski (1984) highlighted the roles of power in distribution channels arguing that dependence and power are conceptually inseparable. Dependence refers to the firm's need to maintain the channel relationship in order to achieve desired goals (Frazier *et al.*, 1989). Wilson (1995) believes that as dependence increases, the other party becomes more powerful in the relationship. While power plays a significant role in supply chain relationships, Maloni and Benton (2000) state that different sources of power have differing impacts on the inter-firm relationship and the performance of the supply chain.

Moorman *et al.* (1993) discussed how the inequity of power in the relationship created conflict and mistrust. Schurr and Ozane (1985), Anderson and Narus (1990) and Dwyer *et al*. (1987) found that the inequality of power led the more powerful party to dominate the relationship, enabling it to force its will upon the more dependent party.

3.8.4.4 Commitment

Commitment is seen as an enduring desire to maintain a valued relationship (Moorman *et al.*, 1993). Commitment is an implicit and explicit pledge of relational continuity between exchange partners (Dwyer *et al.*, 1987). Wren and Simpson (1996) view commitment as the attitude-based outcome of interaction in buyer-seller relationships. If both parties consider the relationship to be important, there will be a desire to continue it into the future (Wilson, 1995). Lawler and Yoon (1993) describe commitment as an emotional attachment to a group in which members will tend to remain in the relationship and do something extra like providing gifts or volunteering to help maintain the relationship.

Commitment is demonstrated in three ways: idiosyncratic or customised effort, attitude, and the long-term intention of the parties to remain in the relationship

(Scanzoni, 1979; Gundlach *et al.*, 1995). Anderson and Weitz (1992) and Williamson (1985) argue that commitment involves pledges, credible commitments, idiosyncratic investments and the dedicated allocation of resources to the relationship.

3.8.4.5 Communication

Anderson and Narus (1990:p44) define communication as "*an activity to share information between firms either formally or informally*". This definition is supported by Frazier and Summers (1984) who state that communication in marketing channels serves as the process by which information is transmitted. Communication enables information from each member to be exchanged that may reduce certain types of risk perceived by either one of the parties in the transaction (McQuiston, 1989). The exchange of information allows the firms to stabilise and to coordinate their interdependence leading to a credible commitment between both firms (Landeros and Monczka, 1989). Since the parties in a long-term relationship are more likely to trust one another and to share compatible goals, communication occurs with a higher frequency and more bi-directional flows, more informal modes and more indirect content (Mohr and Nevin, 1990).

Communication has been described as the glue that holds together a channel of distribution (Mohr and Nevin, 1990). This means that effective communication plays an important role in social and business relationships.

Effective communication can increase the level of coordination, satisfaction, commitment and the performance of the relationship between channel members (Goodman and Dion, 2001; Mohr and Nevin, 1990). Through communication, firms obtain better knowledge about their counterpart's activities and resources, which increases the possibility of identifying other combinations of resources and activities that may further improve effectiveness (Hertz, 1992).

3.8.4.6 Relationship Specific Investment

An investment is a process in which resources are committed in order to create, build or acquire other resources to be used in the future (Easton and Araujo, 1994). This means that business relationships between buyers and sellers in a marketing process also requires investments. A firm that wants to improve its relationship with its business partner will need to commit resources to the relationship (Ford *et al.*, 1996). Through interacting with other firms and committing resources to specific relationships, firms have the opportunity to use relationships as a resource for the creation of other resources, product adaptations and innovations, process improvements, or to provide access to third parties (Hakansson and Snehota, 1995).

Any investment that is made specifically to a channel relationship is a relationship specific investment. This kind of investment is difficult if not impossible to reallocate to another relationship therefore, they lose substantial value if the relationship is terminated (Jackson, 1985; Dwyer *et al.*, 1987; Morgan and Hunt, 1994). This kind of investment includes training and or dedicating staff towards servicing a specific firm's product, adopting common order processing systems, or, building specialized facilities to handle a specific firm's product (Anderson and Weitz, 1992). The form of investment is likely to vary, but may also include adaptations of either product or production processes, delivery procedures, quality systems and social norms (Easton and Araujo, 1994; Ganesan, 1994).

3.8.4.7 Personal Relationship

Personal relationships play an important role in agribusiness supply chains in the developing countries because contracts are very difficult to uphold (Singgih and Wood, 2003). To succeed, agribusiness firms must build trust in their relationships. Personal trust in a business relationship is very rarely offered spontaneously; rather it results from a long period of interaction with an exchange partner (Dwyer *et al.*, 1987; Lane, 2000). During this period, both parties accumulate knowledge of each other either from direct contact or indirect collaboration.

Personal trust is normally based on the familiarity that is derived both from interaction and similarity. Zucker (1986) described characteristic-based trust as that which emerged when both parties belonged to the same social group or community or shared the same religion, ethnic status, or family background. Similarly, Fukuyama (1995) describes how trust evolves in relationships where common values and norms, often based on kinship, familiarity and common interests and backgrounds predominate. In Ghana, Lyon (2000) describes how many business relationships are referred to in terms of personal friendships. Granovetter (1985) concludes how trust is embedded in particular social relations and the obligations inherent within them.

Anderson and Narus (1990) seek to differentiate between trust as a construct in inter personal relationships and trust within working relationships. In interpersonal relations, participants expose themselves and their resources to potential loss, whereas in inter organisational relationships, it is the firm that potentially incurs the loss. In small family farms, since it is seldom possible to separate farm business activities from household activities, interpersonal trust is anticipated to assume greater importance.

Chapter Four

RESEARCH METHODOLOGY

4.1 Introduction

In this chapter, data collection methods are outlined, and the units of analysis described. Issues of research quality are considered and measures adopted to optimize the reliability, validity and generalisability of the data and findings are outlined. This chapter is divided into nine sections. The selection of the research paradigm applied is discussed in Section 4.2. Section 4.3 provides the justification for the methodology used in this study based on the epistemological and ontological context of the research problem. The design of the survey, the selection of the research area and the sample are described in Section 4.4. Section 4.5 discusses the data required and the variables measured in this study. Section 4.6 describes the development of the questionnaire. Section 4.7 and 4.8, discuss the method of data collection and the data analysis, respectively. The last section summarizes the content of this chapter.

4.2 Selection of the Research Paradigm

The literature describes two opposite research paradigms - positivism and interpretivism (Hussey and Hussey, 1997; Checkland, 1999; Pawson and Tilley, 1997; Shanks *et al.*, 1993; Falconer and Mackey, 1999). The choice of paradigm affects the way in which the researcher thinks about the research problem, selects their methodologies, and interprets the output emanating from the research.

4.2.1 Positivism

The positivist paradigm originated from the work of August Comte (1798 – 1857) with the basic assumption that the world is objective and exists separately to the observer (Giddens, 1974). Ontologically and epistemologically, a positivist views the world or reality as a research object which is value-free and consists only of facts. Positivists believe that the world is based on regularities and causal relationships between its fundamental elements like people, events, values and the environment (Burrell and Morgan, 1994). Similarly Walsham (1995) argued that positivism takes the position that facts and values are distinct and scientific knowledge only consists of facts. Positivists normally use techniques that separate a whole object into its constituent parts and analyse increasingly smaller parts of the whole (reductionism). Therefore, research methodologies used by positivist commonly involve a clearly defined research problem, a set of hypotheses, and a clear sampling technique (Denzin and Lincoln, 1998) which corresponds with the scientific approach.

The positivist views of the natural and social sciences are based on the same logical foundation, which suggests that the methodological procedures of natural science can be directly adapted to social science. Neuman (2000:p66) argued that positivists see social science as an "*… organised method for combining deductive logic with precise empirical observations of individual behaviour in order to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity*".

However, Wilhelm Dilthey (1833 – 1911) argued that social science, unlike natural science, cannot be studied in isolation for it needs to be put in context because the elements of social phenomenon will not have meaning without human interaction (Checkland, 1981; Stowell, 1993; Berg, 2001). Therefore, it is not appropriate to analyse social science problems using a purely positivist paradigm.

Despite the development of a range of alternative paradigms in the last few decades, the positivist approach is still widely adopted today. Orlikowski and Baroudi (1991) reported that 97 percent of the research carried out in the USA is conducted under a positivist paradigm. In Australia, Ridley and Keen (1998) reported a slightly lower figure of 88 percent.

4.2.2 Interpretivism

Interpretivism is characterised as the opposite of positivism. Interpretivism is defined as "*a systematic analysis of socially meaningful action through the direct detailed observation of people in a natural setting in order to arrive at understanding and interpretations of how people create and maintain their social world*" (Neuman, 2000: p71). Interpretivists see the world, as a research object that is a relative thing that can only be understood by becoming directly involved within the object's activities (Falconer and Mackay, 1999). Some experts stated that this paradigm is closely associated with qualitative research (Brennen, 1992) and naturalistic enquiry (Patton, 1991). This paradigm is also called phenomenology; an approach which believes that reality is not external but is socially constructed by people (Husserl (1946) cited by Easterby-Smith *et al.*, 1991). This is probably what inspired Kukla (2000) and Lincoln and Guba (1985) to use the term 'constructivism' to describe this paradigm.

This paradigm developed as a result of the domination of scientific enquiry by positivists during the 19th and 20th century, which was challenged by the academic and intellectual world in general, and the social or soft sciences in particular. The debate revolved around the shortcomings of the dominant paradigm (Capra, 1983, 1994; Kuhn, 1962) and saw the development of a post-positivist (Habermas, 1978) paradigm based on human inquiry (Reason, 1997). This then emerged with a new discipline based on an understanding of multiple social realities (Goodman, 1984; Gardner, 1985; Bruner, 1986; Maturana and Varela, 1988). Parallel with this was the emergence of constructivism as a school of thought based on the understanding that social reality is constructed by different individual human beings with different mental ability (Lincoln and Guba, 1985). Schwandt (2000), when comparing the two paradigms, stated that positivism explains the phenomena and interpretivism understands the phenomena (*verstehen*). Rudner (1966 as cited by Suriasumantri, 2001) stated that the *verstehen* approach assumes that social science needs different methods to those used in the natural sciences because human beings are different from plant, animal and non-living creatures.

Interpretivism is also related to the concept of the 'hermeneutics circle' (Dilthey, 1961; Neuman, 2000). The 'hermeneutics circle' concept states that a person can understand an object, issue or phenomenon better by actually undertaking the process (such as selling rice) which provides a higher level of understanding compared to when they observe it or do it under supervision (Klein and Myers, 1999). It was adopted by Max Weber, a proponent of interpretivism, who argued that the causal functional approach could not be applied in social research because social science aims to understand the phenomena (Schutz, 1954). However, Schutz criticised Weber's work, especially its inability to deal with the subjective inter-dependent nature of social reality. Similarly, Klein and Myer (1999) stated that interpretive research attempts to understand phenomena through the meanings that people assign to them, without the need to predefine dependant and independent variables. This is possible because the research focuses more on the complexity of the human interaction that occurs as the situation emerges. The role of the researcher when using this paradigm is to orchestrate the dialogue and facilitate a dialectic communication between researcher and the researched. This interaction helps them develop viable meaning and understand the problem situation. In short, constructing the meaning of the phenomena is the major role of the researcher in this research process and the outcomes of the research therefore do not usually generalise for different times and issues.

This research will adopt an interpretive approach because the objective is to understand the problem situation. A positivist approach will be adopted in the following two components of the research (Chapter 6 and 7). Overall the research described in this thesis will apply a multi-paradigm approach (Gioia and Pitre, 1990) and meta-triangulation at the methodology level (Lewis and Grimes, 1999).

4.3 Selection of Methodology

To accomplish the objective of this study, a combination of qualitative and quantitative approaches has been applied. The qualitative approach is characterised by flexibility and interpretation, while the quantitative approach by certainty and fixed structure. The qualitative approach is used to collect and understand human experiences and to discover the essential meaning of the problem situation under the analyst's investigation. This approach is used to show a way of interpreting, understanding and experiencing the social world holistically rather than breaking it down to be some patterns.

What has emerged from the literature review is that the systems approach is the appropriate paradigm to adopt in complex decision spaces that involve human interactions. In other words, the systems approach is suitable for analysing the unstructured problem situation (Checkland, 1981) or the 'wicked' problem (Rittel and Webber, 1984) or the 'messes' (Ackoff, 1979). Conklin and Weil (1997) summarised the key criteria of the 'wicked' problem as follows:

1) The problem is an evolving set of interlocking issues and constraints so there is no definitive statement of the problem.
2) The problem involves many stakeholders who care about and have their own opinion on how to solve the problem so the solution is social in nature. Therefore the right answer is not as important as having stakeholders accept whatever solution emerges.
3) The constraints on the solution, like availability of resources and political issues, always change overtime.
4) Since there is no definitive problem statement, there is no definitive problem solution. The process of solving the problem ends when the resources like time, money and energy run out, not when some perfect solution emerges.

It is clear that the issues revolving around agribusiness supply chains have the characteristics of a 'wicked' or 'ill-structured' problem making it appropriate to adopt a systems approach for their analysis. Further, agri-food supply chains have a significant human activity component therefore suggesting that a Soft Systems Methodology (SSM) (Checkland, 1981) approach will be applicable.

Quantitative approaches were applied for the analysis of the production system for dryland farming using a stochastic production function to compute technical efficiency and the analysis of the marketing system using marketing margin analysis, transaction cost analysis and relationship marketing. The main purpose of this approach is to make valid and objective descriptions of the phenomenon. A quantitative approach is usually used to discover principles and laws that can be extended to a larger population by manipulating some variables from the research objects. Moreover, this approach can accomplish high objectivity by minimising personal bias which may influence the analysis and interpretation of the data. Therefore personal contact between the researcher and research object should be kept to a minimum level. The research phenomenon must be understood by isolating and examining the interrelationship among variables in a control situation or at least under certain assumptions.

The first quantitative approach is the analysis of the farm production system. In general, there are two main quantitative approaches to analyse farm production systems: a mathematical programming approach and an econometric approach. Mathematical programming using both linear and non linear models is usually used to find an optimal solution that satisfies both the conditions of the problem and the objective (Pannell, 1997; Johannes, 2002). This approach can be effectively used if several basic requirements are met by the problem and the problem environment. According to Hughes and Grawiog (1973) and Hazel and Norton (1986), the application of mathematical programming requires some alternative courses of action that must be interrelated through some types of restriction; a clear objective that must be stated before the model can be built, and variables in the problem that must be clearly related either linearly or non-linearly to the resource used and the planned objective.

The econometric approach on the other hand is concerned with the empirical estimation of economic relationships among variables (Supranto, 2004). The econometric approach was preferred in this study as it allows identification of variables influencing productivity and technical efficiency that are statistically significant. Factors that may influence productivity include labour use, land use, use of inputs such as fertilisers and chemical, personal education, year of experience of the farmer and other personal characteristics (Coelli and Battese, 1996; Chaovanapoonphol *et al.*, 2005; Khairo and Battese, 2005))

Another quantitative approach utilised in this study is the analysis of the marketing system. One measurement in marketing system analysis is the value of marketing margin. Markets are said to be efficient if the price consumers ultimately pay adequately reflects storage costs, transportation costs and differences in price due to product form (Harris-White, 1995). Since price data is usually the most readily available and most reliable source of market information, the performance of marketing system is most often evaluated using price margins or marketing margin. Marketing margins may also fluctuate due to the perishability of the product, the number of actors involved in the exchange, the marketing services provided and the risk and uncertainty borne by each actor (Pomeroy and Trinidad, 1995).

By definition, marketing margin is the difference between the price at the consumer level and the price at the producer level. This means the calculation of marketing margin must involve all cost that must be paid by buyers to transact the trading commodity. Therefore, the analysis of marketing margin will be better if it is completed with the analysis of transaction cost.

Transaction cost theory primarily developed by Williamson (1979, 1985) assumes that various costs are associated with an exchange. These costs are comprised of the costs of obtaining and processing information, negotiating contracts, monitoring agents and enforcing contracts. These costs may become significant in the presence of information asymmetry, uncertainty and transaction specific investments.

The final measurement used to analyze the marketing system is buyer-seller relationship. Some literatures identify factors affecting the establishment and maintenance of buyer-seller relationships as the key constructs of satisfaction, trust and commitment (Anderson and Narus, 1990; Anderson and Weitz, 1992; Han *et al.*, 1993; Morgan and Hunt, 1994). Using the key dimensions of satisfaction (Frazier, 1983; Anderson and Narus, 1990), trust (Dwyer *et al.*, 1987; Moorman *et al.*, 1993; Ganesan, 1994; Morgan and Hunt, 1994) and commitment (Anderson and Weitz, 1992; Ganesan, 1994; Gundlach *et al.*, 1995; Morgan and Hunt, 1994), Heide and John (1988) and Frazier *et al.* (1989) have investigated in an atmosphere moderated by power and dependence. This means that the key construct of buyer-seller relationship is satisfaction, trust, commitment and power dependence. To identify each of this construct, factor analysis is employed for this study. The reliability of every factor is tested with the value of Cronbach Alpha.

In short, there are three kinds of measurement applied to analyse marketing system; marketing margin, transaction cost and buyer-seller relationship.

4.4 Survey Design

Lombok administratively consists of four district areas or municipalities - Mataram municipality, the West, Central and East Lombok Districts. For agricultural purposes, however, the island is divided into three zones: North, Central and South. This research was designed based on agricultural zones. The characteristic of each zone was described in Chapter 2.

Two zones, the north and the south, were selected as the areas for this study based on their characteristics (dryland, rainfall, cropping intensity and crop grown). The north zone has four sub-district areas with dominantly dryland areas, while the south has six (Table 4.1).

Table 4.1. Population of Farmers in Northern and Southern Zones of Lombok Island in 2001

Sub-district	Area (ha)
Northern Zones	
Kecamatan Gangga	2096
Kecamatan Bayan	**2300**
Kecamatan Sembalun	1984
Kecamatan Kayangan	1700
Southern Zones	
Kecamatan Sekotong Tengah	2302
Kecamatan Praya Barat	2463
Kecamatan Pujut	**5031**
Kecamatan Keruak	2083
Kecamatan Jerowaru	3356
Kecamatan Praya Barat Daya	1837

Source: West Lombok in Figure (2001) and Central Lombok in Figure (2001)

The sub-districts with the largest dryland areas from these two zones, were selected as the study areas. Those sub-districts are Kecamatan Bayan from the northern zone and Kecamatan Pujut from the southern zone. The selection of villages was based on the population of farmers (Table 4.2). Two villages, were selected from each sub-district, from which the sample was drawn. Those were Desa Akar-akar from Kecamatan Bayan and Desa Kawo from Kecamatan Pujut. One hundred per cent of the land used for agricultural purposes in these selected villages were classified as dryland.

Table 4.2. Population of Farmers for the Villages in Kecamatan Pujut and Kecamatan Bayan in 2001

Kecamatan Bayan		Kecamatan Pujut	
Village	**Population**	**Village**	**Population**
Akar-akar	**1366**	Pengembur	1591
Sukadana	876	Kuta	467
Anyar	1054	Rembitan	1211
Senaru	1259	Sengkol	1651
Bayan	1234	Teruwai	1622
Loloan	1094	**Kawo**	**1847**
		Ketara	441
		Tanak awu	1406
		Mertak	1587
		Pengengat	1244
		Gapura	540
		Tumpak	1003
		Segala Anyar	589
		Sukadana	1000
		Prabu	745

Source: BPP Bayan and BPP Pujut

The farmers' names were obtained from three sources, namely, the head of the sub-village or hamlet (*Kadus*), the leader of the farmer group organisation, and from extension workers. A total of 227 farmers from each village were randomly selected as respondents, giving a total of 454 respondents. Diagrammatically, the process is shown in Figure 4.1.

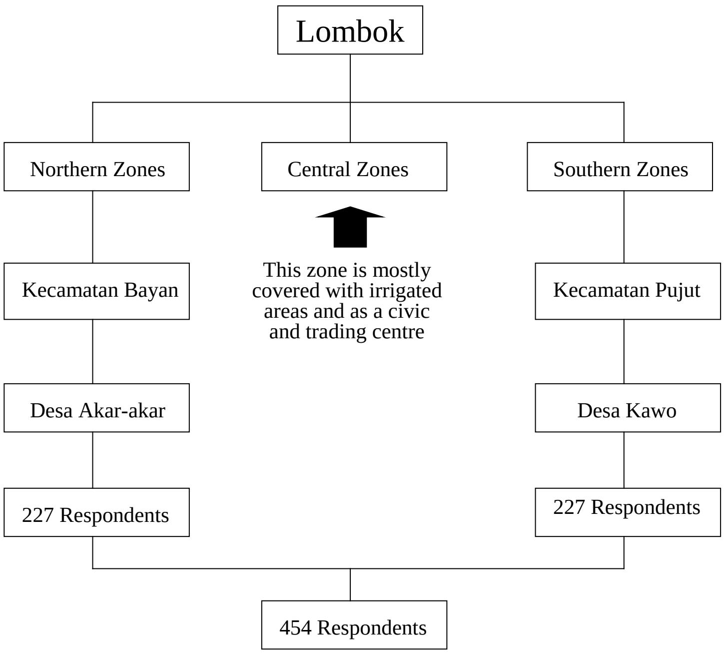

Figure 4.1: Survey Design

4.5 Data Required and Variables

4.5.1 Data Required

This study used qualitative and quantitative data from both primary and secondary sources. Primary data was collected from dryland farmers and consisted of data about the farm and the farmers. Farm data consisted of data about farm inputs (land or farm size, seed, labour, fertilisers, pesticides and growth stimulants and other farm inputs), output (production) and prices for both inputs and output. Data was collected for a period of one year, covering production for the dry season and wet season. The data about farming areas included land holdings, the farmed area, land ownership and planted area. Land holdings included all land held by the farmer under his right; farmed areas are the land that is farmed but may not be currently planted to crops; and planted areas are the land that are planted with crops by the farmer. Data about the farmers covered general characteristics such as age, education, farming experience, distance between farmers' residence and their farms, and the number of farmers' dependents.

Secondary data was collected from various agencies including the Office of Statistics Bureau, the Regional Planning Board, and the Agricultural Service Offices at the provincial, district and sub-district levels. Secondary data consists of data about dryland areas, rural credit systems, farm input availability at the sub-district and village level and other data regarding institutional support.

The farm information was collected using a questionnaire designed specifically for farmers. The questionnaires were pilot-tested with 20 respondents; 10 in each of the two selected villages for two weeks before the main survey commenced. The test led to an improvement in several areas such as the order of the questions, the unit measurement, improvements in scales and the general structure of the questionnaire. The questionnaire was translated to *Bahasa Indonesia* because most farmers in the research site only understand *Bahasa Indonesia* and their traditional dialect.

Each respondent was visited and interviewed face-to-face to gather reliable information because the respondents have a low-level of literacy and mail facilities in the villages are poor. The interview was conducted using the local language (Sasaknese and Balinese). An appointment for a convenient time was arranged and interviews were carried out on the farm. A field assistant was sometimes required to assist in communicating the questionnaire when the respondent only communicated in a traditional dialect. Other efforts (such as visual representations, gestures and demonstrations) were also employed to assist some illiterate farmers. This included explaining questions in different ways and conducting on-site visits to farmers' growing areas.

4.5.2 Variables and Their Measurement

The method of selecting and measuring variables for the production function vary from one researcher to another. Generally, most studies try to include as many relevant variables as possible based on time and resource considerations and model specification. The variables in this study consisted of variables for the frontier function analysis and variables for the regression analysis. The frontier function was constructed to measure the level of farm-specific technical efficiency, while the regression analysis was used to detect significant sources of farm-specific technical efficiency. The variables for constructing the production function are described below.

4.5.2.1 Farm size

In this study, farm size was defined as the total area of land that farmers cultivated. Although, farmers may cultivate crops in several parcels of land (eg. backyard garden), the main focus of this cultivation was the farm. Most of the crops cultivated in other places are usually done as recreation. In addition, the farming commonly practiced in Lombok is mix-cropping, meaning that one piece of land could be planted with several kinds of crop. However, in the study areas (dryland of northern and southern zones of Lombok) the farming practiced is monoculture.

Given this situation, the farm size considered as a variable for this study was the total size of the farmer's farm, measured in "*are*", which is equivalent to 100 m^2. This variable will not be included in the model if the model specification of the production function (i.e., output and inputs) is structured on a per hectare of land basis. The term "land" and "farm size" in this study are used interchangeably.

4.5.2.2 Fertilisers

There are two types of fertilisers commonly used by farmers in the research area: nitrogen in the form of urea (42 per cent N) and phosphorus in the form of SP36 (36 per cent P). The amount of fertiliser used is measured in kilograms, but for this analysis, the amount is converted into kilograms of Nitrogen and Phosphorus. The analysis only includes the fertiliser that is used by farmers in cultivating crops in their farm. This includes fertiliser purchased from suppliers, leftover stock from previous season, and gifts from others, if any that were used in current season. Data recorded did not include the fertiliser used by farmers in their backyard.

4.5.2.3 Seeds

Two kinds of seeds are used by farmers: certified and uncertified seed. Certified seed is provided by the government or a private organisation, authorised by the government. This seed is commonly distributed through village cooperative units or farm input shops. Uncertified seed is produced by farmers and can be bought directly from farmer producers or from the wet market. This seed usually has a lower germination rate than certified seed, but the price is cheaper. Normally, farmers use a larger amount of this seed for the same unit of land. Farm input suppliers in the village may provide both types of seed. This study recorded the seed variable in kilograms.

4.5.2.4 Pesticide

Pesticide is generally used for paddy in the research areas. Most farmers think that only paddy needs pesticides. Since there are several forms of pesticide applied by farmers, this variable is included in terms of its purchase value in rupiahs. Some farmers applied pesticides to their seed before planting; some used it several days after planting. Pesticides used can be in the form of granules, liquids, solids and powders. The use of pesticides is not part of the input recommended for farmers by the local agricultural extension station. The cost of pesticides is defined as the total expenses for purchasing all pesticides used for cultivating the crops on the farmers' farm.

4.5.2.5 Labour

Farmers generally use both family and hired labour. The labour used in farm management activities is the summation of labour employed for land preparation, nursery, planting, weeding and harvesting. Labour use in farming is man, oxen and tractors. Land preparation is mostly done using oxen or tractors beside human labour. For all other activities human labour is used. The variable labour is expressed in man-days for human labour and in Rupiah for machinery and animal costs.

4.5.2.6 Production

Production in the study was the gross production in standard form before subtracting costs such as wages and irrigation fees. Expenditure refers to the real cost of production activities and does not include the cost of purchasing inputs for stock, shares and rent of land. This is applied to express the real effect of all inputs to the real farm production. Traditional ceremonies in relation to farming activities like the cost of praying were not included in the expenditure. The portion of farm production consumed by farmers' family members was also included in the production variable. This variable is measured in terms of grain harvested in kilograms.

4.5.2.7 Technical efficiency

The level of farm-specific technical efficiency was obtained from the estimation made in the analysis of the frontier function and its value is between 0 and 1. This variable is used as the dependent variable in the regression model. The value indicates the percentage efficiency achieved by farmers in using their farm input and current level of technology.

The sources of technical efficiency differentials include variables that affect performance on the farm and may include such characteristics of the farm, farm management and farmer's characteristics. In this study, the following variables were examined in analysing farm-specific technical efficiency.

4.5.2.8 Age

This variable is measured in years. It is hypothesised that age indicates the level of maturity of farmers' mentality that in turn will affect the attitude towards farming. In rural parts of the country, the real age of farmers is very difficult to record particularly for those who are older than 40. This is because most rural people at that time did not consider it important to record their children's birthday.

However, most of the respondents knew the year they were born. For those who cannot remember the year of their birthday, the approach used is to recall specific events like a volcano eruption, colonisation and rebellions in relation to how old they were at the time, and use that to estimate the year they were born.

4.5.2.9 Farming Experience

As the farming system common in the research area is traditional farming system, the length of experience farmers have in managing the farm is hypothesised to affect the way crops are cultivated and managed. The more farming experience the farmer has, the more skilful the farmer is in managing the farm. This is expected to have an effect on the efficiency of applying farm inputs. As farming is the way of life in most rural areas, most farmers grew up in a farming environment. However, not all the farmers' children have responsibility for a certain amount of the farm. In this study, the number of years experience refers to the period farmers have been managing their own farm. Some farmers started managing the farm once they got married and inherited farmland. This variable is measured in number of years.

4.5.2.10 Education

Education in this study is limited to formal education such as primary, high school and college or university tuition. Informal and non-formal education like vocational courses, participation in focus group discussions and participation in lectures conducted by extension workers were not considered as education in this instance. The number of years of schooling completed by the household head was used as a measure of education. It is hypothesised that a combination of educational level and farming experience may lead towards a better assessment of the management decisions and in turn affect the efficiency of farm input use.

4.5.2.11 Distance

Distance between a farmer's house and farm is also considered to have an effect on the allocation of farm inputs used. Some farmers receive their farm input from the supplier at their place of residence and not on their farm. This is because the time required to use the input does not match the time of obtaining inputs from suppliers. It is even worse if farmers use credit facilities either from the government or from private sources. As a consequence, farm family members have to take their farm inputs from their house to their farm. At first, the variable distance is measured in minutes taken for walking from their residence to their farm. Due to most farmers do not know the time they spend for walking from their residence to their farm, this variable then is stated as dummy with 1 for farmers whose farm inside their residential sub-village and 0 otherwise.

4.5.2.12 Credit

Some farmers in the research areas use credit to obtain farm inputs. There are two kinds of credit normally used by farmers; 1) credit from the government which is commonly in the form of farm inputs; and 2) credit from private sources which can be in the form of farm inputs and/or cash. The sources of private credit are relatives, rich farmers, private usurers or *lintah darat* and friends. It is hypothesised that farmers using credit work more carefully in managing their farm because they have an obligation to repay the credit. Therefore, this will affect the application of farm inputs in cultivating crops. Availability of credit may also influence access to application of inputs.

4.6 Questionnaire Design

For the purpose of gathering qualitative data for the application of Soft System Methodology, semi-structured questionnaires were developed based on the manual of Wilson and Morren (1994). Some modification from the questionnaire was conducted based on the topic of this study and the results of a pilot survey.

For the purpose of gathering data on the hard systems a semi-structured questionnaire developed by Batt (2003) was used to obtain the desired information with some modification based on the results of a pilot survey and adaptations to fit the prevailing marketing system in Lombok for the four target commodities. The questionnaire for farmers was slightly different from that for farm input suppliers and market intermediaries. The questionnaire for farmers consisted of four sections: 1) characteristics of the respondent, 2) farm production activities, 3) marketing farm produce, and 4) buyer-seller relationships. The questionnaire for market intermediaries did not include a section on farm production activities.

Section 1 sought to gather information about the supply chain participants including farmers, farm input suppliers and the intermediaries' household that may influence their business decisions. Questions in this section included issues such as: the number of people in the respondent's household, employment in the family, the level of education of each family member, the period of time the respondent had been in business, marital status, the age of every family member and the distance between the respondent's home and the business.

Section 2 sought to describe the farming activities from land preparation until post-harvest handling including farm resource allocation for every activity. This section was based on the study of farm productivity in West Timor (Benu, 2003), farmer cooperative performance in West Lombok (Tanaya, 1998), and dryland farming on Lombok Island (Usman, 1997). This section sought to gather information needed for the analysis of farm production system (Chapter 6).

A section about farm product marketing was included in the questionnaire for farmers and market intermediaries but not for farm input suppliers. This section sought to gather information that was needed for the analysis of the marketing margins at each step of the supply chain. Some questions were based on a previous study of fresh produce marketing conducted by Batt (2003). For example, questions about the harvest time; about the proportion of farm produce that was sold, retained for seed, consumed as food or given away; and the average price per kilogram for produce that was received from the buyer. This section also contained questions about both the buying and selling price as well as the cost of performing various activities such as grading, sorting, packing, storing and transporting the produce. This data was used to calculate the price margin for market intermediaries.

The questions which were needed to undertake the gap analysis were included in Section 4 on buyer-seller relationships. These questions sought to gather information about the product and service quality that was expected by the buyer and the capability of suppliers to fulfil buyer's expectations. Respondents were asked to answer the questions on a scale from 1 to 6 where 1 was "not at all important” and 6 was “very important”, and 1 was “not at all well” and 6 was “very well”.

Monzcka *et al.* (1998) suggested that customers will choose suppliers who can provide the desired amount of goods within predetermined quality specifications on time at an agreed price. This means that ‘quality’ plays a significant role in the process of selecting business partners. Based on Batt (2003), questions about the desired variety, the desired physiological age, the product purity, the desired size and freedom from pests and disease, as factors in choosing upstream trading partners were applied. These questions began with the words “I choose my trading partner who is able to provide product…”

1. of the desired variety
2. that has high purity
3. of the desired size
4. that is free from pest and disease
5. that is free from physical injury
6. that is graded well
7. has the dryness desired
8. has the maturity desired
9. is packed appropriately

Based on the work of Cunningham and White (1973), Dempsey (1978), Ellram (1990), Hakansson and Wootz (1975) and Lehmann and O’Shaughnessy (1974), a number of questions were asked that sought to evaluate the extent to which the trading partner was able to deliver the product to the customer. These questions began with the word “I choose my trading partner who…”

10. is able to provide farm product that is available in the required amount
11. is able to deliver farm product on time
12. is placed a suitable distance from my farm/warehouse
13. offers a competitive price for farm products

From the industrial purchasing literature reported by Athaide *et al.* (1996), Dempsey (1978), Ellram (1990), Ellram (1991) and Lehmann and O’Shaughnessy

(1974), the supplier's willingness to support downstream customers was explored. These questions began with the words, "I choose my trading partner who…"

14. takes my farm product soon after harvesting
15. has a good reputation
16. has many strong customers
17. is financially strong
18. provides credit or loan
19. provides technical information
20. frequently communicates with me
21. frequently visits my business

In exploring the long term relationships between upstream suppliers and downstream customers', the constructs of satisfaction, trust, commitment, power dependence, communication, relationship-specific investments and personal relationship were pursued using the measures developed by Batt (2003). Respondents were asked to respond to 25 questions on a scale from 1 to 6 where 1 was "I disagree a lot" and 6 was "I agree a lot". Questions for each construct were as follows:

Trust

I trust my trading partner

My trading partner often considers my best interest

I have confidence in my trading partner

I think my trading partner is honest with me

My trading partner always keeps their promises

My trading partner gives me the best offer

Satisfaction

My trading partner often meets my requirements

Dealing with my trading partner is less risky

I think my trading partner treats me fairly

There is good cooperation with my trading partner

Communication

My trading partner usually informs me of price changes

My trading partner often asks about the way they have rewarded me

My trading partner often makes suggestions on how to improve our trading method

It is easy to find my trading partner

Power Dependence

I am free to choose my trading partner

My trading partner has the power in making decisions

I have to agree with my trading partner's decision

I am more dependent upon my trading partner than they are upon me

Commitment

A long term relationship with my trading partner guarantees a sale for my product

I plan to continue my business with my trading partner into the future

Relationship-Specific Investment

My trading partner usually offers financial assistance to me

Personal Friendship

I have a close personal friendship with my trading partner

The questionnaire was prepared in English and translated into *Bahasa Indonesia*. Translation was conducted solely by the researcher. There were no significant problems experienced in the process of translating the questionnaire. However, some technical terms like 'supply chain' and 'variety' were retained because of the difficulty in finding appropriate words in *Bahasa Indonesia*.

Before conducting the main survey, the questionnaires were tested on 20 respondents (10 in the Northern zone and 10 in the Southern zone) of Lombok for reliability and appropriateness.

Some significant changes were made as a result of this preliminary testing. The proposed 7 point scale was reduced to a 6 point scale. During the pilot testing, the first 18 respondents selected the neutral mid point (4) for their answer. The scale was changed to a 5 point and again tested with 14 different respondents to again find that most chose 3 for their answer.

After discussions with the village head (*Kepala Desa*), religious leaders (*Imam and Tuan Guru*), and agricultural extension workers (*Penyuluh Pertanian*

Lapangan), the researcher realised that the respondents felt safer if they chose the neutral mid point. This situation forced the researcher to conduct a third pilot test using a scale from 1 to 6. The aims and objectives of the survey were explained to all respondents. The survey was absolutely free of political nuance. Moreover, the respondents were free to choose whether they provided personal information. This test provided a much better result than the previous two. Therefore, the scales ultimately used for the questionnaire were all 6 points scale.

4.7 Data Collection

Lombok Island has two dryland zones (Northern and Southern zones). The process by which the two villages were chosen was discussed in Section 4.4. Basically, the selection of the survey area was based on purposive sampling.

Respondents for this study were dryland farmers, farm input suppliers, collector agents, wholesalers, and inter-island traders.

The first step in the data collection process involved applying for permission from the Regional Planning Board both at the provincial and district level. With a formal letter of consent, the researcher was able to approach the head of the village and to cooperate with religious leaders and the leaders of farmer groups. The names of individual respondents were collected from the farmer groups. Based on this information, farmer respondents were selected randomly. The contact name and address for additional respondents like farm input suppliers and farm produce traders were sought during the interviews with farmers using the snowball technique (Kumar *et al.*, 1999).

The survey was conducted from December 2001 until August 2002 with 454 dryland farmers, 20 farm-input suppliers, 51 collector agents, 31 wholesalers and 7 inter-island traders. Face-to-face personal interviews were the only appropriate means of gathering the information required from respondents. As some respondents were not able to speak *Bahasa Indonesia*, the interview was sometimes undertaken in a local dialect with the assistance of local people. The researcher often requested the respondents to show him their farm and what they did to confirm the data accuracy.

For SSM, the main data collection methods are document review, interview, and observation. Document review is acknowledged as an integral part of qualitative research (Denscombe, 1998; Nasir, 2004). Documents reviewed included regional statistics of the sample villages and subdistricts, organisational profile of farmer groups, and the data base of the Department of Agriculture offices in Kecamatan Bayan and Kecamatan Pujut. Data from these documents were mostly used to consider the number of respondents who will be interviewed and to understand more about the activity of village organisations.

In social research, interviews are often seen as the appropriate method to collect data. Interviews offer a unique opportunity to systematically catch the respondents' subjective interpretation of the studied phenomenon. Once interviews are used as a method of collecting data, the analyst must accept the duality of mind and reality. Positivists view this method as merely a technique for data gathering, but an interactionist is bound to view this method as a symbolic order based on interactions. The relation between the interviewees and the world they describe affects the communication as well as the language, and it is necessary to think twice before claiming that interviewees give information to real facts about the world. It is dangerous to accept all that might be said in interviews as truth. This calls for rigor, awareness and reflection. This insight can be especially important for post-positivists.

Denscombe (1998) and Nasir 2004 stated that there are three main types of interviews: 1) structured interviews where there is a tight relationship between the list of questions and the answers expected from the interviewee, the interviewees response is limited to the scope of the question list; 2) semi-structured interviews where the interviewer still has a clear list of issues to be covered; this type of interview is more flexible in terms of topic development because the interviewees are provided with room to develop their own ideas as long as it does not divert too much from the main point; and 3) unstructured interviews occur when the interviewee has freedom to develop ideas, the interviewer only introduces the topic and then the interviewee develops his own responses with no interference.

The interviews applied in this SSM study have been arranged as semi-structured. This is because semi-structured interviews provide a balance between the freedom of the interviewee to develop their own responses and the need for fixed control over the topic in a flexible manner.

Often the statements of the interviewees have been repeated and concluded in order to avoid misunderstandings. At the commencement of the interview, respondents were advised that their participation was entirely voluntary and that their responses would be used only for the intended research purposes. The interviews were done in the respondents' normal environment, to benefit from the advantages this brings, a fact that thus also has meant various interruptions. The semi-structured questionnaire used in this SSM can be seen in Section 5.2.1.

Dingwall (1997) described the two basic methods of data collection in qualitative research as interview and observation. One is asking questions and the other is 'hanging out'. The advantage of conducting direct observation is to taste, smell and experience the case study observed in order to really get to know the phenomena that is being studied by the researcher. Observation also provides the possibility to avoid interview bias caused by the 'interview society' – a situation where interviewees act and talk in interviews as they think they are supposed to (Silverman, 1993). To support the answer from the interview, it is possible to verify by observing what is really going on. This is an example of the need for triangulation, caused by the discrepancy between the actions and the interview answers.

In this study, observation was undertaken to identify tasks performed in the respondents' business and the tools employed to manage the farm and trading business; to observe interactions between supply chain actors and systems; produce logs, "day-in-the-life-of" descriptions; or to make drawings of structures/layouts; record video or take photos; and observe participants.

On average, it was only possible to complete three interviews with farmer respondents per day. However, for the other respondents, it was possible to complete four to five per day. In order to reduce the fatigue for both the respondent and the researcher, the interview situation was very relaxed and informal with the researcher providing coffee and cigarettes (even though the researcher does not smoke).

4.8 Data Analysis

Three kinds of data analysis were employed for this study: data to develop a rich picture of the SSM; data for farm production analysis; and data for the marketing system.

4.8.1 Data Analysis for SSM

Descriptive analysis was used to show the general outcome and reason for the frequency distribution in the survey. The analysis included a summary derived from the samples that were used to condense or graphically illustrate the data, providing clear descriptions of the univariate responses. Descriptive analysis is concerned with the ways of collecting and organizing data. The descriptive analysis of this study was used to describe the characteristics of the variables in terms of their frequency distribution and percentages. The descriptive analysis was focused on the socio-economic profile of respondents.

The analysis to be performed on the rich picture of the SSM was comprised of the following:

1) Intervention analysis - identifies the issues that people involved in the situation regard as problematic in the agribusiness supply chain for dryland farm products.
2) Social analysis - identifies the roles supply chain actors play along the supply chain, the norms of behaviour those actors display, and the values by which their behaviour is judged.
3) Power analysis - is concerned with such issues as “What are the commodities of power in this situation?”, “How is the commodity obtained?”, and “How is the commodity passed on?”

The problem-owners provide the input for the process. The researcher performs an analysis on the soft system and ends up with a rich picture of outputs. This rich picture bridges the communication between the researcher and the problem-owner. The rich picture is used to identify problems and to inform the problem-owners of the situation, rather than provide possible solutions. The next steps after developing the rich picture follows the seven step of SSM by Chekland and which detail can be seen in Appendix 2.

4.8.2 Data Analysis for Farm Production System

For the farm production system, appropriate model specifications were made for the empirical stochastic frontier analysis and the model for identifying sources of farm-specific technical efficiency levels.

4.8.2.1 Empirical Stochastic Frontier Model

Identifying the functional model in empirical research is vital because it will directly affect the result. Gujarati (2003) suggested that a model should be developed with respect to biological, economic and environmental considerations. This implies that the model adopted and developed should reflect the nature of the study. Hendry and Richard (1983) suggested five criteria in selecting a model: 1) the model should be consistent with the theory as indicated by the sign of the parameters; 2) data admissibility - the ability of the model to produce a logical prediction; 3) data coherency - the power of the model to explain the studied phenomena; 4) parsimony which is related to model specification; and 5) parameter consistency, that is, the ability of the model to predict. Cody and Smith (1985) suggested emphasising common sense and the principles of parsimony in deciding a model. A flexible model is usually preferred because it does not involve restrictions on both the parameters and technical relationships among inputs used.

The production function in this study can be represented by:

$$y = f(X_1, X_2, \ldots, X_n, \varepsilon)$$

Various model specifications were tested using R^2, F-test and LR test. The Cobb-Douglass production function was selected for this study because a Cobb-Douglass model is suitable for describing the farm production process (Soekartawi, 2001). Moreover, this model has been widely used to describe farm production activities (Soekartawi, 2001). The model is elaborated in sub-sections

6.2.4. Application of this model was tested with the value of R-square in the OLS model and the value of Log-Likelihood Ratio Test in the Maximum Likelihood estimation as statistical goodness of fit (see Section 6.5.2).

The analysis was carried out in two stages. Firstly, the Cobb-Douglass production function was estimated using Ordinary Least Squares (OLS) method. This analysis was done to determine significant variables that affect production output. Stochastic frontier production function analysis was then conducted (stage 2). Separate models were specified for paddy, corn and soybean. The Cobb Douglas model is given below:

$$Y = \beta_0 X_1^{\beta_1} X_2^{\beta_2} \ldots X_i^{\beta_i} \ldots X_n^{\beta_n} e^u \qquad (5.18)$$

This equation can also be rewritten as follows:

$$\ln Y_i = \beta_0 + \sum_{i=1}^{n} \beta_i \ln X_{ij} + \varepsilon_i \qquad (5.19)$$

where:

Y_i = dryland farming production such as paddy, corn, peanut or cassava in kg;
X_{1i} = amount of fertiliser used in crop cultivation in kg,
X_{2i} = amount of seed used in kg,
X_{3i} = cost of pesticides used in *rupiah*,
X_{4i} = human labour used in man days,
X_{5i} = animal/tractor power used in oxen days,
ε_i = error term
ln = natural logarithm, i = 1,…n.

The second step is constructing the stochastic frontier production function with the selected variables from step one. The formulation of the stochastic production frontier model is as follows:

$$\ln Y_i = \beta_0 + \sum_{i=1}^{n} \beta_i \ln X_{ij} + \varepsilon_i \qquad (5.20)$$

where: the variables X_{ij} are the dependent variables as determined in step 1 and ε_i is the error term which is equal to $v_i - u_i$. Therefore, the complete stochastic frontier model is:

$$\ln Y_i = \beta_0 + \sum_{i=1}^{n} \beta_i \ln X_{ij} + (v_i - u_i) \tag{5.21}$$

The v_i is the two-sided "noise" component which captures random variation in output as a result of factors outside the control of farmers (Coelli *et al.*, 1998). This component is assumed to be independently and identically distributed (iid), symmetric or $v_i \sim iidN(0, \sigma_v^2)$ and independently distributed of u_i. The density function of the v_i is as follow.

$$f(v) = \frac{1}{2\pi\sigma_v} \exp\left\{ -\frac{v^2}{2\sigma_v^2} \right\} \tag{5.22}$$

The u_i is the nonnegative technical inefficiency component of the error term (ε_i). This component is assumed to be independently half normal distributed or $u_i \sim iidN^+(0, \sigma_u^2)$. The density function of the u_i is:

$$f(u) = \frac{2}{2\pi\sigma_u} \exp\left\{ -\frac{u^2}{2\sigma_u^2} \right\} \tag{5.23}$$

This distributional assumption has been employed in several empirical works for a long time like the work of (Battese *et al.*, 1996; Kebede, 2001; Kibaara, 2005). The value of u_i is the ultimate objective of the estimation. This can be achieved if separate estimates of the noise component v_i and the technical inefficiency u_i can be extracted from the error term (ε_i) for each farm. Using both density functions of v_i and u_i above, the estimation of TE can be expressed as follows.

$$\mathrm{TE}_i = \exp(-u_i) \tag{5.24}$$

This value is estimated based on the stochastic frontier function analysis (Battesse and Coelli, 1995; Coelli *et al.*, 1998). The parameters of the stochastic frontier function and technical inefficiency are estimated by the maximum likelihood method using the computer package FRONTIER Version 4.1 by Coelli (1994).

4.8.2.2 Determinants of Technical Efficiency

The determinants of farm-specific technical efficiency were analysed using regression analysis using OLS. The model is specified as:

$$U_i = \gamma_0 + \gamma_1 z_{1i} + \gamma_2 z_{2i} + \gamma_3 z_{3i} + \gamma_4 z_{4i} + \gamma_5 z_{5i} \qquad (5.25)$$

where,

U_i = value of technical efficiency for the *i*th farmer

z_{1i} = age of the *i*th farmer in years

z_{2i} = experience of *i*th farmer in years

z_{3i} = education of *i*th farmer in years

z_{4i} = dummy of farm location for ith farmer (1 if inside own sub-village and 0 if outside)

z_{5i} = dummy of credit usage for ith farmer (1 if using credit and 0 if not using credit)

Based on expectations and logical assumptions, the expected sign for these variables are summarised in Table 4.3 below.

Table 4.3. Parameters Used to Determine the Value of Farm-Specific Technical Efficiency

Parameter for	Expected sign
Age	Positive
Education	Positive
Experience	Positive
Location	Postive or negative
Credit	Postive or negative

As the value of farm-specific technical efficiency is between 0 and 1, the application of OLS is suspected to yield biased result toward zero. Therefore, the maximum likelihood estimation (MLE) method was applied to estimate the regression parameters.

4.8.3 Data Analysis for Marketing System

Three kinds of analyses were utilised for the marketing system. After finishing the survey, all data were entered into EXCEL. The choice of EXCEL was based on the ease with which the data could subsequently be transferred into packages like Frontier and SPSS.

The price margin was calculated from the difference between the selling price and the buying price and the various costs of sorting, grading, packaging and transporting produce. The price margin can be formulated as follows:

$$PM = SP - (BP + TC)$$

Where:
PM : Price Margin
SP : Selling Price
BP : Buying Price
TC : Transaction Costs

Gap analysis aimed to reveal the gap between the customers' expectations and the capability of the supplier to meet these expectations. The analysis used the paired sample t-test from the SPSS package. The level of significance sought was 95 percent ($p = 0.05$).

To determine whether there was any significant difference between the market intermediaries' requirements at each step in the supply chain, the analysis of variance (ANOVA) was employed. The post-hoc Honest Significant Difference (HSD) was applied to identify any significant difference between the observations.

A similar procedure was utilised to explore differences in the relational dimensions between farmers and market intermediaries and between the market intermediaries themselves. In the first instance, the downstream relationships with customers were explored. In the second instance, the upstream relationships with suppliers were investigated.

Factor analysis was undertaken for these two purposes. Exploratory factor analysis was undertaken to identify any underlying constructs, for it seemed highly unlikely that farmers would use all criteria offered in the questionnaire in making their decision. Since the majority of the scales used to evaluate the nature of the supply chain actor's relationship with their up and downstream layer were untested, exploratory factor analysis was undertaken to identify which variables loaded onto their intended construct and those which cross-loaded across multiple constructs.

Factor analysis is a general scientific method for analysing data. There is no restriction on the content of the data used in this method. It is a procedure that takes a number of variables and investigates variables to determine whether they have a small number of factors in common that account for their inter-correlation.

Factor analysis is used to reduce the number of variables to a manageable level so that the basic structure of the underlying set of variables is found. This type of procedure groups the variables into independent factors in with each factor represents a scale measure of some dimension. Weights were given to each variable. Factor analysis usually proceeds in four steps:

1) The correlation matrix for all variables is computed. Variables that do not appear to be related to the other variables can be identified from the matrix and associated statistics. In other words, the correlation matrix can develop a set of correlation between all identified intervally-scaled variables;
2) A set of initial components is extracted from the correlation matrix so that the data can be determined;
3) The initial components are rotated to find a final solution and make them more interpretable; and
4) The scores for each factor will be computed and then used in a variety of other analysis.

