Chapter 1

Introduction

1.1 Background

Cacao is one of the estate commodities that play an important role in terms of export earnings and employment opportunities in Indonesia. It is placed fourth in value among Indonesian export commodities and is the main source of income for more than one million farm households. Most cacao farms are owned by smallholder farmers who are considered poor. Due to the industry's importance to the economy and the role of smallholders in it, there is the potential for the industry to play an important role in poverty alleviation.

The Directorate General of Plantations of Indonesia (2012a) reported that the planted areas of cacao in Indonesia in 2009 were 1,587,136 ha. These areas contributed about 7 per cent to the total planted area of estate crops. Total cacao output from those areas was 809,583 tonnes. Cacao is planted throughout Indonesia; however, the largest growing areas are in Eastern Indonesia, particularly Sulawesi. In 2009, 66 per cent of the national cacao output originated in the four provinces of Sulawesi (Southeast Sulawesi, South Sulawesi, Central Sulawesi, and West Sulawesi). In Western Indonesia, the biggest share of the cacao area was in West Sumatra, which contributed about 9 per cent (Ministry of Agriculture Republic of Indonesia, 2010).

Even though its share was much less than the four provinces in Sulawesi; West Sumatra had the highest annual growth rate among the top ten cacao areas in the period 2004–2009.The share of cacao area to total estate crops area in this province increased six-fold during this period (Ministry of Agriculture Republic of Indonesia, 2010). Cacao area is expected to increase further in West Sumatra due to continuing government support programs to develop cacao-coconut intercrop farming systems.

Indonesian cacao producers can be classified into three categories: smallholders, private estates, and government-owned estates (PTPs). In 2009, smallholders contributed about 94 per cent of the cacao area (1,491,808 ha), with private estates and the government-owned estates contributing 3 per cent each (Directorate General of Plantations of Indonesia, 2012a). About 92 per cent of total cacao output came from smallholders in

2009. This figure indicates that development of the cacao industry has the potential to improve the economic conditions of smallholders.

About 66 per cent of cacao output in Indonesia was exported in 2009. Indonesia contributed 15 per cent to total world cacao output in 2009/2010 (International Cocoa Organization (ICCO), 2012). Indonesia continues to be the third largest cacao producer in the world after Côte d'Ivoire and Ghana, which contributed 34 per cent and 17 per cent of world production, respectively. The ICCO (2010) reported that the world demand for cacao experienced an upward trend with an annual growth rate of 2.4 per cent accompanied by an upward pattern in market prices in the period 2000/2001–2009/2010. This led to a significant increase in Indonesian export earnings from the cacao industry from US$0.34 billion in 2000 to US$1.4 billion in 2009 (Directorate General of Plantations of Indonesia, 2012b).

Some analysts (e.g. Akiyama and Nishio, 1997; Badcock, Matlick and Baon, 2007) noted that Indonesia's cacao industry has a comparative advantage in producing cacao beans due to low real costs, high productive capacity, efficient infrastructure and an open marketing system. This competitive advantage, however, has been threatened by a number of problems in production and marketing. In order to address these problems, the Indonesian Government launched a program of *Gerakan Nasional Pengembangan Kakao* in 2009. This program is being conducted mainly in Eastern Indonesia but new cultivation areas of cacao are also being developed in Western Indonesia. West Sumatra has been designated as an area of central production in Western Indonesia.

Although the cacao industry has grown dramatically in West Sumatra, a study by Handayane (2007) found that cacao farms in this province were unprofitable. This problem may be related to production and marketing constraints facing the cacao industry in Indonesia. Some empirical studies found that cacao yields in Indonesia could not achieve their potential yields (ACDI/VOCA, 2005; Handayane, 2007; Sahara, Dahya and Syam, 2005). Improper use of fertilizer was identified as a cause of low production of cacao, while pests and diseases contributed to problems of low production and low quality as well. Based on a study by ACDI/VOCA (2005) and Handayane (2007), improper fermentation was identified as another cause of low quality of cacao beans. Moreover, the World Cocoa Foundation (WCF, 2007) found that a weak bargaining position, lack of access to financial support and receiving a less remunerative price for fermented cacao bean are marketing problems facing Indonesian cacao farmers.

In order to develop the cacao industry in West Sumatra, the study aims to identify the factors limiting development and establish priority areas for action. These issues are investigated in agribusiness sub-systems along the cacao supply chain that involve all stakeholders. The issues are identified using an Impact Pathways (IP) logic model, accompanied by a network mapping approach to understand the relationships among stakeholders. A strategy to address the identified issues is generated in order to achieve the aim of agricultural development that results in increased farmers' income that, in turn, will contribute to poverty alleviation.

The population in this study is cacao smallholders in West Sumatra. Based on three categories of cacao producers classified by the Directorate General of Plantations of Indonesia, we can define cacao smallholders as farmers who manage cacao tress on their own property that is relatively small in size. Plantations managed by private companies and government-owned estates are considered as large-scale businesses. This definition is similar to the concept of small-scale and large-scale forestry by Schirmer (2007).

Nagayets (2005) reviewed some definitions of small farms. Some analysts (e.g. Lipton, 2005; Narayanan and Gulati, 2002) characterized small farms as family farms that are the main source of income and operated mainly by family labour. Others defined small farms as farms with size of landholding less than 2 ha (World Bank, 2003), having limited resource endowment (Dixon, Taniguchi, and Wattenbach, 2003) and having sales cut-offs of $50,000, $250,000 or $500,000 (ERS, 2005). Nagayets argued that the size of landholdings is a limited measure for small farms because of its failure to account for the quality of resources, the types of crops grown, disparities across regions, various institutional and market arrangements available to farmers, and a farm's labour arrangements. Therefore, he defined smallholders as farmers who have less than 2 hectares of owned or rented land, where the farms are the main source of family income and use family members as the primary source of labour.