The factors are inferred from the observed variables and can be estimated as linear combinations of them. The general estimation of *j*th factor F_j can be written as follows:

$$F_j = \sum_{i=1}^{p} W_{ji} X_i = W_{j1} X_1 + W_{j2} X_2 + ... + W_{jp} X_p$$

where,

Wj's = factor score coefficients

p = number of variables

In each instance when factor analysis was employed, the supply chain actor’s responses were analysed using principal component analysis, with varimax rotation and Kaiser normalisation. Those items with factor loadings below 0.5 or with cross-loadings greater than 0.4 were excluded (Nunnally, 1978). Further clarification of the items contributing to each factor was achieved by applying the reliability coefficient (Cronbach, 1951). Where the alpha coefficient was below 0.5, the factor was excluded from further analysis.

4.9 Chapter Summary

In examining the agribusiness supply chain for dryland farming products in Lombok, the study sought information not only from the supply chain actors but also from other participants considered important in the supply chain such as transporters, cooperatives and governmental personnel. Specific research design adopting document reviews, observations and semi-structured surveys helped to ensure that the objective of data collection was accomplished. The study location was selected under purposive sampling based on the information from database from governmental institutions. Farmer respondents were selected under random sampling based on information from farmer group leaders. Then, the snowball technique was subsequently employed to identify other potential respondents from farm input suppliers, collector agents, wholesalers and inter-island traders.

Although the questionnaires were originally prepared in English, the questionnaires used in actual the interviews were translated to Bahasa Indonesia and some had to be delivered in the local dialect as most of the respondents do not understand English and not even Bahasa Indonesia. Several considerations were taken into account in formulating the questions, carefully selecting words that can be understood by respondents.

The procedures for data analyses were carefully designed and selected to meet all of the study objectives. The SSM as described by Checkland was used as the main analytical framework for this study. As part of the SSM two hard systems analyses (farm production analysis and marketing system analysis) were used to enhance the robustness of qualitative findings leading to a better understanding of the agribusiness supply chain, holistically.

Finally, attention was given to bias response errors to avoid interview fatigue. Having an appointment with the potential respondents to arrange time and conducting interviews in the respondents' houses were expected to reduce the error. Conducting interviews at night in a more relaxed situation and drinking coffee and smoking cigarette were also some of the things done to ease respondent fatigue.

Chapter Five

SOFT SYSTEMS ANALYSIS IN AGRIBUSINESS SUPPLY CHAIN

5.1 Introduction

The agribusiness supply chains (SC) for small farmers in Indonesia are, like other supply chains, complex and the efficiency of their operation is heavily dependent on the often complex interaction of human activities on the flows of products and information. These characteristics make them appropriate for analysis with soft systems methodology (SSM). This chapter begins by describing the application of SSM to the agribusiness supply chain for dryland farming products in Lombok Island (Section 5.2). Section 5.3 reflects on the application and the last section (Section 5.4) summarises the research and discusses the place of SSM in the analysis of agribusiness supply chains.

5.2 Application of SSM in Agribusiness Supply Chain

The methodology adopted for this section of the research is the SSM mode 2 approach which involves seven stages. This section describes the application of this methodology to the agri-food supply chain associated with dryland farming systems in Lombok, Indonesia.

5.2.1 Understanding and Describing the Situation

The main objective of conducting this first step is to derive the richest possible picture of the supply chain management associated with dryland farming systems in Lombok. This step was started with the collection of secondary data from official governmental sources like the Department of Agriculture at district and sub-district level. Two subdistricts, one subdistrict in the northern zone (*Kecamatan Bayan*) and another in southern zone (*Kecamatan Pujut*) were selected as the focus of the research. These subdistricts were selected because each of them had the largest dryland areas in their zone and characterised the broad problems found in the dryland farming systems supply chain.

Two villages (or *desa*) of two sub-districts (or *kecamatan*) were selected, one from each of the northern and southern zones. The northern village was Desa Akar-akar of Kecamatan Bayan and Desa Kawo of Kecamatan Sengkol in the southern zone. The villages were purposively selected based on the criteria that the farming in each was 100 % dryland and because each village had the largest dryland area in its zone.

Data for this study was collected from December 2001 to August 2002. Farmers and other supply chain participants were asked to respond to a comprehensive survey instrument which sought to obtain information about the dryland farming agribusiness supply chain system. Therefore the data collected covers farm input procurement, production practices, post-harvest processing and marketing.

An initial meeting was held with the head of each village, extension workers, community leaders, and religion leaders to determine the key people who were involved in the supply chains to be studied. These local key informants were able to identify the key small farmers, intermediaries, farm input suppliers and retailers for each of the supply chains.

The first phase of this step was guided by the following questions proposed by Checkland (1981):

1. What resources are deployed in what operational processes under what planning procedures within what structures in what environments and wider systems, by whom?
2. How is the resource deployment monitored and controlled?

These two questions were elaborated to be more appropriate for the focal supply chains. The resulting questions were:

1. Can you describe, in detail for all inputs, how small farmers in this village purchase farm inputs?
2. When farmers purchase inputs how do they choose their inputs, how do they pay for them and how do they get them delivered, etc.?

3. What are the concerns and opportunities available, including what could be done by suppliers, farmers, government, cooperatives etc to enhance or mitigate these?
4. What are the advantages and disadvantages of this farm input purchasing method to the farm business and why?
5. What are the advantages and disadvantages of this farm input purchasing method to your farm input supplier business and why?
6. Describe in detail the methods used to produce each crop grown?
7. What production activities are adopted and what are the farmers concerns about using these production methods?
8. What programs or activities could be used to enhance the production methods and by whom?
9. Why do individual farmers choose particular production methods?
10. Descriptions of how farmers sell their farm produce including the payment and delivery methods?
11. What are the advantages and disadvantages of each potential selling method to the farm business and why?
12. What are the advantages and disadvantages of this selling method to intermediaries' businesses and why?
13. What are the issues surrounding about the process of buying and selling farm produce in this village/subdistrict/district?
14. What is the role of the government including village unit cooperatives to the marketing methods available?
15. Who would normally initiate changes to selling methods should they be needed?
16. What is the ideal buying and selling method for farm produce from this village?

In general farmers purchased their farm inputs from input suppliers from their own village although a small number either didn't purchase inputs for particular crops or their inputs were supplied by the landowner. In the past almost all farmers purchased inputs through farm cooperatives called KUD which had their main offices in the major sub-district towns or one of the local village service posts (between 4 and 6 posts per village). They also received credit facilities from government.

The cooperative are now not working properly because all support has been removed and the subsidies for farm inputs were stopped in 1998. This situation drew a range of responses from input suppliers, farmers, extension workers, and governmental official workers in village level. Farmers preferred the earlier situation when the distribution of farm input was handled by cooperatives and they were subsidised. However, the input suppliers and extension workers preferred the current situation.

Full details of the production methods adopted by the farmers in the focus villages is described in Chapter 6 but in general most farmers applied very traditional production methods. Levels of mechanisation were found to be low and extension workers rarely visited farmers to help them improve their production methods. The contact farmers had with extension workers was usually at harvest time when the extension workers helped link the buyers to farmers with crop available to sell. However, the farmers could not ascertain whether the extension workers earned money from the buyers for this service.

Most farm produce was sold to *tengkulak* or village intermediaries because the farmers were able to earn cash immediately, could sell small amounts of product at a time, faced less rigorous selection and grading processes and they normally knew each other. There are three kinds of *tengkulak* operating in the villages. The first uses their own money to buy product and then on-sells to other intermediaries. The second group are those who buy on contract for higher-level intermediaries and the third group are speculators who establish a deal with the farmers and then look for a buyer. If they are unable to find the right buyers, they will find an excuse to cancel the deal with the farmer. Farmers continue to use this latter group despite the uncertainty because they generally pay the highest prices. Inputs from government official workers from the Department's of Agriculture, Trade and Industry, and the National Logistic Board in the process are so low as to be insignificant.

The information collected from formal sources, the farm survey and casual discussions with supply chain participants have been collected into the rich picture shown in Figure 5.1 and synthesised into the problem definition shown in Figure 5.2.

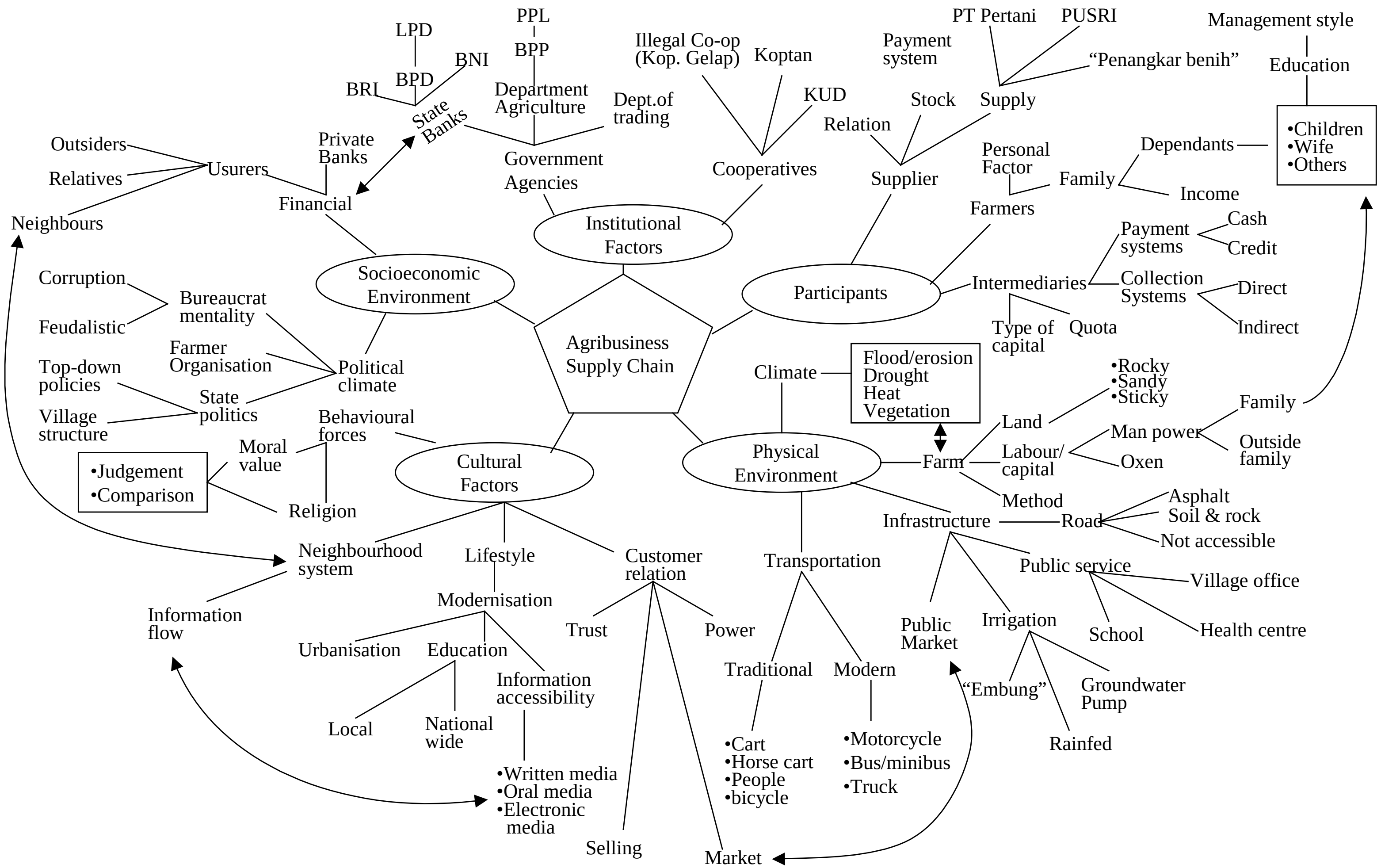

Figure 5.1: Rich Picture of Dryland Farming Supply Chain

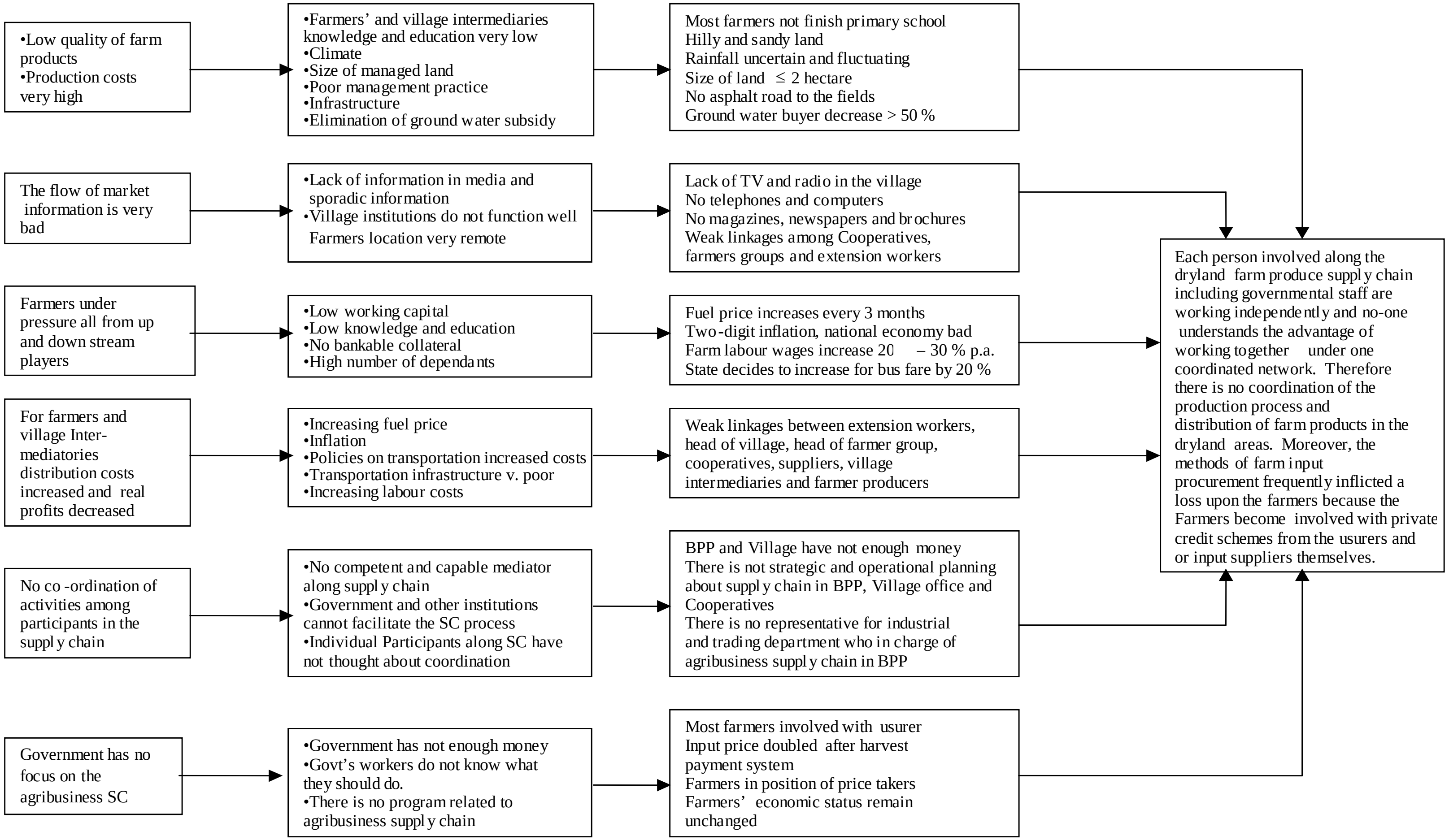

Figure 5.2: A Synthesis of Problem Situation of Dryland Farming Supply Chain

5.2.2 Structuring the Problem Situation

In this step, the researcher created the transformation statements which describe the basic features of an improved situation related to the dryland farming supply chain. These statements indicate how the problems should be transformed to achieve an improved situation. This transformation is also called the relevant system, because it must be relevant to the process of improving the situation. This definition was created using CATWOE; a mnemonic that consists of six items explained in Table 5.1.

Table 5.1. The Elaboration of CATWOE Characteristics (Smythe and Checkland, 1976)

Consideration	Amplification
Customer (C)	Client of the activity, beneficiary or victim, whoever is affected by the main activity(ies). The indirect object of the main activity verb(s).
Actor (A)	The agents who carry out, or cause to be carried out, the transformation process(es) or the activities of the system
Transformation (T)	The core of the root definition. A transformation process carried out by the system. Assumed to include the direct object of the main activity verb(s).
Weltanschauungen (W)	The (often-unquestioned) outlook or taken for granted framework which makes this particular root definition a meaningful one.
Ownership (O)	The owner of the system, control, concern or sponsorship; a wider system which may discourse about the system.
Environmental and Wider System Constraints (E)	Environmental impositions. Perhaps interactions with wider systems other than that included in step 1 above, these wider systems being taken as given

Root definitions created using the CATWOE characteristics can be guided by the following questions with the root definition then being developed around the answers to these questions.

1. What is the fundamental change that comes about if the situation described in the statement is brought into operation?
2. How will that change be brought about?
3. Who will be managing and responsible for the improved situation?

4. Who will be the beneficiaries from the change?
5. Who will be negatively affected by the change?
6. Who will have the necessary authority (power) to stop the process of the change?
7. What are the basic principals, views, values and assumptions on which the statement of improvement rests?

From the data in step 1, the following three transformation statements can be expressed as major concerns.

1. No coordination exists between the participants in the dryland farming supply chain.
2. There is no institutional structure that allows farmers to procure farm inputs and distribute farm products where they have some power.
3. The supply chain lacks appropriate market signals that link consumer desires with the farm production systems.

These concerns were then developed into “relevant systems” for the formulation of “root definitions”. One transformation statement can be used to represent one or more relevant systems. In this case a transformation statement was developed for each relevant system. The relevant systems developed are:

1. A system to coordinate all participants along the dryland area farm produce supply chains in Lombok.
2. A system to establish a local farmer institution that can procure farm inputs and distribute farm produce efficiently and effectively for the benefit of farmers.
3. A system that transmits consumer desires to farmers and includes agricultural extension workers.

These relevant systems were further developed into the following “Human Activity Systems (HAS)” or “root definitions”.

Root Definition 1

A system in which farm production from Akar-akar and Kawo villages is distributed within a coordinated supply chain which has a fair distribution of profits and good information flows in both directions through the supply chain.

Customers: Suppliers, farmers and other participants along the supply chain will earn direct benefit. Indirect benefit will go to state banks and other governmental agencies that are involved in the supply chain. Some *tengkulak* will possibly decrease their profit. Some wholesalers may face a decrease in their profit in the short term, but they will receive net benefits in the long run.

Actors: All participants within the supply chain including final consumers

Transformation: From an uncoordinated to a coordinated supply chain.

Weltanschauungen: A continuous supply of standard quality product with a fair sharing of profits along the chain.
Increase value added of product at every step along the supply chain

Owner: All participants along the supply chain including government agencies that are involved with the supply chain will own the system.

Environment: The supply chain will shift from one in which individual participants act alone to one in which there is a whole of chain focus. Some in the chain will resist this change in focus. Government policy is in conflict with the new improved system.

<u>Root definition 2</u>

A system in which farm input procurement (including credit) and product sales are facilitated by a local institution (such as a cooperative) that is owned and operated by the local community.

Customers: Farmers and other villagers will be the beneficiaries of the system. The major losers will be current usurers who have imposed exploitive credit systems often linked to farm inputs and outputs.

Actors: The system will be established, operated and managed by local farmers in dryland areas. The government has a role in developing management training for farmers who will run the day-to-day operations of the new institution.

Transformation: Farmers have little bargaining power with the existing usurers and farm input suppliers and traders. The transformed system tries to increase the bargaining position of farmers' or increases their accessibility to affordable farm inputs. The transformed system will create better distribution of farm inputs and outputs based on farmer requirements.

Weltanschauungen: Beliefs that ensure this system has the potential to improve the situation are Institutional structures such as cooperatives have been used by farmers for more than 20 years and have been shown to provide farmers with appropriate inputs at an affordable price and these structures ensure that they receive appropriate prices for their farm produce. Therefore, the system can increase productivity, quality and produce value.

This system will enhance farmer solidarity and as a result social capital will increase.

Owner: The system will be owned by farmers, village community and the village council. Although not an owner, the Departments of Agriculture and Cooperatives at the subdistrict level can help facilitate this change.

Environment: Support for the changes will come up from farmers, government development agencies such as BPP, LPD and state banks. Opposition to the change will come from those currently in the supply chain who have been exploiting the farmer's lack of power; such as usurers, input suppliers and traders.

Root definition 3

A system owned by farmers' groups with the purpose of coordinating the production methods and handling of farm produce in order to meet the buyer's quality needs, whilst removing socio-economic constraints to increasing farm productivity, profit and the efficiency of input use.

Customers: Farmers and buyers will earn direct benefit, whilst the owners of transportation facilities will be indirect beneficiaries. Farm input suppliers could possibly decrease their profits.

Actors: Local farmers in dryland areas will operate the system. The government should be encouraged to develop an information system that communicates the buyer and consumer needs regularly to the farmers.

Transformation: Currently farmers produce their farm products without informing or coordinating with others within their local area or along the supply chain. The transformed system endeavours to establish an information system that improves the continuity of supply as well as supplying products that meet consumer requirements.

Weltanschauungen: Beliefs and values that ensure that this system has the potential to improve the situation are. The coordination of the timing and production methods and handling would mean farmers would have more efficient usage of water and other inputs; produce higher value products; reduce production costs; and increase solidarity between farmers.

Under this system it is likely that the quality of produce will increase and flow-on environmental impacts associated with production will be reduced.

Owner: The system will be owned by farmers, the village council and Department of Agriculture in the subdistrict.

Environment: The system will be constrained by the following:

1) Farmers by nature have traditionally been independent.
2) Non-commitment of some farmers (possibly the rich) who will continue to produce out-with the system.
3) Restrictions associated with weather and seasonal nature of the production cycle.

Root definition 4

A system for improving human social relationships among key people involved in the supply chain which considers the traditional values held by rural people.

Customers: Farm input suppliers, farmers, village intermediaries, farm labourers, and transporters will obtain direct benefit from this system. Government agencies, agricultural extension workers and agribusiness actors working with the village will earn indirect benefits. However, speculators and money-lenders will probably suffer a loss of profit.

Actors: The system will be operated by almost all participants considered important for the agribusiness supply chains operating in dryland areas. The government agencies should also actively facilitate the development of improved linkages among all supply chain participants.

Transformation: The current situation is that most rural people think that working in isolation is maximising their returns and ensuring their sovereignty. The transformed system endeavours to change the rural people's mind-set such that they realise that by working together they will generate much larger benefits individually and collectively.

Weltanschauungen: Beliefs and values that this system has the potential to improve the collaboration along the supply chain that will lead to improved returns from the chain as a whole and individually. Moreover, the sustainability and resilience of the actors' business will be improved.

Owner: The system will be owned by all involved in the supply chain at the village level including - farm input suppliers, farmers, village intermediaries, farm labourers, and transporters, and Government agencies in charge of rural development and agricultural extension.

Environment: The transformed system will draw opposition from those in the village who are socially and economically powerful and recognised as having high status within the village. Moreover, some traditional beliefs may also be a constraint to change. However, there are people who are better educated and have had more experience about the real world outside their village who are likely to support the transformed system. Conflicts of interest will therefore be an issue in the transformation process.

5.2.3 Formulising the Situation

The second stage in this process is to develop an accurate definition of a relevant system and then move to describe what the system does by developing an 'activity model' of the system. This is achieved by first developing a model of the basic structure for the relevant system which describes the whole set of activities encompassed by the relevant system. Every activity in the basic structure is then developed into a subsystem. The whole model is derived from each root definition in step 2 by assembling the words indicating activities required for the root definition and connecting them logically, therefore any link between the activities indicates essential flows for the system. The model is purely abstract, it is not a picture of some real world system, nor is it a system that someone is going to try to build in the future. The process for each of the four root definitions is described below.

Root definition 1: A system in which farm production from Akar-akar and Kawo villages are distributed under a coordinated supply chain with fair distribution of profit margins and good information flows in both directions through the supply chain.

The main activity or the basic transformation of this root definition is to coordinate and administer the activities of the supply chain. The activities which need to be coordinated are trading, logistics, product quality and consultation with government agencies. The basic structure of that model is shown in Figure 5.3.

It is now possible to consider the conceptual model for root definition 1 as consisting of at least the five subsystems shown above.

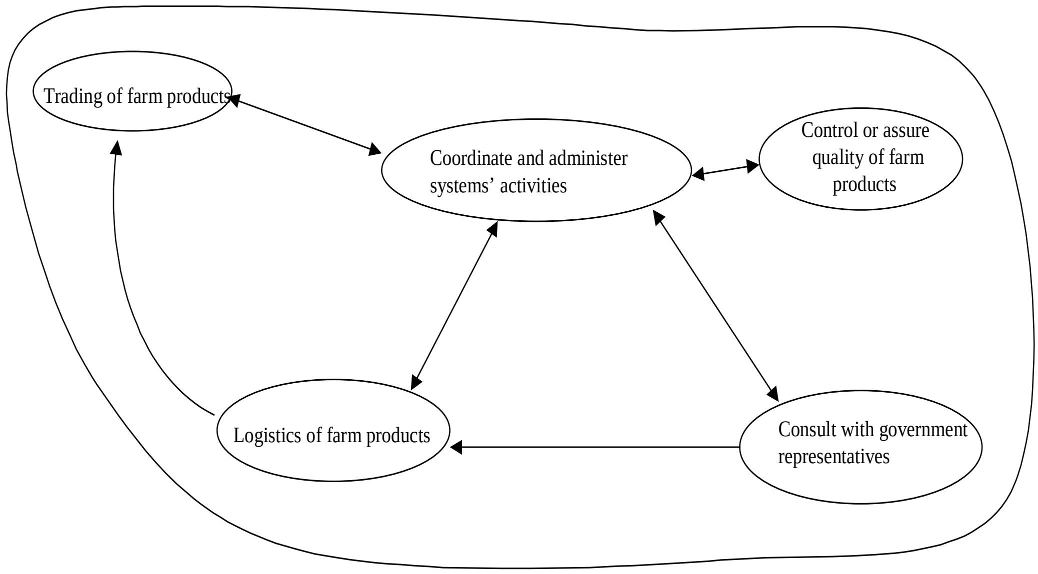

Figure 5.3: Basic Structure of the Coordinated Supply Chain for Dryland Farming

Subsystem 1 is called 'coordination and administration'. Coordination is important because if carried out correctly it will increase efficiency along the supply chain. Coordination implies good planning which encompasses planning activities for the whole system. Coordination can only be effective when there is monitoring (and control) of key activity performance for both product and information flows. Effective communication is important both between the subsystem and between the participants among the supply chain. The traditional way in which this occurs is through a key person or group, and meetings organised by governmental staff. These methods have been most effective in the past. The model suggested for this subsystem is described in Figure 5.4.

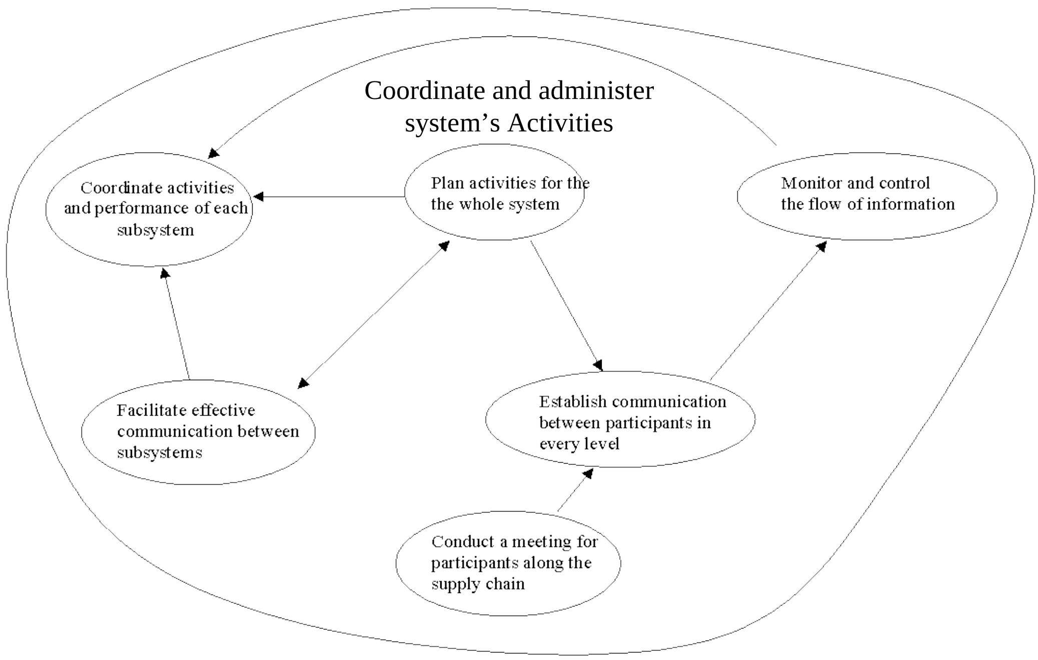

Figure 5.4: Coordination and Administration Sub System

The second subsystem is labelled as the 'trading of farm products'. Trading can occur if there are at least two parties, a buyer and a seller, committing to a transaction. The basis for commitment results from negotiations between the two actors. This negotiation can be about price, and method of purchasing and selling including payment and delivery. The relationship between price and quality is usually highly correlated. The model for this subsystem is shown in Figure 5.5.

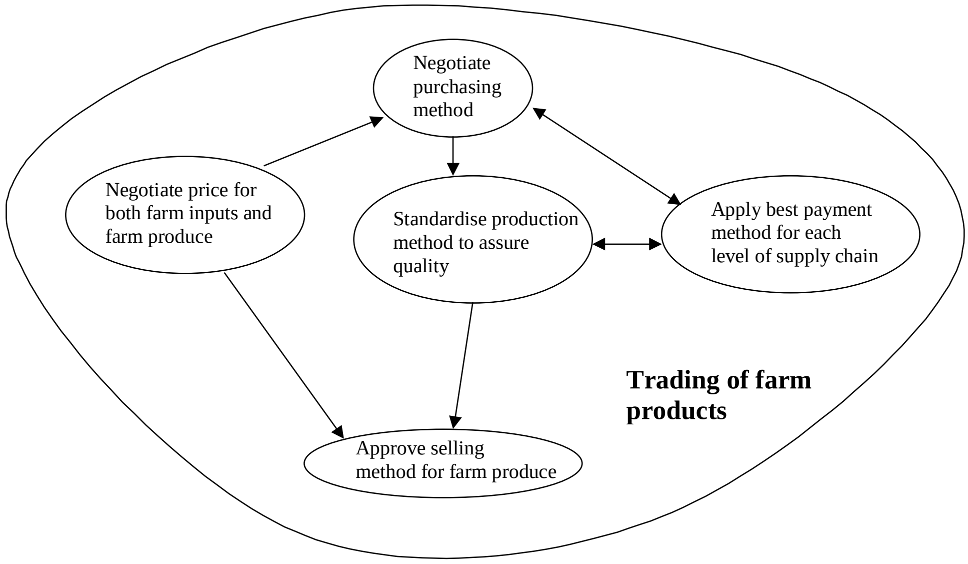

Figure 5.5: Trading of Farm Product Subsystem

Subsystem 3 is named the 'control and quality assurance of farm products'. The quality of farm produce is closely related to the production process and post-harvest handling. The production process was handled in the previous sub-system therefore the main focus of this subsystem is standardised post-harvest handling. This handling consists of at least three activities: cleaning, sorting and grading. Three more activities also need attention; these are storage, packing and general handling of produce during and around the transportation process. In the packing process, product waste and other by-products have to be monitored to ensure minimum waste flows are generate and during storage efforts need to be made to ensure that product doesn't lose value through disease or pest infestation. The proposed model for this subsystem is demonstrated in Figure 5.6.

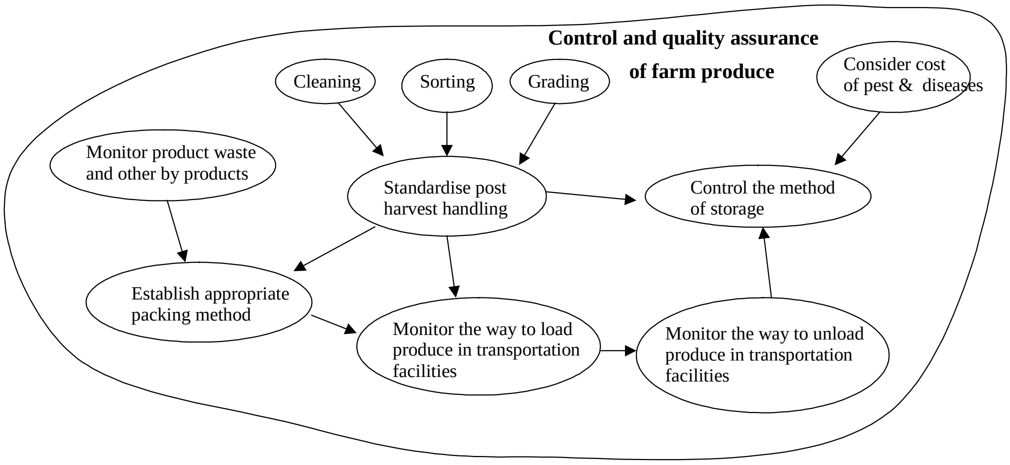

Figure 5. 6: Control and Quality Assurance of Farm Products Subsystem

Subsystem 4 is defined as the 'logistics of farm products'. The initial step in this process is the gathering of farm produce from farmers. In many cases access to the point of production is over very poor roads that are muddy in the wet season and dusty and rocky in the dry season. Often the nearest car accessible road is 1 - 2 kilometres from the farm. The logistics system is also heavily dependent on government policy, especially that relating to fares charged for public transport.

The main function of the logistics system is to distribute the products produced whilst maintaining the quality of the product. Therefore, monitoring the quality during the transporting process is crucial. The objective is to maintain, or minimise quality loss, through the logistics chain until the products are received by retailers or inter-island traders. The model suggested for this subsystem is described below (Figure 5.7).

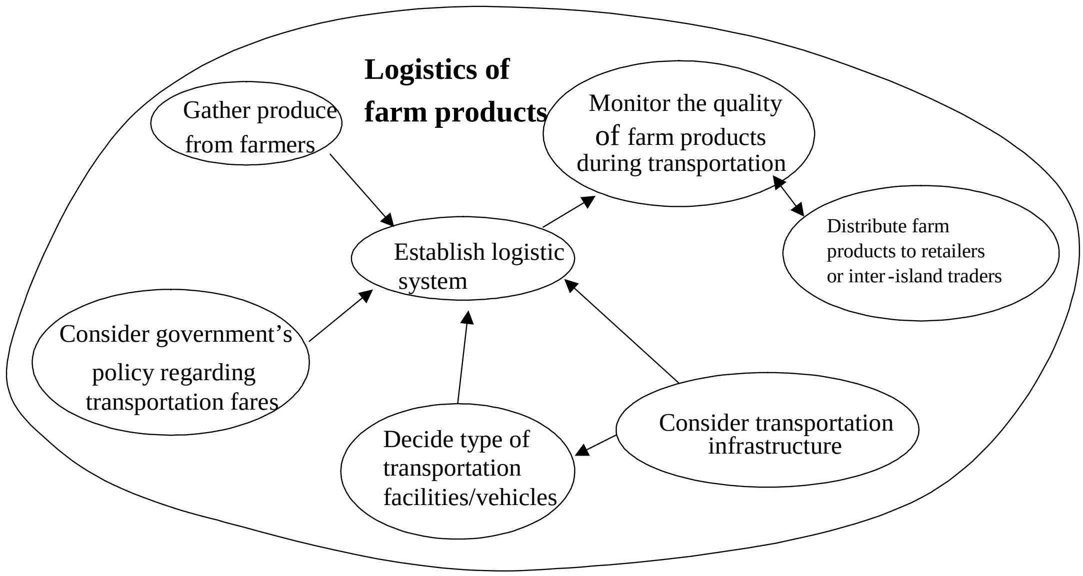

Figure 5.7: Logistics of Farm Products Subsystem

The last subsystem for root definition 1 is has been called 'consult with government representatives'. As is common in developing countries, the government plays a significant role in the process of rural development. Traditionally, most villagers assume that government officials have a higher status than ordinary villagers and that they are cleverer and have a broader view than villagers. Given this status in the community it is important to use these officials in the process of change management, although frequently they do not perform their duties properly. The key groups of officials are those from the Department of Agriculture through the BPP or their council representatives, and the Department of Trading. However, there is no representative for this department at the council level.

The role of these people could be expected to take is to establish regular communication between government representatives and supply chain participants. This kind of communication will increase the Government's understanding of the dryland farm product supply chain and its problems. The reverse is also true in that frequent contact can increase the knowledge of supply chain participants about their rights and obligations as businessmen and as national citizens. Government representatives have dual functions - as development agents, and suppliers of information about new government laws and regulations that impact supply chain participants and their business.

Besides these roles, the government representatives normally have a higher level of education than farmers or other members of the village community and therefore often take on the role of local mediators or educators. This latter role could be utilised to provide training for farmers, village intermediaries, and input suppliers that would enable them to develop feasible business plans. In the role of mediators they should be able to build links between farmers or village intermediaries and the state banks like BRI, BNI, or BPD. If this subsystem was working properly many of the problems currently experienced in the farm input supply area (such as usurer power) would be overcome. The proposed model for this subsystem is displayed in Figure 5.8.

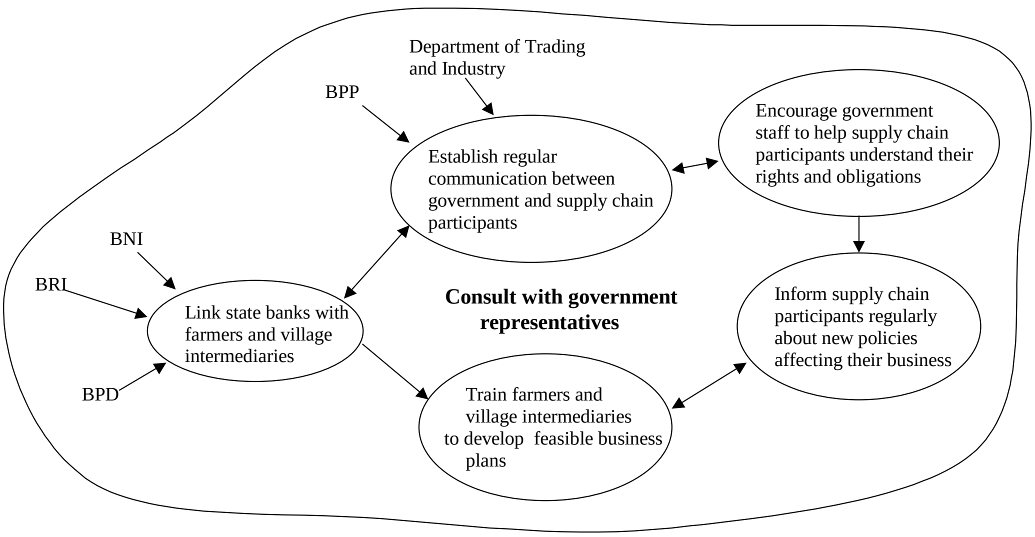

Figure 5.8: Consult With Government Representatives' Sub-System

The final step is combining all of the sub-systems developed for the root definition into a conceptual model for this relevant system. The conceptual model for this root definition is shown in Figure 5.9.

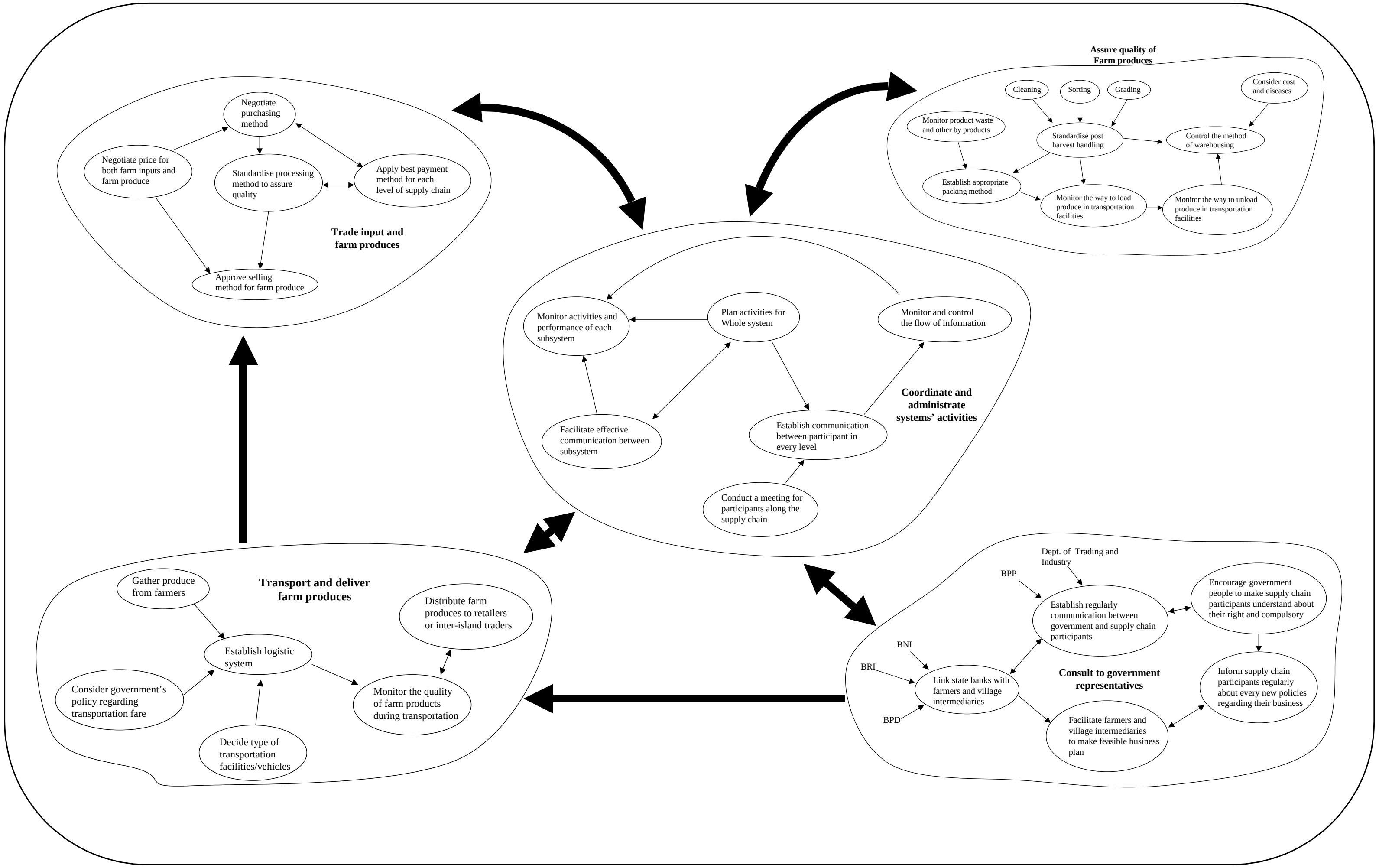

Figure 5.9: Conceptual Model of Coordinated Supply Chain for Dryland Farming

Root definition 2: A system in which farm input procurement (including credit) is facilitated by a local institution (such as a cooperative) that is owned and operated by the local community.

The main goal of root definition 2 is to improve farmer access to farm input procurement. Farmers have been familiar with the systems operated by rural financial institutions and understand the benefits that controlling a rural financial institution could bring. However, a number of farmers have had negative experiences with rural financial institutions like the KUD.

The conceptual model developed invites farmers to establish a rural financial institution like a cooperative thereby reducing the current problems they are experiencing in the procurement of farm inputs and sale of farm outputs. The rural financial institution will be managed and operated by the village community, especially farmers. To be successful the development of the rural financial institution must be preceded by activities that educate farmers about the rural financial institution model and its operation. Such training could be delivered by the Farmers Associations (FA) with support from other parties considered important, such as state and nationally operated banks, universities or NGOs. Once the rural financial institution is established, collaboration with other aligned business actors such as public and private banks, state owned enterprises, and individually owned firms will be essential to retain and increase its performance. The basic structure of this root definition is shown in Figure 5.10.

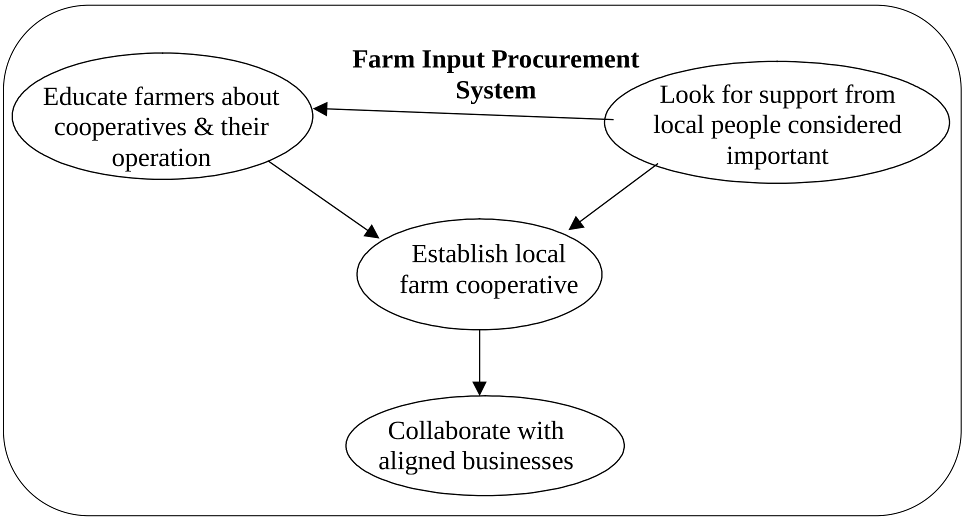

Figure 5.10: Basic Structure of Farm Input Procurement System

The first subsystem for this model is labelled educating farmers about rural financial institutions and their operation. The main output expected from this subsystem is that most farmers in the target dryland areas will have an increased knowledge of rural financial institutions and their operation. It is hoped that the farmers in turn will be ready to operate and manage their own financial institutions. The training inputs should include:

- advantages and disadvantages of being a member of a rural financial institution;
- the rights and obligations of rural financial institution members;
- reward and punishment systems applying to members;
- financial institution business management; and
- development of appropriate information systems.

The major provider of this input should be the FA who have representatives at village level, can coordinate the process, have the resources and can link more easily with research centres, universities and the Department of Cooperatives. The proposed conceptual model for this subsystem is displayed in Figure 5.11.

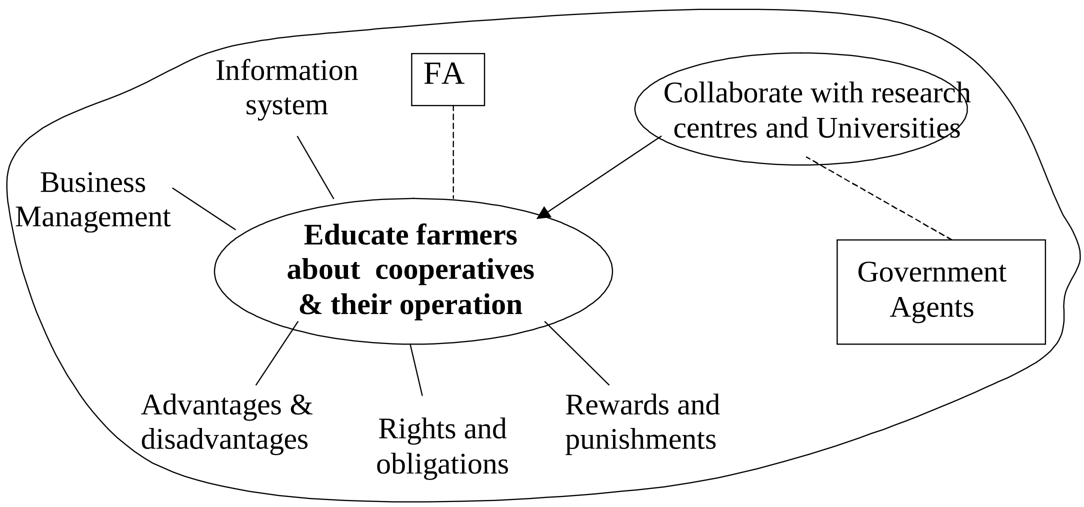

Figure 5.11: Educating Farmers about Rural Financial Institutions

The second subsystem undertakes to obtain support from people and organisations considered important. Support for the idea of establishing a local financial institution is expected from the village council and other village leaders (such as sub-village leaders and religious leaders), the broader community and neighbouring villages as well as government representatives in the villages. The farmers will need to consult with the village-level representatives of the Department of Agriculture, Department of Trading and the State Banks. There are no Department of Cooperative representatives at village and council level which means that discussions with this department will have to occur at the district office. It will also be important to link with aligned business interests who are currently trading or could trade with farmers from the village. Again the group best placed to coordinate the activities are the FA. It will be important to record and analyse the comments and suggestion made by these sources and use them in the design of the proposed rural financial institution. The outcome of these activities will be a conclusion about the viability of establishing a local financial institution and the local level of support. The suggested model for this subsystem is described in Figure 5.12.

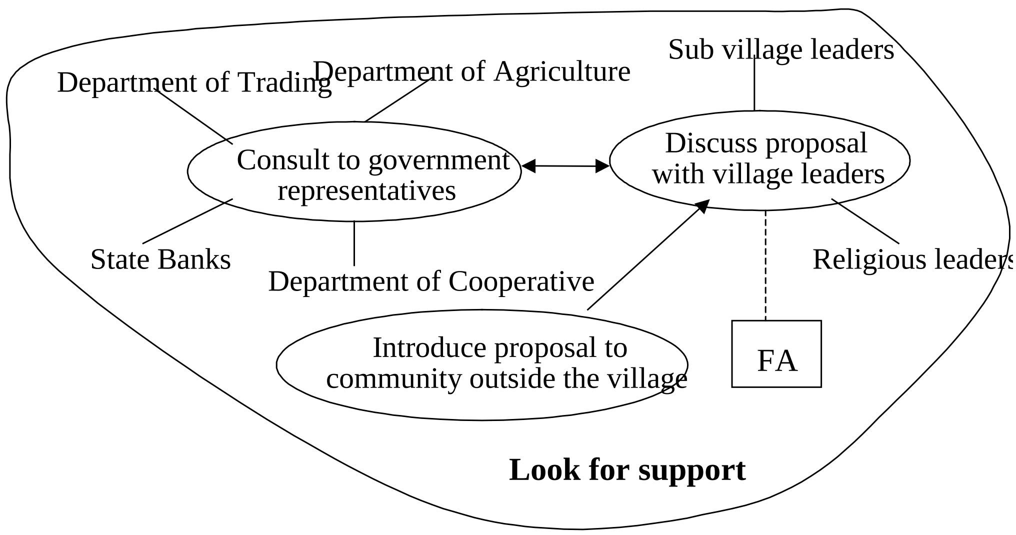

Figure 5.12: Look For Support Subsystem

The major objective of the third subsystem is establishing a local financial institution based on the standard model[1] recommended by the government institution. Formally, every financial institution including cooperatives must be legally approved by the government representative at a district level. This requires the development of formal documentation of the proposal including a clear business plan, which shows support (financial and member) for the proposed rural financial institution. There is therefore a need for training on the establishment of the cooperative rural financial institution and its associated business plan and formal documentation. This can be obtained from government representatives at sub-district, district or provincial level The proposed model for this subsystem is shown in Figure 5.13.

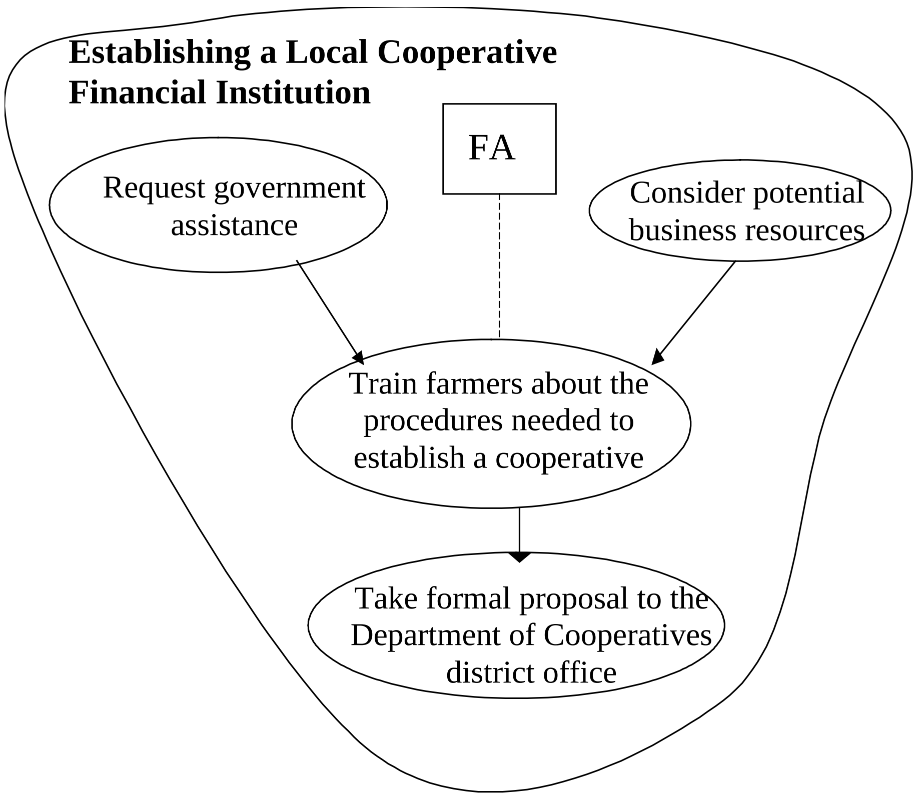

Figure 5.13: Establishing Local Financial Institution Subsystem

[1] Government policies encourage low capital business actors to co-operate together to develop cooperative business structures. They have established standardised procedures for developing cooperatives.

To be viable the proposed cooperative will need to work closely with other businesses, especially the village traders and farm input suppliers; capital providers such as banks and other financial institutions; as well as traders and farm input suppliers at District or higher levels. Inter-business collaboration forms the last subsystem shown in Figure 5.14.

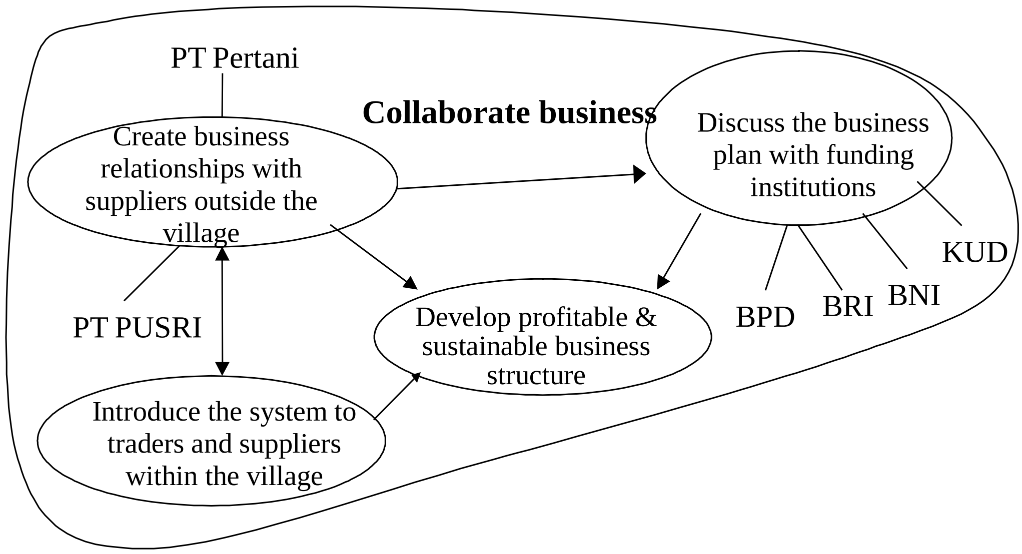

Figure 5.14: Business Collaboration Subsystem

The combined model including these subsystems is shown in Figure 5.15.

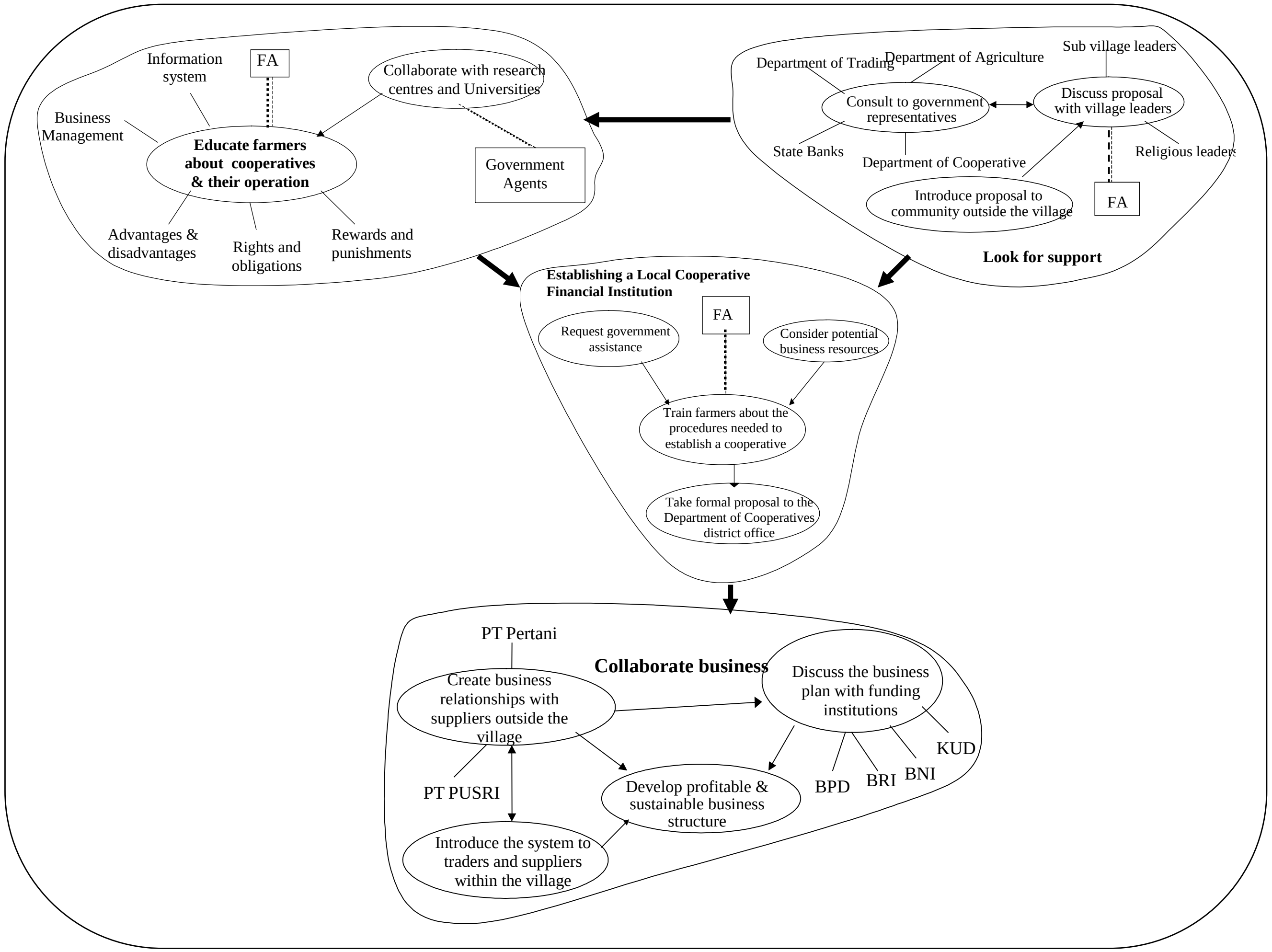

Figure 5.15: Conceptual Model of Farm Input Procurement System

<u>Root definition 3</u>: A system owned by farmers' groups with the purpose of coordinating the production methods and handling of farm produce in order to meet the buyer's quality needs, removing socio-economic constraints to increasing farm productivity, profit and the efficiency of input use.

The main goal of root definition 3 is to create a system that facilitates farmers and other supply chain members to efficiently produce products of a quality that customers and consumers want. Because of the nature of small scale farming in dryland areas, the motor of this system starts with farmer group, or association activities. Farmer Associations (FA) have been established for as long as 20 years in some places. In the 1980s these organisations worked well because they received significant support from the government which was aiming to achieve food self-sufficiency. However, since 1998 support has diminished to the point where today it is minimal. As a result many of the FAs have lost their networks with other FAs and government institutions.

The restructuring of almost all government organisations has meant that farmers have become confused about the roles of these organisations and the changes have often weakened the control that government employees had over production and supply chains. FA activities were commonly closely related to collective activity for purchasing farm inputs, cultivating crops, and post-harvest handling. During the period of this study (four years) the FA in one of the research areas was not visited by government workers. In addition, farmers do not feel confident enough to visit government staff in their offices, although as citizens they have a right to do so. If the FAs are to become effective again they must be refreshed and informed of their rights and obligations relating to their businesses. The basic structure for the conceptual model for this root definition is displayed in Figure 5.16.

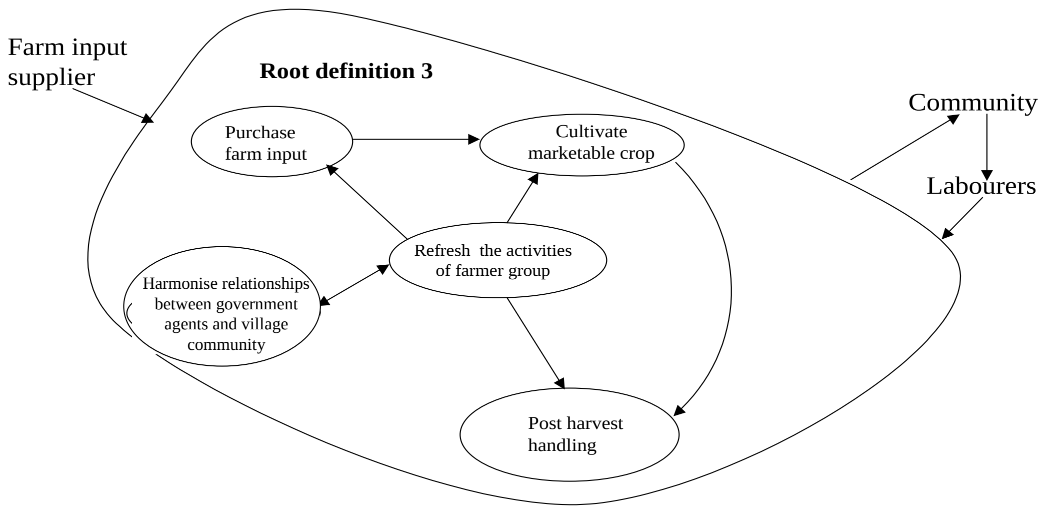

Figure 5.16: Basic Structure of Efficient Farm Production Method

The first subsystem aims to refresh the activities of farmer associations. The term "refresh" is used as the FAs have previously existed but they are currently not working properly. The major input to this system is to encourage FAs to organise collective activities between farmers. The activities that lend themselves to be carried out collectively are irrigation for those who use pumps or "*embung*"; land consolidation for bee keeping; and joint purchase of farm inputs. There are also a group of activities that involve people outside the farmers' community. These include assisting farmers to access and interpret market information, training farmers to become more organised, and mediating between farmers and credit providers.

The proposed conceptual model for this subsystem is shown in Figure 5.17

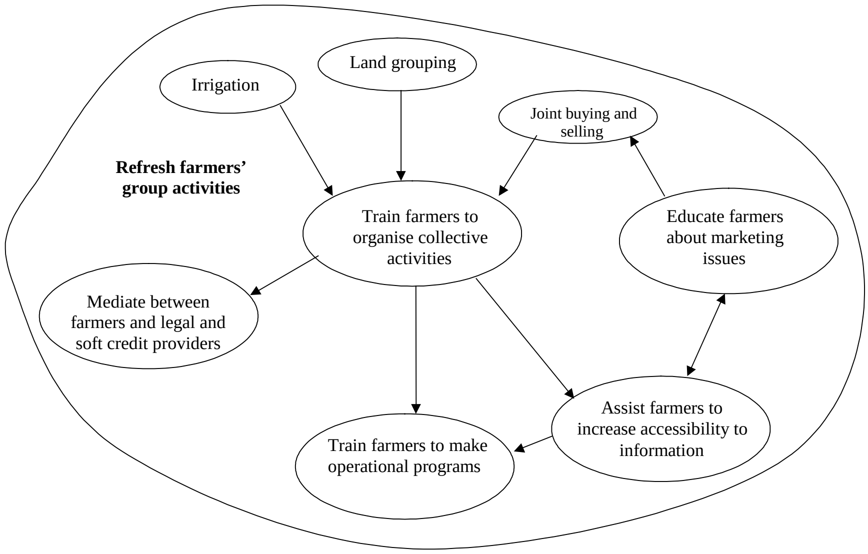

Figure 5.17: Refresh Farmer Group Activities Subsystem

The second subsystem is aimed at improving the efficiency of the farm input supply both for individual farmers and collectively. The ideal would be to develop a group requirement plan for farm inputs or *rencana kebutuhan kelompok* (RKK). This requirement would be derived from the planned cropping program for each plot of land managed by farmers. To improve efficiency farmers will need to first match expected market information with their crop production plans and then aggregate their individual requirements so as a group they can develop lower cost supply arrangements (including repayment methods and delivery standards) with input suppliers. The suggested conceptual model is shown in Figure 5.18.

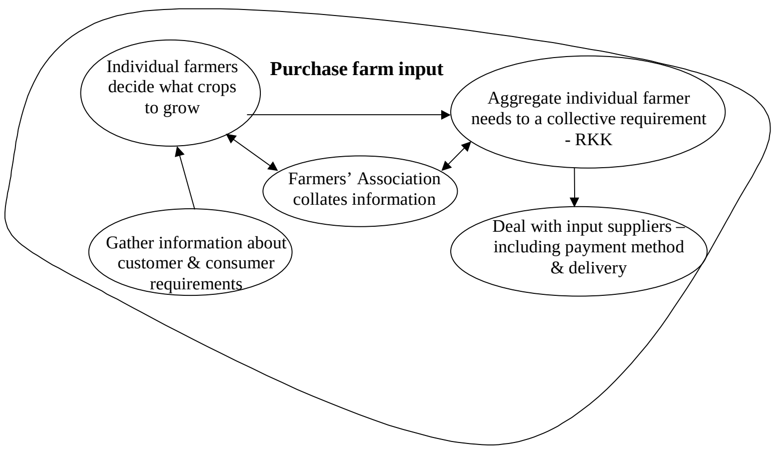

Figure 5.18: Purchasing Farm Input Subsystem

The third subsystem is labelled ‘cultivate a marketable crop’ and is linked closely with the planning and supply of inputs subsystem described above. The term cultivation covers all activities from the preparation of land through to harvest. Ideally, the crop selection should be referred to the RKK because it has a major role in deciding the kind of crops to be planted. This whole system suggests that farmers could work and/or plan together to coordinate each step of the production process. This would require farmers to jointly analyse the resource availability especially for labourers and water, and develop procedures that efficiently allocated these resources in line with the plan determined by the RKK. Procedures also need to be developed that determine actions that should be taken if the harvest fails or some other factor impacts heavily on anticipated production. The RKK and FA personnel must be accessible to all farmer members. These sorts of activities operated for irrigated paddy farmers in the 1980s when paddy cultivation was fully subsidised by the government. The structure of this subsystem is shown in Figure 5.19.

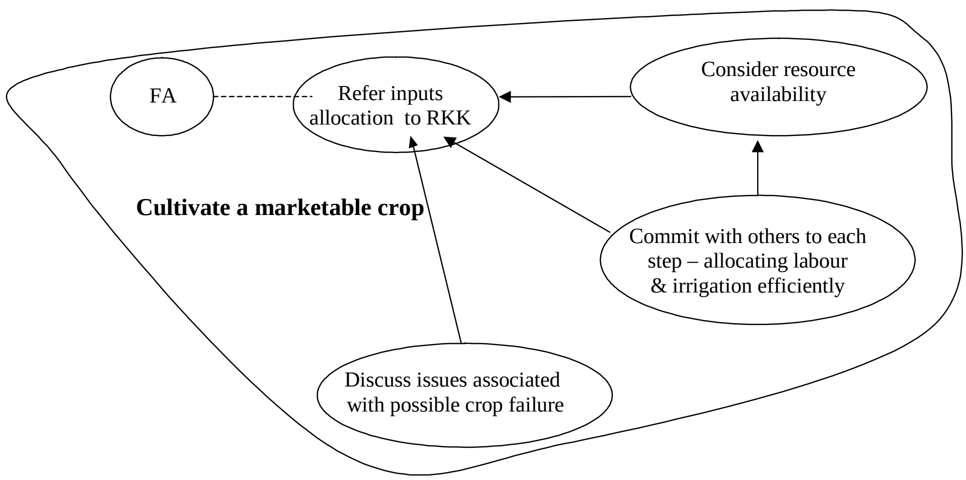

Figure 5.19: Cultivate Marketable Crop Subsystem

Improvements in post-harvest handling are one of the farm business activities that needed to be improved. The major reason is that post-harvest activities were not seen by farmers as part of their locus of control which they saw focused on cultivation and harvest. There is a need to link these areas of activity so that farmers harvest their crops in accordance with the produce maturity and labour availability. This can be discussed within farmer groups or subgroups under control of the Farmer Association. Farmers must match their post-harvest handling methods with their chosen selling method. If farmers sell with the *tebasan* system, they would usually not plan to conduct any special post-harvest handling activities. Those who sell at the farm gate must do the packing and transport of the fresh harvested produce to the point of sale, usually the closest accessible road. However, the farmers who choose to sell dried produce must carry out a range of post-harvest activities and consider whether these activities are better done alone or collectively. The FA has a role in educating farmers about the business case for each option. The proposed model for this subsystem is shown in Figure 5.20.

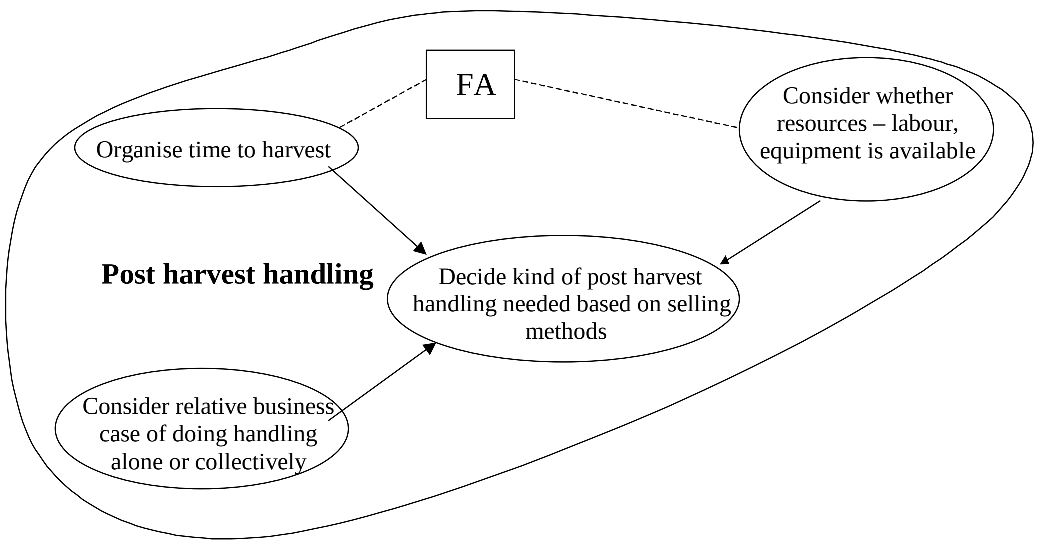

Figure 5.20: Post Harvest Handling Subsystem

The expected output from the last subsystem is harmonised relationships between government agents and the village community. The target government agents are the agents that are based at the village level (Department of Agriculture) or operating at the council level (Department of Trading). The system should encourage these government officials to become more involved in the agribusiness practices associated with their areas of activity. This is more likely to occur if the initiative for developing new ideas comes from the villagers in general, and specifically farmers. Inviting agricultural extension workers (PPL) to visit demonstration plots established by the FA is an example of such an initiative. This approach provides farmers with an opportunity to directly communicate their problems to government agents and allow confidence and understanding to be developed between the two groups.

Another element of this subsystem is the need to request the village head or council to discuss agribusiness issues with the higher-level bureaucrats who attend the council meetings. One thing that should not be ignored is the need to involve other community and religious leaders. The system has to link those leaders to government representatives. This is needed as villagers traditionally place a lot of value on the opinion of religious leaders even in areas not associated with religion. The proposed model is shown in Figure 5.21.

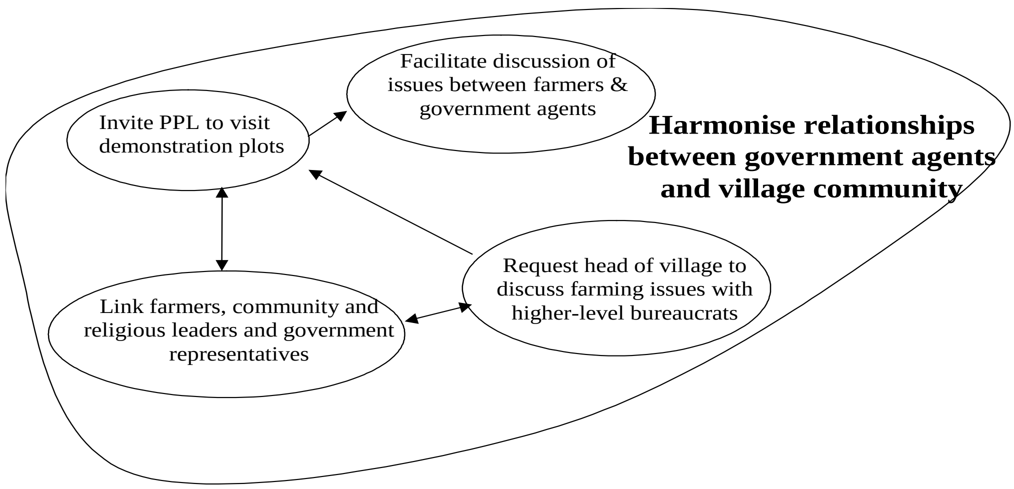

Figure 5.21: Harmonise Relationship Subsystem

The combined model including these subsystems is shown below.

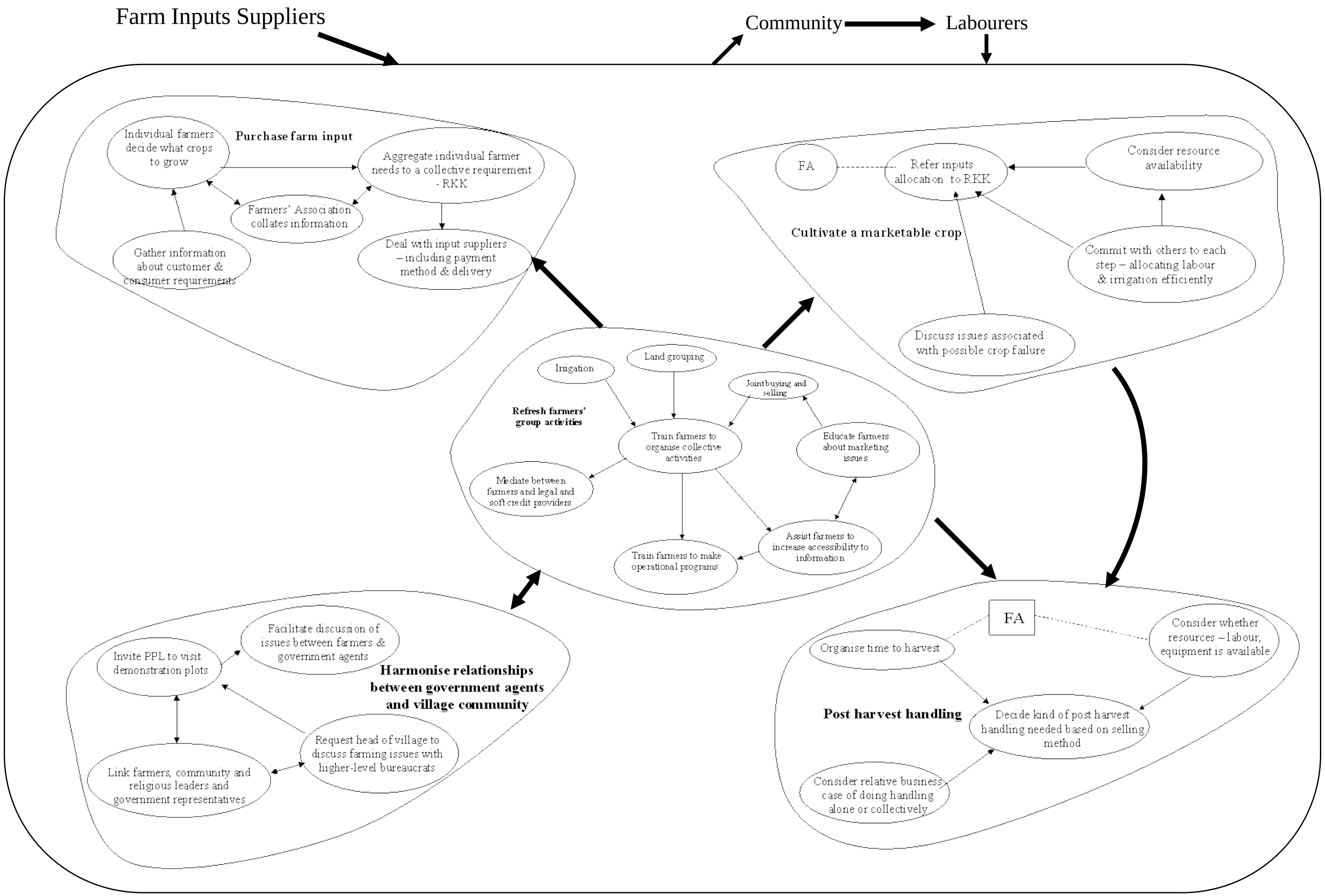

Figure 5.22: Conceptual Model of Method of Efficient Farm Production

<u>Root definition 4</u>: A system for improving human social relationships among key people involved in the supply chain which considers the traditional values held by rural people.

The transformation wanted from the relevant system through its root definition is to improve the relationships between all players in the agribusiness supply chain leading to more efficient production and distribution of produce as well as profit sharing along the chain. A key element is to develop systems that empower people along the supply chain with knowledge and skills that enable them to maintain or improve their economic and social status. A further crucial element is that those involved in the supply chain need to feel they have some security over their assets and way of life. Village security can be retained by the villagers that have a good empowerment system.

In common with many villages in Indonesia, the villages in the study area had poor infrastructure and public facilities, and poorly developed human resources. Changes to the current status could only be brought about by the more powerful people in the village itself or with assistance from people outside the village. Assistance is not only in the form of money or other material things, but also in the form of skill and knowledge development with the assistance of appropriate experts or scholars. Empowered people will also be able to sustain or improve the traditional values held by villagers. This is because people who have enough knowledge and skill will adopt and adapt innovative technologies before introducing them to their village. This means that the people will select the innovation that is suitable to their tradition or the innovation that can improve or develop their tradition. This relevant system is depicted in Figure 5.23.

This root definition consists of five subsystems. The first is focused on empowering supply chain participants especially those residing in rural areas. The term ‘right way’ is used to signify that the process of empowerment should be different to those adopted in previous eras. In the past, government agencies applied a high level of indoctrination to make people adopt new programs. There was very little room for the rural people to express their opinion, even if those suggestions would have been more feasible or led to better outcomes at the village level. Therefore, some programs did not meet the needs of rural people. Some programs were instituted with a clear political motive which ensured that a particular political party won the next election. The result was that rural people were categorised as being empowered when they complied with government programs. The "*right way*" to gain empowerment is for the rural people to be given full freedom to express their opinion, and have it heard, for such things as education, training, establishment of feasible rural financial organisations. They will also ensure that the changes do not conflict with village traditional values.

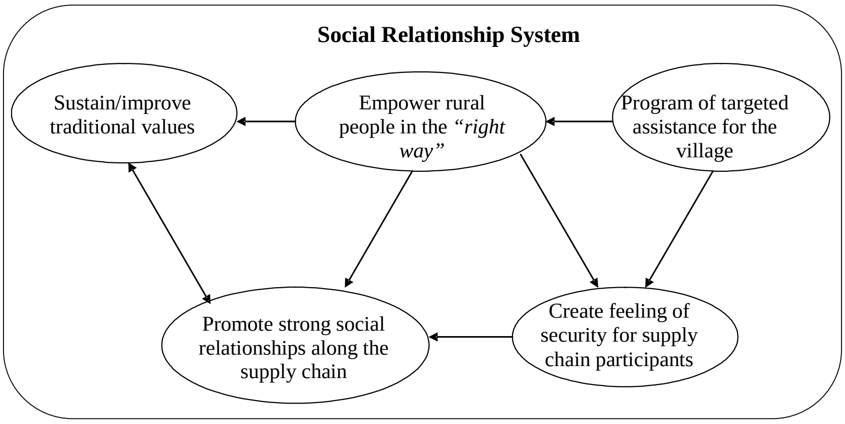

Figure 5.23: Basic Structure of Social Relationship

Education (formal and informal) can be used to help in the empowerment process. Informal education can be delivered through farmer groups, *pengajian* and *banjar*. This ensures a central role for farmer leaders, the coordinator of the *pengajian* (*uztads*) and the president of the *banjar* (*klian*) and helps to revitalise traditional rural organisations. Financial empowerment is also a key element in this subsystem. Although there are financial agencies in the subdistrict that can theoretically be accessed by rural people, they were not accessible for people residing in the research sites because the private and state bank offices were too far away. The key mobilisers for these activities are the public development agencies (especially agricultural extension workers or *PPL)*, the Village Head (*Kepala Desa*), the head of the sub-village (*Kepala Dusun*) and *juru penerang*. This subsystem is illustrated as follows (Figure 5.24).

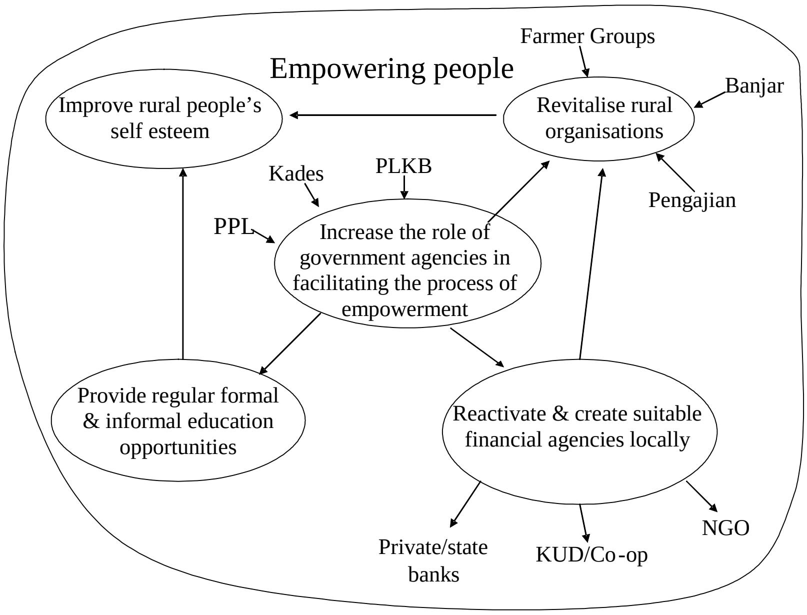

Figure 5.24: Empowering People Subsystem

The second subsystem is focused on creating security. This subsystem consists of four main activities: 1) rebuilding neighbourhood systems, 2) participation in communal activities, 3) responsibility to the community, and 4) the need for a rural security organisation. The neighbourhood system is about bringing the people together. In the past, people who lived in a village had very tight bonds with each other. Modernisation (although at low levels in villages) has meant that relationships are less strong than in the past and economic pressures have meant that people have become more individualistic. Encouraging strong rural neighbourhoods helps to improve people's sense of security which in turn increases people's participation in traditional activities such as funerals, weddings, circumcision and working bees. Such participation in rural activities will encourage people's responsibilities and alertness to other rural security issues.

The last activity, the establishment of a rural security organisation, is also very important. This organisation could be modelled on the one that operated in the 1980s called *siskamling*. The *siskamling* system is a bottom-up security organisation that was facilitated by the governmental agencies at sub-district (for suburban areas) or council (for city and town areas) level. This handed responsibility to develop and retain the security of its *dusun* (for suburban areas) or *lingkungan* (for city and town areas). Professional advice could be obtained from the police department or private security guard agencies like HANSIP and KAMRA. This subsystem is shown in Figure 5.25.

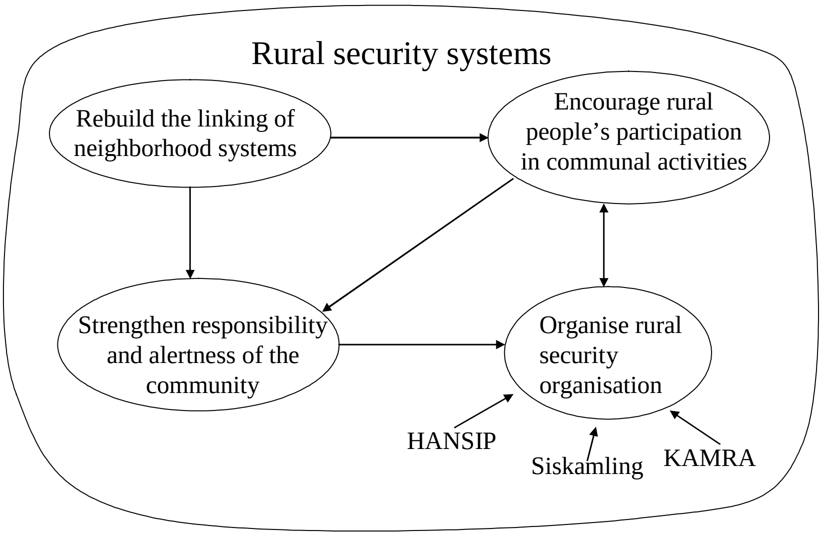

Figure 5.25: Rural Security Subsystem

The third subsystem addresses social relationships which are considered as the relationships among rural people which are not driven by an economic profit motive. This is the development of a consciousness by rural people to know, help, or understand each other purely as human beings. The promotion of social relationships can be strengthened through education related to the meaning and value of social relations. This education can be effectively done through extension, schooling, preaching (*dakwah*) and the like.

People who develop social relations in this way will appreciate and support rural social activities such as *gotong royong*, *arisan*, *besiru*. In turn they will actively participate in other social activities in rural areas. The expected output for this subsystem is when rural people harmoniously build social relationships within the village. If this happens in the village it will make the village more attractive for external investors and improve the possibilities of collaboration with external businesses. Figure 5.26 describes this subsystem.

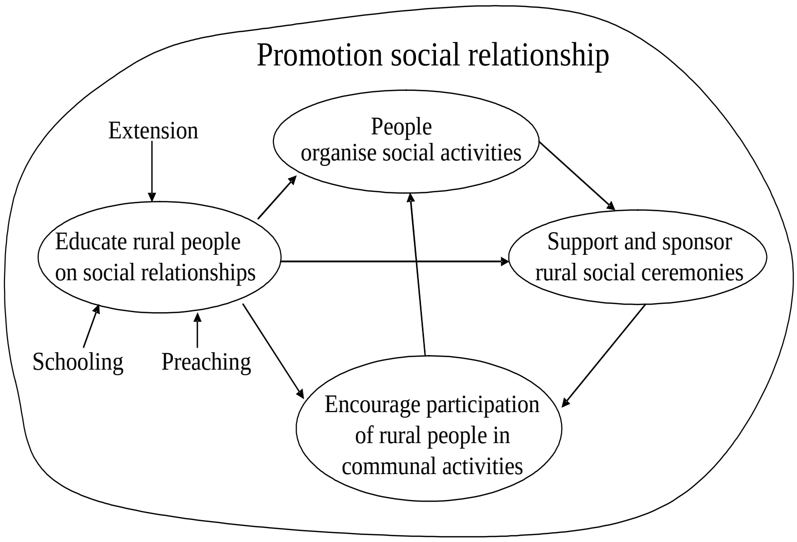

Figure 5.26: Promotion Social Relationship Subsystem

The fourth subsystem focuses on sustaining and improving rural traditional values, which is considered a central issue by those who want to undertake any activities in the village including business activities. Rural people are normally afraid or reluctant of doing things that they think break traditional values although they know that by undertaking the action they will gain an economic profit. Business activities in the study area are highly influenced by traditional values. There are some traditional beliefs that are seen by some as old fashioned but they are still retained because of the people's fear of ancestral spirits. For example, planting a silk cotton tree inside the home yard will attract an unlucky spirit for the family whereas this kind of tree is considered economically valuable. Some very traditional activities have changed slightly (improved) over time but in most cases it has taken generations for such change to be accepted. For instance, uncontrolled logging in the productive forest around the village has ceased although in the past villagers viewed trees as a common property resource to be exploited freely.

There is a need to bring about change in attitudes that recognises that some traditional activities are not suitable for modern supply chain management. This will be difficult as there are many in the older generation[2] who assume that any modernisation will destroy their traditional values. In the research site, it was observed that some of the older generation did not allow their grandchildren to attend school or extension activities.

Some in the community realise that some traditional activities need to be improved so that they, and the community, can improve their situation. They however, have a big challenge – how to revitalise beneficial traditional activities and slowly change or remove the unsuitable ones. Development of the motivation to improve the situation also helps to strengthen those involved with the change and develop leadership. This subsystem is depicted in Figure 5.27.

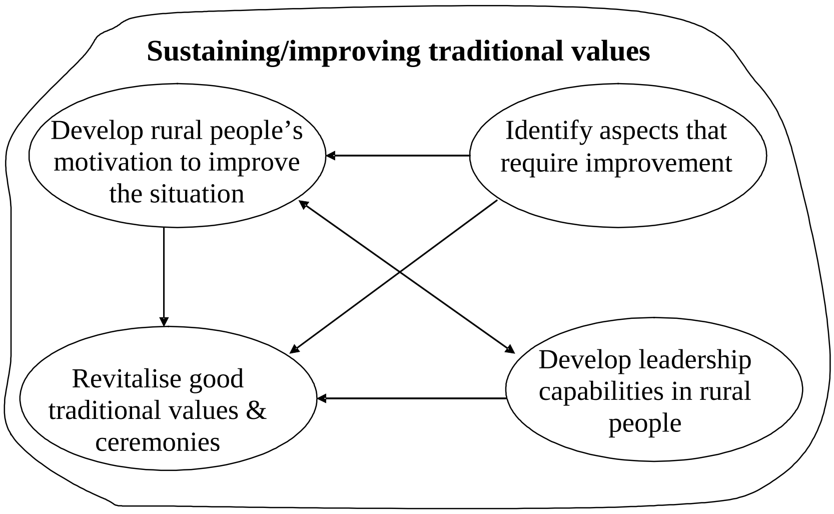

Figure 5.27: Improving Traditional Value Subsystem

The final subsystem focuses on how to encourage targeted external assistance that will enhance the villager's way of life and lead to improved supply chain performance. This subsystem is an input into the empowerment and rural security subsystems. This subsystem starts with the identification of potential partners or agencies that can assist the rural empowerment and security activities. These include external institutions like universities, research centres or stations, non-

[2] These people are also the people likely to hold positions of responsibility within the community.

government organisations and government agencies such as the police department and internal (to the village) public agencies like *Kepala Desa*, *Kepala Dusun* and Agricultural Extension Workers or PPL. It is important to develop strong links between the internal and external agencies to ensure a coordinated approach to improving the situation. This subsystem is shown in Figure 5.28 and the overall conceptual model for improving the social relationship system is shown in Figure 5.29.

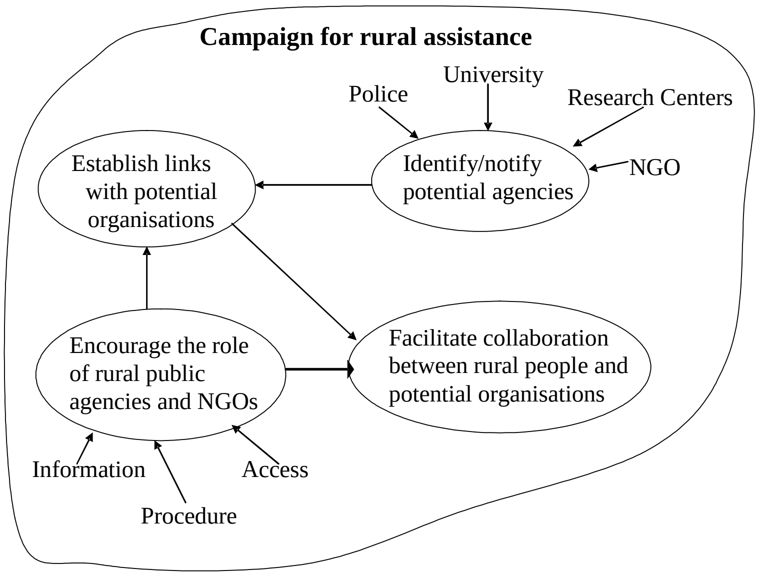

Figure 5.28: Campaign For Rural Assistance Subsystem

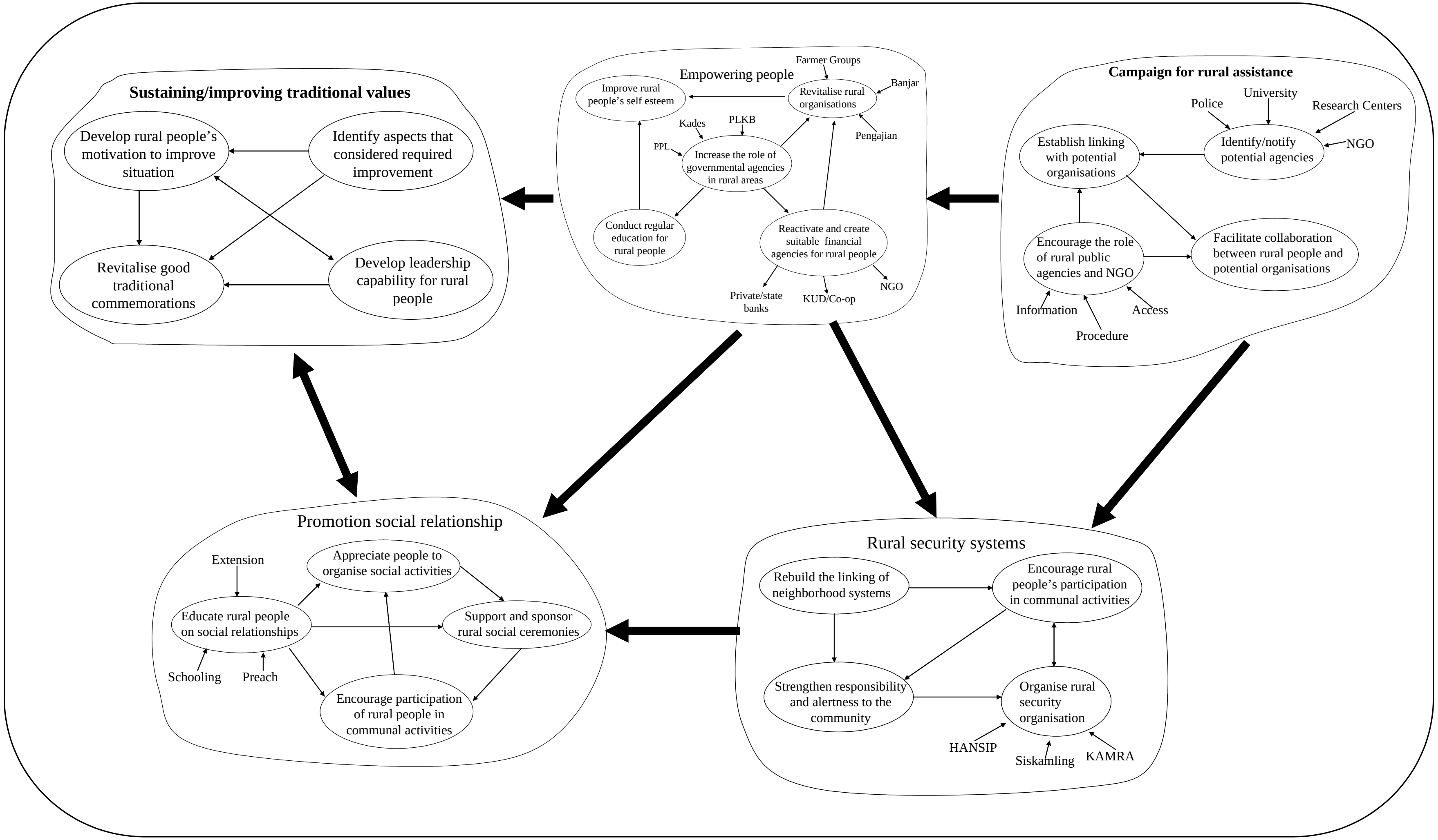

Figure 5.29: Conceptual Model of Improving the Social Relationship System

5.2.4 Comparing the Conceptual Model and Real World

In this stage, the focus of the Soft Systems Methodology (SSM) moves from systems thinking back to the real world. The objective of this stage is to identify the gap between the conceptual model and the real world so in turn to depict the most suitable model for the problem situation. This task was carried out with face-to-face discussions with the major agri-food supply chain participants including farm input suppliers, farmers, village intermediaries, subdistrict intermediaries, inter-island traders, people from financial support bodies, agricultural extension workers, head of villages and transporters. The face-to-face discussions were followed up by a wider workshop of supply chain participants.

Those people involved in the face-to-face discussions were given all the discussion materials three to four days before the discussion. The materials included the rich pictures, mind maps, conceptual models and a short explanation about the process used to develop the conceptual models. However, none of the supply chain participants read or studied these materials therefore they were not very well prepared when the discussion commenced. This meant that the material had to be explained to each of the supply chain participants but not to the agricultural extension workers and the heads of villages. This made this step very time consuming.

This step involves participants shifting from abstract thinking, which was focused on what sorts of activities should be carried out, to thinking about how those activities could be carried out to improve the problem situation. The following questions were used to direct this stage:

1. Does the activity exist in the present situation?
2. How is that activity carried out?
3. Why is the activity carried out in that way?
4. How is the activity judged by its users?
5. How can this activity be changed to make it more feasible?

The discussions with each individual participant in this stage were recorded as notes and then aggregated into a summary table. Some participants from government agencies, financial support agencies, sub-district intermediaries and inter-island traders attempted seriously to understand the process, and were willing to learn more about SSM. Farmers and village intermediaries, although seriously involved in the face-to-face discussion, showed little interest in knowing more about SSM. However, the researcher explained the concept to each person and conducted the discussion using very simple words and local language. Many of the participants found it difficult to relate to the model and its role in the process of improvement of the farm product supply chain from their village.

In the end all participants understood the objectives and goals of the research process to a level where they were able to actively take part in the discussion. These discussions highlighted a number of issues which were used as the basis for debating the desirable and feasible changes in the subsequent workshop. Those issues were:

1. The role of input suppliers at the village level when selling farm inputs through credit systems.
2. The methods used by money lenders or usurers in encouraging farmers to purchase farm inputs.
3. The lack of activity of the existing financial support bodies in rural areas.
4. The low levels of accessibility to good financial support services in subdistrict areas for farmers.
5. The removal or reduction of government aid or subsidies to farmers.
6. The lack of, or poor quality, price information on farm products.
7. The role of *tengkulak* or village intermediaries in collecting or consolidating farm products.
8. The low level bargaining power of farmers when selling their farm products.
9. The absence of any involvement of public agencies in endeavouring to improve farm product marketing systems.
10. The farm product quality which failed to meet the purchasers’ need.
11. The transportation infrastructure especially from farm gate to the main road.

12. The removal of all subsidies for ground water irrigation scheme development in rain-fed village areas.
13. The lessening of people's participation in traditional activities.
14. The increased threat of rural insecurity, especially rustling.
15. The lowering of rural people's solidarity in managing their daily life.

The results of this discussion were recorded in Tables 5.2-5.5

Table 5.2. Result of Discussions Comparing the Conceptual Model To The Real World for Root Definition 1

Activity in the model	In what form does the activity exist at present?	How is the activity carried out?	What are the reasons of this activity being carried out in this way?	How do the users judge the performance of this activity?	How could this activity be changed to make it more feasible?	What are the comments regarding this activity?
Coordination and administration	• No coordination amongst farmers and/or between participants along the supply chain	• Lack of communication • Selfish marketing • No coordination • Non-existent or poor collaboration among participants • Most only have contact with immediate supply chain participants	• Following traditional methods • All SC participants did not know the benefit of coordination and administration in trading process	• There is no method to judge this performance • Every SC participant only evaluates their own business	• More powerful participants initiate communication and do coordination along the chain but ensuring fair terms of trade and a sustainable trading process. • Every participant should understand the need for SC inter-dependency to sustain their business	• Village intermediaries and farmers want to do this. The constraint is that there is no counterpart to act as an initiator • Most of supply chain participants recognise the importance of interdependency
Trading of farm products	• Selling in an un-coordinated way through the supply chain • Trading closely linked to traditional ways and integrated with community	• Done on individual basis • Some with "*tebasan*[3] system" at farm level • Producers often offer the produce to buyers • Buyers in a	• Following traditional methods	• SC participants only evaluate their trading activity based on profit and amount of product sold	• Trading process will be more efficient and give greater mutual benefit if done on a group basis with good collaboration between sellers and purchasers. • Every participant	• This needs powerful and loyal leadership to initiate groups. In some areas the constraint is land topography • Improved information systems are difficult to initiate as current media is poorly

[3] Tebasan system is a method of selling farm produce before it has been harvested. The price is negotiated with the buyer based on the buyer's estimate of the yield.

	culture	position of power over producers • No feedback to the supplier or producers • Asymmetric market information along the chain			should be able to access market information. • Buyers provide feedback to the farmers or other sellers on market prospects.	developed because of the remoteness • Most participants from subdistrict intermediaries are very enthusiastic to provide market information. The constraint is finding a way to deliver it
Controlling the quality assurance of farm products	• Most farmers have never thought about the quality of their produce. They pay more attention to the quantity produced. They do not have appropriate facilities for floor drying, warehousing or packaging • Other SC participants like intermediaries and inter-island traders do undertake low levels of quality assurance following the practices of their	• Harvesting and handling done with very traditional methods • Lack of facilities especially for farmers or producers • Never done by farmers who sell with *tebasan* system • Limited or very poor packaging • Highly depended on climate or seasons • Poor management practices • Lack of knowledge of post harvest handling • No quality standards have	• Especially for farmers, they do not have appropriate facilities to carry out better controlling and assuring quality. • All SC participants did not know the better ways to control and assure the quality of their farm produce, they only follow the way their ancestor's did it.	• A quality control system was in place for paddy – it was judged by the "*rafaksi*" table. • For non paddy, this activity is only judged by remembering and recording the opinions of their product's buyers	• Farmers collectively or KUD build post harvest facilities. • Farmers trained and accredited to grade and sort the produce properly • Purchasers should set up a quality standard • Authorised agencies or inter-island traders should introduce improved packaging	• Post-harvest facilities will need to be built by KUD because most farmers are poor. KUD facilities are normally sponsored by state or federal government and sometimes by private firms. • The participants do not know how to setup quality standards. Need help from research centres or university. Participants realised this issue was important • The constraint is individual farmers are not able to afford the expense of new packaging systems. This will be better if developed collectively

	parents and the level depends on levels of risk associated with climate or seasons	been set up by buyers				or by private/state investors
Distributing and delivering of farm products	• Each farmer normally sells his or her produce to one buyer. In the *tebasan* system the farmer sells at farm-gate. In other systems farmers are responsible to deliver produce to the closest car accessible road because the transport infrastructure within villages is very poor. • Other participants are using motor vehicles on an individual basis – no coordination or cooperation	• Farmers apply very traditional methods so have never thought about alternative ways of transporting or distributing • Happy with current system • Highly depended on hauliers • No insurance for damage etc. • Timing is crucial but often poor • Lack of information facilities • Lack of collaboration • Produce often carted long distances • Very poor road infrastructure in the villages • No knowledge	• All SC participants including farmers only following the method that has already done by their predecessor	• SC participants only want the products to reach the destination. Of course they want their products to reach their destination retaining the harvest quality and on time	• Collaboration among farmers, among intermediaries and between participants will optimise the distribution system • Government can mobilise the community to improve and maintain the transportation infrastructure. • Alternative transportation systems developed e.g. modified motorcycle which is more suitable for topography and conditions • Simple information systems developed for farmers and a more sophisticated one for other participants is needed to coordinate flow of produce onto	• The constraint for collaboration between SC participants is the time taken to make the process work and they often live a long way apart. • Communications facilities like telephone, HT, radio caller are absent in the village. • Collaboration can be effectively carried out for those who live near each other. • Government agencies can only facilitate to maintain basic road infrastructure. • To improve the performance of the road system is very expensive • Need volunteers to do a trial of horses and cows as a transportation tool. Farmers in this area are

		about how to optimise distribution and/or handling systems			the market.	not familiar with horse husbandry. • Development of a modified motorcycle needs skilful mechanics and will be affordable if done collectively or if there is initial investors or subsidy
Consultation with government agencies	• Theoretically farmers can discuss their problems with PPL or village leaders, but this is not occurring at present. • There is not a special government agency based at the subdistrict or village level that oversights the trading system. • There are still a view by villagers that government personnel should be served and not vice versa.	• The PPL have not done their job properly; some have acted as profit-oriented agencies. • Farmers and other SC participants discuss their problems with family members and neighbours rather than government officials. • The personnel of the village assumed that trading issues within their village are not part of their official duties.	• There is little control and evaluation of the PPL's performance • SC participants mostly follow their parents • So villagers is still locked in the psychology and processes of the '*new era*' period.`	• PPL performance is only judged by reports prepared by the PPL and approved by their head office of KCD • SC participants only judged or evaluate their activity based on profit they can extract. They have never thought about their business continuity or sustainability • There is no judgement of this activity because it has never happened	• PPL and other government agencies in subdistrict and village level should become more involved in providing training or regulatory systems to ensure fair terms of trade • The annual programs of Department of Agriculture (at subdistrict level), and the PPL should explicitly include supply chain issues as a focus	• Closer involvement of government agencies in supply chain matters is strongly supported. However it needs approval from higher levels in these institutions

Table 5.3. Result of Discussions Comparing the Conceptual Model To The Real World for Root Definition 2

Activity in the model	In what form does the activity exist at present?	How is the activity carried out?	What are the reasons of this activity being carried out in this way?	How do the users judge the performance of this activity?	How could this activity be changed to make it more feasible?	What are the comments regarding this activity?
Educate farmers about collaborations	• Collaboration is common for religious ceremonies. • Collaboration in farm production activities only occurs for harvesting. • House building is done with close relatives or neighbours. • *Gotong royong* or public busy bees are done if asked by government	• People work together for preparing and running ceremonies. • A group of farmers move around and harvest every farm • People provide their time for free but lunch is provided. • This is compulsory for all people to serve the government	• Traditional values • Besides traditional values, it is considered cheaper • People expect reciprocal help for this • Public rules	• People think this must be retained • Some think it is good but some think it is not relevant anymore • Some think it is good but some think it is not relevant anymore • It will be good if the time doesn't conflict with farming work.	• It is better left unchanged. • Sometimes it is very rigid, make it more flexible. • It is good, no need to change. • Plan so does not occur in farming work season.	• There is no information or training on how to collaborate to provide appropriate farm finance and transport
Encourage establishment of local financial bodies	• Current rural financial body does not work well. It was established by government instruction.	• It does not work because there is not enough capital in this organisation.	• It only follows the requirements of village as directed by the government.	• This organisation is useless for rural people.	• Increase farmer's role in managing this organisation. Link it to the body in sub-	• There is basically no working financial organisation that can help or assist farmers in managing their farm business.

	• There is a financial body in the sub-district areas but it is too far away from research site.	• This institution cannot serve people who live far away from its office.	• There are no vehicles or telecommunication facilities. Also not enough money.	• This organisation is also useless for rural people.	district area. • Collaborate with the organisation at rural level.	• Farmers are keen to work together to establish and manage one.
Promote support from rural people	• Principally people support any activities that could assist them. • However, people do not know how to prioritise the things that must be supported.	• People almost never complained about things that were seen as an obligation.	• People generally have a low education level. They always assume that activities promoted from above are normally publicly beneficial.	• There is not support because this is not an activity promoted.	• It will be good if there is an activity looking to support a rural financial organisation that can help farmers.	• Many rural people dream of having a financial institution at rural level that can assist any of their businesses.
Develop business collaboration with external parties	• Generally people have not been involved with business collaboration with other people from outside their village. • It has been done only by some *tengkulak* at arms length and associated with speculation.	• The *tengkulak* were given some money and were asked by the speculators to collect or procure specific types of farm products.	• Follow traditional farm business methods. Also there is very low bargaining power to establish a real mutual collaboration.	• Rural people think that this mechanism will not increase their economic level into the long term. It will only help them for the short term.	• If people unite together, they can increase their bargaining power.	• Principally the rural people are very enthusiastic to establish collaboration with outside parties. There are some of them that have the skills to approach outside parties.
Construct monitoring and controlling mechanism	• This activity does not exist.	• This activity does not exist.	• This activity does not exist.	• This activity does not exist.	• This activity does not exist.	• This needs to be established once the rural financial body is established.

Table 5.4. Result of Discussions Comparing the Conceptual Model To The Real World for Root Definition 3

Activity in the model	In what form does the activity exist at present?	How is the activity carried out?	What are the reasons of this activity being carried out in this way?	How do the users judge the performance of this activity?	How could this activity be changed to make it more feasible?	What are the comments regarding this activity?
Improve farm inputs' purchasing mechanism	• Most farmers purchase their farm input requirements with credit systems.	• Farmers pay double the price for a one year grace for payment period which equates to ~ 10% interest per month. The same rates apply if farmers borrow money from money lenders.	• Some accept this as they see it as a tradition. This is because there has been no other cheaper alternative finance source.	• It is very negative for farmers in managing their farms.	• By establishing an efficient financial organisation for rural farmers.	• Rural people really need this kind of organisation. Most people are ready to support it if there is someone who can initiate it.
Promote the efficient cultivation of marketable crops	• Farmers do not know which are marketable or non-marketable crops. There is not enough information for farmers to make decisions about this.	• Farmers only cultivate the crops they have traditionally planted. The methods of cultivation are also those used historically.	• Farmers do not want to take a risk with their farm business. • They think that only the traditional crops were suitable for their land.	• Almost all farmers assume that the crops they were planting were profitable even though they didn't know the different profitability levels of the different crop options.	• Information systems and contract farming may help this problem.	• Information about good marketable crops is really needed by farmers and at the same time they also need a guaranteed price for their crops.
Revitalise the activities of farmer groups	• Farmer groups currently don't have any significant activity which is	• Farmer leaders now never organise a meeting to	• Agricultural extension workers have not trained the farmer leaders	• This situation is thought of as a floating situation. • This is also	• PPL and other authorised bodies work together to teach farmers	• The potential activities of farmer groups are still dormant until they

	unlike the situation when there were subsidies. • Farmer groups now are only used to mobilise people when they are needed by other parties.	discuss farm input needs for their groups or organise an event for selling farmer member products. • Farmer leaders will visit their members' houses if there is a request from third parties.	about leadership apart from organising a meeting about subsidies. • The leaders still think that they are an informal servant of government, not a partner serving their members.	considered not good for agricultural development in this village.	about organisations and leadership, plus the meaning and benefit of being a member of an organisation.	are reactivated. Some potential agencies like PPL, NGO and Religious leaders can be mobilised to help them.
Develop efficient post-harvest handling	• Post-harvest handling has been done in the traditional way. • Farmers never calculate or care about the loss of product or the time and costs of poor post-harvest handling.	• Drying, peeling, packaging and transporting in a very traditional way.	• Just follow the way their parents or grand parents handled crops. • The farmers still do not know a better way of handling. • They don't know the way to make even simple changes.	• Most farmers think that this is the best way they can handle crops based on the situation they currently face.	• Simple thrashers and packaging methods may be feasible for assisting or improving post-harvest handling.	• Human resources and other support is present and able to help in developing and implementing simple tools and methods.
Encourage the role of government agencies	• The government agencies which are responsible to rural development are PPL, BRI, BPD, Rural Development Board (BPD).	• PPL rarely visit or train farmers; some places have never been visited. • BRI and BPD cannot reach rural farmers. The BPD only monitor at sub-	• Most rural people do not know the reason why the organisations are so dysfunctional. • Cross checking found that the management of these agencies has been very lax	• Rural people dream about the activities of the past. • They believed that the agencies laziness made the farm subsidies stop. • But in fact it was	• Invite the people from higher level offices to monitor and control the work performance of people in rural areas. • Subsidies cannot be returned but support for other	• Establish systems that means that rural people are involved in the control and monitoring of the work performance of these agencies.

		district office level through *camat*[4]	since the reformation era.	due to the problems with the national economy.	farm production processes is still needed.	

Table 5.5. Result of Discussions Comparing the Conceptual Model To The Real World for Root Definition 4

Activity in the model	In what form does the activity exist at present?	How is the activity carried out?	What are the reasons of this activity being carried out in this way?	How do the users judge the performance of this activity?	How could this activity be changed to make it more feasible?	What are the comments regarding this activity?
Empower people in the right way	• Schooling systems for rural children. • Instructions or one way monolog from governmental persons called *ceramah.*	• School must follow national curriculum. • Personnel from government agencies come to village offices to introduce programs or new rules.	• This is the national rule. • This could be a part of the government agencies yearly programs.	• Rural people mostly think school is expensive and only for children. • People also need education for other purposes • Rural people think that introducing programs run by government personnel is a waste of time.	• Education may also be conducted through informal education like *pengajian*, plot demonstrations and *banjar*. • People may also be trained about specific skills like plumbing, carpentry, and business management.	• This kind of activity will be developed if there is full support from religious and community leaders. • Government and NGO assistance also essential.
Promote social relationship among rural people	• Working together for public facilities. • Participate in rural social events like *ngantar haji* and Independence Day.	• Working bees without payment called *Gotong Royong.* • Going together to airport to	• This is an old tradition. • There is a belief that the people who accompany the Haj pilgrims to	• This must be retained because it is good. • Some people think this is good while others do not	• *Gotong Royong* should not be done on a working day. • People must think about the cost of this activity.	• Social relationship may be increased through the mediums of *pengajian*, *dakwah*, *banjar*, and extension training.

[4] *Camat* is a head of council. One council can cover a number of villages

		support people who are taking part in the Haj pilgrimage. • Ready to be part of village delegation for Independence Day carnival without payment.	the airport will obtain mercy from God. • This shows the degree of nationalism.	really believe it. • People are afraid of not being nationalist because it will affect their whole life.	• If it is done on a working day, the participants should be given payment, even if only part payment.	
Sustain/improve traditional values	• Helping each other in religious ceremonies. • Believing religious leader almost without reserve. • Obey traditional norms and public leaders.	• Working together to prepare and run religious ceremonies. • Always do what the leaders direct or instruct. • Attending and helping at burials, weddings and circumcision ceremonies. • Don't break positive rules.	• The people who do not help other people, will not be helped in the future if they have a party. • The leader has power to impeach people. • Those people who don't help other people, will not obtain the same in the future if they have the need for the same kind of ceremony.	• Most people think this is good. • Sometimes people too irrational to trust the leader. • This tradition must be retained.	• Some traditional values that are considered not relevant anymore for this era may be improved through trying to persuade the community leader to change.	• Changing traditional activity and yet remaining close to religious believes is a very difficult job.
Create good rural security systems	• There are no formal or informal rural security systems, even though there are cases of cattle burglaries.	• This activity does not exist.	• This activity does not exist.	• This activity does not exist.	• This activity does not exist.	• People really need to establish rural security systems like those in place during the 'new order' era (called *siskamling* or neighbourhood

						security systems).
Campaign for village assistance or aid	• There is no activity to campaign for assistance for rural people – especially that focuses on the development of social relationships.	• This activity does not exist.	• This activity does not exist.	• This activity does not exist.	• This activity does not exist.	• This can be established realising that the police and national education department usually have programs relating to rural development.

5.2.5 Desirable and Feasible Changes

The primary objective of this stage was to share individual opinions gathered from Stage 4 among the Stage 4 participants in a workshop. To achieve this it was very important to get as many participants who were involved in Stage 4 as possible to attend the Stage 5 workshop. Some new participants were also included. The second objective was to validate and refine the agri-food chain conceptual models. Key functions were to identify missing elements, actors and relationships that were absent in the models and to determine whether there were relationships which were considered unnecessary or needed modification. The third objective was to understand and develop culturally desirable and technically feasible future improvements for the studied supply chains.

Personal letters of invitation and workshop information kits were given to each potential participant as part of a personal visit by the researcher. Letters of invitation were signed by the head of the village, a high ranking government or KUD official to ensure maximum attendance. The inter-island traders did not have a representative at the workshop because they were unable to get away from their business to attend the workshop but were amenable to a subsequent face-to-face discussion with the researcher. It is important to note that this workshop was the first time that any of the participants had gathered around a table to discuss issues associated with agricultural supply chains or marketing.

In practice the workshop consisted of four sessions – 1) preamble or introduction, 2) distributing and understanding handouts which would form the basis of discussion, 3) discussion within smaller groups and with the group as a whole and 4) a concluding session which closed the workshop. The workshop was facilitated by the researcher. Each workshop was opened formally by the head of the village or the head of the agricultural extension station followed by an introduction by each workshop participant in which they were encouraged to describe their profession and technical knowledge.

During the introduction the researcher also explained the aims of the study in general and of the workshop in particular. He stressed that this study was not aimed at generating subsidies or other aid for rural people but was purely a study being undertaken as part of a research degree. This helped to focus the participants on the purpose of the workshop which was how they could improve their supply chain.

The background material which summarised the research findings to date was handed out in the second session. The participants were given time to digest this material with only minimal intervention from the researcher when the participant didn't understand the material. This intervention was done very carefully in order not to bias the participants' perceptions. It was observed that in general those participants who had higher levels of education and/or had administration as part of their job had fewer problems understanding the material. Participants who were educated up to high school level but were not involved in administrative activities as their main jobs, such as traders, still had serious difficulties understanding the handouts. This gap in understanding was filled by the researcher, with assistance from participating staff from the agricultural extension service, Department of Trading and Industry and the KUD. The researcher monitored these exchanges to ensure inadvertent bias was not introduced into the discussions. When it was felt that all participants understood the handouts, a break was held to allow the participants to relax before moving to the next stage in the process. Lunch, coffee, tea and cigarettes were provided for the participants during this break.

The third session involved group and plenary discussions. Group discussion was used to focus on specific topic areas and the plenary sessions as feedback from the groups. Group sizes were kept to five or six people and were mixed in background. Three government agency participants and one of the village intermediaries did not take part in group discussions because they had other pressing business. Each group was asked to discuss one specific topic (supply chain, input, social and production) based on the handouts distributed.

The discussion was guided by seven general questions.

1. What is the main activity of the subsystem and why?
2. What other activities are closely related to the main activity within the subsystem?

3. How is every activity in the subsystem carried out and why?
4. Who are the actor(s) in every activity of the subsystem?
5. What are the main input(s) and output(s) of every activity in the subsystem?
6. When considering the whole subsystem, what kinds of activities are needed to operate this subsystem and what are the results of those activities?
7. What kind of activities should be changed to make this subsystem operate better?

These questions were written on a whiteboard in the discussion rooms so that participants could refer to them at any stage.

It was necessary to explain some of the concepts being used in the analysis to the participant groups. For instance the 'supply chain' group initially faced difficulties differentiating the differences between supply chains and marketing as constructs. The term 'supply chain' was a very new concept for all participants and required explanation from the researcher who also introduced concepts of value chains and explained the role of activities such as '*logistik*[5] (logistic)' and '*sistems*[6] (systems)'.

5.2.5.1 Supply Chain Sub-group

The supply chain group felt that the subsystem was workable even though there was a need for some additional inputs such as further funds, flexible negotiators or mediators, and continuity of production. Funds would be used to facilitate coordination and administrative activities as a main activity of this subsystem. Therefore the group recommend establishing a formal body either at subdistrict level (*kecamatan*) or district level (*kabupaten*) to administer this activity. This was considered very important and has not been part of the process of distributing farm products.

[5] Logistics was seen as being related to the government agency that runs the social security network for rice as a staple food called *Badan Urusan Logistik (BULOG), Depot Logistik (DOLOG)* and *Sub Depot Logistik (SUBDOLOG)* at national, provincial and district levels respectively.
[6] 'S*istem*' was mostly interpreted as a technique or a way to do something rather than the definition defined in section 4.2.

Four activities - trading, quality assurance, logistics and improving consultation with government representatives - were considered as supporting activities. While these four activities already existed in the agri-food supply chain, they were carried out in very traditional ways and at low intensities. The continuity of production was also considered important. The major issue identified was the need to revitalise the ground water scheme with new management that intensively involved rural farmers as the owners of the systems so that the water availability was maximised and two crops per year became possible. None of the participants were aware of technologies such as windmills or solar pumps which could be used in both study areas if they were found to be technically and financially feasible.

The third input needed to operate this subsystem was the need to have skilled or experienced people to act as negotiators or mediators for the system. These people needed to link, or broaden linkages, among supply chain participants or between supply chain participants and outside industries. They were also seen as potential brokers of reliable market information to supply chain participants. When this was discussed with the inter-island traders (who didn't attend the workshop) they all agreed with the workshop outputs but were worried that the suggested systems might by-pass their role in distributing farm products from Lombok.

The supply chain group identified that the following outputs would be expected from this sub-system when it was operating well:

- An improvement in the sharing of marketing margins and information for all supply chain participants;
- Less use of market power by agents in the chain because of the level of transparency;
- Improved quality of product supplied to the chain. All of the participants had no idea that products they produced (and handled) were being used further down the chain by commercial food processors or manufacturers in Java or Bali[7];

[7] Had the island traders been present this would not have been the case.

- An increased role of government field staff in providing advice in supply chain management and crop production methods. It is worth noting that none of the participants explicitly mentioned an improvement of marketing or price information as the output from this subsystem. This issue was assumed to be included as the role of the government representatives.

5.2.5.2 Input Sub-group

The input sub-group focused on the farm input procurement system. They all agreed that the establishment or revitalisation of local financial institutions was the main activity for this subsystem. Four of the five activities included in the conceptual model had never existed in the research areas. The fifth, educating farmers, has existed and has been carried out by the agricultural extension workers. However, in the past this has not included education about the functioning of financial agencies. It was felt that such training was important and should be carried out by staff from banks or the Department of Cooperatives[8].

Participants had no idea what represented an appropriate financial body but they felt that the rural financial structures put in place in 1996/97, which were under the control of the village head, were inappropriate as it lacked transparency and put too much power in the hands of the head of the village. These institutions have since been closed and all debts were written off by the government[9]. The group agreed that the ideal institutional structure was one in which control was held by ordinary people like farmers or other rural professions and managed democratically. However, none of the participants had ever been educated about banking or cooperative systems.

The group also recognised that supply chain participants had the ability to collaborate but none of the rural people had ever had experience in collaborating with people from formal institutions like banks, non-government organisations (NGOs) or cooperatives. Although most of the farmers had received government subsidies through cooperatives such as the KUD, all the negotiation and

[8] There are branches of two state banks (BRI is national-wide and BPD is provincial-wide) in the closest town to the research site. In addition, there was also a representative who is in charge of regulating cooperatives in the council offices at Bayan and Sengkol.
[9] This process was called *pemutihan*.

documentation was handled by agricultural extension workers, village unit cooperatives (KUD) and the office of the Head of the village. The farmers as subsidy recipients did not know or understand the process. The current areas where collaboration occurred were in traditional ceremonies, building houses for a neighbour or in improving public facilities.

The group identified funds, educators (teachers or trainers) and commitments of rural people and mediators as inputs to this subsystem. There was an expectation that the educators would act as mediators due to the current lack of a skills base. Funds were required to establish the capital base and build a local skills base.

This subsystem was expected to provide an improved mechanism of farm input procurement for farmers that excluded moneylenders or usurers. One member of this group[10] informed the forum that most farmers assumed that all farm inputs supplied to them were seen as a gift requiring no repayment which suggested that there was a need to educate farmers about the market economy. The beneficiaries of an improved farm input procurement system were farmers but the group also believed that there were benefits for village intermediaries and other rural professions.

5.2.5.3 Production System Sub-group

The focus of the production sub-group was on the cultivation of a marketable crop. In some areas the choice of crop was limited because of the prevailing agro-climatic conditions (see Chapter 2) while in many cases, such as in Desa Akar-akar, farmers followed the historical patterns of crops and cultivation methods. The major inhibitor for change was the fear of crop failure. In Desa Kawo farmers also had limited choice due to habit and recommendations from government over a period of 30 years to cultivate paddy as the first season crop in order to achieve a position of rice self-sufficiency for the country. Some farmers in this village who have access to *Batujai* dam water in surplus water seasons can cultivate their farm twice a year.[11] All participants in this sub-group thought that all their current crops were marketable.

[10] This participant was later identified as a farmer leader of a farmer group in the research areas.
[11] This second planting season is called '*palawija*' (see Chapter 2 for more detail)

The participants noticed that the remaining activities in this sub-system were carried out in very traditional ways. They also suggested additional linkages between ‘improve purchasing farm input system’ and ‘encourage the role of government agencies’, and also between ‘updating post-harvest handling’ and ‘encourage the role of government agencies’. The group also changed the relationship between ‘encourage the role of government agencies’ and ‘refresh the activities of farmer group’ from a two-way interaction to a one-way one from government to farmers with no feedback. The group felt that farmers did not have the power and capability to influence government agencies. They also agreed that although the actors involved in this subsystem were farm input suppliers, farmers, agricultural extension workers and transporters, the owner of this subsystem was the farmers as they played the most significant role in continuing and terminating the operation of this subsystem.

The group identified that this subsystem would operate well if the supply of farm inputs from the higher level suppliers like PT Pertani and PT Pusri was sufficient and was to continue into the future. They noted that there was a need to develop and maintain appropriate infrastructure including feasible information dissemination facilities such as TV, radio and newspapers. With respect to media there was a recommendation that either the government or an NGO be encouraged to supply a public TV as only farmers considered as rich had televisions and radios. The village heads estimated that there were less than 20 TVs in Desa Akar-akar and 40 in Desa kawo. They also noted the almost total absence of newspapers and had no idea about the number of radios. Nearly all the participants had never seen a computer before so the use of the Internet was not relevant. Telephones were also considered a luxury and the only public telephones for each village was approximately 25 km away.

The desired (expected) output from this subsystem was a dynamic farm production process where farmers were happy with the fairness of farm input expenses and received a good price for their farm products which were of an improved quality. An interesting observation by the group was that the overall standard of living of farmers had dropped since the reforms following the ‘new era’. Another important output expected was that this subsystem would be able to absorb more labour throughout the year thereby reducing the need for the young men from these villages to travel to the closest irrigated areas to find jobs in their village's fallow season.

5.2.5.4 Social Sub-group

The social sub-group looked at the village social system and identified the activity - 'promoting social relationship among rural people' - as the main activity of this subsystem. The group found it difficult to understand the word 'empower' which in Bahasa Indonesia is '*pemberdayaan*' and required an explanation using examples before they were able to begin the discussion. They initially understood it to be a synonym for the schooling system. They finally understood the term after hearing several examples from the researcher and participants who already understood the term.

The operation of this subsystem would be significantly supported with two main inputs: good community leaders and a good rural legal system. The participants identified that a good rural leader required '*sholeh*'. Realising that the researcher was not a Moslem, they explained the meaning of the word in detail as meaning everything related to the good aspects of human activities such as being honest, firm, fair, responsible, sincere, healthy and willing to serve the people. It was felt that such leadership skills could be exposed in a true democratic election which was free from corruption and was totally transparent. They criticised the elections that were conducted before the reformation era.

Another input recommended was a good rural legal system. There were normally two kinds of rural legal systems - *Peraturan Desa (Perdes)* and *Awig-awig* - recognised on this island. *Perdes* is a formal legal rule issued by the office of the Head of the Village (*Kepala Desa*) with approval from the village parliamentary board called the *Badan Permusyawatan Desa (BPD)*. These are usually standard rules based on federal or state rules, which are similar from one village to the next but contextualised to suite each village.

However, what truly characterised a village from others was the recognition of its own traditional rule called *Awig-awig*, a Balinese term. Lombok was colonised by the Balinese Kingdom for a long period starting in 1740 (Scheltema, 1931).

The *Awig-awig* governed the traditional way of life for rural people including the traditional sanctions for those who broke the rules. However, some sanctions that were not relevant to this era were removed from the *awig-awig*. For example, whipping as a form of punishment for those who were proven to be lying publicly was permanently removed. In short, the participants in this group wanted firm and robust rules that were either formal or traditional for rural areas in general and for the research sites in particular. In addition, they expected better guidance from the new government to improve the rural way of life.

The subsystem was expected to provide a stable social environment in the village. There has been no conflict between villagers despite the range of religions, ethnic groups or races in the village. This was seen as important as it meant outsiders could visit and do business safely in the village, thereby increasing the villagers' welfare. Of course, the outsiders must also understand the village's traditional rules. In short, all participants of this group saw that the social aspects of the villages' life, and Lombok Island in general, were major factors in attracting and retaining strong markets for their farm products. The key components identified were a robust legal system, peaceful and harmonic relationships between villagers, and a transparent and fair leadership.

5.2.5.5 Plenary Session

After all group discussions had finished, all participants had a break and light refreshments before starting the plenary session. This included all participants including the four who were absent from the group discussions. One member of each group presented the findings for their group. This was followed by open discussion once each group had presented their results. Having such an open discussion meant that participants were able to act as individuals rather than as group members. There was no chairman or moderator for this discussion. The researcher only acted as a facilitator for the process of brainstorming.

The discussion flowed well and the four absentees fitted into the discussion well[12] and were very helpful in assisting others to understand the specific terms, to

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[12] There was a worry that these participants who had a higher education level and social status than others might dominate the discussion.

address questions, and to clarify some complexities. In fact, the forum tended to be dominated by the farmer leaders and the intermediaries. A further point worth noting was that all participants regretted the absence of the inter-island traders from the workshop as they felt they would have added a further valuable perspective. To this end the participants asked that the researcher convey the results of the workshop to the inter-island traders and asked that he organise a second workshop with them involved. This was not possible due to time and financial limitations. The summary outputs of this plenary discussion were discussed with the inter-island traders and combined in the next section as a series of recommendations.

5.2.6 Recommended Pathways of Improvement

The recommendations that resulted from the plenary session can be grouped into two categories. The first group focused on the recommendations to improve the performance of the agribusiness supply chain and the second group of recommendations focused on aspects of the adopted methodology. These recommendations are aspirational and will need modifying after discussions with the appropriate policy and implementation bodies. This might require further debate by the group.

5.2.6.1 Recommendations to Improve Supply Chain Performance

Recommendations that the plenary session identified that they felt would improve the performance of agribusiness supply chain were:

1. Reactivate a democratic village financial body or *Lembaga Keuangan Pedesaan* (LKP)[13] to be managed by the villagers, for the villagers. The workshop participants were adamant that a previous structure which was dominated by the Head of the Village and the Head of the Village Parliamentary Board was not appropriate. It was thought that trying to develop the new financial body at district level would be difficult and there was more chance of success if the focus was at village level.

[13] This rural financial body was established in the new era order between 1987 and 1997.

2. Create a farmer group whose role would be to encourage collaboration amongst its members and to bridge the interests of members to other supply chain participants, up- and down-stream.
3. Farmers, together with other supply chain participants including the KUD, should consider building post-harvest handling facilities in the village to assist farmers and village intermediaries to control and assure the quality of farm products. The facilities considered urgent by the forum were a drying floor and storehouses. These may be constructed with finance from those participants who have money and managed by the supply chain management board. The key to the success of this recommendation was that the facilities were made available to farmers at a reasonable cost. Another capital item considered important were threshers that may be purchased by individual farmers or a small group of farmers via a feasible credit plan.
4. Organising frequent formal and informal meetings among all supply chain participants to improve healthy communication that in turn would improve the performance of the supply chain in particular and rural development in general. In particular, the forum expected more intensive involvement of agricultural extension workers as a focal point for agricultural development. The success of this initiative would be reliant on an open and honest discussion and actions by all supply chain participants, including those holding market or financial power.
5. The personnel of government institutions like the Department of Agriculture, Department of Cooperatives, Department of Trading and Industry, State Banks and Council Offices should pay more attention to the processes of the supply chain and include this issue in their annual strategic planning discussions. This would require these organisations to share information with each other and also with the public. The forum encouraged a whole of government approach to supply chain issues.
6. Rural people must maintain village security. This was expected to increase the interest of outsiders to invest their money in the village or to

do business with villagers. The forum felt that this would automatically occur when there was a harmonic relationship between villagers.

7. Basic research into the supply chain and its problems must be undertaken to measure and evaluate supply chain performance. Priority areas identified were rural microfinance, income distribution, marketing and production efficiency, and analysis of farming productivity.

5.2.6.2 Recommendations on the Methodology

The plenary session participants were asked to make recommendations on the methodology adopted in this research. They made the following recommendations:

1. Stakeholders felt that they must be intensively involved in the research process from the start to end so they develop a full understanding of the process. This would lead to the quicker development of better outcomes whether in a similar or different context.
2. That the conceptual model be presented with more simple statistics or using qualitative data that was easy to interpret to help them understand the proposed improved situation. The forum believed that addressing this would result in more accurate inputs and opinions from the workshop participants.
3. Overall the participants in the research felt that SSM tools and techniques were a good vehicle for developing an understanding of agri-food supply chain issues in rural Lombok. They found that the application of SSM was particularly useful for describing the complexity and uncertainty of the supply chain process that involved several kinds of actors, each with their own individual interests.

5.3 Reflections on the Use of Soft Systems Methodology

5.3.1 Background

Soft systems methodology (SSM) consists of three important words. ‘Soft’ refers to problems that are ill-defined, unstructured, wicked, have flexible interpretation and where there will be various perceptions, views, understandings and opinions.

The word 'systems' implies that the nature of this approach is analysing the problem situation in an object holistic way and 'methodology' means a set of structured techniques or methods that meet the requirement of epistemology. Therefore SSM is a methodology to study soft problem situations holistically which implies the research is undertaken in a qualitative way. SSM may also be used as both a learning system, (Checkland, 1985) because it facilitates an understanding of the problem situation and changes iteratively, and as a problem solving system because it produces recommendations which improve the problem situation.

Since it was first developed at the University of Lancaster, SSM has been applied to a diverse range of problems such as health science, library administration research, information and agricultural systems and engineering. The wide use of SSM is a result of its ability to address any kind of 'wicked complex problem' in any organisation or social situation. In addition, this approach can produce various types of result due to the appreciation of the world views (*Weltanschauungen*) of the participants involved in the problem situation studied. Thus, this result would be expected to satisfy the actors and the owners of the problems.

The objective of the approach presented in this chapter was to show how SSM as a participatory research methodology could be applied to the supply chain systems associated with dryland farming systems in a developing country like Indonesia. The nature of the agri-food supply chain is characterised by complex relationships and interactions between supply chain members and the associated socioeconomic and biophysical environment. In this case the base problem situation is characterised by 1) significant risk and uncertainty around production and markets, 2) the supply chain involves multiple stakeholders each with different interests and values that frequently conflict, 3) low levels of stakeholder education and experience in dealing with conflict resolution and 4) a very traditional attitude to agricultural production and marketing which means that there were strong forces working to maintain the status quo. These factors indicate that the choice of a participatory approach to achieve problem resolution was appropriate.

The nature of the SSM approach means that an analysis is likely to produce a wide range of issues within the problem situation. This was the case in this study which meant that the research had to be focused down to a smaller number of issues due to time and resource constraints. As a result this study only analysed the four major root definitions that were considered as the most relevant to the problem situation. It is also worth noting that the researcher has to be an independent observer when using SSM. In this case the researcher was familiar with the general culture on Lombok, having been born and grown up there but he still had to develop a deep understanding of the rural people's perceptions, views, interests and feelings because his background was predominantly urban.

The remainder of this section discusses the problems encountered in this study which have been categorised into problems related to the methodology and problems related to involving people in the problem situation.

5.3.2 Problems Related To Involving the People In The Process

SSM is a time-intensive way of problem solving for both the researcher and the problem owners. The methodology incorporates feedback loops and allows steps to be repeated. This suggests that the researcher should be resident in the study area for the major part of the study period. This was clearly not possible in this study as the researcher was only able to spend a limited amount of time in the study area. In practice this meant that some elements of the research were truncated but it is believed that this has had little impact on the overall validity of the study.

The second major hurdle faced by the researcher was the need to develop a rapport with the problem owners. This meant developing new skills which ensured that there was strong communications lines developed and that there was flexibility on the part of the researcher to not only understand the perspectives of the different groups but also the ability to help them develop the debate which led to problem resolution. There was always the need to ensure that the researcher was seen as independent of the problem situation and the evolving views of the problem owner groups.

The third significant point was that there was a need for the researcher to interpret during the process of the study. There was the obvious need to interpret between English and Bahasa but there was a further level of interpretation required. This was to take what is basically a theoretical construct and interpret it for the particular problem situation being investigated. This was further complicated by the low levels of education held by the supply chain participants. While care was taken in undertaking these translation activities there were a small number of occasions when this was compromised. These were assessed to have no major impact on the output from the research.

A further problem encountered was ensuring at all stages of the study, but in the development stage in particular, that expectations were not raised by the researcher. The focus of SSM is on developing improvements to an existing problem situation. This expectation was managed throughout the study, by the researcher pointing out that the outputs from the study were owned by the participants themselves and that the study would produce recommendations and a learning system that could be used to derive change. In fact the results of the research will be conveyed to the office of the Regional Planning Board and the state and district administrators for their consideration and possible action. This was a requirement of them providing a permit to undertake the study.

In short, entering the problem situation was itself problematic. Despite the researcher’s familiarity with the culture and habits of the people on Lombok there was a cultural difference between his experiences and those of the supply chain participants, especially the farmers. The researcher was definitely an outsider and therefore was required to introduce a new concept to the participants. This study was unlike many other reported SSM studies where the analyst or a team of analysts were invited by an organisation to enter the problem situation. In this study, the author as a researcher stepped rigorously into the situation on his own initiative. The essential question therefore was for whom was the SSM study being carried out? Was it for the researcher or for the participants or for policy makers? In fact the answer was for all stakeholders.

5.3.3 Problems Related To the Methodology

A number of problems were encountered in taking the theoretical construct of SSM and applying it to the real world situation. There were problems at each stage of the process but the following summarises the major problems and how these were overcome during the process of the research.

Developing the rich picture to reflect precisely and honestly the real problem situation was difficult. SSM provides a wide freedom for the researcher to explore and express the problem situation. The difficulty comes up first in determining who must draw the picture? The options include the researcher alone, the researcher together with the participants, or only the participants? In the first instance the researcher drew the rich picture alone but the result was considered very weak. This was identified when it was shown to a number of the key people involved in the supply chain. They failed to understand the content and the goal of the rich picture. Once the objectives of developing the rich picture were explained, the participants provided much valuable information which considerably improved the rich picture. Considering the time required to bring all participants together, the rich picture was finally drawn by the researcher but based heavily on the input of the supply chain members. von Bollow (1989:p36) argued that "*it is taken as given that no objective and complete account of the problem situation can be provided because 1) the social world is by far too complex to be matched by a model as one to one, and 2) people attach different meaning to the same social phenomena*".

In summary the development of a good rich picture required meticulous understanding of the situation where the study was being undertaken (ontological aspect) and thoroughly capturing the crucial issue impacting the problem. The development of the rich picture should depict both the ontological and the epistemological issues. It must also allow for 1) real individual participation, 2) the structure of the prevailing socioeconomic conditions of community and their interaction with the biophysical elements of environment, and 3) an understanding of the processes involved in the supply chain operating in the research sites, including power relationships between the actors and the owners of the systems.

The next area of difficulty relates to the definition of the relevant systems, root definitions and building of conceptual models. As was noted earlier SSM is not only a problem solver but is also a process of learning. The learning element came through in the development of the relevant systems and their root definitions. If there were too many then this would generate a large number of options for the participants and researcher to consider when recommending improvements but if there were too few there might not be enough material to derived appropriate recommendation for improving the situation. In the end this process took a number of iterations with the emphasis being on focusing the study rather than expanding it. In the end the decision was made to restrict the number of important issues that could appropriately be studied to the timeframe and resource availability but balancing this with the need to appropriately represent the problem space.

In developing conceptual models, a major issue was articulating the relationships between customers, actors and owners of the models. It was important to get this step right as these relationships were closely related to the set of actions that would finally be taken to improve the situation. A further problem encountered was restricting the detail to be included in the models especially the potential to proliferate a large number of sub-systems thereby making the model(s) too difficult to interpret. This was resolved by continually reflecting that the conceptual models were no more than a tool to stimulate and structure a debate among participants to improve the situation (Jackson, 1990; Checkland and Schole, 1990). The conceptual models only provided a framework from which a real problem situation may be compared. Therefore, when the conceptual model was considered appropriate enough to facilitate a debate a decision was made to halt further subsystem development.

The final area where problems were experienced was in the comparison between the conceptual models and the real problem situation. The initial problem related to the range of perspectives held by participants in the workshop. Initially a number of participants did not understand what the models had been developed for while others thought the conceptual models were not appropriate. However, in both cases the resulting discussion as a good starting point for the ensuing debate.

As Davis and Ledington (1988) noted, conflict is appropriate and essential when this conflict stimulates participants to identify an innovative change.

5.4 Summary

The major conclusion from this research is that the soft systems methodology adopted in this research was successful in identifying a feasible pathway for change for the agri-food supply chains associated with dryland farming in Lombok. The major benefit of using SSM was that the methodology provided the opportunity for people who were involved in the agri-food supply chain to come together for the first time and co-jointly participate in finding a solution(s) for their supply chain problems. This was a formative experience for those who participated and the participatory approach increased each individual's commitment to implementing the proposed changes, although in final practice there may be some further refinement of the proposed pathway of change.

Secondly, the process produced realistic and feasible solutions in a culturally acceptable way. The outcomes would most probably have never been achieved had a reductionist approach been used to address the problem situation. A reductionist approach would have reduced the supply chain members to being providers of information and rarely, if ever, solvers of the problem. However, there were gaps in the analysis which suggest that there is a place to include more quantitative approaches such as statistical and mathematical programming modelling alongside the SSM approach (see Section 5.1 and Section 5.2.3). The key areas identified in the SSM study were the assessment of the production efficiency of the farm production systems and looking more closely at the relationships between supply chain participants. These two areas are developed further in the next two chapters.

Finally, the nature of the SSM approach unconsciously helped the supply chain members to understand, look at, think, analyse and solve their problem through collaborative action. As a result the approach helped to educate all participants involved in the research. This should help them in the future as they apply the same broad holistic principles to other problems facing their supply chain and relevant problems. To this end there is a need to develop a simplified SSM approach which significantly reduces the sophisticated systems jargon and technical terms that have been developed by the SSM research community. The success of the approach suggests that it should be taught to students, educators, planners and policy makers as an approach that has significant utility in resolving complex problem situations that involve interactions between social, economic, environmental and cultural systems.

Chapter Six

ANALYSIS OF FARM PRODUCTION

6.1 Introduction

This chapter is about the farming system in the research site and is based on the qualitative and quantitative data gathered from the survey. This chapter consists of seven sections. Section 6.2 presents farming practises in dryland farming system of Lombok Island in the Northern and Southern Zones. Section 6.3 is about the characteristics of farmer respondents. This section discusses the distribution of farmer respondents based on their age, education, farming experience, number of land parcels managed, family members and sources of income. Section 6.4 describes the farm input and output characteristics and Section 6.5 discusses the production function analysis results of the Cobb-Douglass stochastic frontier function and the results of the analysis of farm technical efficiency. Section 6.6 discusses the determinants of farm-specific technical efficiency. The last section contains the summary, conclusion and policy implications of the research findings for this chapter. This section also discusses the limitations of this study and outlines some suggestions to be considered in undertaking future research in a similar field.

6.2 Farming Systems in the Research Site

The farming systems in dryland areas of Lombok can be differentiated based on the location or classification zone. In the northern zone, farmers do not cultivate rice but instead plant corn, peanut and cassava because the area is mostly dryland rainfed. In the southern zone where the soil is compact and water can be retained, farmers prefer to cultivate rice. Consequently, the farming systems in these two zones are different.

6.2.1 Farming in the Northern Zone

6.2.1.1 Land Preparation

Farmers perform land preparation using simple manual methods and using traditional tools such as hoes, choppers, axes, crowbars and ploughs. Most activities are carried out by family labour. However, ploughing which uses hired labour is often contracted out on a per hectare or a per day hire basis. The survey shows that there is a preference for farmers to contract on a per hectare basis because:

- the cost is guaranteed although the contracts are generally only oral contracts;
- the land-based contract is also generally lower than the daily-hire system as the farmer is also expected to provide food, snacks and coffee for their labourers;
- the work is normally finished within the time agreed; and
- farmers do not need to worry about controlling and motivating labourers.

6.2.1.2 Planting

The start of planting is based on several considerations such as the weather pattern, seed and labour availability and advice from village leaders. The greatest determinant is the seasonal weather pattern with most farmers commencing planting after one or two periods of rain. Many also base their decisions on changes in tidal conditions, the zodiac or flowering of certain trees like silk cotton and cashew nut. Most farmers plant local seeds instead of certified (high yielding) seeds. The plant density and population per punch depend on seed and labour availability. The technique of planting is almost the same for all farmers. Corn and peanuts are planted using the dibble technique, while cassava is planted with a stake.

6.2.1.3 Weeding, Fertilising and Pest Control

All farmers weed and fertilise their crops. However, the intensity of weeding depends on cash availability. Farmers usually employ women workers, and some farmers only use their own family labour. Weeding is done by hand and involves using a stick to loosen the soil and then pulling the plant from the ground rather than cutting. Fertilising is carried out one to two days after weeding by family labour. Some farmers fertilise twice, first with urea and then with phosphate. Very few farmers actively control pests because they believe that only paddy needs pest control and second crops (*palawija*) do not. Although corn and peanuts are the first crops in northern Lombok, farmers still assume they are *palawija*. The second reason is that a number of farmers in the north have had bad experiences with pesticides when there was a cashew nut project in that area. Farmers reported that the recommended pesticides applied to their corn field did not improve yields and the residue poisoned their cattle. Finally, many farmers do not know the right pesticides to use on their crops and they claim that they obtain a reasonable yield without applying pesticides.

6.2.1.4 Harvesting

Harvesting brings many people who have been working outside the village back to help with the harvest. Four types of labour usage for harvesting were identified: sharing, working bees, own harvest and hired labour. The sharing system is based on labourers being entitled to 10 percent of the yield. In addition, corn and peanut labourers often asked for some of the crop leaves for their cattle. The working bee system involves farmers helping each other harvesting their own crop. This is normally done by a group of farmers whose farms are close to each other. This group is called *besiru*. Farmers who harvest their own crops usually have a small area or harvest small amounts of their crop for their own daily consumption. Hired labour is employed under the same conditions as that used for ploughing. Hired labour is also used for crops which have been sold as standing crop.

6.2.1.5 Marketing

Most farmers sell their product after some post-harvest value adding such as removing the corn from the cob after drying and cleaning and drying peanuts. The buyers come to their farms or houses and negotiate the price with the farmers but do not collect it until they have purchased sufficient amount to fill their vehicle. This normally occurs two to four days after the sale negotiation.

Some farmers sell their crop unprocessed at the farm gate. They rarely sell in the traditional markets because they can only sell small volumes thereby increasing their per unit marketing cost and adding to the costs of transport. Those farmers who do sell in markets usually combine the marketing activity with another such as buying clothes or purchasing their daily needs.

Once harvested and processed, crop storage is done only by a few farmers. The main reasons are:

- Farm households need cash immediately to support their families;
- Storing the harvest incurs additional costs;
- It is hard to predict future prices making storage risky; and
- Farmers are worried about loss of quality and hence loss of value.

6.2.2 Farming in the Southern Zone

6.2.2.1 Land Preparation

Traditional land preparation for dryland farming areas in the southern zone of Lombok uses traditional equipment like hoes, crowbars and mouldboard ploughing which is drawn by animal. Land to be planted with paddy is prepared two weeks before the wet season or early in the wet season. Before starting tillage the land is cleaned by removing all crop residues or using crop residues as fodder for animals. Burning rice straw residue has also been frequently conducted during the last decade. The soil is tilled to a depth of 20–30 cm, followed by a sequence of harrowing, smoothing, rolling and hoeing. Tractors have never been used to replace draft animals because the soil is very sticky in the wet season and very hard in the dry season.

6.2.2.2 Planting

The *gora* system relies heavily on the farmer picking the right time to plant the seed. The normal practice is to plant after one or two rainfall events but occasionally these rains may not be the true break for the rainy season and the seed may need replanting. Rice seed planting is normally applied by the dibbling system. This method requires more time and labour than the alternative practice of broadcasting which has the disadvantage that seeds could rot under wet soil conditions. However, dibbling is used when the topsoil is too dry for broadcasting. The distance between holes is more or less 20 cm but farmers only estimate this distance.

6.2.2.3 Fertilising

All farmers use urea and phosphate (SP36) during rice cultivation and some apply potassium (KCl). While the recommended rates per hectare are 200 kg of urea, 100 kg TSP and 50 kg KCl, very few farmers apply at these rates. Family members usually apply the fertiliser. Fertiliser application is carried out traditionally by hand. There is no machinery used for this activity. Solid fertiliser in the form of granules is broadcasted evenly over the rice field by the farmer using hand. All farmers recognise the name of 'urea' or '*rabuk putik*' (meaning white fertiliser as the colour of urea is white). However, farmers do not know the name 'phosphate' or 'potassium'. Farmers only call them '*rabuk beaq*' (meaning red fertiliser for phosphate) and '*rabuk bedeng*' (meaning black fertiliser for potassium).

6.2.2.4 Weeding

Weeding is intensively carried out for rice cultivation. Farmers normally weed their rice before fertilising because they want the fertilisers to be absorbed effectively by the rice. Some farmers weed their crops twice depending on the amount of weeds present in the field. First weeding is conducted three weeks after planting and the second, six weeks after planting. Weeding is conducted using traditional tools called '*gasrok*' or '*kikis*'. This tool looks like a bamboo stick with a sharp knife at the end for cutting the weed. No farmers used weeding machines in the research area.

6.2.2.5 Harvesting and Marketing

The traditional method of harvesting rice is using a traditional tool called *sabit*. Long-stalks of the paddy are cut by the harvester using *sabit*, a long crescent knife. This is the most widely-used manual method of harvesting in Indonesia including Lombok. The stalk is cut about 10-15 cm above the ground or a stalk length of about 60-70 cm for ease of bundling and threshing. The stalks are laid in small bundles on the stubble. After enough stalks are gathered to be threshed, every bundle of stalk is threshed by hitting them to the threshing board. Harvesters hit the board four to six times until all the seed has fallen out. The harvester has 10 percent of all the grain while the owner gets 90 percent.

After harvesting, the crop is dried in the field or taken home in small sacks to be dried around the homestead. When space around the house is limited, the grain is dried along the roadside. Most of the produce is sold directly to local traders, although farm households may retain small amounts for home consumption.

6.3 Basic Profile of Farmers

6.3.1 Land and Farming

The landholding areas of the surveyed farms in the two villages ranged from 25 to 400 *ares*[1], with an average of 169 *ares*. This is larger than the average holding in the province of West Nusa Tenggara which is 56 *ares* (Central Bureau of Statistic of NTB, 2000). This is because the average land holding throughout the province includes farms that are irrigated which are normally less than 50 *ares*.

Table 6.1. Distribution of Farmer Respondents Based on Land Holding in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
50 and less	0	22	22
	0.0%	*100%*	*100%*
	0.0%	**9.7%**	**4.8%**
51 to 100	19	126	145
	13.1%	*86.9%*	*100%*
	8.4%	**55.5%**	**31.9%**
101 to 200	115	74	189
	60.8%	*39.2%*	*100%*
	50.7%	**32.6%**	**41.6%**
Over 200	93	5	98
	94.9%	*5.1%*	*100%*
	41.0%	**2.2%**	**21.6%**
Total	227	227	454
	50%	*50%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

[1] One *are* is equal to 100 square metres or one hectare is equal to 100 *ares*.

Overall, the majority of farmers (63%) manage more than 100 *ares* but in Desa Akar-akar most farmers (92%) manage more than 100 *ares* while in Desa Kawo the majority of farmers (65%) cultivated less than 100 *ares* (Table 6.1). This is because Desa Akar-akar was a transmigration area in the 1970's. All transmigrants were given between 100 and 200 *ares* of forest or virgin land to turn into farmland. The area allocated depended upon when the immigrants arrived and whether they were prepared to move to the upper area and in turn, to be allocated a larger parcels of land. This land is locally called "*aguman*".

In Desa Kawo, the farmers obtained their land through succession. This has meant that over time land holdings have become smaller and there is a tendency for farmers to manage more than one parcel of land. However, on average 73% of farmers' respondents do not have more than one parcel (Table 6.2).

Table 6.2. Distribution of Farmer Respondents Based on Land Fragmentation in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
One Parcel	161	168	329
	48.9%	*51.1%*	*100%*
	70.9%	**74.0%**	**72.5%**
More Than One Parcel	66	59	125
	52.8%	*47.2%*	*100.%*
	29.1%	**26.0%**	**27.5%**
Total	227	227	454
	50.0%	*50.0%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

Land fragmentation is an important consideration when determining the level of farm specific technical efficiency and is often correlated with land holding size. Figure 6.1 describes the relationship between fragmentation and the land holding of the farmer respondents.

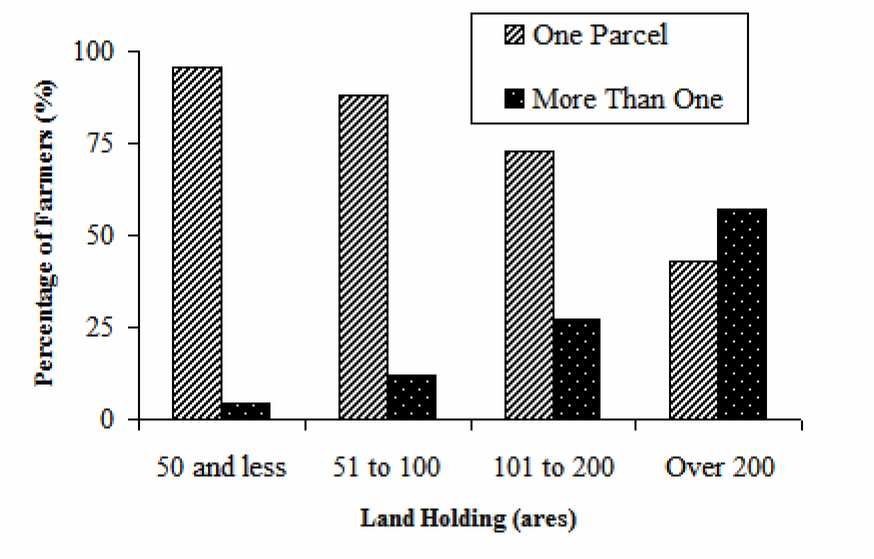

Figure 6.1: Land Parcels Managed by Farmers by Land Holding Range in Lombok Dryland Farms, 2002

Nearly 85% of farmers who have more than one parcel of land also hold more than 100 *ares* of land and more than 50% of farmers who had more than 200 *ares* had more than one parcel. This is understandable because farmers who held more than 100 *ares* of land in dryland areas can be categorised as financially better off and able to afford to purchase additional land. Some farmers also manage other parcels of land on behalf of land owners.

Seven categories of land ownership status were found in the research areas (Table 6.3). The majority of farmers (76%) own their farmland and in Desa Akar-akar all farmers owned their farmland. In Desa Kawo, a range of ownership structures were found where more than 25% of farmers did not own their land.

The use of share farming is not common in subsistence dryland farming but it was found in Desa Kawo. The share going to the owner ranged from between 25-50% but the most common was one third. The ratio depended on who contributed the farm inputs. Land is normally rented on an annual basis and the rent is paid either as cash or in harvested crop. The rent is usually paid as a single lump sum or by instalment plus interest. Another arrangement found was a situation where the farmer lent money to the landowner whose land was then used as collateral.

Table 6.3. Distribution of Farmer Respondents Based on Land Ownership in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
Owned	194	149	343
	56.6%	*43.4%*	*100%*
	85.5%	**65.6%**	**75.6%**
Owned and Grant	20	0	20
	100%	*0.0%*	*100%*
	8.8%	**0.0%**	**4.4%**
Owned and Rent	0	4	4
	0.0%	*100%*	*100%*
	0.0%	**1.8%**	**0.9%**
Owned and Shared	13	16	29
	44.8%	*55.2%*	*100%*
	5.7%	**7.0%**	**6.4%**
Rent	0	6	6
	0.0%	*100%*	*100%*
	0.0%	**2.6%**	**1.3%**
Shared	0	51	51
	0.0%	*100%*	*100%*
	0.0%	**22.5%**	**11.2%**
Shared and Rent	0	1	1
	0.0%	*100%*	*100%*
	0.0%	**0.4%**	**0.2%**
Total	227	227	454
	50.0%	*50.0%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

Grant status is defined as a situation in which the farmer manager is allowed to cultivate land by the landowner without any liabilities. This generally happens when the landowner is rich and lives in the city or far away from the land. In these situations the landowner does not require income from their land to meet their daily needs but they want to retain the social status associated with owning land. Such people are normally high-level government workers (civil servants) at the provincial or federal level or from the traditional Lombok royal family. The owner will occasionally visit the village and often bring a reward to the farmer who often reciprocates by presenting the owner with a small amount of the harvest.

6.3.2 Crop Cultivation

Four seasonal crops were recorded in this survey: paddy, cassava, peanuts, and maize (Table 6.4) with farmers only growing one seasonal crop.

Farmers in each of the two study villages grew different crops. Almost one-third (32%) of the farmers in Desa Akar-akar grew cassava, 35% grew maize, and 33% grew peanuts. No farmer in Desa Akar-akar grew paddy because the land was not suitable for rice production.

Table 6.4. Distribution of Farmer Respondents Based on Crop Cultivated in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
Cassava	73	0	73
	100%	*0.0%*	*100%*
	32.2%	**0.0%**	**16.1%**
Maize	80	0	80
	100%	*0.0%*	*100%*
	35.2%	**0.0%**	**17.6%**
Paddy	0	227	227
	0.0%	*100%*	*100%*
	0.0%	**100%**	**50.0%**
Peanut	74	0	74
	100%	*0.0%*	*100%*
	32.6%	**0.0%**	**16.3%**
Total	227	227	454
	50.0%	*50.0%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

On the other hand, all farmers in Desa Kawo grew paddy because the farmland was suitable and because regulations enforced during the 'new era' required farmers to grow rice in paddy fields once or twice a year as a means of assisting Indonesia reach self-sufficiency in rice production.

Because of the seasonality of rain all farmers in Desa Akar-akar and Desa Kawo fallow their land during the dry season. Therefore the cropping intensity on dryland area is once a year. By comparison, the cropping intensity on irrigated land is three times per year.

6.3.3 Age, Education and Experience

Farmers' ages ranged from 24-72 years with an average of 41 years (Table 6.5).

Table 6.5. Distribution of Farmer Respondents Based on Farmers' Age in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
25 and younger	1	29	30
	3.3%	*96.7%*	*100%*
	0.4%	**12.8%**	**6.6%**
26 to 50	187	164	351
	53.3%	*46.7%*	*100%*
	82.4%	**72.2%**	**77.3%**
Over 50	39	34	73
	53.4%	*46.6%*	*100%*
	17.2%	**15.0%**	**16.1%**
Total	227	227	454
	50.0%	*50.0%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

The majority of farmers (77 %) were aged between 26 and 50 years old with only 7% being less than 25 years old. Little variation was found between the two study sites. There is a general reluctance among the younger generation to become farmers. There appears to be a strong correlation between the farmer's age and the highest level of education achieved by the respondents (Figure 6.2).

Younger farmers tended to have higher levels of education with more than 76% of those aged less than 25 years old having finished Junior High School. Nearly half of all farmer respondents older than 50 years have not had any formal schooling and only one respondent had completed Junior High School. Education was the focus of a government program called *Wajib Belajar 6 Tahun*[2] which was first introduced in the 1980s and which continued as *Wajib Belajar 9 Tahun*[3] in 1990s. This encouraged young rural people into education, but overlooked people older than 50.

[2] *Wajib Belajar 6 Tahun* is a government program to free all students from tuition fees until year 6
[3] *Wajib Belajar 9 Tahun* is a government program to free all students from tuition fees until year 9

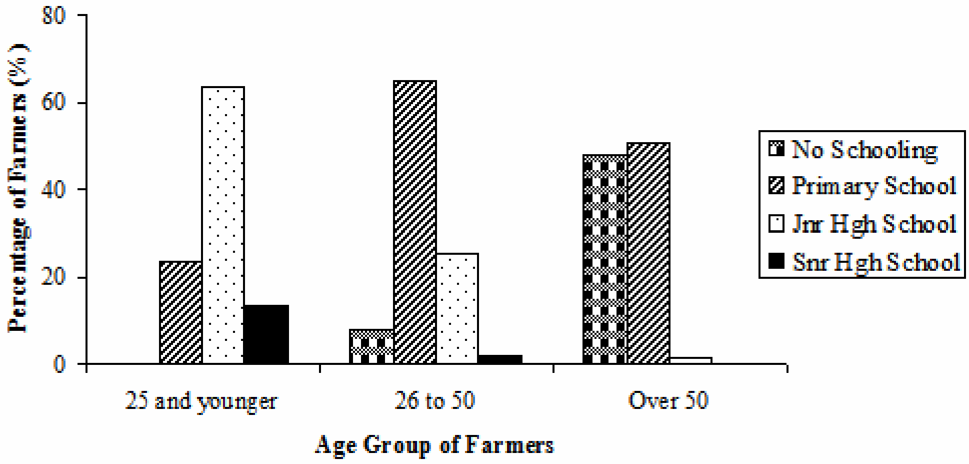

Figure 6.2: Education Levels of Farmers by Age Range in Lombok Dryland Farms, 2002

Most farmers (60%) in the two villages had been educated to primary school level, but 14% had never attended school (Table 6.6).

Table 6.6. Distribution of Farmer Respondents Based on Farmers' Education Level in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
No Schooling	16	46	62
	25.8%	*74.2%*	*100%*
	7.0%	**20.3%**	**13.7%**
Primary School	132	140	272
	48.5%	*51.5%*	*100%*
	58.1%	**61.7%**	**59.9%**
Junior High School	72	37	109
	66.1%	*33.9%*	*100%*
	31.7%	**16.3%**	**24.0%**
Senior High School	7	4	11
	63.6%	*36.4%*	*100%*
	3.1%	**1.8%**	**2.4%**
Total	227	227	454
	50.0%	*50.0%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

Less than 3% of farmers had completed Senior High School. The main reasons for this are related to economic status and job prestige. Senior High Schools are normally located in the city or a council town, which means farmers have to pay for their children to pursue education out of their village whilst also losing part of their farm labour force. Another reason is that educated rural people are reluctant to be farmers because society perceives farming to be a low prestige job which should not be undertaken by people with higher education.

Almost half the number of surveyed farmers (46%) have farming experience ranging from 15 to 24 years (Table 6.7). Experience is defined as the time that they had been fully responsible for managing their farm.

Table 6.7. Distribution of Farmer Respondents Based on Farmers' Experience in Fully Managing Farm in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
Less than 5 years	10	18	28
	35.7%	*64.3%*	*100%*
	4.4%	**7.9%**	**6.2%**
5 to 14 years	82	42	124
	66.1%	*33.9%*	*100%*
	36.1%	**18.5%**	**27.3%**
15 to 24 years	69	142	211
	32.7%	*67.3%*	*100%*
	30.4%	**62.6%**	**46.5%**
25 years and over	66	25	91
	72.5%	*27.5%*	*100%*
	29.1%	**11.0%**	**20.0%**
Total	227	227	454
	50%	*50%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

Farmers were generally more experienced in Desa Kawo which was understandable due to the length of time that farming had been carried out in the area. Not unexpectedly, older farmers were found to have more farming experience and vice versa.

6.3.4 Farmer's Family and Source of Income

On average, each respondent was responsible for four other people (Table 6.8). Dependants can include people other than the immediate family such as nieces, nephews, aunties, uncles or even other non-related people. This is very common in most parts of Indonesia.

Table 6.8. Distribution of Farmer Respondents Based on the Number of Dependants in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
1 Person	0	7	7
	0.0%	*100%*	*100%*
	0.0%	**3.1%**	**1.5%**
2 Persons	12	13	25
	48.0%	*52.0%*	*100%*
	5.3%	**5.7%**	**5.5%**
3 Persons	93	62	155
	60.0%	*40.0%*	*100%*
	41.0%	**27.3%**	**34.1%**
4 Persons	97	107	204
	47.5%	*52.5%*	*100%*
	42.7%	**47.1%**	**44.9%**
5 Persons	25	38	63
	39.7%	*60.3%*	*100%*
	11.0%	**16.7%**	**13.9%**
Total	227	227	454
	50.0%	*50.0%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

Little difference was observed between the two villages surveyed. In Desa Akar-akar, 84% of respondents cared for three to four dependants while in Desa Kawo the figure was 74%. The number of dependents is important as they are an important source of labour for the household. Most respondents reported having one or two people whom they could use as farm labour, with only one respondent reporting five family members able to provide farm labour (Table 6.9).

Family members do not only work on their farm but are also available to work on other farms or in the non-farm sector. The additional household income levels derived from employment are shown in Table 6.10. Although the figures are shown on a monthly basis, additional work is usually only available for –four to eight months per year because the majority of people are engaged in farming/agribusiness related activities. The majority of respondents (75%) reported additional earnings of less than Rp. 300 000 per month.

Table 6.9. Distribution of Farmer Respondents Based on the Number of Family Labourers in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
1 Labourer	83	134	217
	38.2%	*61.8%*	*100%*
	36.6%	**59%**	**47.8%**
2 Labourers	65	49	114
	57.0%	*43.0%*	*100%*
	28.6%	**21.6%**	**25.1%**
3 Labourers	59	39	98
	60.2%	*39.8%*	*100%*
	26.0%	**17.2%**	**21.6%**
4 Labourers	19	5	24
	79.2%	*20.8%*	*100%*
	8.4%	**2.2%**	**5.3%**
5 Labourers	1	0	1
	100%	*0.0%*	*100%*
	0.4%	**0.0%**	**0.2%**
Total	227	227	454
	50.0%	*50.0%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

Table 6.10. Distribution of Farmer Respondents Based on Extra Monthly Income in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
Less than 300,000	155	185	340
	45.6%	*54.4%*	*100%*
	68.3%	**81.5%**	**74.9%**
301,000 to 500,000	58	39	97
	59.8%	*40.2%*	*100%*
	25.6%	**17.2%**	**21.4%**
501,000 to 900,000	13	3	16
	81.3%	*18.8%*	*100%*
	5.7%	**1.3%**	**3.5%**
Over 900,000	1	0	1
	100%	*0.0%*	*100%*
	0.4%	**0.0%**	**0.2%**
Total	227	227	454
	50%	*50%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

Additional income was also earned from poultry and small animals which are usually managed in a non-intensive way. Ducks and chickens are fed food scraps and receive no animal health interventions. Almost all farmers in both villages had chickens and some farmers in Desa Kawo had ducks. Small animals like pigs and goats are also popular with farmers in Desa Akar-akar.

Like the poultry they were managed in a non-intensive way with families having – two or three pigs or goats. Larger animal like milking cows or beef cattle are considered significant enough for farmers to allocate resources including time, capital and family labour. Cattle are expensive so approximately one third of farmers did not have any cattle (Table 6.11).

Table 6.11. Distribution of Farmer Respondents Based on Owning Cows in Desa Akar-akar and Desa Kawo in 2002

	Akar-akar	Kawo	Total
Not Have Cows	60	90	150
	40.0%	*60.0%*	*100%*
	26.4%	**39.6%**	**33.0%**
Have Cows	167	137	304
	54.9%	*45.1%*	*100%*
	73.6%	**60.4%**	**67.0%**
Total	227	227	454
	50.0%	*50.0%*	*100%*
	100%	**100%**	**100%**

Note: Italics represent a row percentage
Bold case is a column percentage

Cows were often hired by other farmers to assist in land preparation and were thus a source of extra income. However, only some cows may be used to assist land preparation and pregnant cows were not allowed to be used in tillage or clearing land. The major problem associated with cattle was providing them with feed during the dry season. Some farmers reported having to travel up to 5 – 6 km to collect grass and in some cases having to hire a vehicle collectively to transport feed.

6.4 Farm Inputs and Outputs

The input and output statistics for the four types of farms are summarised in Table 6.12.

Table 6.12. Summary of Input and Output Statistics for Dryland Farming in Lombok Island, Indonesia in 2002

Items	N	Mean	SD	Min	Max
Corn					
Size of land (are)	80	223.8	75.0	100	400
Amount of urea (kg)	80	232.8	80.4	97	468
Amount of SP36 (kg)	80	46.7	53.8	1	150
Cost of pesticide (Rp)	80	988.4	3266.3	1	15000
Amount of seed (kg)	80	50.0	18.9	20	100
Hours of animal power (hour)	80	93.8	30.9	42	168
Hours of labour (hour)	80	992.9	245.5	453	1436
Cost of water (Rp)	80	36612.8	38202.6	1	125000
Amount of produce (kg)	80	40.7	14.2	18	80
Peanut					
Size of land (are)	74	187.8	52.2	100	300
Amount of urea (kg)	74	204.0	54.1	100	340
Amount of SP36 (kg)	74	32.7	40.0	1	100
Cost of pesticide (Rp)	74	446.9	2264.1	1	15000
Amount of seed (kg)	74	82.3	25.7	30	140
Hours of animal power (hour)	74	78.3	22.4	35	126
Hours of labour (hour)	74	891.3	201.7	347	1360
Cost of water (Rp)	74	67081.2	41981.1	1	144000
Amount of produce (kg)	74	17.7	5.5	7	32
Cassava					
Size of land (are)	73	182.2	69.4	100	400
Amount of urea (kg)	73	0.0	0.0	0	0
Amount of SP36 (kg)	73	0.0	0.0	0	0
Cost of pesticide (Rp)	73	0.0	0.0	0	0
Amount of seed (kg)	73	158.8	54.8	50	290
Hours of animal power (hour)	73	0.0	0.0	0	0
Hours of labour (hour)	73	572.8	140.6	345	990
Cost of water (Rp)	73	0.0	0.0	0	0
Amount of produce (kg)	73	137.4	54.8	60	310
Paddy					
Size of land (are)	227	99.6	44.7	30	250
Amount of urea (kg)	227	140.6	72.2	30	430
Amount of SP36 (kg)	227	51.6	35.2	0	190
Amount of KCl (kg)	227	29.0	23.0	0	100
Cost of pesticide (Rp)	227	18964.8	8402.6	0	50000
Amount of seed (kg)	227	52.7	18.9	20	120
Hours of animal power (hour)	227	84.7	36.9	14	224
Hours of labour (hour)	227	679.3	273.6	276	1464
Cost of water (Rp)		0.0	0.0	0	0
Amount of produce (kg)	227	37.1	16.3	9	95

The farm size in the research areas varied with a minimum of 30 *are* and a maximum of 400 *are*. The average farm size for corn, peanut, cassava and paddy farm areas were 223.8 *are*, 167.8 *are*, 182.2 *are* and 99.6 *are* respectively. This result was different from Wathoni (1999) who studied dryland areas of East Lombok District and found the average farm size of dryland farmers was only 46 *are,* but these are farmers that use ground water schemes. This difference can perhaps be attributed to the way farmers obtained their land. Almost all of the farmers in this study are transmigrants who were granted from 150 *are* to 200 *are* of virgin land for farming. Based on Indonesian law, this land must be opened and formed by the transmigrant and their family to become 'farming' areas. Farmers studied by Wathoni (1999) were conventional farmers that have not been granted land by the government, but rather, either bought, leased or inherited their land.

In terms of farm inputs used, the farmers in the research areas used local and certified seed, chemicals such as urea phosphorus (SP36) and potassium (KCl) fertilisers, pesticide including insecticides, animal power, human labour, and some used ground pump water. The application of urea and phosphorus was far less than the recommended levels. BPP in Sub-districts (*Kecamatan*) of Bayan and Pujut recommended fertiliser usage levels for corn and peanut to be 200 kg per hectare or 2 kg per *are* for urea, 100 kg per hectare or 1 kg per *are* for SP36 and 50 kg per hectare or 0.5 kg per *are* for KCl (only for paddy). There was no recommendation found for the use of these three fertilisers for cassava production and no recommendation for the use of KCl for corn and peanut.

Farmers who cultivated corn and peanuts in the research site only applied 101-110 kg per hectare of urea and 19 – 22 kg per hectare for SP36. This is because farmers do not have enough capital to purchase potassium fertiliser. Likewise, some farmers believed that potassium is only important for rice cultivation, while some have never heard of potassium fertiliser. Similarly, rice farmers also applied urea, SP36 and KCl below the recommended levels. On average, rice farmers use 152 kg per hectare for urea, 52 kg per hectare of SP36 and 27 kg per hectare of KCl. Urea is the most popular fertiliser with all farmers using urea although not all used SP36. It is very common in rural areas in Indonesia that when people talk about fertiliser, farmers assume it is urea. One interesting finding in the study was that farmers who cultivate cassava did not use fertilisers at all. Based on the information gathered by the author, the cassava farmers still believed the myth that fertilisers like urea and SP36 might make the cassava tuber poisonous.

In terms of pesticide usage, the application of pesticide was even rarer during cropping. While farmers will use pesticide if they find the sign of pests or diseases around their farm, they apply the pesticide only around the affected plants. Many farmers however use pesticide with their seed before they were planted. This is to protect the seed from underground insects or fungi in the first week after planting. The popular brand for this is the pesticide *Sevin*. Other kinds of pesticides that combat insects and diseases that attack leaves, stems, flowers and pods would be applied if considered really necessary. Three main reasons for the rare use of pesticides were revealed from the survey. First, this was due to the lack of cash. Secondly, some farmers were afraid of poisoning the plants' leaves with unknown pesticides because post-harvest leaves are normally used to feed their cattle. Therefore they only relied on brands that have already been used before like *Gandasil B*, *Gandasil D*, *Basudin* and *Antracol*. The survey revealed that some corn farmers are still afraid of using pesticides because of bad experiences with pesticide use. According to them, in 1997, farmers received pesticide aid from the government to increase their maize production. However when they fed the corn leaves and stems to their cattle, most of their cattle died and some got sick so they had to kill the diseased cattle to reduce the loses. Although there is no formal report from authorised institutions at the time this research was conducted, farmers still believe that the cause of the problem was the use of pesticides. The last reason was farmers' assumptions regarding second crop cultivation methods. Traditionally, it is presumed that non-paddy (*palawija*[4]) cultivation does not need pesticides.

With regards to the seed, farmers used both local and certified seed. The combination depended on the availability of cash to purchase the seed. Local seeds were much cheaper than certified seeds but the quality was lower. Some

[4] *Palawija* refers to the second crop cultivated after paddy.

local seeds were produced from the farmers' own farm and some from others. Several farmers were trusted to produce seed even though they are not authorised to produce certified seed. However, these seeders are considered helpful due to the absence of certified seeders around the dryland areas. Certified seeders (*penangkar benih*) unfortunately were not available around the study villages and even in the sub-district. The closest certified seeders were approximately 75 km from the village. This was considered far due to the absence of transportation facilities and poor road infrastructure. In addition, with some of these seeders, there was not enough supply to distribute out of their own areas. To deal with this situation farm input suppliers from the study village purchased certified seeds at a price higher than normal. Moreover, the retail price had to include transportation cost, adding to the total cost of seeds.

A different situation occurs with cassava farmers. What is planted in cassava production is a stick from the cassava stems. Most cassava farmers use cassava stems from their previous cultivation as the source of sticks. Farmers believed that the stick could only be produced from cassava that has been harvested after eight months. A number of farmers, for some reason, harvested their cassava after 10 months. Other farmers requested the stems from these farmers for planting which were given basically free of charge. The farmer requesting sticks collect the stems themselves from the owner's field. The requester helps harvest the owner's cassava for free until the amount of stems he needs is met. If the requester then continues to help the owner harvest the cassava, he would be renumerated based on the normal rate of payment. This method has existed for a long time from their ancestors.

Another important input was labour with two kinds of labour: human and animal labour. Human labour also came from two sources: family and hired labour. Human labour is used in every stage of the plant cultivation process. Hired labour is used during the intensive labour stages such as soil preparation, planting and harvesting. However, hired labour is not normally used for light activities such as fertilising, weeding, and for some areas, watering. Animal power was only used in soil preparation such as ploughing, tillage and *garu*[5].

Of the four crops, cassava required the least labour for the whole cultivation process. This is because cassava farmers did not till, fertilise, weed and water the crop. Cassava cultivation did not need animal power, while corn and peanut cultivation used both human and animal labour.

Regarding water use for watering plants, most farmers relied on rain as the main source of water. Farmers who did not have enough water when needed, purchased water from ground water pump management. This could be done by farms in areas covered by the ground pump water scheme and only in the Northern zone. Rice farmers in the Southern zone did not have ground pump water scheme, thus they only depended on rain water.

6.5 Farm Level Technical Efficiency

The farm-specific variables summarised in Table 6.13 show that cassava and peanut farmers are about 40 years old, while corn farmers are slightly older at 43 years and the youngest are rice farmers. The number of years of schooling is about six years for all types of farmers. The number of years in farming varies from 16 years on average for cassava farmers to about 25 years on average for paddy farmers.

Table 6.13. Farm-Specific Variables of Dryland Farmers of Lombok Island

Crops and Variables	N	Mean	SD	Min	Max
Corn					
Age of respondent (years)	80	43.5	9.66	24	72
Education of respondent (years)	80	5.9	2.91	0	11
No. of years farming (years)	80	22.2	10.49	4	45
Number of family labour	80	2.4	0.96	1	4
Number of dependents	80	3.4	0.52	3	5

[5] *Garu* is the process of land preparation after ploughing aimed to flatten the land evenly and to clean the land from unwanted waste like plastics, stones, brick, big stems, etc. This process uses traditional wooden hand made fork that is pulled by cows.

Table 6.13. Farm-Specific Variables of Dryland Farmers … (Continued)

Crops and Variables	N	Mean	SD	Min	Max
Peanut					
Age of respondent (years)	74	40.1	8.79	26	60
Education of respondent (years)	74	5.7	2.43	0	9
No. of years farming (years)	74	17.3	9.14	3	38
Number of family labour	74	2.0	1.10	1	5
Number of dependents	74	3.9	0.93	2	5
Cassava					
Age of respondent (years)	73	40.2	7.61	26	56
Education of respondent (years)	73	6.5	2.20	0	12
No. of years farming (years)	73	16.1	8.36	4	32
Number of family labour	73	1.8	0.86	1	4
Number of dependents	73	3.5	0.71	2	5
Paddy					
Age of respondent (years)	227	37.8	10.06	25	63
Education of respondent (years)	227	5.7	2.72	0	12
No. of years farming (years)	227	24.6	7.80	4	34
Number of family labour	227	1.5	.82	1	4
Number of dependents	227	4.0	1.09	3	7

Prior to estimating farm specific technical efficiency the data were analysed using ordinary least squares method to find significant variables that affect production level. This analysis is based on the Cobb-Douglass model and run for four target crops - corn, peanut, cassava and paddy. After identifying the significant variables in this model, farm specific technical efficiency is calculated using maximum likelihood estimation under statistical package Frontier 4.1. The result of the OLS estimation is presented in Table 6.14.

Table 6.14. Models Resulting From OLS Method

Variables	Corn	Peanut	Cassava	Paddy
Constant	-1.208	-0.207	0.151	-1.278
	(-3.370)	(-0.253)	(0.278)	(-11.538)
ln Land (are)	0.945***	0.183	0.974***	0.065***
	(8.577)	(0.841)	(9.615)	(2.299)
ln Urea (kg)	0.045	0.352**		0.045**
	(0.597)	(1.873)		(1.473)
ln SP36 (kg)	0.001	0.012		0.001
	(0.135)	(1.071)		(0.059)
ln KCl (kg)				-0.002
				(-0.382)

Table 6.14. Models Resulting From OLS Method (Continued)

Variables	Corn	Peanut	Cassava	Paddy
ln Pest (Rp)	0.006*	-0.005		0.012***
	(1.581)	(-0.427)		(3.090)
ln Seed (kg or stick)	0.023	0.215	0.061	1.008***
	(0.568)	(1.363)	(0.614)	(16.245)
ln Human Lbr (hours)	-0.078	0.171	-0.096	0.021
	(-0.784)	(0.814)	(-0.633)	(0.646)
ln Animal Lbr (hours)				0.026*
				(1.050)
ln Water (Rp)	0.001	-0.003		
	(0.245)	(-0.646)		
R - Square	0.943	0.756	0.911	0.962
Sig	0.000	0.000	0.000	0.000

***** significant at 5 % level; ** significant at 10 % and * significant at 15 % level**
Numbers in brackets are the t-ratios

The OLS estimations in Table 6.14 were significant at the 5 per cent, 10 per cent and 15 per cent level with high adjusted R-square ranging from 0.756 for peanut production to 0.962 for paddy production. This means that 75.6 per cent of the variance of peanut production can be explained by the variables included in the regression model. For corn, cassava and paddy, the R-square are 94.3 percent, 91.1 per cent and 96.2 per cent respectively. This indicates that the Model has a good fit.

Different inputs significantly determine the variation of production for different crops cultivated. This could be due to the variation in cultivation process within any one crop. Interestingly, the variable land is highly significant in determining the production for all the target crops except for peanut. The effect of labour changes in corn production is not significant because the cultivation method applied in the research area is still traditional. The seed is planted in the field after the area is tilled before the rainy season. The small corn plant is hardly maintained until harvesting time. Fertilising and spraying pesticides are carried out only by the farmer himself. Weeding which usually uses large amounts of labour was not conducted in this cultivation process. This indicates that the nature of farming in Lombok dryland is more extensive than intensive.

Based on the variables selected in the OLS model, farm specific technical efficiency is calculated using maximum likelihood estimation (MLE) method using an econometric software package, Frontier 4.1. The coefficients estimated in the maximum likelihood estimation (MLE) method are shown in Table 6.15.

6.5.1.1 Corn

The estimated coefficients of the stochastic frontier production function measures the elasticity of production with respect to inputs. The results show that land is statistically significant at the 5 per cent level of significance for corn production with a coefficient 0.896. This implies that increasing land by one per cent will result in an increase in corn output by 0.896 per cent. Pesticide has also a significant effect on corn production at the 15 per cent significance level with an elasticity of 0.46. Other inputs like urea, SP36 and cost of water did not significantly affect corn production even though results (elasticities) show they have positive effects.

6.5.1.2 Peanuts

Stochastic frontier production analysis results showed that land, urea and phosphorus have positive but non-significant effects on peanut production. Of all seven inputs estimated, two inputs, i.e., pesticide and water have negative effects with elasticities of -0.192 and -0.126, respectively. This indicates that addition of these inputs will decrease peanut production, even though the changes are not significant. With regards to pesticide use, the above result may be due to the farmers not knowing the correct dosage of pesticide nor the appropriate pesticides to use to eliminate disease or insects, hence the negative effect. Regarding water, some peanut farmers were worried about the timing of the rains. Because farmers believe that peanuts could not grow well without enough water, some farmers purchased water before the onset of rain. It is possible that the amount of water supplied was more than what was needed. Hence additional water may have a negative effect. In addition, most groundwater schemes are in peanut farm areas which were not the case for corn and cassava farmers.

Table 6.15. MLE Estimates for the Parameters of the Cobb-Douglas Stochastic Frontier Production Function for Dryland Farmers of Lombok Island

Variables	Corn	Peanut	Cassava	Paddy
Constant	-1.506	-0.260	0.355	-1.193
	(-7.816)	(-0.367)	(0.870)	(-16.044)
ln Land (are)	0.896***	0.376	0.974***	0.029***
	(12.049)	(0.177)	(11.560)	(2.235)
ln Urea (kg)	0.704	0.823		0.048***
	(1.037)	(0.675)		(2.467)
ln SP36 (kg)	0.794	0.596		0.009**
	(0.150)	(0.075)		(1.729)
ln KCl (kg)				0.002
				(0.793)
ln Pest (Rp)	0.462*	-0.192		0.007***
	(1.241)	(-0.179)		(2.903)
ln Seed (kg or stick)	0.127	0.137	0.049	1.034***
	(0.334)	(0.083)	(0.589)	(23.455)
ln Human Lbr (hours)	0.152	0.495	-0.096	0.041**
	(0.411)	(0.272)	(-0.767)	(1.901)
ln Animal Lbr (hours)				0.002
				(0.011)
ln Water (Rp)	0.955	-0.126		
	(0.501)	(-0.297)		
Total variance	0.014	0.089	0.035	0.010
	(3.742)	(0.288)	(4.243)	(8.929)
Gamma	0.758	0.993	0.932	0.960
	(5.361)	(0.161)	(16.395)	(13.678)

***** significant at 5 % level; ** significant at 10 % and * significant at 15 % level**
Numbers in brackets are the t-ratios

6.5.1.3 Cassava

In cassava production, land significantly affected the amount of produce with an elasticity of 0.974. This indicates that an additional one per cent of land will increase cassava produce by 0.974 per cent. Cassava tubers (sticks) have a positive effect on output although it is not significant at the five per cent level. Similarly, family labour does not have a significant influence on cassava production. The elasticity of family labour is negative indicating that the use of labour in cassava production is already in surplus. Other inputs like urea, SP36 and pesticides were not applied by farmers in cassava production due to their traditional habits and poor knowledge on appropriate input use. Cassava farmers did not purchase water because there is no ground water scheme around their farm. Therefore the farmers are totally dependent on rainwater for the water needs of their farm.

6.5.1.4 Paddy

The estimated elasticities of mean output with respect to land, urea, SP36, pesticide, seed and human labour inputs are 0.029, 0.048, 0.009, 0.007, 1.034 and 0.041 respectively. This means that for a 10 per cent increase in each of these inputs, rice output will increase by 0.29 per cent, 0.48 per cent, 0.09 per cent, 0.07 per cent, 10.34 per cent and 0.41 per cent. The elasticity estimates of land, urea, pesticide and seed are statistically significant at 5 percent, while that of SP36 and human labour are significant at 10 per cent level of significance. These results indicate the relative importance of the inputs in rice production. Seed appears to be the most important factor of production because seed is not readily available at affordable prices to the rice farmers in the area of study. Moreover, there are farmers who can not afford certified seed for all their land therefore they mix certified seed with the local seed. Fertilisers such as urea and SP36 are also important. Despite the price of fertilisers being subsidised by the government, farmers in the research areas sometimes do not receive the fertilisers at the right time.

Human labour and land are next to urea in terms of importance. Human labour is mostly used in harvesting. Some rice farmers hired labour from outside their village during the harvesting season. Rice grain may fall from the panicle if it is left too late for harvesting. With regards to land or farm size, rice fields in the southern zone are relatively small because of the inheritance system which makes the farm size successively smaller.

Testing for model adequacy, the value of gamma was close to 1 (0.758, 0.993, 0.932 and 0.960 for corn, peanut, cassava and paddy respectively), indicating that the models were appropriate.

The results of the study showed that the mean efficiency levels of paddy, corn, peanut and cassava farmers in Lombok are 0.940, 0.924, 0.797, and 0.871, respectively. The distribution of farmers within the technical efficiency decile ranges are shown in Figure 6.1.

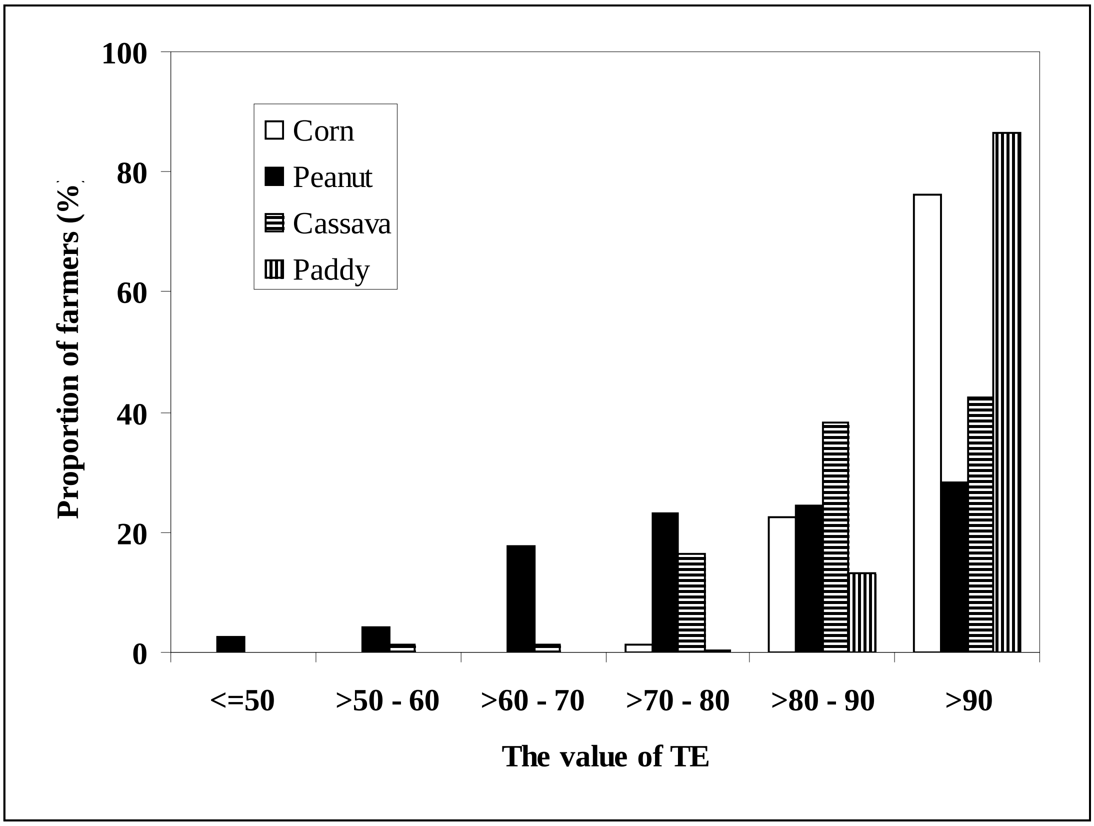

Figure 6.3: Proportion of Farmers within the Technical Efficiency Decile Ranges in Dryland Farming Areas of Lombok Island

As mentioned before, technical efficiency is the ratio of actual and potential production. In the case of the four crops above, the values indicate that there are still opportunities for improving on-farm production practices. For example, corn farmers have an average technical efficiency of 92.4 percent. This means that corn farmers can increase their production by 7.6 per cent without addition of new resources. The same analogy also applies for peanut and cassava farmers.

In terms of the proportion of farmer's levels of technical efficiency as shown in Figure 6.1, more than 75 per cent of corn and rice farmers seem to have a high level of technical efficiency (TE > 90). This finding is similar to Suparmin (2000) who compared the technical efficiency for Hybrid-CPI-1 corn farmers using dam irrigation and ground water scheme irrigation in East Lombok. The author concluded that overall, technical efficiency for farmers using this variety of corn was over 0.75 (75 per cent). Similarly, Llewelyn and Williams (1996) found that the average overall technical efficiency for food crop (peanut, cassava, onions, mungbeans, rice, corn, soybeans and pepper) production in East Java province – Indonesia is 0.981 per cent, 0.955 per cent, 0.977 per cent for the rainy, middle and dry seasons, respectively. Unfortunately, the authors did not elaborate their findings on why this is so. High technical efficiency was also found by Nufus (2003) who studied productivity of soybean in Lombok and found technical efficiency to be 0.954. However, this finding is different from Margono and Anindita (2002) who found corn farmers in Kecamatan Sukodono, East Java District had an average technical efficiency of 57 per cent. This is probably due to the social nature of corn in the rural daily menu. Rice is the staple food in Indonesia and corn is a second staple food for Indonesians in general and the first staple food for some regions in eastern Indonesia. Peanut and cassava were normally used as snacks or raw materials for industrial goods like peanut butter and tapioca starch. In rural areas where this study was conducted, most people cooked rice mixed with corn as their daily staple food. Some farmers even stated that they felt full longer when having lunch with cooked rice mixed with corn rather than rice only. Therefore, farmers managed their corn farms intensively.

It seems that more than 80 per cent of cassava farmers were allocating their resources efficiently, with the value of technical efficiency over 0.8. While there seems to be no study in Indonesia to compare with this finding, the results in this study is similar to Timothy (2005) who found the technical efficiency for traditional cassava farmers in South-western Nigeria was 0.82 on average. This is because the inputs needed to cultivate cassava were only stakes and labour. The growth condition required for cassava in the research site was only rain without fertilisers and pesticides. Cassava farmers normally start to grow cassava after it has rained once or twice to make sure that the rainy season has already occurred. Almost none of the steaks planted were dead even when the rain came one or two weeks late. Therefore the resource wastage may be low.

With regards to peanut cultivation, nearly 50 per cent of farmers were found to have technical efficiency lower than 0.8. A similar study conducted by Rao *et al.*

(2003) who studied groundnut farming efficiency in Andra Pradesh, India found that the technical efficiency of the groundnut farming ranged from 46 – 99 per cent with an average of 79 percent. Shanmugam (2003) studied technical efficiency for irrigated and rainfed groundnut farming in Tamil Nadu, India and found that the technical efficiency was 68 and 76 per cent for irrigated and rainfed farming, respectively. The relatively low technical efficiency found in the study is probably because peanut required a lot of water to grow well. Due to the inability of farmers to forecast weather, some farmers often buy ground water before the rain comes to anticipate drought. However, some farmers often have to work hard to manage their drainage system when it rains. This situation may result in a snowball or domino effect like having to replace some rotten young plants and organise re-fertilising for some parts of planted areas due to the run-off effects.

6.6 Determinants of Farm Level Technical Efficiency

To analyse the determinants of farm level technical efficiency, OLS analyses were conducted. Results from the regression analysis are presented in Table 6.16 for corn, Table 6.17 for peanut, Table 6.18 for cassava and Table 6.19 for paddy. The OLS estimation results in these tables show that some variables significantly influence the value of farm level technical efficiency although the R-squares are low for the models for corn, peanut and cassava. Several models were run and the best three models for each commodity are presented below.

For corn, of the three models, model 1 seems to explain the variance of farm level technical efficiency for corn farming best, providing the highest value of R-square. Age was found to have a significant relationship with technical efficiency at 20 per cent level of significance and age square at 15 per cent level of significance. Even though the coefficient is rather low, the sign of the coefficient for age and age square were negative and positive, respectively in the model. This means that the technical efficiency decreases as age increases, reaches a minimum then increases as age increases. This finding is similar to Sudarmanto (1994) who found that farmers between 25 and 40 years old tend to be slow in adopting technology and are worried about adopting new technology but those who are older than 50 were better even though they still maintained their traditions. This group was also very slow in adopting new innovation (Usman, 1997).

Table 6.16. Technical Efficiency Model of Corn Farming In Dryland Lombok Island

	Model 1		Model 2		Model 3	
	B	t-sig	B	t-sig	B	t-sig
Constant	190.265	0.015	182.055	0.007	175.711	0.007
Age	-4.889	0.156*	-4.802	0.158*	-4.560	0.172*
Edu	-9.097	0.222	-7.757	0.055***	-7.469	0.060***
Famlbr	-2.939	0.778	-2.792	0.787	-1.958	0.846
Length	1.974	0.422	2.207	0.314	2.036	0.343
Loc	-0.761	0.616	-0.824	0.577	-0.753	0.606
Prcl	-0.814	0.622	-0.786	0.630	---	---
Age2	0.043	0.121**	0.043	0.121**	0.042	0.125**
Educ2	0.053	0.829	---	---	---	---
Famlbr2	0.754	0.560	0.770	0.548	0.861	0.495
Length2	-0.031	0.264	-0.033	0.203	-0.032	0.214
AE	0.262	0.133**	0.255	0.134**	0.242	0.146**
AF	-0.248	0.415	-0.240	0.423	-0.279	0.332
AL	---	---	---	---	---	---
EF	0.600	0.314	0.566	0.321	0.570	0.315
EL	-0.217	0.225	-0.234	0.143**	-0.223	0.156*
FL	0.260	0.301	0.242	0.304	0.260	0.263
R-square	0.184		0.183		0.180	
Sig F	0.505		0.426		0.362	

****** significant at 5 %; *** significant at 10 %; ** significant at 15 %; * significant at 20 %**

The interaction of age and education (AE) has a positive and significant effect at the 15 per cent significance level. The higher the age and education of the farmer the higher the technical efficiency.

The determinants of farm level technical efficiency for peanut farmers is provided in Table 6.17. From the three best models for peanut farmers, model 1 is considered the best based on the signs of the coefficient, R square and significant variables. In model 1, three variables: number of years experience, location of farm from farmer's residence, and the number of land parcels managed by farmers were found to significantly affect technical efficiency. The F-test results also showed that the model is significant with F equal to 0.057 ($p \leq 0.10$).

The regression coefficient of length of experience in farming and length square is positive indicating that the technical efficiency increases as the experience increases. This is because the longer the farmer manages a farm they will have more experience using farm inputs and hence understand better about managing their farm. A study by Siagian (1991) found similar results. In his study, he found that farming experience had positive and significant effects on the application of agricultural technology. He attributed this to the fact that farmers in his study were born and raised on the farms and thus they have the necessary experience to manage their farm effectively. This was understandable because farmers could learn from both their successes and failures in the farm. Those experiences might be used as a 'compass' in managing their farm.

Table 6.17. Technical Efficiency Model of Peanut Farming in Dryland Lombok Island

	Model 1		Model 2		Model 3	
	B	t sig.	B	t sig.	B	t sig.
Constant	184.821	0.157	184.700	0.020	228.060	0.040
Age	-9.399	0.223	-7.482	0.181*	-12.120	0.046****
Edu	1.955	0.857	---	---	1.963	0.854
Famlbr	12.620	0.685	-21.577	0.332	---	---
Length	7.208	0.165*	7.059	0.096**	9.983	0.045****
Loc	-3.912	0.195*	-3.435	0.240	-4.357	0.144**
Prcl	-7.064	0.032****	-7.504	0.022****	-7.301	0.025****
Age2	0.144	0.207	0.135	0.178*	0.176	0.050***
Educ2	-0.245	0.620	---	---	-0.271	0.563
Famlbr2	-0.147	0.942	0.029	0.988	---	---
Length2	0.128	0.306	0.120	0.165*	0.021	0.826
AE	0.188	0.472	---	---	0.194	0.396
AF	0.462	0.622	0.532	0.531	---	---
AL	-0.264	0.117**	-0.282	0.068***	-0.210	0.194*
EF	-3.210	0.089***	---	---	---	---
EL	-0.044	0.898	---	---	-0.414	0.130**
FL	-0.647	0.448	-0.032	0.964	---	---
R-square	0.333		0.280		0.278	
Sig-F	0.057		0.026		0.028	

****** significant at 5 %; *** significant at 10 %; ** significant at 15 %; * significant at 20 %**

Farm location which was measured in the form of a dummy variable (1 if outside the farmer's residential sub-village and 0 if within the farmer's residential sub-village) has a negative effect on farm-specific technical efficiency. The results show that the further the location of the farmer's farm from their residence, the lower the level of technical efficiency. This is because farmers receive their farm inputs from farm input suppliers at their houses rather than on their farm land. Farmers did not want to receive their farm input at their houses because they did not have storage facilities around their house. Moreover, most farmers do not receive the farm input on the day they need it because the farm input supplier did can not deliver farm inputs like seed and fertilisers if not in large amounts or if less than eight to ten farmers are ordering. This result is similar to Usman (1997) who found the further the distance from the farmer's house to the farmer's farm, the lower the speed of adoption of new agricultural technology. This was because farmers who live far away from their farm have less time to monitor the development of their crops. Sometimes, these farmers were reluctant to visit their farm if they considered it not really important because of the time and energy required to travel to the farm.

Similarly, a negative relationship was found for the number of parcels managed by the farmer. The results show that the more parcels the farmer manages, the lower the technical efficiency. This is because the more parcels of land the farmers manage, the more time and energy they must spend to manage their farm. In addition, the number of parcels will affect the efficiency of distribution of farm inputs.

The results of the analysis for cassava farmers are shown in Table 6.18. All three models provide only one significant variable, and the R-square are low. However, model 3 was chosen as the best model as the F-value is significant and the signs of the coefficients are logical. Model 3 results showed that family labour significantly affects the technical efficiency of cassava farmers with a positive regression coefficient. This indicates that the technical efficiency of cassava farming increases as family labour increases. Cassava cultivation in dryland areas Lombok depend mostly on family labour. This is because cassava only requires planting and harvesting. Most cassava farmers in the research area do not use hired labour. Ajibefun *et al*. (1996) found that family labour is a highly significant variable influencing the value of technical efficiency for rural and urban farming in Ondo State, Nigeria.

Table 6.18. Technical Efficiency Model of Cassava Farming in Dryland Lombok Island

	Model 1		Model 2		Model 3	
	B	T sig	B	T sig	B	T sig
Constant	40.331	0.720	40.771	0.714	12.596	0.885
Age	-1.009	0.865	-1.026	0.861	0.691	0.858
Edu	7.337	0.535	7.315	0.532	9.458	0.359
Famlbr	4.638	0.860	4.562	0.861	-4.889	0.836
Length	0.694	0.862	0.717	0.856	---	---
Loc	-2.807	0.286	-2.822	0.277	-2.945	0.242
Prcl	0.157	0.952	---	---	---	---
Age2	0.067	0.443	0.067	0.439	0.018	0.690
Educ2	0.034	0.923	0.032	0.927	-0.032	0.917
Famlbr2	6.185	0.075***	6.209	0.070***	6.029	0.071***
Length2	0.084	0.227	0.085	0.216	---	---
AE	-0.185	0.617	-0.182	0.617	-0.181	0.390
AF	-0.782	0.323	-0.778	0.320	-0.454	0.417
AL	-0.107	0.410	-0.108	0.403	---	---
EF	-0.196	0.900	-0.209	0.891	-0.184	0.889
EL	0.086	0.762	0.084	0.764	---	---
FL	0.211	0.720	0.207	0.721	---	---
R-square	0.229		0.229		0.197	
Sig-F	0.433		0.355		0.153	

****** significant at 5 %; *** significant at 10 %; ** significant at 15 %; * significant at 20 %**

Education was not a significant influence on the level of technical efficiency. This is perhaps because almost all farmers have low education levels (and the variation in education level in the survey group was not very wide). As discussed in section 6.5.2, most farmers received an education below the year six level. In addition, the quality of education in rural areas outside Java was much lower than the national standard. This probably explains why the study result was different from the result of Saleh (1992) which found the education level for farmers in Java positively and significantly affects the application of new farming technology.

The technical efficiency model of paddy farming is considered good with relatively high values of R-square and a highly significant F-value (Table 6.19).

From the three models for paddy farmers, model 3 is considered as the best model. In this model there are three variables (age, education, and number of parcel) that significantly influence the level of technical efficiency. Model 1 and model 2 have only two significant variables although the R squares are slightly higher than model 3. Another reason for choosing model 1 is that the signs of the coefficient of regression for the number of family labour (Famlbr) seem more logical in model 3 than in model 1.

Table 6.19. Technical Efficiency Model of Paddy Farming in Dryland Lombok Island

	Model 1		Model 2		Model 3	
	B	t sig	B	t sig	B	t sig
Constant	-0.210	0.386	-0.232	0.281	-0.471	0.002
Age	0.031	0.061***	0.029	0.064***	0.043	0.000****
Edu	0.026	0.267	0.025	0.271	0.025	0.155*
Famlbr	-0.068	0.518			0.042	0.643
Length	0.012	0.476	0.013	0.424		
Loc	-0.019	0.314	-0.017	0.358	-0.022	0.248
Prcl	-0.053	0.010****	-0.055	0.008****	-0.041	0.050**
Age2	0.000	0.180*	0.000	0.442	0.000	0.000****
Educ2	0.009	0.000****	0.009	0.000****	0.009	0.000****
Famlbr2	-0.010	0.600			-0.015	0.394
Length2	-0.001	0.071**	-0.001	0.125**		
AE	-0.002	0.089**	-0.002	0.042****	-0.001	0.006****
AF	0.005	0.052**			0.001	0.505
AL	0.001	0.358	0.000	0.649		
EF	-0.007	0.287			-0.008	0.215
EL	0.001	0.672	0.001	0.689		
FL	-0.005	0.154*				
R-square	0.627		0.616		0.599	
F-Value	0.000		0.000		0.000	

[****] significant at 5 %; [***] significant at 10 %; [**] significant at 15 %; [*] significant at 20 %

The results concerning age suggest that older farmers have higher levels of technical efficiency than younger ones. Older farmers normally know more about rice cultivation. Moreover, most farmers were born and grew up in the village where farming is the way of life. This result is consistent with the finding of Bravo-Ureta and Pinheiro (1997), Binam et al. (2003) and Sukiyono (2005). Rahim (2002) reported that older farmers are more likely to have contacts with extension workers because they attend the *pengajian* where the extension workers give lectures to disseminate new technology more often than younger farmers. Furthermore, Rahim (2002) found that older farmers in rural areas are very cautious in adopting new technologies because they are afraid of losing.

The result of this study reveals that the association between education and farm level technical efficiency is positive and significant. This indicates that the higher the level of farmer education, the higher is farm level technical efficiency. This is because farmers who have more formal education might be better in gathering information and understanding new practices that in turn will improve technical efficiency. Other studies that also found a positive connection between education and technical efficiency are Belbase and Grabowski (1985), Kalirajan and Shand (1986) and Tijani (2006).

A negative relationship was found for the number of parcels managed by the farmer. The results show that the more parcels the farmer manages, the lower the technical efficiency. This is because the more parcels of land the farmers manage, the more time and energy they must spend to manage their farm. In addition, the number of parcels will affect the efficiency of distribution of farm inputs.

6.7 Chapter Summary

This study estimated stochastic frontier production functions for farmers who grew maize, peanuts, cassava and paddy. The technical efficiency varies widely from 47.6 to 94.0 per cent which indicates there is still significant opportunity for improvements in production practices. From the model of the four crops analysed, land is still considered as the most important factor of production with a significant elasticity value. In this case, farmers increase their production through increases in land area. This means that the government through its field agricultural extension workers must seriously pay attention to demonstrating up to date technology that is suitable for dryland farming. This can also be conducted through providing plot field demonstrations that use the most suitable and accessible technology. In this study accessibility means that the demonstration plot should use the tools and inputs that may be accessed by the farmers geographically and financially.

Paddy farmers and corn farmers seem to be more technically efficient than both peanut and cassava farmers, which has implications for policy making related to specialisation. Realising that there are many specialised extension workers (PPS)[6] who are based in the city as administrators, this situation perhaps needs more attention as specialist extension workers focusing their knowledge on peanut and cassava are needed. The government should facilitate better access to extension for farmers. Alternatively, a PPS for peanuts and cassava could be assigned responsible for educating farmers in specific crop potential zones.

Regarding the factors affecting farm-specific technical efficiency, for corn farmers, technical efficiency is only affected by age. For peanut farming, the determinants are age, location and the number of parcels, for cassava, the only significant factor is education, while for paddy farmers the significant factors are age, education and the number of parcels managed by the farmer. Realising these factors, three suggestions may be considered. In terms of age, the government or any institution interested in rural development should work hand in hand to educate the rural young in new innovations and farm management practices. A program like *Lomba Klompencapir*[7] which exists in the new era order would be a good vehicle to educate younger farmers. Furthermore, the agricultural extension workers should also introduce innovation in agriculture to younger farmers through *Karang Taruna* and *Remaja Mesjid*[8]. Secondly, the government must actively support land consolidation to minimise unused inputs and maximise production. For example, if there were four farmers with a total area of 10 hectares, schemes such as joint management which can improve the use of inputs can be tested (although such schemes need to be studied in more detail). This might be a way of encouraging a more efficient use of resources. However this must be coordinated in a very careful way to reduce, or eliminate, personal

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[6] There are three kinds of agricultural extension workers in Indonesia based on their promotion and experience; PPL (*Penyuluh Pertanian Lapangan*) or field agricultural extension workers; PPM (*Penyuluh Pertanian Madya*) or medium level agricultural extension workers; and PPS (*Penyuluh Pertanian Spesialis*) or specialist agricultural extension workers.

[7] *Lomba Klompencapir* is a competition for villagers about all aspects of rural development including agriculture. It was established and maintained in the new era order (1967 – 1997).

[8] *Karang Taruna* is a youth organisation for a Desa, the lowest administration level of Indonesia . *Remaja Mesjid* is refers to a young devotees of a certain mosque so only applies for Moslem people.

conflict among the group members whose lands are consolidated together. Thirdly, the government must strongly facilitate the program of nine year basic education for rural people, and improve farmers' understanding about the importance of their and their children's education.

Chapter Seven

MARKETING SYSTEMS

7.1 Introduction

The two previous chapters demonstrated the application of soft systems methodology to an analysis of agribusiness supply chains and built an understanding of the technical efficiency of production systems at the grower level. This chapter extends the analysis to investigate in more detail the marketing system associated with dryland farming on Lombok Island, Indonesia.

This chapter consists of five sections that begin with an analysis of price margins in the supply chain (Section 7.2). Section 7.3 discusses the gap analysis or the distance between what the buyer wants and the buyer received from suppliers. The upstream and downstream relationships between buyers and sellers are discussed in Section 7.4. The chapter ends with a chapter summary, implications and suggested areas for further research.

7.2 Price Margin in the Supply Chain

For the four crops selected for this study of dryland farming on Lombok Island, three different marketing chains were found. Maize and peanut marketing involved collector agents (CA), wholesalers (W) and inter-island traders (IIT). Cassava marketing only involved collector agents and inter island-traders. A more specific marketing system was found for paddy because its distribution from the farm gate to the retail store is regulated by government. Regulation covers the buying and selling price from the floor price at the farm gate to the selling price at the retail level. Moreover, there are quotas for the procurement of paddy and the need for downstream market intermediaries to be licensed. In this highly regulated market, there is little opportunity for private inter-island traders to speculate on the market.

Although respondents were assured that any price information given would not be passed onto other parties, respondents may have purposefully over-valued the commodity purchasing price and under-valued the commodity's selling price in order to reduce their perceived profit margin. For those who traded in paddy, it was also their intention to show that paddy was purchased above the prevailing floor price.

Farmers who cultivated maize and peanuts sold their farm produce at an average price of IDR 891 and IDR 1742 per kg respectively (Table 7.1).

Table 7.1. Mean Buying and Selling Prices Along the Supply Chain for Dryland Farm Products

Commodity	Farmer		Collector Agents				Wholesaler				Inter Island Traders			
	Sell	SD	Buy	SD	Sell	SD	Buy	SD	Sell	SD	Buy	SD	Sell	SD
Maize	891	35.54	1171	37.16	1349	34.43	1439	20.93	1651	38.27	1884	45.70	2192	28.27
Peanut	1742	68.35	1927	95.65	2150	96.48	2224	16.45	2503	37.59	2571	33.24	2932	51.26
Cassava	345	68.81	427	23.30	607	21.60	-		-		886	84.36	1218	87.34
Gaplek			-		-	-	-		-		-		1518	51.26
GKP[1]	919	10.48	1155	24.44	-	-	-		-		-		-	
GKS[2]			-		1312	27.40	1465	7.80	-		-		-	
GKG[3]			-		1390	26.78	1520	6.11	-		-		-	
Rice 1			-		-		-		2257	39.58	-		-	
Rice 2			-		-		-		2306	41.66	-		-	

[1] GKP stand for *Gabah Kering Panen* means harvested drying un-hulled rice
[2] GKS stand for *Gabah Kering Sosoh* means sun dried un-hulled rice but not qualified to be hulled
[3] GKG stand for *Gabah Kering Giling* means sun dried un-hulled rice qualified to be hulled

However, the collector agents or *tengkulaks* indicated that they purchased maize at an average price of IDR 1171 per kg and peanuts at an average price of IDR 1927 per kg. These products were then sold to wholesalers at an average price of IDR 1349 per kg and IDR 2150 per kg for maize and peanut respectively. Wholesalers indicated that they purchased maize at an average price of IDR 1439 per kg and peanuts at an average price of IDR 2224 per kg. In turn, these commodities were sold to inter-island traders at an average price of IDR 1651 and IDR 2503 per kg respectively. Inter-island traders indicated that they generally purchased maize at IDR 1884 per kg and peanuts at IDR 2571 per kg, on-selling these to customers off-shore for IDR 2192 per kg and IDR 2932 per kg respectively. This means that the difference in the selling price obtained by inter-island traders was 2.46 and 1.68 times the price the farmer received at the farm gate for maize and peanut respectively.

A different case was observed for those farmers who cultivated cassava. There was a difference of approximately IDR 80 per kg between the selling price at the farm level and the purchasing price paid by collector agents. For cassava, collector agents did not re-sell the product to wholesalers but transacted directly with the inter-island traders. Collector agents reported that they generally sold the cassava to inter-island traders at an average price of IDR 607 per kg. Inter-island traders, however, indicated that they generally paid up to IDR 886 per kg, re-selling the cassava to off-shore customers at an average price of IDR 1218 per kg.

The marketing mechanism for cassava is also different, because unlike the two previous commodities, inter-island traders gave money to their preferred collector agents to secure the purchase of the cassava prior to harvest. This money was then used as a down payment to the farmers who planned to harvest their cassava with the balance provided when the harvest was complete. This mechanism was employed because there is no specific season for harvesting cassava. Farmers might harvest their cassava from 6 to 12 months after planting, depending on their need for cash. Normally, farmers in the research area harvested their cassava 10 to 12 months after planting. The longer the time spent until harvest, the larger the tubers became giving more weight at harvest.

No processing was required for cassava before transporting to the inter-island traders warehouse. On receipt, the cassava was graded into two categories: one that would be sold directly as cassava tubers and another that would be sold for processing into *gaplek*. The selling price of cassava by the inter-island traders was three times that at the farm level.

Another very different marketing system was found for paddy. Theoretically, anyone may purchase harvested rice at the farm gate as *gabah kering panen* (GKP) at any price agreed between the farmer and the buyer. However, the government determines the lowest price at which paddy may be purchased depending on the quality level. The quality is measured with a *rafaksi* table that is held by all government agents for the procurement of rice at the farm gate called *satgas dolog*. These agents usually come to the farm areas when the rice is harvested. If the average price for the paddy is over the floor price, these agents will not buy the farmers' paddy. However, if the price is lower than the predetermined floor price, these agents must buy the farmers' paddy at the floor price. As these agents have the authority to determine the quality of farmers' harvested paddy, regrettably, there is an opportunity for the agents and the private buyers to collude.

In 2001, the floor price for GKP was IDR 1150 per kg for the variety IR. The IR rice is the most popular rice variety for farmers to plant and all respondents in the research area grew this rice variety. Farmers sold their GKP at an average price of IDR 919 per kg, but none of them received the floor price for their paddy. However, all the buyers indicated that they purchased GKP at an average price of IDR 1155 per kg or IDR 5 above the floor price.

GKP is then processed by the collector agents to *gabah kering sosoh* (GKS) or *gabah kering giling* (GKG). GKG is unhulled rice that meets the quality to be milled or hulled, whereas GKS is unhulled rice that nearly meets the quality to be milled or hulled. If GKS were hulled, the rice produced would be low quality. These two kinds of unhulled rice are then sold to wholesalers. The wholesalers for paddy are licenced by the government and frequently called '*kontraktors*' at the village level. At the *kontraktor* level, GKS is dried to produce GKG which is then hulled to produce consumable rice at two quality levels: quality 1 and quality 2. These quality levels are determined by the *kontraktor,* not by the government.

In terms of the marketing margin participants in the supply chain were able to extract, the marketing margin increases along the supply chain as the product moves closer to the final consumer (Table 7.2).

Table 7.2. Mean Prices Margin Along The Supply Chain Participants For Dryland Farm Products

Commodity	Collector Agents	Wholesaler	Inter Island Traders
Maize	178	212	308
Peanut	223	279	361
Cassava	100	-	332
GKP	111	-	-
GKS	139	-	-
GKG	-	193	-

The marketing margin for maize and peanuts at the collector agent level was IDR 178 and IDR 223 per kg respectively. However, collector agents had to transport these commodities from the closest accessible road to their warehouse. The fee for transporting these commodities from the farm to the closest accessible road was charged to the farmers. The transportation cost was in the range of IDR 15 – 20 per kg depending on the amount of product. Sometimes this charge included harvest wages but sometimes not.

Collector agents did not perform any value-added processing like drying and grading, for the processing of these commodities was mostly done by wholesalers. Wholesalers had to pay both the transportation cost and the processing cost. The transportation costs paid by the wholesalers was the fare to deliver the commodities from the collector agents warehouse to the wholesalers' warehouse and in turn, to deliver these commodities to the inter-island trader's warehouse. This meant that wholesalers paid the transportation costs for both procuring and selling maize and peanuts.

Since there are no quality standards for maize and peanuts, the weight loss after post-harvest processing was stated as insignificant. With the average cost of handling approaching IDR 20 – 35 per kg for both commodities, wholesalers were able to extract a higher marketing margin than collector agents.

For the inter-island traders, the price was adjusted after deducting the cost of transport from Lombok to the importers' warehouse in Bali or Java. The inter-island traders re-sorted and re-graded the entire product prior to despatch as their off-shore customers were very strict with quality. The inter-island traders employed people to sort and grade the product more thoroughly at an average cost of IDR 40 – 50 per kg. As a result, the inter-island traders were able to extract a price margin of IDR 308 and IDR 361 per kg for maize and peanut respectively.

For the distribution of cassava, the price margin that inter-island traders were able to extract was more than double the collector agents' price margin. This was because the collector agents in the cassava supply chain were employed indirectly by the inter-island traders. The collector agents did not use their own money to purchase the cassava but rather the money provided by inter-island traders. For cassava, the collector agents did not pay any transportation or processing costs because the farmers moved the cassava to the closest accessible road. As soon as there was sufficient product to fill the inter-island trader's vehicle, the truck would come and pick the product up. Handling cassava was considered much easier than maize or peanuts.

The lowest price margins were reported for paddy. Collector agents could only extract a margin of IDR 111 and IDR 139 per kg for GKP and GKS respectively. The wholesalers who hulled the GKG could only extract a price margin of IDR 193 per kg. This figure was calculated based on a recovery rate of 69 percent after hulling.

In an earlier study, Batt and Parining (2000) were able to demonstrate that the price margins market intermediaries were able to extract for fresh vegetables was very much influenced by the seasonality of supply. At the start of the season when supply was constrained the prices were high, competition between the traders constrained the margins that they could extract. However, during the main season of supply when product was readily available, market intermediaries were able to extract much higher price margin. At the farm-gate level, while the marketing margins market intermediaries are able to extract is inversely related to the prevailing price, for fresh vegetables, this seasonal pattern of production often resulted in strong seasonal price movements. Prices are high at the start of the season, then fall during the main harvest period, only to rise again as the harvest draws to close.

However, a clear distinction must be made between the finding of Batt and Parining (2000) and the finding of this study. Fresh vegetables are highly perishable. Farmers can only retain the products for a few days after harvesting, for without appropriate storage, they will rapidly deteriorate, rot and decay. For durable products like paddy, corn, peanut and cassava, seasonality is much less important and thus there is much less variation in the price.

In Indonesia, including Lombok, paddy is produced on a seasonal basis, especially where farmers must rely on the monsoons to bring the rain. Soon after harvest most rice farmers will sell their product. Theoretically, the price of rice at this time will be low because the supply is abundant. However, rice marketing in Indonesia is controlled by the government. The government periodically releases the 'floor price' for unhulled rice, based on the variety and quality. The floor price is the lowest price that must be paid to rice farmers to purchase their rice. If the buyers offer a price lower than the floor price, governmental officials called *'satgas dolog'* will buy the farmers' rice at the floor price.

Unhulled rice is a relatively durable product. Monthly price variations are not expected to be great for government policy provides a mechanism to effectively stabilise price. Furthermore, how much rice the farmer chooses to sell will be determined by the household anticipated consumption, which not unexpectedly will be related to the productivity per unit area. In those seasons (years) when the monsoons fail (drought) and or heavy rain occur late in the season (floods), yields will decline. There will be less rice available and hence the increase demand will result in higher prices. However, the extent to which this occurs will depend on the amount of rice in storage and the cost of importing rice from an alternative source.

In the case of corn and peanut farmers, the price system is not ruled by the government. However, these commodities can be stored after harvesting. With appropriate storage farmers can wait for a good price or chose to sell the crop when they need cash. Farmers in the study area stored these two commodities in two forms: kernel or cob for corn and seed or pods for peanut. Farmers who have an urgent need for cash to pay school fees, to meet medicinal bills or other household goods will sell their farm produce immediately after harvest.

Cassava farmers are even more flexible because cassava in the study area can be harvested 6 to 12 months after planting. Most farmers harvested their cassava 8 to 10 months after planting. Similar to corn and peanut farmers, cassava farmers can wait until a market intermediary approaches them with a good price or until they need cash. Unlike the other crops, the longer cassava is left to grow, the bigger the tuber becomes and the higher the yield. Consequently, the longer the crop grows before harvest, the higher the productivity per unit area and the greater the profit.

7.3 Gap Analysis

In the first part of the analysis, data is presented which explores the perceived importance of 12 product offer quality criteria in the downstream customer's decision to purchase farm products. Additional analysis was undertaken to explore the extent to which the customers perceived needs were consistent along the supply chain.

In the second part, the extent of the gap is explored between 1) what farmers think their downstream customers want and what the farmers believe they can deliver; 2) what collectors agents want from their upstream suppliers and what they actually receive from farmers; 3) what wholesalers want from their upstream suppliers and what they actually receive from collector agents and farmers; and 4) what the inter-island traders want from their upstream suppliers and what they actually receive from collector agents and wholesalers.

Farmers believed that those variables that were most important to their downstream customers in their decision to purchase were a competitive price, close proximity, reliable delivery, maturity at harvest, the quantity available and the moisture level of the product (dryness). Those variables that were considered least important included the variety and freedom from pests and disease (Table 7.3).

Table 7.3. The Extend To Which Sellers Meet the Buyers' Need Along Agribusiness Supply Chain in Lombok

	FT	FD	P	CAW	CAG	P	WW	WG	P	IIW	IIG	P
Price of the product competitively	5.59	3.49	*0.000*	5.67[a]	3.53	*0.000*	5.42[ab]	4.97	*0.001*	5.14[b]	5.00	*0.682*
Distance to travel product	5.56	5.47	*0.023*	5.53[a]	5.33	*0.046*	5.32[a]	4.52	*0.000*	5.29[a]	4.71	*0.049*
Delivery when required	5.52	4.49	*0.000*	5.71[a]	5.49	*0.033*	5.61[a]	4.61	*0.000*	5.57[a]	4.57	*0.004*
Maturity desired	5.51	4.34	*0.000*	5.43[a]	4.73	*0.000*	5.71[ab]	4.55	*0.000*	5.29[b]	4.43	*0.009*
Amount availability	5.49	5.56	*0.070*	5.61[a]	4.61	*0.000*	5.68[a]	4.55	*0.000*	5.86[a]	4.43	*0.000*
Dryness desired	5.45	4.51	*0.000*	5.71[a]	4.57	*0.000*	5.71[a]	5.16	*0.000*	6.00[a]	5.29	*0.008*
Packed appropriately	4.94	3.57	*0.000*	4.59[a]	3.67	*0.000*	5.55[b]	3.32	*0.000*	5.57[b]	3.00	*0.000*
Size desired	4.53	4.60	*0.057*	5.65[a]	5.61	*0.686*	5.52[a]	5.39	*0.315*	5.71[a]	5.43	*0.317*
Free from physical injury	4.43	3.54	*0.000*	4.45[a]	3.57	*0.000*	5.58[b]	4.55	*0.000*	5.29[b]	4.43	*0.009*
Graded well	4.43	4.44	*0.692*	5.43[ab]	4.25	*0.000*	5.58[b]	3.61	*0.000*	5.00[a]	3.71	*0.005*
Free from pest and disease	3.65	2.45	*0.000*	4.55[a]	2.43	*0.000*	5.68[b]	4.58	*0.000*	5.71[b]	4.29	*0.000*
Variety desired	3.46	3.52	*0.125*	5.57[a]	5.55	*0.844*	5.61[a]	5.68	*0.603*	5.86[a]	5.57	*0.273*

Where 1 is "Not at all important" and 6 is "Very important"

FT is what farmer's think
FD is what farmer is able to deliver
CAW is what collector agent's want
CAG is what collector agent's get
WW is what wholesaler's want
WG is what wholesaler's get
IIW is what inter island trader's want
IIG is what inter island trader's get

Those items with the same superscript are not significantly different at p = 0.05

At the farm level, farmers believed that they were unable to meet their downstream customers' expectations for all but four criteria: the amount of product available, the desired size, well graded and the desired variety. Most farmers believed that they were unable to meet their downstream customers' expectations for product that was competitively priced, mature at harvest, sufficiently well dried, and free from both physical injury and pest and diseases. Most farmers believed that they were too far from the road or the collector agents to be able to deliver product reliably. Most farmers acknowledged that the product they delivered to collector agents was not appropriately packed.

At the farm level, while farmers believed they could supply sufficient quantities of product to downstream market intermediaries, each of the market intermediaries reported that their upstream suppliers were unable to supply the product in sufficient quantities. The inability to supply sufficient quantities of product was further aggravated by the inability at the farm level to grade the product appropriately.

Farmers assumed that there was little need to grade the product as much of it was purchased under the *tebasan* method. Others sold at the farm gate after only very basic sorting as the product was purchased primarily by weight and few incentives were offered for superior quality product.

At the market intermediary level, purchasing product that had been appropriately graded was significantly more important if market intermediaries were to meet the needs of their more discerning downstream customers.

Collector agents considered reliable delivery and dryness of product to be the most important variables in their decision to purchase. On both criteria, farmers were unable to fulfil the collector agents' expectations.

Reliability of delivery was considered important by the collector agents for several reasons. For those collector agents who used their own money to collect product and process it before resale, in order to reduce the costs of processing they wanted to use the labour that was readily available in the rural areas. If product was delivered when the harvest season was nearly finished, much of the labour had already left the village or returned to the cities which meant that the price of labour was higher.

For those collector agents that used money from their downstream partner, they did not want to disappoint the money owner. In order to retain their business, the collector agents wanted to provide the best product to the wholesalers.

In terms of the gap between what the collector agents wanted and the collector agents received, farmers were only able to meet the collector agents' needs with regard to delivering product of the desired size and variety. This implied that the collector agents would experience great difficulty in meeting the downstream wholesalers' needs. Those variables that were most problematic included competitive pricing, maturity at harvest, the limited amount of product available, the inadequate dryness of product, poor grading, the high levels of physical injury, and pest and disease infestation.

With regard to price, there were a number of collector agents who bought farm products in the village, so farmers could choose between several alternative collector agents, except for those farmers who had borrowed from village money lenders. Product maturity, the quantity available and the dryness of product were related to the time of harvest. Farmers tended to harvest their crops based on the availability of labour and the household's need for cash. The high incidence of physical injury and pest and disease infestation were largely due to the prevailing methods of production and harvesting. The lack of inputs, inadequate crop rotations and the reliance on unskilled manual labour to harvest the product were the major impediments. Product was seldom graded because the downstream market intermediaries failed to provide sufficient incentives for quality and there were no other means for disposing of reject product.

In exploring the gap between what the wholesalers wanted and what the wholesalers received, the situation was not dissimilar. Ten of the 12 variables were significantly different at $p = 0.05$. Collector agents were only able to meet the wholesalers' needs to provide products of the desired size and variety. For three variables, there was a significant difference between what the wholesalers expected and collector agents expected from their upstream suppliers.

Wholesalers placed much greater importance than collector agents on appropriate packaging, freedom from physical injury and freedom from pests and diseases.

Somewhat surprisingly, the inter-island traders placed significantly less importance on grading than the wholesalers, suggesting that their downstream customers' needs might be somewhat less demanding than the wholesalers believed or what they were receiving was suitable. Nevertheless, on all but three variables, upstream suppliers were unable to meet the inter-island traders' expectations. Wholesalers were not only able to deliver product of the desired size and variety, but also to deliver product that was competitively priced. As the inter-island traders provided the only means for producers on Lombok Island to access the markets in Bali and Java, it was apparent that the inter-island traders were able to purchase the product at a price they were willing to pay. As there were only seven inter-island traders operating in Lombok, they could behave as price makers.

7.4 Relationships in the Agribusiness Supply Chain

In examining the relationship between supply chain participants for dryland farm products on Lombok Island, seven key constructs were employed: trust, satisfaction, communication, power-dependence, commitment, relationship specific investment and personal friendships.

Looking firstly at the nature of the relationship between farm input suppliers and the farmers who purchased their farm inputs, most farmers trusted their preferred input suppliers. Farmers had confidence in their preferred farm input suppliers, believing that they often acted with the farmers' best interests at heart. Farm input suppliers were perceived to be honest, to give farmers the best offer, and to always keep their promises (Table 7.4).

However, from the input suppliers' perspective, the level of trust in their relationship with farmers was significantly lower. Farmers often failed to keep their promise with preferred input suppliers and were perceived to be less honest. This situation arose because most farmers paid their farm input suppliers after receiving money from collector agents. If the collector agents who purchased the farmers' products could not provide payment on time as promised, farmers in turn were unable to keep their promise to pay farm input suppliers.

Table 7.4. Mean Score in the Relationships Between Farm Input Suppliers and Farmers

Item	S>F		F>S		P-value
	Mean	SD	Mean	SD	
Trust	**4.49**	**0.29**	**5.40**	**0.48**	**0.000**
I trust my MTP	4.90	0.64	5.50	0.56	0.000
MTP often considers my interests	5.35	0.49	5.55	0.54	0.099
I have confidence in MTP	5.35	0.59	5.55	0.52	0.161
I think MTP is honest to me	4.45	0.76	4.93	0.74	0.005
MTP always keep his promises	2.20	0.70	2.56	0.55	0.000
MTP gives me the best offer	4.70	0.66	5.37	0.62	0.000
Satisfaction	**3.56**	**0.30**	**4.49**	**0.45**	**0.000**
MTP often meets my requirement	5.75	0.44	5.56	0.58	0.077
Dealing with MTP is less risky	1.75	0.55	1.81	0.58	0.653
I think MTP treats me fairly	1.50	0.51	5.48	0.58	0.000
I have good cooperation with MTP	5.25	0.72	5.13	0.73	0.462
Communication	**3.35**	**0.33**	**3.73**	**0.42**	**0.000**
MTP usually informs me of price changes	1.85	0.59	5.11	0.69	0.000
MTP often asks about his way of rewarding me	2.45	0.51	2.57	0.52	0.003
MTP often suggests trading method	2.65	0.49	5.06	0.65	0.000
It easy to find MTP	4.50	0.51	5.48	0.51	0.000
Power Dependence	**2.49**	**0.34**	**2.89**	**0.44**	**0.000**
I am free to chose MTP	2.35	0.49	4.48	0.50	0.000
MTP has full authority in decision making	2.60	0.50	2.58	0.49	0.836
I have to agree with MTP's decisions	2.60	0.50	2.51	0.51	0.419
I depend more on MTP than him on me	2.40	0.50	2.01	0.66	0.009
Commitment	**2.33**	**0.34**	**5.05**	**0.46**	**0.000**
Long term relationship with MTP guaranteed my product	1.80	0.52	5.37	0.49	0.000
I plan to continue my business with MTP in future	2.85	0.37	4.73	0.56	0.000
Relationship Specific Investment					
MTP usually offers financial assistance to me	2.25	0.44	2.55	0.50	0.009
Customer Friendship					
I have a close friendship with MTP	4.05	0.99	4.55	0.57	0.000

Note: where MTP stands for My preferred trading partner

where 1 is "I disagree a lot" and 6 is "I agree a lot"
S > F demonstrates the farm input suppliers' relationship with farmers
F > S demonstrates the farmers' relationship with their farm input suppliers

It was no surprise then to find that, in terms of satisfaction with the exchange, most farm input suppliers believed that farmers did not treat them fairly. In part, this could be related to the subsidies that were sometimes provided by NGOs or international aid agencies to the farmers but were never shared with the farm input suppliers. Nevertheless, there was evidence to suggest that both parties generally met each other's expectations and there was some evidence of both parties cooperating. Good cooperation between the farm input suppliers and farmers was observed with regard to the amount, time and place to which farm inputs were delivered. However, neither the farm input suppliers or the farmers believed that mutual exchange reduced risk. Agriculture is inherently a high risk industry, subject to the vagaries of nature. Moreover, farmers could not guarantee that they would continue to purchase from their preferred farm input supplier, nor could the farm input supplier guarantee that they would remain in business.

In terms of communication, it was clear that there were several significant differences in the nature of the relationship between farm input suppliers and farmers. Farmers almost never informed farm input suppliers about price changes, but not unexpectedly, in order to do business with the farmer, most farm input suppliers usually discussed prices. Farmers did not feel that it was necessary to either inform farm input suppliers about price changes for farm products or to disclose differences in the price of various inputs between alternative farm input suppliers. Whereas most farmers were subsistence farmers, trading in farm inputs was a business. Therefore, most farm input suppliers had greater skill and knowledge and were more able to discuss alternative ways of doing business. Generally, as the farmers chose their farm input suppliers, they reported that it was much easier to find their preferred input suppliers.

At the farm input level, it was somewhat surprising to find that farm input suppliers were generally more dependent on the farmers. Farmers on the other hand could readily choose between alternative trading partners. This meant that farm input suppliers needed to retain their customers. Neither farmers nor input suppliers were able to exert any undue power or influence over their preferred exchange partner.

In terms of commitment, while the majority of farmers indicated a strong desire to continue to trade with their preferred farm input supplier, most farm input suppliers did not wish to commit to any long-term relationship. This was because most farm input suppliers did not believe that a long-term relationship with impoverished subsistence farmers could guarantee the continuity of their business.

Moreover, neither the farm input suppliers nor the farmers themselves were able to offer any financial assistance to their preferred trading partner in difficult times.

While both farmers and farm input suppliers indicated that they enjoyed a moderately close personal friendship, as inputs were often extended on credit, farm input suppliers preferred to maintain an ‘arms length’ relationship, thereby enabling them to pressure farmers in the event of non payment.

In examining simultaneously the farmers’ downstream relationship with collector agents and their upstream relationship with farm input suppliers, it appears that while farmers trust their farm input suppliers, they did not trust the collector agents. Farmers had little confidence in collector agents because they thought that most collector agents were seldom honest, they rarely acted in the farmers’ best interest and they seldom gave the best offer. Generally, the collector agents had a higher economic status than the farmers. Collector agents were considered rich in the village and they were more business oriented than the farmers. However, the collector agents seldom offered any financial assistance to the farmers (Table 7.5).

Furthermore, farmers were generally more satisfied in their relationship with farm input suppliers than their preferred collector agents. The higher levels of satisfaction resulted from the farm input suppliers’ capacity to more often meet farmers’ requirements. Farm input suppliers treated the farmers more fairly than the collector agents and farmers believed that it was significantly less risky to deal with their preferred farm input suppliers than it was to transact with collector agents.

Nevertheless, as the collector agents represented the customers, there was evidence of a higher degree of cooperation between the farmers and collector agents. However, it would appear that the need to cooperate was something enforced upon the farmers by the collector agents. Whereas the farmers were free to choose which farm input suppliers they dealt with, much fewer choices were available in deciding to whom they would sell their produce. As a result, farmers were significantly more dependent upon collector agents than they were upon their preferred farm input supplier. Collector agents had the power to choose whether they would or would not buy the farmers produce.

Table 7.5. Mean Score in the Relationships Between Farmers and Farm Input Suppliers and Between Farmers and Collector Agents

Item	F>S		F>CA		P-value
	Mean	SD	Mean	SD	
Trust	**5.40**	**0.48**	**2.60**	**0.37**	**0.000**
I trust my MTP	5.50	0.56	3.77	0.42	0.000
MTP often considers my interests	5.55	0.54	2.50	0.58	0.000
I have confidence in MTP	5.55	0.52	2.70	0.46	0.000
I think MTP is honest to me	4.93	0.74	2.56	0.55	0.000
MTP always keep his promises	2.56	0.55	2.07	0.58	0.000
MTP gives me the best offer	5.37	0.62	2.03	0.57	0.000
Satisfaction	**4.49**	**0.45**	**4.27**	**0.55**	**0.000**
MTP often meets my requirement	5.56	0.58	4.64	0.66	0.000
Dealing with MTP is less risky	1.81	0.58	1.58	0.62	0.000
I think MTP treats me fairly	5.48	0.58	5.39	0.65	0.045
I have good cooperation with MTP	5.13	0.73	5.48	0.53	0.000
Communication	**3.73**	**0.42**	**4.51**	**0.56**	**0.000**
MTP usually informs me of price changes	5.11	0.69	5.36	0.70	0.000
MTP often asks about his way of rewarding me	2.57	0.52	2.02	0.70	0.000
MTP often suggests trading method	5.06	0.65	4.97	0.63	0.080
It easy to find MTP	5.48	0.51	5.30	0.70	0.000
Power Dependence	**2.89**	**0.44**	**3.26**	**0.35**	**0.000**
I am free to chose MTP	4.48	0.50	2.32	0.47	0.000
MTP has full authority in decision making	2.58	0.49	3.56	0.50	0.000
I have to agree with MTP's decisions	2.51	0.51	1.88	0.52	0.000
I depend more on MTP than him on me	2.01	0.66	5.28	0.46	0.000
Commitment	**5.05**	**0.46**	**2.20**	**0.39**	**0.000**
Long term relationship with MTP guaranteed my product	5.37	0.49	2.16	0.46	0.000
I plan to continue my business with MTP in future	4.73	0.56	2.24	0.43	0.000
Relationship Specific Investment					
MTP usually offers financial assistance to me	2.55	0.50	2.71	0.46	0.000
Customer Friendship					
I have a close friendship with MTP	4.55	0.57	2.57	0.57	0.000

Note: where MTP stands for My preferred trading partner

Where 1 is "I disagree a lot" and 6 is "I agree a lot"
F > S demonstrates the farmers' relationship with their farm input suppliers
F > CA demonstrates the farmers' relationship with collector agents

However, in order to secure the farmers' produce, collector agents needed to inform the farmers of any significant changes in the price of farm outputs. However, collector agents seldom discussed or provided any suggestions to assist farmers in achieving a higher price in the output market.

It was abundantly clear that farmers were much more distant from the collector agents both socially and geographically. Whereas most farmers indicated that they had a close personal friendship with their farm input supplier, their relationship with collector agents was significantly more impersonal. Similarly, most farmers indicated that they would experience more difficulty in trying to locate those collector agents with whom they ordinarily transacted.

Not unexpectedly, given the low levels of trust and satisfaction in their exchange with collector agents, farmers were constantly looking for better, alternative buyers. Whereas most farmers indicated their desire to maintain their relationship with their upstream farm input suppliers, the majority of farmers had little desire to maintain any long-term relationship with collector agents.

In exploring the relationship between farmers and collector agents, it was apparent that collector agents trusted the farmers more than the farmers trusted the collector agents. Collector agents' trust and confidence in the farmers was high because farmers were perceived to be honest and to act in the collector agents' best interests. However as the farmers did not always keep their promises, collector agents were generally less satisfied in their relationship with the farmers (Table 7.6).

Nevertheless, on most occasions, farmers met the collector agents' requirements and there was evidence of good cooperation between the farmers and their downstream collector agents.

Not unexpectedly, with little knowledge of the downstream market and customers requirements, farmers were unable to suggest how collector agents might best improve the quality of their offer or to advise collector agents of any change in commodity prices in the market.

As the farmers generally brought their products to the places designated for pick-up by the collector agents, collector agents indicated that they would experience greater difficulty in attempting to locate the farmers. However, whereas farmers indicated that their relationship with collector agents was largely impersonal and driven by the search to locate the collector agent who offered the highest price, collector agents believed that they had built a close personal relationship with the farmers. However, one could not consider this to be an enduring relationship for there was little evidence on either side of the desire to maintain a long-term relationship.

Table 7.6. Mean Score in the Relationship Between Farmers and Collector Agents

Item	F>CA		CA>F		P-value
	Mean	SD	Mean	SD	
Trust	**2.60**	**0.37**	**4.72**	**0.39**	**0.000**
I trust my MTP	3.77	0.42	4.47	0.81	0.000
MTP often considers my interests	2.50	0.58	5.37	0.69	0.000
I have confidence in MTP	2.70	0.46	5.39	0.72	0.000
I think MTP is honest to me	2.56	0.55	5.35	0.72	0.000
MTP always keep his promises	2.07	0.58	2.71	0.46	0.000
MTP gives me the best offer	2.03	0.57	5.00	0.75	0.000
Satisfaction	**4.27**	**0.55**	**3.70**	**0.33**	**0.000**
MTP often meets my requirement	4.64	0.66	5.57	0.57	0.000
Dealing with MTP is less risky	1.58	0.62	1.51	0.58	0.069
I think MTP treats me fairly	5.39	0.65	2.22	0.41	0.000
I have good cooperation with MTP	5.48	0.53	5.63	0.53	0.058
Communication	**4.51**	**0.56**	**3.48**	**0.32**	**0.000**
MTP usually informs me of price changes	5.36	0.70	2.43	0.57	0.000
MTP often asks about his way of rewarding me	2.02	0.70	2.45	0.58	0.000
MTP often suggests trading method	4.97	0.63	2.73	0.45	0.000
It easy to find MTP	5.30	0.70	4.43	0.54	0.000
Power Dependence	**3.26**	**0.35**	**2.57**	**0.29**	**0.000**
I am free to chose MTP	2.32	0.47	2.71	0.46	0.000
MTP has full authority in decision making	3.56	0.50	2.29	0.46	0.000
I have to agree with MTP's decisions	1.88	0.52	2.76	0.43	0.000
I depend more on MTP than him on me	5.28	0.46	2.53	0.50	0.000
Commitment	**2.20**	**0.39**	**2.04**	**0.30**	**0.001**
Long term relationship with MTP guaranteed my product	2.16	0.46	1.88	0.52	0.000
I plan to continue my business with MTP in future	2.24	0.43	2.22	0.41	0.649
Relationship Specific Investment					
MTP usually offers financial assistance to me	2.71	0.46	2.24	0.43	0.000
Customer Friendship					
I have a close friendship with MTP	2.57	0.57	5.45	0.61	0.000

Note: where MTP stands for My preferred trading partner

Where 1 is "I disagree a lot" and 6 is "I agree a lot"
F > CA demonstrates the farmers' relationship with their collector agents
CA > F demonstrates the collector agents' relationship with farmers

Even though collector agents had the majority of power in the relationship, it was apparent that they had little opportunity to exercise it. Collector agents had to accept what the farmers offered for sale or to go elsewhere to source the product.

As there were a number of alternative farmers with whom the collector agent could transact, the collector agents were not dependent on the farmers.

In examining the collector agents' downstream relationship with wholesalers and their upstream relationship with farmers, it appeared that the collector agents' upstream relationship with farmers was a great deal more positive. Collector agents indicated a great deal more trust and confidence in their relationship with farmers because the farmers were more honest with them. Collector agents were also more satisfied in their relationship with farmers than with the wholesalers because the wholesalers less often met the collector agents' requirements and seldom treated the collector agents fairly (Table 7.7).

From the collector agents' perspective, there was little difference in the extent to which they communicated with farmers and wholesalers. However, collector agents more often spoke with wholesalers and were more proactive in suggesting ways for the wholesaler to improve business.

In exploring the collector agents' relationship with downstream wholesalers, it was immediately apparent that the collector agents were more dependent on their downstream wholesalers than they were upon their farmer suppliers. Collector agents had to concur with the demands made by their downstream customers. Furthermore, while collector agents indicated that they enjoyed a very close personal friendship with their upstream suppliers, their relationships with wholesalers were much less personal. As collector agents perceived that wholesalers did not always treat them fairly and equitably, there was little evidence of any long-term commitment. In the absence of any relationship-specific investments, collector agents could readily choose an alternative downstream trading partner.

Table 7.7. Mean Score in the Relationships Between Collector Agents and Farmers and Between Collector Agents and Wholesalers

Item	CA>F		CA>W		P-value
	Mean	SD	Mean	SD	
Trust	**4.72**	**0.39**	**3.39**	**0.40**	**0.000**
I trust my MTP	4.47	0.81	1.73	0.56	0.000
MTP often considers my interests	5.37	0.69	5.57	0.50	0.104
I have confidence in MTP	5.39	0.72	3.47	0.50	0.000
I think MTP is honest to me	5.35	0.72	2.24	0.55	0.000
MTP always keep his promises	2.71	0.46	2.35	0.69	0.003
MTP gives me the best offer	5.00	0.75	4.98	0.79	0.898
Satisfaction	**3.70**	**0.33**	**3.07**	**0.27**	**0.000**
MTP often meets my requirement	5.57	0.57	3.61	0.49	0.000
Dealing with MTP is less risky	1.51	0.58	1.88	0.43	0.000
I think MTP treats me fairly	2.22	0.41	1.43	0.50	0.000
I have good cooperation with MTP	5.63	0.53	5.37	0.66	0.255
Communication	**3.48**	**0.32**	**3.48**	**0.28**	**0.871**
MTP usually informs me of price changes	2.43	0.57	2.20	0.75	0.078
MTP often asks about his way of rewarding me	2.45	0.58	2.67	0.48	0.042
MTP often suggests trading method	2.73	0.45	4.59	0.57	0.000
It easy to find MTP	4.43	0.54	4.55	0.54	0.274
Power Dependence	**2.57**	**0.29**	**3.03**	**0.24**	**0.000**
I am free to chose MTP	2.71	0.46	2.39	0.49	0.001
MTP has full authority in decision making	2.29	0.46	2.47	0.50	0.068
I have to agree with MTP’s decisions	2.76	0.43	3.53	0.50	0.000
I depend more on MTP than him on me	2.53	0.50	3.73	0.45	0.000
Commitment	**2.04**	**0.30**	**2.39**	**0.38**	**0.000**
Long term relationship with MTP guaranteed my product	1.88	0.52	1.90	0.64	0.865
I plan to continue my business with MTP in future	2.22	0.41	2.88	0.32	0.000
Relationship Specific Investment					
MTP usually offers financial assistance to me	2.24	0.43	2.16	0.45	0.506
Customer Friendship					
I have a close friendship with MTP	5.45	0.61	2.43	0.64	0.000

Note: where MTP stands for My preferred trading partner
Where 1 is “I disagree a lot” and 6 is “I agree a lot”
CA > F demonstrates the collector agents’ relationship with farmers
CA > W demonstrates the collector agents’ relationship with wholesalers

In examining the nature of the collector agents’ relationship with their wholesale buyers and the wholesalers’ relationship with the collector agents who supplied them, the collector agents were much less trusting of their downstream trading partners. Collector agents had little confidence in the wholesalers, believing that they were often dishonest. Thus it was no surprise to find that wholesalers seldom met the collector agent’s expectations (Table 7.8).

Similarly, it was no surprise to find that the collector agents were generally more dependent upon their wholesale trading partners than the wholesalers were upon the collector agents. In order to sell the produce they had accumulated, collector agents had to adhere to their downstream buyers demands.

Table 7.8. Mean Score in the Relationship Between Collector Agents and Wholesalers

Item	CA>W		W>CA		P-value
	Mean	SD	Mean	SD	
Trust	**3.39**	**0.40**	**4.31**	**0.27**	**0.000**
I trust my MTP	1.73	0.56	4.13	0.56	0.000
MTP often considers my interests	5.57	0.50	5.55	0.51	0.860
I have confidence in MTP	3.47	0.50	5.48	0.57	0.000
I think MTP is honest to me	2.24	0.55	3.74	0.68	0.000
MTP always keep his promises	2.35	0.69	2.06	0.68	0.068
MTP gives me the best offer	4.98	0.79	4.87	0.72	0.530
Satisfaction	**3.07**	**0.27**	**3.46**	**0.30**	**0.000**
MTP often meets my requirement	3.61	0.49	5.32	0.70	0.000
Dealing with MTP is less risky	1.88	0.43	1.65	0.61	0.042
I think MTP treats me fairly	1.43	0.50	1.35	0.49	0.499
I have good cooperation with MTP	5.37	0.66	5.52	0.63	0.334
Communication	**3.48**	**0.28**	**3.40**	**0.40**	**0.279**
MTP usually informs me of price changes	2.20	0.75	2.06	0.73	0.438
MTP often asks about his way of rewarding me	2.67	0.48	2.52	0.51	0.180
MTP often suggests trading method	4.59	0.57	2.74	0.44	0.000
It easy to find MTP	4.55	0.54	4.48	0.57	0.606
Power Dependence	**3.03**	**0.24**	**2.51**	**0.33**	**0.000**
I am free to chose MTP	2.39	0.49	2.45	0.50	0.602
MTP has full authority in decision making	2.47	0.50	2.52	0.51	0.694
I have to agree with MTP’s decisions	3.53	0.50	2.61	0.49	0.000
I depend more on MTP than him on me	3.73	0.45	2.48	0.51	0.000
Commitment	**2.39**	**0.38**	**2.21**	**0.31**	**0.020**
Long term relationship with MTP guaranteed my product	1.90	0.64	1.74	0.57	0.258
I plan to continue my business with MTP in future	2.88	0.32	2.68	0.48	0.023
Relationship Specific Investment					
MTP usually offers financial assistance to me	2.16	0.45	5.37	0.66	0.207
Customer Friendship					
I have a close friendship with MTP	2.43	0.64	2.00	0.68	0.005

Note: where MTP stands for My preferred trading partner
Where 1 is “I disagree a lot” and 6 is “I agree a lot”
CA > W demonstrates the collector agents’ relationship with wholesalers
W > CA demonstrates the wholesalers’ relationship with collector agents

Although neither party showed any real commitment to their respective trading partner, collector agents indicated a greater desire to continue their relationship into the future. It was also evident that at this stage in the supply chain, the collector agents' relationship with their wholesale buyer and the wholesalers' relationship with the collector agent were very impersonal. The relationship was strictly business.

The impersonal nature of the relationship was observed to increase still further in examining the nature of the wholesaler's relationship with the inter-island traders who purchased the product prior to shipping. In particular, the level of trust exhibited in the wholesalers relationship with the inter-island traders was significantly lower than that observed between the wholesaler and the collector agents who supplied them (Table 7.9).

The wholesalers had little confidence in the inter-island traders, believing that they were seldom honest and seldom kept their promises. The inter-island traders seldom acted in the wholesaler's best interest and seldom provided the best offer.

Yet despite the very low level of trust evident in the exchange, the majority of wholesalers indicated that the inter-island traders often met their expectations and there was a good deal of cooperation present in the exchange. Nevertheless, most wholesalers believed that they had not been treated fairly in the exchange. As a result, most wholesalers indicated that they had no desire to maintain their relationship with the inter-island traders.

However, despite most wholesalers indicating that they were free to choose another trading partner at any time, it was evident that wholesalers were significantly more dependent upon the inter-island traders than they were upon the collector agents who supplied them. This anomaly may arise from the knowledge that even though alternatives are available, they are no better and perhaps even worse than the trading relationship in which the wholesaler is already engaged.

Table 7.9. Mean Score in the Relationships Between Wholesalers and Collector Agents Between Wholesalers and Inter-Island Traders

Item	W>CA		W>II		P-value
	Mean	SD	Mean	SD	
Trust	**4.31**	**0.27**	**2.81**	**0.31**	**0.000**
I trust my MTP	4.13	0.56	1.71	0.59	0.000
MTP often considers my interests	5.55	0.51	2.45	0.57	0.000
I have confidence in MTP	5.48	0.57	4.45	0.57	0.000
I think MTP is honest to me	3.74	0.68	2.42	0.62	0.000
MTP always keep his promises	2.06	0.68	2.19	0.83	0.507
MTP gives me the best offer	4.87	0.72	3.61	0.71	0.000
Satisfaction	**3.46**	**0.30**	**3.50**	**0.28**	**0.585**
MTP often meets my requirement	5.32	0.70	5.39	0.67	0.712
Dealing with MTP is less risky	1.65	0.61	1.84	0.52	0.184
I think MTP treats me fairly	1.35	0.49	1.39	0.49	0.797
I have good cooperation with MTP	5.52	0.63	5.39	0.56	0.395
Communication	**3.40**	**0.40**	**3.11**	**0.31**	**0.002**
MTP usually informs me of price changes	2.06	0.73	1.97	0.60	0.571
MTP often asks about his way of rewarding me	2.52	0.51	2.55	0.51	0.803
MTP often suggests trading method	2.74	0.44	2.74	0.44	1.000
It easy to find MTP	4.48	0.57	3.45	0.51	0.000
Power Dependence	**2.51**	**0.33**	**3.48**	**0.30**	**0.000**
I am free to chose MTP	2.45	0.50	4.74	0.44	0.000
MTP has full authority in decision making	2.52	0.51	2.26	0.44	0.037
I have to agree with MTP's decisions	2.61	0.49	2.58	0.50	0.800
I depend more on MTP than him on me	2.48	0.51	4.35	0.49	0.000
Commitment	**2.21**	**0.31**	**2.09**	**0.37**	**0.069**
Long term relationship with MTP guaranteed my product	1.74	0.57	1.68	0.54	0.651
I plan to continue my business with MTP in future	2.68	0.48	2.42	0.50	0.042
Relationship Specific Investment					
MTP usually offers financial assistance to me	5.37	0.66	2.00	0.45	0.164
Customer Friendship					
I have a close friendship with MTP	2.00	0.68	1.84	0.78	0.389

Note: where MTP stands for My preferred trading partner
Where 1 is "I disagree a lot" and 6 is "I agree a lot"
W > CA demonstrates the wholesalers' relationship with collector agents
W > II demonstrates the wholesalers' relationship with their inter island traders

Despite the low level of trust shown in the wholesaler's relationship with inter-island traders, the inter-island traders were far more trusting of the wholesalers who supplied them. The inter-island traders had confidence in the wholesalers and believed that they often acted in their best interest. However, wholesalers did not always keep their promises (Table 7.10).

Table 7.10. Mean Score in the Relationship Between Wholesalers and Inter-Island Traders

Item	W>II		II>W		P-value
	Mean	SD	Mean	SD	
Trust	**2.81**	**0.31**	**4.59**	**0.43**	**0.000**
I trust my MTP	1.71	0.59	4.86	0.38	0.000
MTP often considers my interests	2.45	0.57	5.57	0.53	0.000
I have confidence in MTP	4.45	0.57	5.57	0.53	0.001
I think MTP is honest to me	2.42	0.62	4.86	0.69	0.000
MTP always keep his promises	2.19	0.83	2.00	0.82	0.581
MTP gives me the best offer	3.61	0.71	4.71	0.49	0.000
Satisfaction	**3.50**	**0.28**	**3.64**	**0.20**	**0.213**
MTP often meets my requirement	5.39	0.67	5.57	0.53	0.500
Dealing with MTP is less risky	1.84	0.52	2.00	0.58	0.474
I think MTP treats me fairly	1.39	0.49	1.43	0.53	0.845
I have good cooperation with MTP	5.39	0.56	5.57	0.79	0.469
Communication	**3.11**	**0.31**	**3.36**	**0.50**	**0.252**
MTP usually informs me of price changes	1.97	0.60	1.86	0.90	0.693
MTP often asks about his way of rewarding me	2.55	0.51	2.29	0.49	0.233
MTP often suggests trading method	2.74	0.44	2.43	0.53	0.187
It easy to find MTP	3.45	0.51	4.71	0.76	0.008
Power Dependence	**3.48**	**0.30**	**2.53**	**0.34**	**0.000**
I am free to chose MTP	4.74	0.44	2.71	0.49	0.000
MTP has full authority in decision making	2.26	0.44	2.71	0.49	0.021
I have to agree with MTP's decisions	2.58	0.50	2.29	0.49	0.184
I depend more on MTP than him on me	4.35	0.49	2.43	0.53	0.000
Commitment	**2.09**	**0.37**	**2.36**	**0.38**	**0.056**
Long term relationship with MTP guaranteed my product	1.68	0.54	1.71	0.76	0.881
I plan to continue my business with MTP in future	2.42	0.50	3.00	0.00	0.000
Relationship Specific Investment					
MTP usually offers financial assistance to me	2.00	0.45	2.29	0.49	0.142
Customer Friendship					
I have a close friendship with MTP	1.84	0.78	1.57	0.53	0.396

Note: where MTP stands for My preferred trading partner

Where 1 is "I disagree a lot" and 6 is "I agree a lot"
W > II demonstrates the wholesalers' relationship with inter island traders
II > W demonstrates the inter island traders' relationship with their wholesalers

While neither party was perceived to treat the other fairly, both parties often met each others expectations and there was evidence of good cooperation between both the wholesalers and the inter-island traders. However, neither party believed that having a long-term relationship would reduce the risk inherent in the exchange. As a result, neither party expressed any desire to build and maintain an enduring relationship.

While the inter-island traders indicated that they were significantly less dependent upon the wholesalers than the wholesalers were upon the inter-island traders, the inter-island traders indicated that they had few alternative sources of supply.

7.4.1 Downstream Relationships

In examining the downstream relationships along the supply chain the research has found that while the farm input suppliers generally trust farmers, farmers do not trust the traders who purchase their farm outputs. In turn, the traders do not trust the wholesalers who purchase the product they have on-sold and the wholesalers do not trust the inter-island traders (Table 7.11).

Those items with the same superscript are not significantly different at p = 0.05
With the exception of the farm input suppliers, it is apparent that most actors in the supply chain do not believe that their downstream customers have been honest with them nor have they always acted in their best interest.

Irrespective of the position the focal actor occupied in the supply chain, it was apparent that few market intermediaries kept their promises. Furthermore, with the exception of the farmers and their relationship with the traders who purchased their farm outputs, few actors in the downstream supply chain believed that they had been treated fairly and equitably.

Risk was inherent within the downstream supply chain. Despite the benefits that are often believed to accrue from entering into a long-term relationship with customers, there was little evidence to suggest in the farm output market that trading with preferred customers was any less risky.

Despite the lack of trust, there was from the suppliers' perspective, a willingness to cooperate with downstream customers. Suppliers generally cooperated with their downstream customers because they wanted to, not because they had to. There was no evidence of any coercion, except at the level of the traders. Since most traders acted as an agent for a downstream wholesaler, this was not unexpected.

Table 7.11. Mean Score in the Downstream Relationship Along The Supply Chain For Dryland Farm Products

Item	S>F	F>CA	CA>W	W>II
Trust	**4.49[a]**	**2.60[b]**	**3.39[c]**	**2.81[b]**
I trust my MTP	4.90[a]	3.77[b]	1.73[c]	1.71[c]
MTP often considers my interests	5.35[a]	2.50[b]	5.57[a]	2.45[b]
I have confidence in MTP	5.35[a]	2.70[b]	3.47[c]	4.45[d]
I think MTP is honest to me	4.45[a]	2.56[b]	2.24[b]	2.42[b]
MTP always keep his promises	2.20[a]	2.07[a]	2.35[a]	2.19[a]
MTP gives me the best offer	4.70[a]	2.03[b]	4.98[a]	3.61[c]
Satisfaction	**3.56[a]**	**4.27[b]**	**3.07[c]**	**3.50[c]**
MTP often meets my requirement	5.57[a]	4.64[b]	3.61[c]	5.39[a]
Dealing with MTP is less risky	1.75[a]	1.58[a]	1.88[a]	1.84[a]
I think MTP treats me fairly	1.50[a]	5.39[b]	1.43[a]	1.39[a]
I have good cooperation with MTP	5.25[a]	5.48[a]	5.37[a]	5.39[a]
Communication	**3.35[a]**	**4.51[b]**	**3.48[a]**	**3.11[a]**
MTP usually informs me of price changes	1.85[a]	5.36[b]	2.20[a]	1.97[a]
MTP often asks about his way of rewarding me	2.45[ab]	2.02[a]	2.67[b]	2.55[b]
MTP often suggests trading method	2.65[a]	4.97[b]	4.59[b]	2.74[a]
It easy to find MTP	4.50[a]	5.30[b]	4.55[a]	3.45[c]
Power Dependence	**2.49[a]**	**3.26[b]**	**3.03[c]**	**3.48[b]**
I am free to chose MTP	2.35[a]	2.32[a]	2.39[a]	4.74[b]
MTP has full authority in decision making	2.60[a]	3.56[b]	2.47[a]	2.26[a]
I have to agree with MTP's decisions	2.60[a]	1.88[b]	3.53[c]	2.58[a]
I depend more on MTP than him on me	2.40[a]	5.28[b]	3.73[c]	4.35[d]
Commitment	**2.32[a]**	**2.20[a]**	**2.39[ab]**	**2.04[ac]**
Long term relationship with MTP guaranteed my product	1.80[ab]	2.16[a]	1.90[a]	1.68[b]
I plan to continue my business with MTP in future	2.85[a]	2.24[b]	2.88[a]	2.42[b]
Relationship Specific Investment				
MTP usually offers financial assistance to me	2.25[a]	2.71[b]	2.29[a]	2.00[a]
Customer Friendship				
I have a close friendship with MTP	4.05[a]	2.57[b]	2.43[b]	1.84[c]

Note: where MTP stands for My preferred trading partner

Where 1 is "I disagree a lot" and 6 is "I agree a lot"
S > F demonstrates the farm input suppliers' relationship with farmers
F > CA demonstrates the farmers' relationship with their collector agents
CA > W demonstrates the collector agents' relationship with their wholesalers
W > II demonstrates the wholesalers' relationship with their inter island traders

With the exception of the wholesalers, most actors were free to choose their downstream customer. Furthermore, there was some evidence to suggest that wholesalers were more dependent on the inter-island traders to whom they sold their produce. This would suggest that there was an apparent lack of alternative trading partners. However, the inter-island traders had to accept whatever product was delivered to them, for there was little to differentiate between alternative offers.

Despite the presence of alternative buyers, the level of dependence was greatest at the farm level. Traders it seemed had the greatest choice in deciding whether they would purchase the farmers product. Nevertheless, farmers were not bound to the trader and did not have to concur with the traders' decision. Product was offered for sale and farmers either accepted or rejected the offer made by respective traders.

With the low levels of trust apparent within the supply chain, farmers showed little commitment to their relationship with traders. They were, just as all other actors were, constantly searching for better exchange partners.

Regarding the communication within the exchange, traders were the most willing actors in the supply chain to provide market information. This is not surprising, for farmers were unlikely to sell to the traders until they could be convinced that they were being offered the best price. Traders were also the most willing to provide information to farmers that might enable them to improve the quality of their product offer.

It was only at the farm level where downstream customers were perceived to offer any financial assistance. No doubt this was in part related to the prevailing *tebasan* system where the farmers received a proportion of their income prior to harvest.

It was also apparent that the relationship between farm input suppliers and their downstream customers was a great deal more personal than any of the other downstream relationships. In part, this may have been due to the need for farm input suppliers to often extend credit to the farmers. A strong social relationship might facilitate the building of trust and thus provide a greater guarantee of the loan being repaid, although there was always some risk that this may not eventuate.

7.4.2 Upstream Relationship

In exploring the upstream relationships with suppliers in the supply chain the research found that in contrast to the low levels of trust extended to downstream customers, most actors trusted their upstream suppliers. Most actors perceived that their upstream suppliers were honest and made the best offer. As a result, the focal actors had confidence in their upstream suppliers, believing that they often acted in their best interest. However, with the exception of the farmers' relationships with their upstream farm input suppliers, most actors believed that their preferred suppliers did not always keep their promises (Table 7.12).

Most upstream suppliers were perceived to meet the focal actor's requirements and most suppliers willingly cooperated with their downstream customers. However, with the exception of the farmers' relationships with upstream input suppliers, all other actors in the supply chain did not believe that their suppliers treated them fairly and equitably. This may relate more to the inability of farmers to provide downstream customers with the quality of product they demanded at a fair price.

In a similar manner to the downstream relationship with customers, all actors in the supply chain did not believe that a long-term relationship with preferred suppliers would reduce the risk inherent in the exchange.

In terms of communication, farmers most often informed their farm input suppliers about the prices being offered by competitors. No doubt, there was an attempt to secure a lower price. Similarly, farmers were likely to suggest ways in which farm input suppliers could better meet their needs. However, at all other levels of the supply chain, suppliers were reluctant to provide any price information to customers or to engage in any dialogue to improve their ability to meet downstream customers' needs.

At the farm level, farmers indicated that they enjoyed a close and personal friendship with their preferred upstream supplier. Similarly, traders believed that they had also established a meaningful and personal relationship with the farmers who supplied them, probably through the offer to purchase their crop prior to harvest. However, at both the wholesaler level and the inter-island trader level, the relationship with upstream suppliers was entirely economic.

Table 7.12. Mean Score in the Upstream Relationship Along The Supply Chain for Dryland Farm Products

Item	F>S	CA>F	W>CA	II>W
Trust	**5.40[a]**	**4.71[b]**	**4.31[c]**	**4.59[c]**
I trust my MTP	5.50[a]	4.47[bc]	4.13[c]	4.86[b]
MTP often considers my interests	5.55[a]	5.37[a]	5.55[a]	5.57[a]
I have confidence in MTP	5.55[a]	5.39[a]	5.48[a]	5.57[a]
I think MTP is honest to me	4.93[a]	5.35[a]	3.74[b]	4.86[a]
MTP always keep his promises	5.52[a]	2.71[b]	2.06[c]	2.00[c]
MTP gives me the best offer	5.37[a]	5.00[a]	4.87[a]	4.71[b]
Satisfaction	**4.49[a]**	**3.73[b]**	**3.45[b]**	**3.64[b]**
MTP often meets my requirement	5.56[a]	5.57[a]	5.32[a]	5.57[a]
Dealing with MTP is less risky	1.81[a]	1.51[a]	1.65[a]	2.00[a]
I think MTP treats me fairly	5.48[a]	2.22[b]	1.35[c]	1.43[c]
I have good cooperation with MTP	5.13[a]	5.63[a]	5.52[a]	5.57[a]
Communication	**3.73[a]**	**3.47[a]**	**3.40[a]**	**3.35[a]**
MTP usually informs me of price changes	5.11[a]	2.43[b]	2.06[c]	1.86[c]
MTP often asks about his way of rewarding me	2.57[a]	2.45[a]	2.52[a]	2.29[a]
MTP often suggests trading method	5.06[a]	2.73[b]	2.74[b]	2.43[b]
It easy to find MTP	5.48[a]	4.43[b]	4.48[b]	4.71[b]
Power Dependence	**2.89[a]**	**2.57[b]**	**2.51[b]**	**2.53[b]**
I am free to chose MTP	4.48[a]	2.71[b]	2.45[b]	2.71[b]
MTP has full authority in decision making	2.58[a]	2.29[a]	2.52[a]	2.71[b]
I have to agree with MTP's decisions	2.51[ab]	2.76[b]	2.61[ab]	2.29[a]
I depend more on MTP than him on me	2.01[a]	2.53[b]	2.48[b]	2.43[b]
Commitment	**5.05[a]**	**2.04[b]**	**2.21[b]**	**2.36[bc]**
Long term relationship with MTP guaranteed my product	5.37[a]	1.88[b]	1.74[b]	1.71[ab]
I plan to continue my business with MTP in future	4.73[a]	2.22[b]	2.68[c]	3.00[c]
Relationship Specific Investment				
MTP usually offers financial assistance to me	2.55[a]	2.24[a]	2.16[a]	2.29[a]
Customer Friendship				
I have a close friendship with MTP	4.55[a]	5.45[b]	2.00[c]	1.57[d]

Note: where MTP stands for My preferred trading partner

Where 1 is "I disagree a lot" and 6 is "I agree a lot"
F > S demonstrates the farmers' relationship with farm input suppliers
CA > F demonstrates the collector agents' relationship with their farmers
W > CA demonstrates the wholesalers' relationship with their collector agents
II > W demonstrates the inter island traders' relationship with their wholesalers
Those items with the same superscript are not significantly different at $p = 0.05$

There was no evidence of any social relationship at these levels in the supply chain. This might in part explain the significantly lower levels of trust observed in relationships at both the wholesale and inter-island trader level.

Despite the significant variation in the quality of the product offered to downstream customers, there was no evidence of any upstream suppliers being able to exert any coercive power on downstream customers. With the exception of the farmers who indicated that they were less free to choose between alternative farm-input suppliers, all other actors indicated that they could choose from a number of alternative suppliers. However, this did not make the farmers any more dependent on their upstream suppliers.

Nevertheless, farmers indicated a much greater desire to continue their relationship with upstream suppliers. For the traders, wholesalers and inter-island traders, it was apparent that they were constantly looking for suppliers who could deliver a superior quality product at a more competitive price.

7.5 Chapter Summary

There are four kinds of marketing system for dryland farm products on Lombok Island. The marketing chain for maize and peanut involved collector agents (CA), wholesalers (W) and inter-island traders (IIT), whereas the cassava marketing chain only involved collector agents and inter-island traders. The marketing system for paddy was different again because its distribution from the farm gate to the retail market is strictly regulated by government. Moreover, market intermediaries for this commodity need to be licensed.

The three different measures used to analyse supply chain performance were 1) the marketing margin; 2) the gap between what buyers want and what buyers received; and 3) relationship marketing. The main advantage of using these three methodologies simultaneously is that it provides a more complete description about the performance of the supply chain.

While it is often suggested that those actors who obtain the greatest margin are able to do so because they possess and wield the greatest power (Anindita, 2003), there is little empirical evidence to support this proposition. The analysis of marketing relationships revealed that there was no evidence of any coercive exploitation of any one group by another.

As the prices for agricultural outputs are determined primarily by supply and demand and producers are paid the residual amount after all market intermediaries have deducted their margins, there was no evidence of any market intermediary using their power to deduct a disproportionate margin. For both maize and rice, the returns to the farmer were equivalent to 40 percent of the wholesale price. For peanut, the farmers' share of the wholesale price reached almost 60 percent but for cassava, the farmers' return of the wholesale price was just 28 percent. The poor return for cassava no doubt reflects the significant costs of downstream processing that are necessary to produce a product suitable for the consumer market.

From the marketing margin analysis, it was apparent that market intermediaries had adopted a cost-plus marketing approach. The market intermediaries added the various costs of drying, grading, storage and transportation, plus their desired profit margin. It was only for cassava that the market intermediaries did not perform drying or grading.

The price margin increased as the product moved further downstream. This implies that an increased margin was necessary to cover the greater risks associated with a highly volatile market and the greater costs associated with sorting, grading, packaging, transport and product loss (wastage). For the wholesalers and inter-island traders, there were often additional overhead costs associated with the need to lease and maintain warehouses, and the costs of complying with local taxes and government administration.

At the collector agent level, some of the grading and repacking may not have been adequately costed as there are few other employment opportunities in rural areas. As a result, there is very low inferred opportunity cost for labour.

Another advantage of the plural methodology is that it reveals which parts of the supply chain are operating more or less efficiently than others. By understanding this, it becomes possible to identify where interventions will be the most effective and have the greatest impact.

Every supply chain participant along the chain beyond the farm gate conducted some level of processing to increase the extent to which the quality of the product offered would better satisfy the next buyers' need. Despite the many problems associated with the lack of market infrastructure, poor transport and logistics and the lack of appropriate storage, the root problem can be traced back to the farm and the manner in which the product has been cultivated and harvested.

Whenever product quality is compromised during production because of the lack of inputs or where the product is subsequently damaged during harvesting and transport, the grading and removal of inferior quality product will represent a significant and increasing cost for each of the downstream market intermediaries. Product quality cannot be improved along the chain: rather, it can only be maintained by removing that product which is substandard. Thus, to improve the efficiency and the performance of the supply chain, the on-farm constraints that impede the farmers' ability to deliver superior quality product must be addressed. These constraints included the inability of most farmers to self purchase the required inputs, the lack of inputs, the poor quality of the inputs, inappropriate technology and lack of knowledge and a weak farmer association.

Nevertheless, while significant gains in productivity and economic efficiency can be achieved by addressing production constraints at the farm level, without addressing the failure of the marketing system to adequately reward the farmers for producing superior quality product, little improvement will be forthcoming. Farmers supply low quality product to the buyers because most of them preferred to transact under the *tebasan* system. Farmers preferred this system because they did not have to pay for the costs of transportation, grading or packing; farmers might avoid the chance of being cheated by unknown or unfamiliar buyers since payments are made directly in cash; and farmers could obtain cash in advance.

Under the *tebasan* system, there is little financial incentive for farmers to improve product quality because of their poor financial situation, even although their financial position might be better in the short term, and the difficulty they will face in disposing of reject produce. Batt and Parining (2000) reported that in Bali, under the same system of marketing, farmers were encouraged to sell their produce (vegetables) ungraded to local collector agents and wholesalers.

Furthermore, although actors may seek to pursue economically rational goals, their ability to do so will be constrained by the embedded nature of the long-term marketing relationships that exist. In the absence of definitive quality standards for most farm products (except rice), and in order to secure a reliable supply of farm inputs, market intermediaries preferred to transact with known and reputable trading partners. Long-term relationships were established to reduce much of uncertainty associated with both the quality and the quantity of farm products. However, in a highly volatile and dynamic market, relationships cannot provide any price certainty. Therefore, every supply chain participant may from time-to-time abandon their relationship to secure a better price.

Within the downstream relationships, with the exception of the farm input suppliers, it was apparent that most actors in the supply chain do not believe that their downstream customers had been honest. However, there was little evidence of any coercion in the relationship. Furthermore, while most actors can readily identify an alternative trading partner, as many of these relationships have yet to be tested, actors prefer to transact with those exchange partners who have proven themselves.

Exploring the levels of communication within the relationship revealed that most traders were willing to provide farmers with market information and information that might help them to improve the quality of their product offer. Farmers were the only supply chain participant who needed financial assistance.

While personal relationships were considered very important at the village level, the personal friendships among supply chain actors became less important the further down the supply chain the product moved. In part, this was because the geographic distance between supply chain participants increased as the product moved further downstream. Farmers and collector agents mostly lived in the same village, but this was not the case for farmers and wholesalers or inter-island traders. The relationship between farmers and collector agents was built on the traditional values recognised in the village. The farmers mostly communicated with the collector agents and visited each others business. Moreover, for the farmers, their relationship with the market intermediaries with whom they transacted was very important because very few farmers have the capability to market their own product beyond the farm gate. For the wholesalers and inter-island traders who were located in a subdistrict town or a city, they had a much greater business orientation. Wholesalers would meet the inter-island traders only when they had product to sell, to take payments or to handle complaints. Often, the inter-island traders would not meet the wholesalers, but rather they would delegate their people to handle the business. The inter-island traders would transact with the wholesalers only when the issue was considered to be very important. This meant that the relationship between the wholesalers and inter-island traders was very formal.

Although the research has found that most supply chain participants generally trusted their upstream partners, few participants believed that their exchange partner would keep their promise. For six quality variables: maturity, dryness, packaging, freedom from injury, grading, and freedom from pest and disease, suppliers could not meet the buyers' demands at any level of the supply chain. Furthermore, most suppliers were unable to meet the buyers' needs in terms of the amount of product required, the delivery time and the transport distance. Increasing the quality at the farm level will be difficult because most farmers sell their farm products under the *tebasan* system. This will make it difficult not only to improve the product quality but also to improve the functional quality through the formation of collaborative farmer group who might otherwise seek to aggregate their product and indeed, to undertake some preliminary grading or processing of the product. Furthermore, agricultural extension workers are only assigned to assist farmers in terms of cultivating crops and to improve the post-harvest handling of their products. No personnel are formally assigned to assist or to educate farmers in the downstream marketing of their products.

In the overall supply chain, despite the impediments at the farm level, the gap did not increase when the commodity moved further downstream. This indicated that each of the downstream market intermediaries was performing some value-adding activity. Furthermore, perhaps because of the durable nature of the products themselves (rice, cassava, maize and peanut), there was little evidence of any deterioration in the quality of the product itself as it moved down the supply chain.

In the absence of any suitable transport and post-harvest infrastructure, for perishable products such as fresh fruit and vegetables, a vastly different situation might be expected.

Although most supply chain participants were moderately satisfied with their upstream suppliers, they did not believe that dealing with their preferred trading partner would reduce risk. Probably this was because most supply chain actors did not believe that communication was good between them. Good upstream communication was only apparent between farmers and farm input suppliers. One reason was the short-term orientation of most supply chain participants: very few were committed to their relationship.

The farmers' relationship with upstream suppliers was very different to their downstream relationship with customers. In part, this reflects the difference between the procurement function and the selling function.

In sum, relationships between the actors in the supply chain were very important, even although most of the actors were opportunists. Not unexpectedly, they want to sell to whoever offers the best price.

While it is necessary at each stage of the supply chain to ask how much the market intermediaries paid for the produce they purchased, what value-adding activities they undertook, how much it cost to perform those activities and for how much they subsequently sold the produce, such a means of data collection is fraught with error. This error occurred because no farmers and very few market intermediaries have any written records of their business activities including the prices at which they buy and sell their farm products. The respondents providing the data were relying entirely on their memory. Even although there were probably records at the inter-island trader level, there is a degree of confidentiality associated with the reporting of some items of business including market prices. Respondents might deliberately choose to over value the prices at which they have purchased farm products and under value the prices at which they have been sold to reduce their perceived profit margin. This error could be tested by looking at the difference between what the respondents said the respondents buy or sold and what their respective upstream and downstream trading partners said.

The result of the analysis of the marketing system provides useful support to the earlier soft system methodology component of the research in the following ways:

1. The need to develop a model that reflects every activity undertaken by every actor to calculate the marketing margin and thus evaluate the performance of the supply chain. For example, a detailed base line study of the costs of processing, grading and transporting that can used to monitor or describe change associated with suggested or implemented interventions.

2. There is a need to research the marketing chain system as a whole to capture not only the relationship based results generated here but also to bring in the other relevant downstream problems such as poor logistics, transport, the lack of post-harvest storage, product packaging, road taxes and risk mitigation.

3. This study did not seek to explore the relationship between the constructs like satisfaction and trust, communication and trust, power dependence and trust. This would be a valid and productive area of future research as there may be areas that will facilitate an overall improvement in the performance of the supply chain.

Chapter Eight

SYNTHESIS AND CONCLUSIONS

8.1 Introduction

This chapter synthesises the research results from this thesis. This thesis has sought to develop and assess a pluralistic approach towards analysing agribusiness supply chains in Lombok, Indonesia. The term ‘pluralistic approach’ is taken in this thesis to mean the combination of two or more analytical approaches to solve or analyse a problem or specific issue. The word ‘approach’ was deliberately used to capture the flexibility in implementing the method, tools or analysis.

This chapter is divided into six sections: the first summarises the outputs of the three analytical approaches used to analyse supply chain for dryland farm products on Lombok (Section 8.2). Section 8.3 discusses the most suitable model for analysing issues affecting the supply chain and in particular, outlines how a combination of Soft Systems Methodology (SSM) and hard system approaches such as relationship, and technical efficiency, analysis can help resolve problems being experienced in the supply chains. The next section discusses the appropriateness of the pluralistic model compared to other theoretical frameworks. Areas for further research are discussed in Section 8.5 and Section 8.6 discusses a possible model for analysing agribusiness supply chains in general, based on the experience gained from the Lombok study.

8.2 Summary of the Results

This section summarises the results that were discussed in the three previous chapters. While a number of research approaches have been found to be acceptable both ontologically and epistemologically, most agribusiness supply chain research has been developed using reductionist approaches around structured positivist methods. However, in many developing countries, like Indonesia, such approaches have often been found to be ineffective in practice. In these situations, the supply chain is made up of unstructured problem situations with complex interactions between social, political and cultural factors which suggests that the alternative interpretivist approaches, such as the soft systems methodology (SSM) developed by Checkland (1981) are more appropriate. This study adopts an interpretivist stance as the base analytical approach, but then develops a pluralistic approach by investigating the value of using two positivist methods to provide complementary support elements to the basic interpretivist framework. It is worth noting that the literature on the use of pluralistic approaches to analyse agribusiness supply chains in the developing countries is growing through the work of Batt (2003, 2004); Herlambang *et al.*, (2006) and Setyadjit *et al.* (2004). Many researchers realise that there is a need to understand the complex and unstructured social components of supply chains alongside the traditional economic approaches.

The positivist approaches adopted in this study were farm production analysis which focused on farm specific technical efficiency, and a marketing system analysis which consisted of an analysis of marketing margins, gap analysis and an analysis of buyer-seller relationships.

8.2.1 Soft Systems Methodology (SSM)

The soft systems analysis identified that the main problem associated with the supply chains connected to the dryland farming systems in Lombok was the lack of any coordination. The farmer associations which had been established to support farmers did not work and there was no appropriate financial institution for village industry. The village unit cooperative or KUD that formally belonged to the villagers (including farmers) was also ineffective in both marketing inputs and farm products. In addition, the villages had very poor infrastructure with very limited access to transport and no communication facilities. While each of these problems could be identified as unique problems, the key to a solution was recognising the inter-linkages between each of the individual problems.

The application of SSM in the agribusiness supply chain in Lombok was undertaken using a conventional approach and well understood stages. The first stage was to understand the problem situation which included a cultural stream analysis. This provided a clear understanding of the political, social and cultural influences along the supply chain. The analyses also identified parts of the problem situation that were considered unsolvable and endemic in nature such as the lack of formal records (no contracts and paperwork) surrounding financial and marketing transactions.

The logic-based stream of analysis utilised by the SSM was used to blend together the information that was obtained from the cultural stream analysis through developing root definitions and relevant systems, establishing conceptual models, and making feasible and desirable changes to the models after comparing them to the real world situation. Finally, the model was employed to make some recommendations for improvement.

The SSM approach produced realistic and feasible solutions in a culturally acceptable way. This would not have occurred had a reductionist approach been used. The key difference between the approaches is that a reductionist approach would have been reduced to being a provider rather than providing a solution to the problem. The nature of the SSM approach unconsciously helped the supply chain members to understand, to look at, think, analyse and propose solutions to their problems through collaborative action. The involvement of agri-food supply chain members in the research should help them in the future as they seek to apply the same broad holistic principles to other problems facing their supply chain.

The major conclusion from this component of the research is that soft systems methodology was successful in identifying a feasible pathway for change in agri-food supply chains in Lombok. A key factor was that the SSM provided a unique opportunity for people who were involved in the agri-food supply chain to come together for the first time and collectively participate in finding a solution(s) for their supply chain problems. This increased each individual's commitment to implementing the proposed changes. However, the process does not stop at this point and reiterations will be needed to ensure that stable and effective outcomes occur.

The SSM approach, as it is currently structured, is too complex for use in developing countries. There is a need to develop a simplified SSM which significantly reduces the sophisticated systems' jargon and technical terms that have been developed by the SSM research community. The approach is broadly applicable in developing countries and would have significant utility in resolving complex problem situations that involve interactions between social, economic, environmental and cultural systems.

While the SSM approach was successful in helping to resolve problems in the agri-food supply chain, a key finding was that there were gaps in the SSM which could logically be resolved by simultaneously using quantitative approaches such as statistical and mathematical programming. The key areas identified in this study were the assessment of the production efficiency of the farm production systems and looking more closely at the relationships between supply chain participants. These two areas are developed further in the next two sections.

8.2.2 Farm Technical Efficiency

While the SSM was able to identify problems in the human systems components of the supply chain, it gave no indication of the technical efficiency at the farm level. The second part of this research focused on developing an understanding of the technical efficiency of farm production in the study area. The analysis was undertaken using a stochastic model based on a Cobb-Douglas production function. The most difficult step in this part of the research was to find the most suitable model based on the available data. The 'best' model was found after a large number of iterations in which variables were added or removed from the model.

The research found that the technical efficiency varied widely from 47.6 to 94.5 per cent which indicates that there is still significant opportunity for improvements in production practices. The policy implication of this finding is that there is a need to enhance the efforts of agricultural extension workers in facilitating the adoption of more up-to-date technology that is suitable for dryland farming in Lombok, particularly for the cultivation of peanuts and cassava. Furthermore, agricultural extension workers should focus more on introducing innovation to younger farmers through *Karang Taruna* and *Remaja Mesjid*[1]. However, these efforts will need to be linked to the provision of credit that is simple and affordable (identified in the SSM component) if maximum benefits are to be achieved.

The research found that land was the most important factor of production. This suggests that current farming methods are still largely extensive and that farmers increase their production primarily through increasing their land area. This raises two opportunities for improvement. The first is that there is an important role for the Government to actively support land consolidation to minimise unused inputs and maximise production. From a conceptual viewpoint, while this may be a way of encouraging the more efficient use of resources, it was recognised from the SSM component of the research that such change must be implemented very carefully to reduce, or eliminate, personal conflict among the farmers whose lands are being consolidated.

As age and education were also found to be significant factors impacting on efficiency, there is a clear need to implement a program of nine years of basic education for rural people, and to improve farmers' understanding about the importance of their children's education as well as their own education.

A drawback of the research was that it concentrated on the technical efficiency of crop production, yet technical efficiency is only one part of the whole production efficiency picture. Allocative and economic efficiency were not analysed here as it was beyond the scope of the study. Future studies will be enhanced if these two areas of efficiency are examined along with the determination of total productivity.

8.2.3 Market System Analysis

The third part of this empirical work was a marketing system analysis which used three different measures to analyse supply chain performance: 1) the marketing margin; 2) the gap between what buyers want and what buyers received; and 3) relationship marketing. The main advantage of using these three methodologies

[1] *Karang Taruna* is youth organisation for the lowest administration level of Indonesia called Desa. *Remaja Mesjid* is young devotee of a certain mosque so only for Moslem people.

simultaneously is that it provides a more complete description about the performance of the supply chain.

The marketing margin analysis revealed that market intermediaries had adopted a cost-plus marketing approach. The market intermediaries added the various costs of drying, grading, storage and transportation, plus their desired profit margin. It was only for cassava that the market intermediaries did not perform drying or grading.

The price margin increased as the product moved further downstream. This implies that an increased margin was necessary to cover the greater risks in a highly volatile market and the greater costs associated with sorting, grading, packaging, transport and product loss (wastage). For the wholesalers and inter-island traders, there were additional overhead costs associated with the need to lease and maintain warehouses, and the costs of complying with local taxes and government administration.

Similarly, at the collector agent level, some of the grading and repacking may not have been adequately costed as there are few other employment opportunities in rural areas. As a result, there was a very low inferred opportunity cost for labour.

An advantage of the plural methodology was that it was able to reveal which parts of the supply chain were operating more or less efficiently than others. By understanding this, it becomes possible to identify where interventions will be the most effective and have the greatest impact. In particular, the application of price margin analysis in parallel with an analysis of the marketing relationships between supply chain actors (trust and power) revealed the extent to which one party in the exchange may be forced or coerced to trade in a particular manner. Previous studies by Dwiastuti (1997), Efendy *et al.* (2000) and Anindita (2003) suggest that downstream market intermediaries often use their position or power to extract a higher margin. If smallholder farmers are being taken advantage of by opportunistic traders, and they know it, trust will be very low.

The seasonality of production may strongly affect the supply and price of farm products in the market. This situation normally occurs for perishable farm products like fruit and vegetables. However, seasonality of supply has little influence on durable products like paddy, corn, peanut and cassava. Although the planting and harvesting of rice in Indonesia is largely determined by the monsoons, theoretically, the price of rice during the harvesting season will be low because the supply is very large. However, the marketing of rice in Indonesia is governed by government policy. In the case of corn and peanuts, the price system is not influenced by the government. However, these commodities can be stored after harvesting. Farmers will sell their farm products immediately after harvest if they need money urgently to meet expected or unforeseen family expenses. Cassava farmers are even more flexible, because this product is not harvested at any particular time. Most farmers harvested their cassava 8 to 10 months after planting. Similar to corn and peanut farmers, cassava farmers can wait until there is good price for their products or until they need cash. Farmers do not need to store harvested cassava. Therefore, seasonality of supply had little effect on the commodity price because the products are durable and especially for rice, the price is determined by government. Nevertheless, significant differences in the price both between and within seasons may arise from chance events associated with adverse climatic events which can have a significant impact on the quantity of product ultimately available for sale.

The inclusion of gap analysis further strengthens the capacity of the model to propose meaningful solutions. While the technical efficiency study showed that significant gains in productivity and economic efficiency could be achieved by addressing production constraints at the farm level, there will be little improvement if the marketing system is unable to deliver superior quality products to customers. Currently, farmers supply low quality product to the buyers because most of them prefer to transact under the *tebasan* system. Farmers preferred this system because 1) they did not have to pay for the costs of transport, grading or packing, 2) farmers might avoid the chance of being cheated by unknown or unfamiliar buyers, since payments are made directly in cash and 3) farmers could obtain cash in advance.

While the research found that trust between the actors in the supply chain was very important, most of the supply chain actors behaved opportunistically. Not unexpectedly, they sold to whichever buyer offered the highest price.

Over all, the analysis of the marketing system provided useful support to the SSM component of the research in the following ways:

1. The need to develop a model that reflects every activity undertaken by every actor to calculate the marketing margin and thus evaluate the performance of the supply chain. For example, a detailed base line study of the costs of processing, grading and transporting that can be used to monitor or describe change associated with suggested interventions.
2. There is a need to research the marketing system as a whole to capture not only the relationship-based results generated here, but also to bring in the other relevant downstream problems such as poor logistics, transport, the lack of post-harvest storage, poor product packaging, road taxes and risk mitigation.
3. This study did not seek to explore the relationship between the constructs like satisfaction and trust, communication and trust, power dependence and trust. This would be a highly productive area for future research as there may be areas that will facilitate an overall improvement in the performance of the supply chain.

8.3 Model for Lombok Agribusiness Analysis

While agribusiness is different from other businesses (Said and Intan, 2001; Soekartawi, 2002; Saragih, 2002), the one thing that most writers agree on is the need to analyse agribusiness in a systemic way, which implies the need for a multi- rather than a single-disciplinary approach (Murray-Prior *et al.*, 2004). This research has explored this space and has concentrated on three different analysis methods to develop a pluralistic approach to resolve agribusiness supply chain issues in Lombok.

Bennet (1985) noted that pluralistic approaches can be developed in three ways - comparison, enrichment and integration - based on the nature of the linkages between the approaches used. Comparative approaches were developed to compare the similarities and differences between analysis methods and to determine if the combination of methods led to an improved problem resolution.

Enrichment refers to the improvement of one method by encompassing elements of another without producing any new overall content. Integration involves fusing elements of existing approaches to develop something new.

In practice, this means that comparative approaches are commonly used for issues that have more than one component problem and where each of the problems requires the use of one specific analysis method. Enrichment approaches are built around a single foundation to which complementary or supplementary approaches are linked. The original nature of each methodology used may still be identified which contrasts with integrated approaches where the nature of each original methodology is difficult to identify.

Mingers (1997) stated that five dimensions should be considered when combining methodologies. The first is whether more than one methodology is used or not. The second and the third emphasised whether the methodologies used come from the same or from different paradigms, and whether they are used or not within the same intervention. The last two dimensions specify whether whole methodologies are used or parts are taken out and combined as methodological partitioning, and whether a single methodology dominates, or whether the parts are linked to form a particular approach to a specific situation.

This research adopted SSM as the core methodology and used two hard systems approaches: relationship analysis and technical efficiency analysis, to enhance the soft systems methodology. SSM was chosen as the core methodology because the agribusiness supply chain is reliant not only on physical linkages, but also strong human interactions if it is to work efficiently.

The choice of SSM as the base methodology has been supported by Petkov *et al.* (2004) and Mingers (2000:686) who argued that *"SSM is very flexible and can be used to structure the whole intervention. It is often used as the dominant method augmented by other techniques".* Mingers (2000) described several studies that used SSM as the base and used other methodologies such as Multi-criteria Decision Analysis (MCDA) and Analysis Hierarchy Process (AHP), but none of these studies focused on agribusiness supply chains.

The enrichment approach used in this research (referred to as the Lombok Method) has been summarised in Figure 8.1 below.

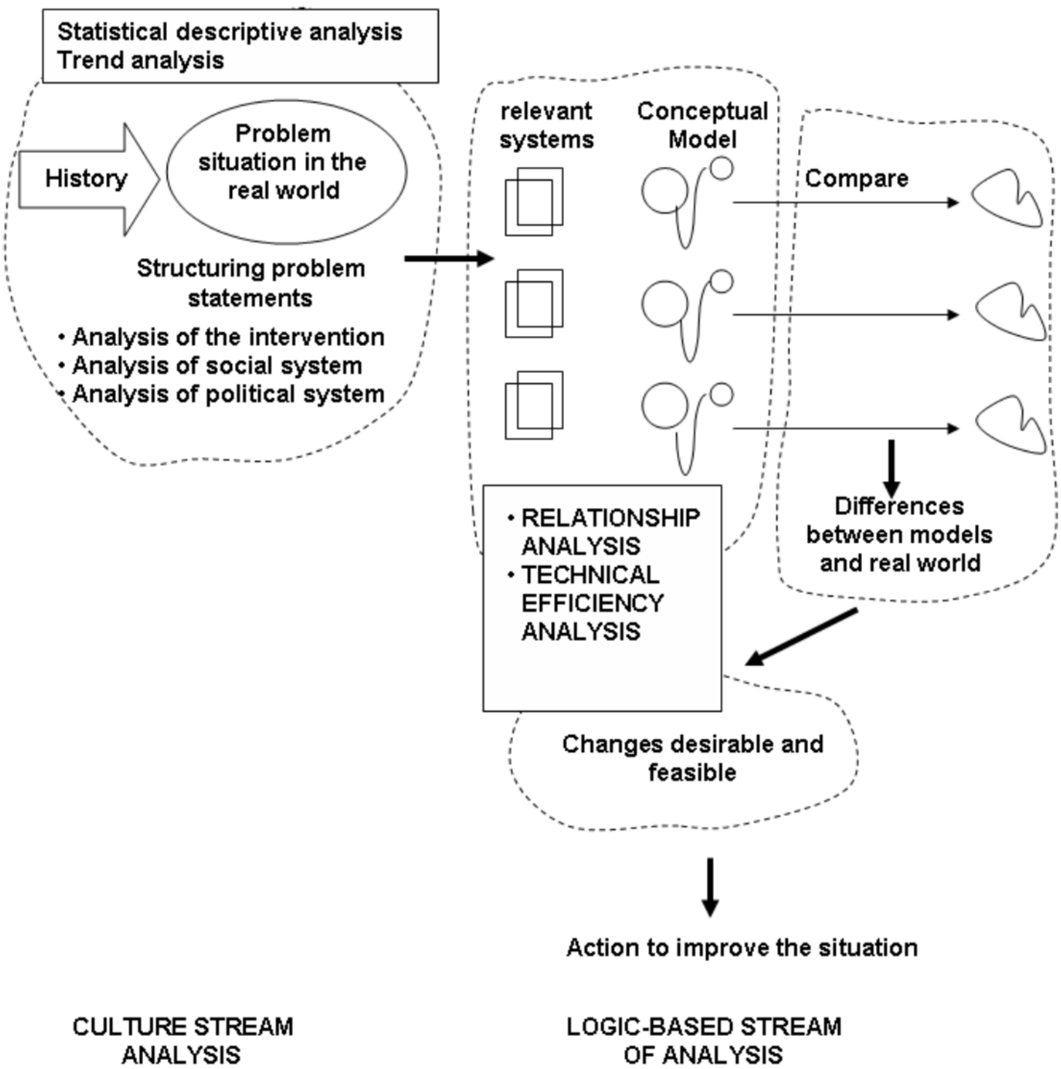

Figure 8.1: The Lombok Method

The Lombok Method (LM) was based on the SSM mode 2 described by Checkland (1988). A number of methodologies such as descriptive statistical analysis, marketing system analysis and farm production analysis (focused on the individual farm technical efficiency) have been added to provide a more rigorous base for resolving the problems found in agribusiness supply chains for dryland farm products in Lombok. In particular, these techniques enhanced the SSM steps involved in creating the relevant systems, establishing conceptual models and debating the differences between the conceptual models and the real world. The approach adopted in this study has grouped some of the activities traditionally seen as discrete elements in SSM to make it easier to show how the enrichment process takes place. This is shown in Figure 8.1 where the first two steps of a traditional SSM approach have been combined and supported by introducing a significant component of descriptive statistical analyses. For example: instead of recording that 'most farmers in the research site were young' in Step One, it is more rigorous when the data is supported with the mean or mode of the age of farmer respondents and then included in the rich picture (Step 2). Similarly, Step 3 (developing root definition and relevant systems) and Step 4 (establishing and developing conceptual models) were backed up with the results and further in-depth analysis of the technical efficiency of the farm production system and statistical relationship analysis from the marketing system.

As the focus of this research was to enrich the SSM, the following discussion describes how this occurred in the proposed LM.

The starting point is to understand the problem situation, which uses historical information and data supplemented with analyses of the intervention as well as the social and political systems. Descriptive statistical analyses like mean, median, mode, standard deviation and chi-square can enhance the analysis at this point. The SSM proposes that the initial step in the process was to capture or record the history of the problem situation through discussions with the participants. The LM enriches this step by collecting quantitative data such as annual statistical data from appropriate institutions, plotting trends and linking this with the qualitative information provided by respondents. By combining the SSM and simple statistical analyses, the LM provides a much more robust information base from which to develop the problem root definitions.

The next step in the SSM process was to develop purposeful activity models that depicted the complexity of the expected participants' day-to-day life. These models were purely purposeful activity concepts that were developed based on the *weltanschauungen* (world view) of the analyst or others involved in developing the models. This means that there could be different models for the same problem based on the different *weltanschauungen* of the analyst(s). For example, a researcher could develop different purposeful activity models for trading and marketing systems than a government official. However, all the conceptual models in this study were established and developed by the researcher after considering the *weltanschauungen* of all supply chain participants. This is logical because the development of conceptual models is within the 'systems thinking' world (see SSM mode 1) and conducted by the researcher or analyst.

Each model was correct from the viewpoint of an individual and as Checkland (1985) asserts, it is not a matter of determining which models are correct, because all are correct for each individual. The models were only tools to stimulate, encourage and structure debate in subsequent discussions.

System theory states that one activity in a model can be used as an input or output for another. Therefore, these models are concerned with relationships among activities within the system. In the process of developing these conceptual models, the analyst must consider two things: 1) the kind of activity described by the models and 2) the relationship patterns between or among activities within the models. As each activity is conducted by its actors, understanding the relationships among these actors is also an important consideration when developing the models. In the LM model, these relationships were deemed important enough to warrant a separate research activity that complemented the SSM, the market relationship analysis.

The relationships considered important were those that related to the sequential relationships between participants along the agribusiness supply chains under investigation. This analysis was also complemented with a transaction cost and marketing margin analysis. Intervention at this stage in the SSM was intended to enhance the robustness of the conceptual models that were developed.

The next stage in the SSM involved comparing the conceptual models with the real situation. The objective of this process was to develop a well-structured and logical discussion regarding the various ways to improve the perceived problem situation. This stage provides a description of the discrepancies between what is supposed to happen to achieve the objectives specified in the root definition and what is actually happening in the real situation.

Checkland and Scholes (1990) and Naughton (1985) proposed a method of comparison called formal questioning. The discussion about the differences can be performed by questioning an individual or a group of people. In this activity, the designed conceptual models were used as a foundation for the questions asked of the participants. The result was recorded in a tabular matrix (see Section 5.2.3).

There was no place for including an external analysis tool (to SSM) in this stage of the analysis because the focus at this stage was to initiate a debate about desirable and feasible changes. It was considered more significant if other analyses are included in the next step which was to facilitate discussion to formulate, evaluate and implement desirable and feasible changes.

The last step of the SSM methodology requires the analyst to determine the desirable and feasible changes that will improve the perceived problem. This step, like the previous one, is best achieved using tabular matrices. However, there is scope to use the rich picture, root definition with its CATWOE and the conceptual models together with the matrices in the discussions as required. Two main criteria for successful outcomes are that the changes are both desirable and feasible. This means that they must be meaningful as a result of the knowledge-based activities and acceptable within the cultural parameters of participants, especially for the actors within the systems.

In this stage, the LM approach introduced the results from the relationship and technical efficiency analysis together with the tabular matrices that were produced in the previous step as foundations for the debate/discussion. The results of the relationship analyses were introduced into this step because if the proposed changes were to be meaningful and culturally acceptable, they needed to consider the structure of the existing relationships among the actors and owners as well as between the actors and owners.

The discussion around the desirability of change was enhanced by the introduction of the results of the technical efficiency analysis jointly with the relationship analysis and some simple statistical analysis. The main reason for introducing the results of the technical efficiency analysis at this point was that it is at the farm production level that many of the subsequent improvements in supply chain efficiency were based. If improvements were not made to improve the efficiency of input use then the chain as a whole would be limited in the level of improvement that could be made. In many cases the analyst would use optimisation methods such as linear programming to determine the best mix of land use and inputs. In this case the farming activities operating in the research site did not have a wide range of options therefore limiting the effectiveness of a linear programming study. In other situations where a wider range of options were available this could be a logical extension of the approach.

A key outcome from the debate of feasible and desirable change is that the changes recommended must benefit all participants along the agribusiness supply chain. Therefore, this debate must include both the primary supply chain participants and secondary actors like government agencies, banks, input suppliers and transporters. The changes resulting from such a debate can be changes in the structure of the problem situation such as 1) changes in organisational structure, 2) in procedure-like changes in the way commodities are transacted i.e. from a basis of trust to one involving contracts and 3) in attitudes like the changes to learning styles or individual or group motivations.

The last step of the SSM is to take action to improve the perceived problem situation. This step is beyond the scope of this study. However, the outputs of this study will be reported to the Regional Planning Board of Lombok, which was a condition of their supplying an official permit letter to conduct this study.

8.4 Appropriateness of the Lombok Method

The success of the approach adopted here can only be judged on the basis of whether the participants involved in the study, the problem owners, adopt the suggested changes. However, it is possible to make some general comments about the success or otherwise of the approach. The following observations result from a process of reflection.

Developing an understanding of the agribusiness systems operating in the study region (Chapter 3) was very complex and involved many participants. The pluralistic approach adopted in this study was more appropriate than the adoption of any one of the individual approaches on their own because the problem situation involved both human activity, as well as economic and biological systems. This meant that both qualitative and quantitative data needed to be blended to help improve the problem situation, suggesting that a single methodology would be unsuitable. As the supply chain relied heavily on human activity systems to operate, a soft systems methodology (SSM) approach was seen to be the most appropriate base methodology. The research process has validated this decision.

However, the adoption of the SSM on its own was deemed inadequate as SSM is repeatedly criticised for its relativistic stance (Staker, 2000; Flood and Jackson, 1991). The inclusion of positivist analyses or hard systems approaches was seen as a way of reducing this limitation, but it is worth noting that the decision on which hard analysis methods to adopt was done on the basis of the problem situation.

In Lombok, both local and federal governments have done a lot of research to increase the welfare of farmers, specifically dryland farmers. However, the economic condition of farmers remains unchanged and can be described as worse if the impacts of inflation are taken into account. The research carried out in this study was designed to identify the key issues that would lead to improvement in the supply chain and in turn, improve dryland farmers' welfare.

Agribusiness supply chains involve many primary participants from farm input suppliers, to farmers, to market intermediaries through to retailers and involve many secondary participants such as transport companies, agricultural extension workers and agricultural cooperatives which were theoretically established to provide rural finance. Farmers, as the focal point of the supply chain, are also rural residents who are further bounded by their rural culture that impacts on their farming operations and in turn, on their product supply chains. Besides these social and cultural factors, a range of biological and physical factors like climate and land topography need to be considered along with the timing and transaction methods that affect the farm product supply chain process. All these factors were interlinked to one another.

It was on this basis that SSM was adopted as the base analytical method. This was supplemented with farm production and marketing system analysis to account for the impacts of the physical drivers and markets. It was initially thought that mathematical programming could be used to improve farm-level efficiency however, the range of possible land-use and production systems were very limited. Instead, the farm production analysis focused specifically on technical efficiency as this was seen as a major driver of the whole agribusiness supply chain. An efficient farm production system will produce goods at a lower cost and higher quality means higher returns to the producer. Ideally this should result in the more equitable distribution of marketing margins. However, in reality, some supply chain actors may use their power or influence to extract a disproportionate share.

The market systems analysis was included in the LM because marketing is an integral part of the supply chain process. Basically, every transaction between buyer and seller along the supply chain impacts on the returns for all participants in the supply chain. The focus of the analysis was on marketing margins and gap analysis, plus the development of an understanding of the buyer-seller relationships along the chain. The results of these three analyses were important in backing up the development of the conceptual models and provided additional important information for the debate surrounding desirable and feasible changes. For example,

- By calculating the marketing margin for all participants along the supply chain it was possible to understand which actors were the most able to achieve their desired margins. As a result, it was possible to develop a conceptual model about the trading system which was focused on providing fair returns to all supply chain participants.

- The gap analysis revealed the difference between the customer's expectation and the supplier's capabilities to meet that expectation. This analysis used the quality of the products as its focus which supported the development of conceptual models for improving production on farm and more appropriate mechanisms for post harvest handling of the product.

- The analysis of buyer-seller relationships was used to back up the development of conceptual models as well as debate the social interactions between actors in the supply chain.

Overall, the marketing system analysis significantly enhanced the SSM process by injecting more important data and information which led to a more rigorous debate about the desirable and feasible change.

There were some clear benefits of inclusion for the hard systems analyses in the SSM. In terms of modelling capability, the SSM provided some guidance in creating a social model. However, the SSM is not built on a robust theoretical foundation because it has been designed to accommodate every participant's interpretation without judging how successful or detrimental it might be. The modelling process in SSM is dependent on the knowledge and experience of participants. As a result, the model developed in a SSM is not able to be tested or challenged by others. The inclusion of hard system analysis can enhance the robustness of the model produced which means it can be validated and challenged. Therefore, the pluralistic approach is more resilient than the SSM model alone.

Another benefit is related to the interpretivistic nature of SSM. In the development of SSM there were some critiques about the relativistic nature of this methodology. SSM allows a very wide range of interpretation from any party and each is judged as valid no matter how wide the difference between the two might be. This means that SSM is very loose in standardising any aspect of the analysis. For example, the word 'feasible and desirable' may have different outcomes depending on the individuals or groups involved in the discussion. There are no standards on how one can judge the condition of feasible versus unfeasible and desirable versus undesirable. The inclusion of hard systems analysis approaches helps to increase the verifiability of the results either in the form of models or recommendations. For example, a feasible supply chain process occurs when marketing margins are distributed evenly along the chain measured by the analysis of sales data (means and standard deviations) (Nitisemito, 1996;

Mubyarto, 2002; Winardi, 2001). A desirable supply chain can be evaluated by the proportion of the final selling price which is received by the producer (which should be more than 50%) (Swastha, 1998).

The last advantage of pluralistic approaches is that they enhance the learning that goes on around the analysis. SSM is structured around a learning process rather than problem solving. All participants using a SSM learn about their situation and identify their problem situation. They may even decide how to improve their situation through implementing a systematic SSM based on their knowledge and experience. This means that in the SSM, the source of learning is the knowledge and experience of the participants. A pluralistic approach like the LM enhances this by providing additional knowledge from external sources based on hard system analysis. For example, participants will learn about the efficiency of the farm production process from the result of the technical efficiency analysis, and an analysis of the buyer-seller relationships determines the levels of trust and dependency along the supply chain.

In summary, SSM is a powerful tool in modelling real world situations like agribusiness supply chains. This research has built on this strength by adopting SSM as the main framework and enhanced the total problem solving environment by enriching the SSM with the inclusion of hard systems analyses; in this case, farm technical efficiency and marketing system analysis. This pluralistic approach is called the Lombok Method.

8.5 Further Research Required for the Lombok Method

A number of areas of further research were identified during the process of this research. These are described below.

The LM was developed with the assumption that a perfectly competitive market existed where both parties (buyer and seller) were free to choose their trading partner. In fact the analysis found an oligopsony situation where farmers were price takers although both sellers and buyers still had the freedom to choose their business partner. Farmers were forced to accept a low market price, not because of the lack of buyers, but more because of the inability to access credit. There is therefore a need to undertake further empirical research to understand the nature and scale of this market failure.

Another assumption in this research was that farmers had few opportunities to change the crop that they grew. As a result, the optimisation analysis that was planned at the initiation of the research was discarded and replaced with the farm-level technical efficiency analysis. There is a considerable body of research developing on the application of optimisation techniques to supply chain systems and there is scope for such analyses in the Lombok agri-food supply chain. Such an analysis could be done at the individual supply chain participant level (farmers, buyers, wholesalers) or for the whole chain.

The LM approach has included a descriptive statistical analysis only at the initial stage of the analysis where the problem situation was defined. While some time series data were used in this process, mainly economic and demographic data, there is a clear need to expand this to include changes to natural resources and changes brought on by external variables such as climate.

The analysis of social interactions among supply chain actors in this study was based on the construction of buyer-seller relationship dimensions using factor analysis. Due to the limitation of time and resources, the research did not try to model the dynamic relationships of all dimensions which would be possible using structural equation modelling (SEM) or a causal loop diagram (CLD). Modelling the relationships between the relationship dimensions like trust, satisfaction, commitment, power dependence, communication and relationship specific investments would assist in the identification of which relationship dimensions are most significant in governing transactions in the supply chain. This understanding would allow the development of more refined conceptual models and produce a more desirable and feasible outcome.

SSM is powerful in modelling systems ideas, but there is very little theory supporting the process. For instance, the process of generating conceptual models was largely founded on the knowledge and experience of the researcher supported by other supply chain participants. Moreover, there has been no standard established for the conduct of human interaction in the SSM process and the methodology does not clarify the kind of real world that should be sought by the participants. These are important areas for further research.

8.6 Conclusion

This research has shown that Soft Systems Methodology (SSM) can be used effectively as a tool to analyse agribusiness supply chains in developing countries and more specifically, the supply chains associated with dryland farming in Lombok, Indonesia. Although applied successfully in this case, it was found to have some limitations, but these were not significant. A key feature of the SSM approach is that it has been developed to analyse complex human interaction systems such as those found in agri-food supply chains. The systematic approach embodied in SSM meant that it was possible to improve the identified problem holistically. A further important feature of adopting SSM was that the approach encouraged and facilitated a learning process between all participants in the supply chain which allowed them to understand their own problem situation and to seek to improve that situation.

A major drawback of the SSM was accessibility of the approach by lay people. The development of the approach over time has involved the excessive use of jargon or technical terms that can normally be understood only by highly educated people thus making it inaccessible to poorly educated people without significant interpretation. A further observation is that SSM is resource intensive requiring considerable resources in terms of both stakeholders and facilitators time. While this can be seen as a negative, it is positive in that it creates an effective learning environment and one that leads to significantly better outcomes than those that would have been obtained had a more conventional research approach been adopted.

The key conclusion that this research has demonstrated is that pluralistic approaches which combine the best components of SSM and enhance that analysis with quantitative approaches leads to significantly better solutions. The adoption of an enrichment approach which adopted SSM as the core methodology and used two hard systems approaches - relationship analysis and technical efficiency analysis - to enhance the SSM produced superior results and gave insights that any one of the methods alone would not have found. In fact, the pluralistic approach provided a more challenging way of thinking based on the exploration of the interrelationships between hard and soft systems analyses. The resulting model named here as the Lombok Method (LM) is considered more appropriate for analysing agribusiness supply chains in developing countries.

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Appendix 1. The seven stages of Soft Systems Methodology

Stage 1 – Problem Identification

The focus of stage 1 is to identify the problem situation as it is exists in the real world. The focus is using all available historical, quantitative and qualitative information for use as inputs for the next stage. An output from this stage is often a pictorial representation of the problem space; referred to as a 'rich picture'.

A major issue encountered in this stage is to ensure an unbiased assessment of the problem situation. This means that the researcher(s) must initially recognise that by undertaking the study they themselves become part of the problem situation. It is important therefore to ensure that the researcher(s) resist attempts to impose a particular structure on the situation; recognize their involvement in the situation; be clear about their objectives and reasons for becoming involved; and do some thinking about the roles of clients, problem solver and problem owner in the situation (Naughton, 1985).

Wilson and Morren (1990) described the tasks required for this stage as:

1. Capture the people's perspectives of a particular context and help them describe a complex situation.
2. Capture the way that people associate their activities with time, place, impact and outcome.
3. Grasp an understanding of a situation by engaging people and events.
4. Capture people's expressions of concern, opportunity, and hope and relate them to the structures and processes of the ongoing situation.
5. Help the all people involved in the situation to avoid the development of restricted viewpoint from which to look at the situation.

Stage 2 – Describing the Problem Situation

SSM is concerned with getting from finding out situation to taking action to improve problem situation. Therefore, the complexity of the situation as problematic should be summarising or expressing in the most efficient, economical and illuminating way (Naughton, 1985). The team also suggest expressing it by building a cartoon-jargon of the approach, called *rich picture*. The authors explain that this picture basically contains 'hard' information like factual data about demand changes, rainfall fluctuation, population issues, and ‘soft’ information regarding subjective perceptions about the situation.

The objectives of doing stage 2 are Wilson and Morren (1990):

1. Help participants display the situation so as to reveal a range of possible and relevant choices for improvement.
2. Fully describe the present and necessary structures and processes of a situation and the climate resulting from their interactions.
3. Fully describe the principal themes of concern or issues and the primary tasks associated with the current situation.
4. Prepare a synthesis report documenting the foregoing in written and graphical form.

Stage 3 – Naming Relevant Systems and Constructing ‘Root’ Definitions

Stage 3 is naming relevant systems and constructing root definition. Relevant system is a systemic formulation of viewing rich pictures. At this stage, researcher move from thinking of real world to start using systems thinking knowledge to build models of human activity systems (HAS). Relevant systems are still vague, general, and entirely abstract ideas. It needs to be refined, developed and sharpened up by describing it as precisely as possible in form of sentence. This formulation is called root definition. Wilson and Morren (1990) state four main activities of this stage.

1. Develop a transformation statement for each primary issue; primary task; and the structural, process related, and climatic concern identified in stage 2.
2. Further develop each transformation statement so that the minimum features of an improved state are described.
3. Conduct discussion with actors, owners, and clients involved in the current situation to determine which relevant system definitions will be further developed into models.
4. Formulate recommendations regarding the kinds of basic science, technology development, and hard systems research needed to work on parts of the improved state of affairs. Communicate these recommendations to the appropriate parties for action.

Well-formulated root definitions should be prepared by consciously considering the elements of the mnemonic CATWOE. The components of this mnemonic are explained below (Checkland and Scholes, 1990:p35):

C	Customer	: The victims or beneficiaries of transformation
A	Actors	: Those who would do transformation
T	Transformation process	: The conversion of input to output
W	Weltanschauung	: The worldview which makes this transformation meaningful in context
O	Owner(s)	: Those who could stop transformation
E	Environmental constraints	: Elements outside the system which it takes as given

The CATWOE emphasizes that each transformation need people to carry it out (actors), has impacts on people (customers), will be influence by powerful interests and decision makers (owners), will operate with various resources and constraints (environment), and will be subject to owners' and other actors' views of the world (*Weltanschauungen*), which is implied in the group's sense of the transformation.

Stage 4. - Building Conceptual Models

Soon after relevant systems have been composed in a good verbal terms, researcher have found what the system is. This is not enough to compare with the components exist in problem situation. Researcher needs to elaborate what the system does or must do. This is conducted by conceptualising a model of the relevant systems uses systems thinking framework. The models formed are called conceptual models in terminology of SSM. Conceptual models are not as ideal system models of real situation, the nature is not descriptive of actual real world manifestation of human activity systems, still less prescriptive (Checkland and Scholes, 1990:p173). Wilson and Morren (1990) summarise the most productive order to construct a human activity system model as follows: 1) clarify the transformation statement, 2) develop the subsystems, 3) identify inputs, 4) identify outputs, 5) locate boundaries, 6) establish measures of performance, 7) agree on decision process, 8) clarify environmental effects, 9) use checklists, and 10) communicate the model.

Validation of the conceptual models can be conducted by comparing the relevant human activity systems with the constructed conceptual models. The measurements are not such thing like ‘valid’ or ‘not valid’ but rather than ‘defensible’ or ‘ indefensible’. Checkland (1993) clearly states that if the conceptual models are not valid, at least defensible.

Stage 5. - Comparing Conceptual Model to Real World

This stage makes the researcher leave abstract world of systems thinking back to real world. Wilson and Morren (1990) state two main goals of carrying out this stage. First, to come down from the highly abstract model-building phase by self-consciously returning to the complex real world as originally recorded in the situation summary, composite mind maps, cartoons, or other materials develop in stage 2. Another is to get the human activity system models ready to be communicated in the next phase of the approach when the proposals for change are debated by the people involved. The authors also documented four techniques to compare the two: general discussion, question generation, overlaying the models on the picture of reality, and historical reconstruction. Similarly, Naughton (1985), express the expectation of doing this comparison is to find out some similarities and a lot of apparent differences. The team also suggest making agenda at the end of this stage to record the result of this stage. The agenda is described as follow.

Activity in Conceptual models	Present in Real World Situation	Comments	Include on Agenda
A1	*No*	*Part of the activity already done, but no coordination*	*Yes*
A2	*Yes*	*Done by Sub-librarian on a monthly basis*	*No*
Etc.	*Etc*	*Etc.*	*Etc.*

Stage 6. - Debating Desirable and Feasible Change

Checkland (1993:p180) states that changes in three kinds may be made after comparison: changes in structure, in procedures, and in attitudes. The author also explicitly claims that the changes have to meet two criteria. They must be arguably systematically desirable as a result of the insight gained from selection of root definitions and conceptual model building, and must also be culturally feasible given the characteristics of the situation, the people in it, their shared experiences and their prejudices. Similarly, Naughton (1985), added one other change to the three kinds above with ‘changes in policy’. The team state the purpose of this stage is to conduct a structure discussion with the actors about the ideas which are starting to emerge from analysis. While Wilson and Morren (1990) reveal two significances of obtaining desirable and feasible changes from the debate. First, they help the people concern to understand and analyse what is already going on and how to conceive ideas about problems and improvements. Second, they provide a framework to test and introduce proposals for change with the participants in the situation. Wilson and Morren (1990) also discuss the meaning of desirable and feasible change. To be desirable the changes must be desired by someone in relation to features of his or her W (in CATWOE). Moreover, they state that feasible means two specific things. 1) A change can only be implemented with the resources, staff, accessible technology, structures, capabilities and so on at hand; 2) A change is feasible only when it is environmentally appropriate, in terms of avoiding unacceptable, especially irreversible, costs and in terms of involving factors over which people have control.

Stage 7. - Implementation of Action to Improve the Situation

At this stage, the structural and procedural changes are considered, together with changes in attitudes, and more pragmatic matters such as obtaining finance, effect on actors levels and so on. The main task of this stage are: 1) to design an implementation plan; 2) to carry out specific and highly varied actions of that plan; 3) to communicate the specifics to all affected parties, including, but not limited to, actors who have not previously been directly involved in the process, 4) to monitor performance and the environment and evaluate result, and 5) to modify aspects of the plan if information accrues requiring it (Wilson and Morren, 1990).

Appendix 2. Questionnaire

No: [ ] **Questionnaire**

STUDY OF AGRIBUSINESS SUPPLY CHAIN SYSTEMS FOR DRYLAND FARM PRODUCTS OF LOMBOK ISLAND – INDONESIA: A Pluralistic Approach

For Farmer

Researcher
I Gusti Lanang Parta Tanaya

Muresk Institute of Agriculture
Curtin University of Technology
Perth – Western Australia

Part 1. Characteristic Respondent

Q1. Name : ____

Q2. Age : _____________ Year

Q3. Sex : ( ) Male ( ) Female

Q4. Formal Education (In Year):

( ) Never Schooling ( ) Primary School/SD (___)

( ) Secondary School/SMTP (___) ( ) High School/SMTA (___)

Q5. Non Formal Education

Field of Education	Duration	Organiser
Food crops		
Animal Husbandry		
Estate and Forestry		
Family Planning		
Housewife skill		
________________		

Q6. How many dependants do you have?

Status	Sex	Occupation/education	Monthly Income	Comment
Spouse1				
Spouse2				
Child-1				
Child-2				
Child-3				
Child-4				

Q7. Please specify the number of cattle and poultry you manage!

Name	Own	Ngadas	Price	Comment
Chicken				
Duck				
Goat				
Cattle				
…………..				

Q8. How long have you fully managed your farm land? ________Year

Part 2. Farm Land

Q9. Do you own the managed land?

☐ Yes

☐ No (go to Q11)

Q10. What sort of legal document do you have?

☐ Ownership Certificate

☐ Contract Certificate

☐ Tax Document

☐ Other (specify):____________________

Q11. Do you rent the managed land from other?

☐ Yes, with rental method ____

☐ No,

Q12. Do you use the managed land for free of charge?

☐ Yes

☐ No (go to Q14)

Q13. If the answer for Q12 is Yes, how is your relation with the owner and the way you getting this land?

____

____

____

Q14. What is the size of your managed land? __________ Hectares

Q15. Do you use all of your land?

☐ Yes

☐ No, only ________ Hectare

Q16. Do you split your land to be some parcel?

☐ Yes, to be _____ parcels

☐ No

Q17. Please specify the size, type and current crop for every parcel in the table below!

Parcel	Size (Are)	Type $^{\alpha}$	Status $^{\beta}$	Current Crop
1				
2				
3				

$^{\alpha}$ Type: Sawah, Kebun, Tegal, Huma, Other
$^{\beta}$ Status: Owned, Contract, Rent, Gadai, Other

Part 3. Farm input purchasing

Q18. What brands of farm inputs do you like best?

Farm inputs	Brand/Product of	Seller	Reason
Seed			
Fertilisers			
Pesticides			
Growth stimulant			
Other			

Q19. What brands of farm inputs do you currently apply?

Farm inputs	Brand/Product of	Seller	Reason
Seed			
Fertilisers			
Pesticides			
Growth stimulant			
Other			

Q20. Do you know recommended amount of input used for your land? If Yes, please specify in the table below! If No, go to Q21.

Farm inputs	Amount	Recommended by	Comment
Seed of _________			
Urea			
SP36			
KCl			
_______________			

Q21. If you do not know, why?

____

____

Q22. How often do you purchase farm input in this supplier(s)?

☐ Always

☐ Often

☐ Sometimes

☐ Seldom

Q23. Why do you purchase farm inputs from this supplier(s)?

____

____

Q24. Whom do you know this supplier (s) from?

____

____

Q25. Have you ever been informed about other farm input suppliers by the PPL or the leader of farmer association?

☐ Yes

☐ No

Q26. If Yes (for the answer of Q25), what do you do after being informed?

☐ Purchasing farm input from that supplier (s)

☐ Comparing the price and type of products between the two

☐ Deciding not to purchase input from that supplier (s)

☐ Other (specify): ____

Q27. If you doubt to use some kinds of farm input, with whom do you discuss to decide input used?

☐ Agricultural Extension Workers

☐ Leader and member of farmer association

☐ Family members

☐ Farm input suppliers

Q28. What factors do you think significant affecting the selection of farm input suppliers? On a scale of 1 to 6, where 1 is "not at all important" and 6 is "very important" how important each of this item affecting your choice?

	Not at all important					Very important
Input can be bought in an exact amount needed	1	2	3	4	5	6
Input is free from dirt and pest	1	2	3	4	5	6
Input is from certified dealers	1	2	3	4	5	6
Input is conform with recommendation	1	2	3	4	5	6
Input gives better yield	1	2	3	4	5	6
Supplier offer competitive price	1	2	3	4	5	6
Supplier provides various method of payment	1	2	3	4	5	6
Supplier offer a light credit	1	2	3	4	5	6
Supplier provides market information	1	2	3	4	5	6
Supplier gives payment relief if harvest fail	1	2	3	4	5	6
Supplier has a lot of customers	1	2	3	4	5	6
Supplier is financially strong	1	2	3	4	5	6
Supplier is well-known in village area	1	2	3	4	5	6
I have a good experience with the supplier	1	2	3	4	5	6
Supplier can deliver the input to my farm	1	2	3	4	5	6
Supplier warehouse is close to my farm	1	2	3	4	5	6
Supplier can meet my immediate need	1	2	3	4	5	6
Supplier frequently visit my farm	1	2	3	4	5	6
I can visit and see directly supplier's facility	1	2	3	4	5	6
Supplier always introduce new products	1	2	3	4	5	6

Q29. How does your farm input supplier fulfil your need in Q25? On a scale of 1 to 6, where 1 is "not at all well" and 6 is "very well" how well do you think your farm input supplier meet each of this item?

	Not at all well					Very well
Input can be bought in an exact amount needed	1	2	3	4	5	6
Input is free from dirt and pest	1	2	3	4	5	6
Input is from certified dealers	1	2	3	4	5	6
Input is conform with recommendation	1	2	3	4	5	6
Input gives better yield	1	2	3	4	5	6
Supplier offer competitive price	1	2	3	4	5	6
Supplier provides various method of payment	1	2	3	4	5	6
Supplier offer a light credit	1	2	3	4	5	6
Supplier provides market information	1	2	3	4	5	6
Supplier gives payment relief if harvest fail	1	2	3	4	5	6

Supplier has a lot of customers	1	2	3	4	5	6
Supplier is financially strong	1	2	3	4	5	6
Supplier is well-known in village area	1	2	3	4	5	6
I have a good experience with the supplier	1	2	3	4	5	6
Supplier can deliver the input to my farm	1	2	3	4	5	6
Supplier warehouse is close to my farm	1	2	3	4	5	6
Supplier can meet my immediate need	1	2	3	4	5	6
Supplier frequently visit my farm	1	2	3	4	5	6
I can visit and see directly supplier's facility	1	2	3	4	5	6
Supplier always introduce new products	1	2	3	4	5	6

Q30. Considering your farm input supplyer as your preferred trading partner on the scale of 1 to 6, where 1 is "strongly disagree" and 6 is "strongly agree", could you please indicate how is your relationship with your farm input supplyer?

	Strongly disagree					Strongly agree
I confidence to MTP	1	2	3	4	5	6
MTP often considered my interest	1	2	3	4	5	6
MTP often behave opportunistic	1	2	3	4	5	6
MTP give me best offer	1	2	3	4	5	6
I think MTP is honest to me	1	2	3	4	5	6
MTP always keep his promises	1	2	3	4	5	6
MTP usually inform price changes	1	2	3	4	5	6
MTP often suggest about supply method	1	2	3	4	5	6
MTP often aksed about his way to awarded me	1	2	3	4	5	6
It easy to find MTP	1	2	3	4	5	6
MTP often suggest to plant new varieties	1	2	3	4	5	6
I spent less cost to do business with MTP	1	2	3	4	5	6
I have a close friendship with MTP	1	2	3	4	5	6
MTP often meet my requirement	1	2	3	4	5	6
I think MTP treated me fairly	1	2	3	4	5	6
I am free to chose MTP	1	2	3	4	5	6
MTP has full authority in making decision	1	2	3	4	5	6
I have to agree to MTP decision	1	2	3	4	5	6
I dependend more to MTP than him to me	1	2	3	4	5	6
I prefer to do business with MTP	1	2	3	4	5	6
Long term relationship with MTP guaranted my product	1	2	3	4	5	6
I plan to continue my business with MTP in future	1	2	3	4	5	6
MTP usually offer financial assistance to me	1	2	3	4	5	6
I have good cooperation with MTP	1	2	3	4	5	6
MTP willing to share a risk together	1	2	3	4	5	6
Dealing with MTP is less risky	1	2	3	4	5	6
I trust my MTP	1	2	3	4	5	6
I feel I adequately rewarded by MTP	1	2	3	4	5	6

Part 4. Farm Production Process

Q31. Do you follow a specific planting season?

☐ Yes

☐ No

Q32. Based on what principle do you decide your planting season?

☐ Product demand

☐ Climatic season

Q33. For last year, when did your planting season start?

Planting season one:________________

Planting season two:________________

Planting Season One for Parcel One

Q34. What farm inputs and how much of them do you use for cultivating your crops in parcel one?

Farm input	Amount		Price/Unit (Rp)
	Owned	Purchased	
Seed			
Certified			
Non certified			
Stakes/Trellis			
Fertilisers			
Urea			
SP36			
KCl			
Pesticides			
______________			
______________			
Ground Water			
Fuel			
Kerosene			
Premium			
Deisel			

Q35. How many labourers do you use for cultivating your crop in parcel one?

Activities	Family labourers				Hired Labourers				Daily Wage	
	Male		Female		Male		Female			
	D	H	D	H	D	H	D	H	Male	Female
Land preparation										
Land cleaning										
Soil tillage 1										
Garu										
Soil tillage 2										
Nursery										
Planting										

Fertilising										
Weeding										
Spraying										
Harvesting										
Packaging										
Transporting										
Marketing										

Note: D is number of day and H is number of hour

Q36. How do you contact all these labourers?

____

____

____

Q37. How many animal power and machinery do you use for cultivating your crop in parcel one?

Activities	Animal power				Machinery				Cost	
	Owned		Hired		Owned		Hired			
	D	H	D	H	D	H	D	H	Owned	Hired
Land preparation										
Land cleaning										
Soil tillage 1										
Garu										
Soil tillage 2										

Note: D is number of day and H is number of hour

Q38. Did you use the service of financial source for financing your crop cultivation in parcel one?

☐ Yes

☐ No, go to Q39

Q39. What financial source do you take a service from?

☐ Banks (specify its name):____________

☐ Co-operative (specify its name):____________

☐ Money lender

☐ Other (specify its name):____________

Q40. How is the agreement of your loan regarding period, time and method of payment?

____

____

____

Q41. Why do you borrow money from that financial source?

____

____

____

Q42. Who do you know this financial source from?

☐ Agricultural extension workers

☐ Leader of Farmer Association

☐ Friend

☐ Family member

☐ Other (specify its name):____________

Q43. How much your crop production from parcel one and how do you allocate them?

Crop	Total Production (Kuintal)	Consumed Production (Kuintal)	Donated Production (Kuintal)	Sold Production (Kuintal)	Price per Kuintal (Rp)
Maize					
Peanut					
Cassava					
Paddy					

Note: One Kuintal is equal to 100 kilograms

Planting Season One for Parcel Two

Q44. What farm inputs and how much of them do you use for cultivating your crops in parcel two?

Farm input	Amount		Price/Unit (Rp)
	Owned	Purchased	
Seed			
Certified			
Non certified			
Stakes/Trellis			
Fertilisers			
Urea			
SP36			
KCl			
Pesticides			
______________			
______________			
Growth Stimulant			
Ground Water			
Fuel			
Kerosene			
Premium			
Deisel			

Q45. How many labourers do you use for cultivating your crop in parcel two?

Activities	Family labourers				Hired Labourers				Daily Wage	
	Male		Female		Male		Female			
	D	H	D	H	D	H	D	H	Male	Female
Land preparation										
Land cleaning										
Soil tillage 1										
Garu										
Soil tillage 2										
Nursery										
Planting										
Fertilising										
Weeding										
Spraying										
Harvesting										
Packaging										
Transporting										
Marketing										

Note: D is number of day and H is number of hour

Q46. How do you contact all these labourers?

____

____

____

Q47. How many animal power and machinery do you use for cultivating your crop in parcel two?

Activities	Animal power				Machinery				Cost	
	Owned		Hired		Owned		Hired			
	D	H	D	H	D	H	D	H	Owned	Hired
Land preparation										
Land cleaning										
Soil tillage 1										
Garu										
Soil tillage 2										

Note: D is number of day and H is number of hour

Q48. Did you use the service of financial source for financing your crop cultivation in parcel two?

☐ Yes

☐ No, go to Q39

Q49. What financial source do you take a service from?

☐ Banks (specify its name):_____________

☐ Co-operative (specify its name):_____________

☐ Money lender

☐ Other (specify its name):_____________

Q50. How is the agreement of your loan regarding period, time and method of payment?

____
____
____

Q51. Why do you borrow money from that financial source?

____
____
____

Q52. Who do you know this financial source from?

☐ Agricultural extension workers

☐ Leader of Farmer Association

☐ Friend

☐ Family member

☐ Other (specify its name):____________

Q53. How much your crop production from parcel two and how do you allocate them?

Crop	Total Production (Kuintal)	Consumed Production (Kuintal)	Donated Production (Kuintal)	Sold Production (Kuintal)	Price per Kuintal (Rp)
Maize					
Peanut					
Cassava					
Paddy					

Note: One Kuintal is equal to 100 kilograms

Planting Season Two for Parcel One

Q54. What farm inputs and how much of them do you use for cultivating your crops in parcel one?

Farm input	Amount		Price/Unit (Rp)
	Owned	Purchased	
Seed			
Certified			
Non certified			
Stakes/Trellis			
Fertilisers			
Urea			
SP36			
KCl			
Pesticides			
____________			
____________			

Growth Stimulant			
Ground Water			
Fuel			
Kerosene			
Premium			
Deisel			

Q55. How many labourers do you use for cultivating your crop in parcel one?

Activities	Family labourers				Hired Labourers				Daily Wage	
	Male		Female		Male		Female			
	D	H	D	H	D	H	D	H	Male	Female
Land preparation										
Land cleaning										
Soil tillage 1										
Garu										
Soil tillage 2										
Nursery										
Planting										
Fertilising										
Weeding										
Spraying										
Harvesting										
Packaging										
Transporting										
Marketing										

Note: D is number of day and H is number of hour

Q56. How do you contact all these labourers?

____

Q57. How many animal power and machinery do you use for cultivating your crop in parcel one?

Activities	Animal power				Machinery				Cost	
	Owned		Hired		Owned		Hired			
	D	H	D	H	D	H	D	H	Owned	Hired
Land preparation										
Land cleaning										
Soil tillage 1										
Garu										
Soil tillage 2										

Note: D is number of day and H is number of hour

Q58. Did you use the service of financial source for financing your crop cultivation in parcel one?

☐ Yes

☐ No, go to Q39

Q59. What financial source do you take a service from?

☐ Banks (specify its name):____________

☐ Co-operative (specify its name):____________

☐ Money lender

☐ Other (specify its name):____________

Q60. How is the agreement of your loan regarding period, time and method of payment?

____
____
____

Q61. Why do you borrow money from that financial source?

____
____
____

Q62. Who do you know this financial source from?

☐ Agricultural extension workers

☐ Leader of Farmer Association

☐ Friend

☐ Family member

☐ Other (specify its name):____________

Q63. How much your crop production from parcel one and how do you allocate them?

Crop	Total Production (Kuintal)	Consumed Production (Kuintal)	Donated Production (Kuintal)	Sold Production (Kuintal)	Price per Kuintal (Rp)
Maize					
Peanut					
Cassava					
Paddy					

Note: One Kuintal is equal to 100 kilograms

Planting Season Two for Parcel Two

Q64. What farm inputs and how much of them do you use for cultivating your crops in parcel two?

Farm input	Amount		Price/Unit (Rp)
	Owned	Purchased	
Seed			
Certified			
Non certified			

Stakes/Trellis			
Fertilisers			
Urea			
SP36			
KCl			
Pesticides			
______________			
______________			
Growth Stimulant			
Ground Water			
Fuel			
Kerosene			
Premium			
Deisel			

Q65. How many labourers do you use for cultivating your crop in parcel two?

Activities	Family labourers				Hired Labourers				Daily Wage	
	Male		Female		Male		Female			
	D	H	D	H	D	H	D	H	Male	Female
Land preparation										
Land cleaning										
Soil tillage 1										
Garu										
Soil tillage 2										
Nursery										
Planting										
Fertilising										
Weeding										
Spraying										
Harvesting										
Packaging										
Transporting										
Marketing										

Note: D is number of day and H is number of hour

Q66. How do you contact all these labourers?

____

Q67. How many animal power and machinery do you use for cultivating your crop in parcel two?

Activities	Animal power				Machinery				Cost	
	Owned		Hired		Owned		Hired			
	D	H	D	H	D	H	D	H	Owned	Hired
Land preparation										
Land cleaning										
Soil tillage 1										
Garu										
Soil tillage 2										

Note: D is number of day and H is number of hour

Q68. Did you use the service of financial source for financing your crop cultivation in parcel two?

- [ ] Yes
- [ ] No, go to Q39

Q69. What financial source do you take a service from?

- [ ] Banks (specify its name):____________
- [ ] Co-operative (specify its name):____________
- [ ] Money lender
- [ ] Other (specify its name):____________

Q70. How is the agreement of your loan regarding period, time and method of payment?

____

____

Q71. Why do you borrow money from that financial source?

____

____

Q72. Who do you know this financial source from?

- [ ] Agricultural extension workers
- [ ] Leader of Farmer Association
- [ ] Friend
- [ ] Family member
- [ ] Other (specify its name):____________

Q73. How much your crop production from parcel two and how do you allocate them?

Crop	Total Production (Kuintal)	Consumed Production (Kuintal)	Donated Production (Kuintal)	Sold Production (Kuintal)	Price per Kuintal (Rp)
Maize					
Peanut					
Cassava					
Paddy					

Note: One Kuintal is equal to 100 kilograms

Part 5. Post harvest handling

Q74. Do you dry your farm product before selling to the buyer?

- [ ] Yes
- [ ] No, go to Q74

Q75. How do you dry your farm product?

☐ In the farm yard

☐ On the street

☐ On drying floor

☐ Other (specify its name):_____________

Q76. Do you think your drying method is effective?

☐ Yes, because ____

☐ No, because ____

Q77. What aspect must be changed to improve your drying method?

____

____

Q78. Before you pack your farm products, do you sort, grade or classify your farm products?

☐ Yes

☐ No, go to Q78

Q79. How do you sort, grade or classify your farm products?

____

____

Q80. Do you pack your farm product before selling to the buyer?

☐ Yes

☐ No, go to Q78

Q81. How do you pack your farm product?

☐ Using seed or fertiliser sacks and knitted

☐ Using special sacks and knitted

☐ Other (specify):____

Q82. Do you think your packing method is effective?

☐ Yes, because ____

☐ No, because ____

Q83. What aspect must be changed to improve your drying method?

____

____

Part 6. Selling farm products

Q84. Whom do you sell your farm products to?

Name	Address	Role	Percent Bought

Q85. How often do you sell your farm products to this buyer(s)?

☐ Always

☐ Often

☐ Sometimes

☐ Seldom

Q86. Why do you decide to sell your farm products to this buyer(s)?

____

____

Q87. Whom do you know this buyer(s) from?

____

____

Q88. Have you ever been informed about other farm product buyers by the PPL or the leader of farmer association?

☐ Yes

☐ No

Q89. If Yes (for the answer of Q22), what do you do after being informed?

☐ Selling farm products to that buyer(s)

☐ Comparing the price offered between the two

☐ Deciding not to sell my farm products to that buyer(s)

☐ Other (specify): ____

Q90. What factors do you think important to select farm product buyers? Please indicate on a scale of 1 to 6, where 1 is "not at all important" and 6 is "very important", how important each of this item affecting your choice?

	Not at all important					Very important
Taking my farm products soon after harvesting	1	2	3	4	5	6
Close to my farm	1	2	3	4	5	6
Have a good reputation	1	2	3	4	5	6
Have many strong customers	1	2	3	4	5	6
He/she is financially strong	1	2	3	4	5	6
Providing good price for my farm products	1	2	3	4	5	6
Providing credit or loan	1	2	3	4	5	6
Providing convenient payment method	1	2	3	4	5	6

He/she can supply me farm inputs	1	2	3	4	5	6
He/she provides technical information	1	2	3	4	5	6
He/she has close relationship with me	1	2	3	4	5	6
He/she is frequently communicating with me	1	2	3	4	5	6
He/she is willing to meet my immediate needs	1	2	3	4	5	6
He/she is frequently visiting my farm	1	2	3	4	5	6

Q91. How does your farm product buyer fulfil your need in Q25? Please indicate on a scale of 1 to 6, where 1 is "not at all well" and 6 is "very well" how well do you think your farm product buyer meet each of this item?

	Not at all well					Very well
Taking my farm products soon after harvesting	1	2	3	4	5	6
Close to my farm	1	2	3	4	5	6
Have a good reputation	1	2	3	4	5	6
Have many strong customers	1	2	3	4	5	6
He/she is financially strong	1	2	3	4	5	6
Providing good price for my farm products	1	2	3	4	5	6
Providing credit or loan	1	2	3	4	5	6
Providing convenient payment method	1	2	3	4	5	6
He/she can supply me farm inputs	1	2	3	4	5	6
He/she provides technical information	1	2	3	4	5	6
He/she has close relationship with me	1	2	3	4	5	6
He/she is frequently communicating with me	1	2	3	4	5	6
He/she is willing to meet my immediate needs	1	2	3	4	5	6
He/she is frequently visiting my farm	1	2	3	4	5	6

Q92. What do you think the criteria that need to be improved in meeting your needs?

____

____

Q93. Do you have to deliver your farm products to the buyer post?

☐ Yes, with cost of Rp. ______/sack or Rp.__________ in total

☐ No, Go to Qbb

Q94. What kind of losing do you face during delivering your farm products?

____

Q95. To the best of your knowledge, what factors does the buyer consider to purchase farm products? Please indicate on a scale of 1 to 6, where 1 is "not at all well" and 6 is "very well" how important does the buyer think of this item below in purchasing farm products?

	Not at all important					Very important
Products can meet the market needs	1	2	3	4	5	6
Products available in feasible amount	1	2	3	4	5	6
Products have required size	1	2	3	4	5	6
Products have right maturity	1	2	3	4	5	6
Products are free from pest and disease	1	2	3	4	5	6
Products are free from physical injury	1	2	3	4	5	6

Products have right dryness	1	2	3	4	5	6
Products are packed properly	1	2	3	4	5	6
Products are sorted or graded well	1	2	3	4	5	6
Products can be delivered immediately	1	2	3	4	5	6
Products have competitive price	1	2	3	4	5	6
Products available in accessible distance	1	2	3	4	5	6

Q96. How can you fulfil your farm product buyer need in Q25? Please indicate on a scale of 1 to 6, where 1 is “not at all well” and 6 is “very well” how well do you think your farm product buyer meet each of this item?

	Not at all well					Very well
Products can meet the market needs	1	2	3	4	5	6
Products available in feasible amount	1	2	3	4	5	6
Products have required size	1	2	3	4	5	6
Products have right maturity	1	2	3	4	5	6
Products are free from pest and disease	1	2	3	4	5	6
Products are free from physical injury	1	2	3	4	5	6
Products have right dryness	1	2	3	4	5	6
Products are packed properly	1	2	3	4	5	6
Products are sorted or graded well	1	2	3	4	5	6
Products can be delivered immediately	1	2	3	4	5	6
Products have competitive price	1	2	3	4	5	6
Products available in accessible distance	1	2	3	4	5	6

Q97. Do you always try to improve the quality ofyour farm products?

☐ Yes

☐ No, Go to Qbb

Q98. What actions did you take to improve the quality of your farm products?

____

____

____

Q99. What is significant constraint to improve the quality of your farm products?

____

____

____

Q100. Why did you not improve the quality of your farm products?

____

____

____

Q101. How long have you been doing business with your farm product buyer?

____

Q102. Why do you interested in doing business with your farm product buyer?

____

____

____

Q103. Considering your farm product buyer as your preferred trading partner on the scale of 1 to 6, where 1 is “strongly disagree” and 6 is “strongly agree”, could you please indicate how is your relationship with your farm product buyer?

	Strongly disagree					Strongly agree
I confidence to MTP	1	2	3	4	5	6
MTP often considered my interest	1	2	3	4	5	6
MTP often behave opportunistic	1	2	3	4	5	6
MTP give me best offer	1	2	3	4	5	6
I think MTP is honest to me	1	2	3	4	5	6
MTP always keep his promises	1	2	3	4	5	6
MTP usually inform price changes	1	2	3	4	5	6
MTP often suggest about supply method	1	2	3	4	5	6
MTP often aksed about his way to awarded me	1	2	3	4	5	6
It easy to find MTP	1	2	3	4	5	6
MTP often suggest to plant new varieties	1	2	3	4	5	6
I spent less cost to do business with MTP	1	2	3	4	5	6
I have a close friendship with MTP	1	2	3	4	5	6
MTP often meet my requirement	1	2	3	4	5	6
I think MTP treated me fairly	1	2	3	4	5	6
I am free to chose MTP	1	2	3	4	5	6
MTP has full authority in making decision	1	2	3	4	5	6
I have to agree to MTP decision	1	2	3	4	5	6
I dependend more to MTP than him to me	1	2	3	4	5	6
I prefer to do business with MTP	1	2	3	4	5	6
Long term relationship with MTP guaranted my product	1	2	3	4	5	6
I plan to continue my business with MTP in future	1	2	3	4	5	6
MTP usually offer financial assistance to me	1	2	3	4	5	6
I have good cooperation with MTP	1	2	3	4	5	6
MTP willing to share a risk together	1	2	3	4	5	6
Dealing with MTP is less risky	1	2	3	4	5	6
I trust my MTP	1	2	3	4	5	6
I feel I adequately rewarded by MTP	1	2	3	4	5	6

THANK YOU VERY MUCH FOR YOUR INFORMATION

Appendix 3. Abstracts of conference and journal papers.

BUYER-SELLER RELATIONSHIPS IN DRYLAND FARMING SUPPLY CHAINS IN LOMBOK INDONESIA*

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ABSTRACT

Although there have been a number of success stories from the agricultural development programs undertaken in Indonesia in the past three decades it is acknowledged that in many cases the change has not led to a significant improvement of farmers' welfare. This is generally the case for dryland farmers in Lombok. Much of the research and extension effort in Lombok has been targeted at developing improved dryland production systems and little effort has been devoted to developing the product supply chains. This paper describes the agribusiness supply chain (SC) issues for produce from small farmers in dry land areas and analyses the factors contributing to the supply chain process. This study has looked at four product supply chains – those for maize, peanuts, cassava, and paddy. The results explore the relationships between farmers and others in the supply chain.

Key words: supply chain, dryland farming, buyer-seller relationship

* Paper presented in AAERS 48th Annual Conference, 11 – 13 February 2004 Melbourne, Victoria

AN ANALYSIS OF TECHNICAL EFFICIENCY OF DRYLAND FARMING IN LOMBOK ISLAND, INDONESIA**

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[2]Faculty of Agriculture, University of Mataram, Indonesia

This paper seeks to measure farm-specific technical efficiency of dryland farming in Lombok Island, Indonesia. Stochastic frontier production functions were estimated econometrically for a cross-section data of 227 farmers. This procedure provided separation of symmetric random error and a non-negative random variable associated with the value of farm-specific technical efficiency. The result of the analysis includes comparison of farm-specific technical efficiency for three main dryland farming crops in Lombok – maize, peanuts and cassava. The paper also examined the factors influencing technical efficiency.

Keyword: dryland farming, production function, technical efficiency

** Paper presented at the 49th Australian Agricultural and Resource Economics Society (AARES) Annual Conference, February 9-11, 2005, Coffs Harbour, NSW, Australia.

AN APPLICATION OF SOFT SYSTEMS METHODOLOGY TO IMPROVE AGRI-FOOD SUPPLY CHAIN: The Case of Dryland Farming of Lombok Island Indonesia♣

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Abstract

Interest in analysing agri-food supply chains, has grown tremendously in the last decade because of the importance of food in well-being, an increasing globalisation of the food industry and as a result agri-food chains increased in complexity. The complexity also results from the perishable nature of food products, seasonality and the risks inherent in the production systems. In a developing country like Indonesia, these complexities are heightened but a further factor can be added - traditional culture plays an important role in almost every aspect of business activities. Agri-food supply chains are highly organised social systems, which have the objective of efficiently matching consumer demand with product supply. The importance of social factors such as cooperation, trust and relationships suggest that Soft Systems Methodology (SSM) has some potential for exploring improvements to agri-food supply chains. This paper reports on an application of SSM to improve agri-food supply chain performance for dryland farming products from small-scale farmers in Lombok, Indonesia. Some possible future research opportunities are also explored.

Keywords: Soft Systems Methodology, Agri-food, Supply Chain, Lombok, Indonesia

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♣ Paper presented at the 49th Australian Agricultural and Resource Economics Society (AARES) Annual Conference, February 9-11, 2005, Coffs Harbour, NSW, Australia.

FACTORS AFFECTING DRYLAND FARMERS' CHOICE OF FARM INPUT SUPPLIERS: A Case of Dryland Farming Supply Chain In Rural Lombok Island♥

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Abstract

Dryland farming in Indonesia, specifically in Lombok, is becoming more important as much irrigated farming land has been converted for non-farm purposes. Previous research and extension efforts on the island have been targeted on developing and improving the dryland production systems. However, not much effort has been devoted to studying issues related to human relationships in agribusiness activities. This paper describes the relationship between small farmers and their farm input suppliers in the agribusiness supply chain in dry land areas and analyses the factors contributing to farmers' choice of preferred supplier. This study is based on a survey conducted in the northern and southern parts of Lombok with the largest dryland farming areas. Data were collected using face-to-face interview based on semi-structured questionnaires and then analysed using Factor Analysis with Principal Component Method. The results of the study show that the socio traditional value of the villagers coloured the relationship between farmers and their farm input supplier. Farm input quality and financial issues were identified as the most important factors to farmers in choosing their preferred supplier.

Keywords: dryland farming, farm input supplier, factor analysis

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♥ Paper presented in Asian Rural Sociological Association (ARSA) 2nd International Conference, University of Mataram, Lombok - Indonesia 26-29 Maret 2004

FACTORS AFFECTING SUPPLY CHAIN PARTICIPANTS ON CHOOSING THEIR PREFERRED TRADING PARTNERS: A CASE OF AGRIBUSINESS DRYLAND FARMING IN LOMBOK ISLAND – INDONESIA[♠]

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ABSTRACT

Agricultural business development forms a significant part of national development plans in Indonesia. A number of successful policies have been introduced into this sector over three decades however this success has not flowed on in a way that has made significant impacts on farmer's welfare in particular, small farmers in dryland areas. Some studies were carried out on dryland areas has been targeted on improving the production systems. However, not much effort has been devoted to studying issues related to human relationships in agribusiness supply chain activities. This paper describes factors affecting supply chain participants on choosing their trading partners in dryland areas and analyses the reasons of participants in deciding their preferred trading partner. Data were collected based on semi-structured questionnaire and analysed using Factor Analysis. The results of the study show that the socio traditional value of the villagers coloured the relationship between participants and their trading partner.

♠ Paper presented in Agriculture Conngress 4 – 7 October 2004 in Kuala Lumpur, Malaysia

A STUDY OF AGRIBUSINESS SUPPLY CHAIN FOR DRYLAND FARMING PRODUCTS OF LOMBOK ISLAND – INDONESIA: An Application of Pluralistic Approach♦

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ABSTRACT

Interest in analysing supply chain, especially agribusiness supply chain, has tremendously grown in the last decade. Analysis of agribusiness supply chain is considered particularly important due to the nature of the product involved and their significantly different complexity as compared to those in manufactured supply chain. Agribusiness products are normally bulky and perishable. In addition, their production process is highly influenced by the season. In a developing country like Indonesia, agri-food supply chain is even more complex because traditional culture plays an important role in almost every aspect of business activities. This means that the agribusiness supply chain has two analysis domains: quantitative and qualitative. Given the nature of agribusiness supply chain, it is considered suitable to use a pluralistic approach that combines Hard Systems Approaches and Soft Systems Methodology (SSM) for its analysis. Hard Systems Approaches such as statistical and econometric analysis that are based on quantitative data, is very powerful to explain the phenomena that have defined problems. SSM is a potentially powerful tool to improve the situation of complex social systems. This paper reports on an application of a pluralistic approach to improve situations of agribusiness supply chain for dryland farming products from small-scale farmers in Lombok, Indonesia. Some possible future paths of this research are also suggested.

Keywords: Agribusiness, Supply chain, Soft and hard systems, Pluralistic approach

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♦ Paper presented in 1st International Conference on Operations and Supply Chain Management, Bali, 15 – 17 December 2005.

Soft systems methodology: An alternative approach to improve agribusiness supply chain[♥]

Soft systems methodology: Suatu alternatif pendekatan untuk memperbaiki rantai pasokan agribisnis

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Abstrak

Masalah-masalah sosial yang biasanya melibatkan aktifitas manusia sering kali sulit untuk didefinisikan. Soft systems methodology (SSM) menyajikan cara yang efektif dan efisien untuk masalah yang mengandung sifat saling ketergantungan antara proses teknologi dan aktifitas manusia. Rantai pasokan agribisnis salah satu contoh masalah ini. Rantai pasokan agribisnis adalah suatu sistem sosial yang kompleks yang memiliki tujuan pemenuhan permintaan konsumen dari penawaran produsen secara efisien. Pentingnya peran faktor sosial seperti kerjasama, kepercayaan dan hubungan bisnis antara pelaku menjadikan SSM sesusi untuk mencari lebih dalam faktor penentu yang dapat memperbaiki rantai pasokan agribisnis tersebut. Tulisan ini mengungkap suatu penerapan SSM untuk memperbaiki performasi rantai pasokan agribisnis untuk hasil pertanian petani kecil di lahan kering Pulau Lombok, Indonesia. Beberapa kemungkinan penelitian lanjutan dari hasil pemikiran ini juga diungkapkan

Kata kunci: Soft systems methodologi, rantai pasokan, pertanian lahan kering

Abstract

Social problems that usually associated with human activity are frequently poorly defined. Soft Systems Methodology (SSM) provides an effective and efficient way to carry out a systems analysis of problems where technological processes and human activities are interdependent. Agribusiness supply chain is one clear example of the problems. Agribusiness supply chains are complex social systems, which have the objective of efficiently matching consumer demand with product supply. The importance of social factors such as cooperation, trust and relationships among actors suggest that SSM has some potential for exploring improvements to agribusiness supply chains. This paper notifies on an application of SSM to improve agribusiness supply chain performance for dryland farming products from small-scale farmers in Lombok, Indonesia. Some possible future research opportunities are also explored.

Keywords: Soft systems methodology, supply chain, dryland farming

[♥] Paper published in Indonesian national journal, Agrimansion Vol.7, No. 2