In dealing with poverty issues, this study does not discuss poverty analysis but addresses the potential of the cacao industry to alleviate poverty. The discussion emphasizes how cacao industry development has the potential to contribute to poverty alleviation.

The term “cacao” used in this study refers to the trees and seeds of the cacao plant. Oxford Dictionaries (2012) defined cacao as “the small tropical American evergreen tree which bears cacao seeds”. This dictionary also referred to cacao as “beans from which cocoa, cocoa butter and chocolate are made” (Oxford Dictionaries, 2012). This clarified the use of the terms,“cacao” and “cocoa” in this study. The term “cocoa” refers to the product of cacao.

This chapter outlines the structure of the study. In Section 1.2, the research problem is discussed, followed by an outline of the research objectives in Section 1.3. A brief statement of the method of analysis is presented in Section 1.4. The organisation of the thesis is outlined in Section 1.5.

1.2 Research Problem

Incomes of cacao farmers in West Sumatra are low despite the implementation of government programs intended for cacao farmers. A variety of issues facing the cacao industry could influence the economic conditions of cacao farmers and, in some circumstances, may have caused cacao production to be unprofitable. These issues include farm-level factors such as high production costs, low prices received by farmers, improper use of fertilizer, poor pest and disease control, poor weeding and pruning practices, and poor seedling quality. Improper use of fertilizer, poor pest and disease control and poor weeding and pruning practices are suspected to be associated with lack of knowledge of management practices due to, among other causes, low education, and inadequate access to training and extension services.

Other factors that have been identified relate to the cacao supply chain. The weak bargaining position of smallholders and low quality of cacao may be factors causing low farm-gate prices. There is some evidence that farmers lack access to accurate prices. All these issues may lead to some smallholders becoming indebted to traders.

As part of an agribusiness system, the development of cacao farming is influenced by upstream and downstream industries, and the provision of institutional support. Developing the cacao industry should be viewed as an agribusiness challenge which involves all stakeholders along the supply chain.

In order to exploit the opportunities on the world market, the main research problem to be investigated in this study is how to overcome the constraints which are limiting the development of the cacao industry. The aim is to investigate the effects of the above factors on cacao income and to assign priorities to different factors. In this way, it is planned to generate appropriate strategies for cacao industry development that encourage more effective use of government funds.

A participatory approach could be an appropriate method in this study because it allows researchers to identify the problems by involving stakeholders who have experience in the industry. This method enables us to obtain information from its source and avoid false judgments by outsiders. Therefore, the participatory impact pathway analysis (PIPA) approach is applied in this study.

The application of the PIPA approach begins with a PIPA workshop that results in hypothesis in the form of problem tree. The hypothesis is tested using a quantitative approach called “path analysis”. Delphi method is used as a complementary method for PIPA at strategy formulation stage.

1.3 Research Objectives and Propositions

Based on the discussion above, there is the possibility of increasing farmers’ income by increasing productivity, improving the quality of cacao beans and raising the farm-gate prices for cacao beans through improved marketing methods. Cacao has the potential to contribute to poverty alleviation in West Sumatra for two main reasons. First, unlike oil palm and rubber estates, most cacao beans in West Sumatra are produced by smallholders. Smallholder farmers are direct beneficiaries of any government development programs that target them effectively. Second, there is a big opportunity for farmers to gain higher prices for fermented cacao beans if the whole cacao supply chain works well, generating higher incomes. This, in turn, will lead to poverty alleviation in line with the Vision for Rural Indonesia in 2020: a pro-poor growth and rural development program.

Four main issues are addressed in this study:

a. What are the best ways to increase productivity, increase farm-gate prices and to improve quality of cacao in order to develop the cacao industry in West Sumatra?

b. How do all stakeholders get involved in improving the condition of the cacao industry in West Sumatra?

c. Do current government programs of West Sumatra address the cacao industry development issues?

d. How can the cacao industry development contribute to poverty alleviation in West Sumatra?

These issues are reflected in two of the objectives of this study, which aims to:

a. identify constraints on smallholders producing cacao in West Sumatra, and

b. develop a strategy to alleviate the constraints identified that leads to rural poverty alleviation.

The third objective is a methodological one, to:

c. explore the use of the PIPA, PA and Delphi methods in designing strategies to improve the performance of cacao producers in West Sumatra by involving a two-stage process: determining priorities with stakeholders and determining best strategies with the experts.

The application of a PIPA approach allows us to assess stakeholders' opinions on constraints facing the cacao industry. Their views are also the basis for constructing potential strategies to solve the problems in developing the industry. It is presumed that stakeholders share the same views in setting the priority for the strategies.

1.4 Research Approach

An in-depth understanding of a whole range of issues is needed in order to achieve the research objective. This study employs the following approaches, summarized in Figure 1.1:

a. The important issues in the cacao industries are reviewed. This includes a discussion of the opportunities facing the industry.

b. A literature review is conducted to establish the theoretical foundations and conceptual framework.

c. Participatory workshops are performed to obtain a full understanding of the nature of agricultural production and marketing activities in research locations.

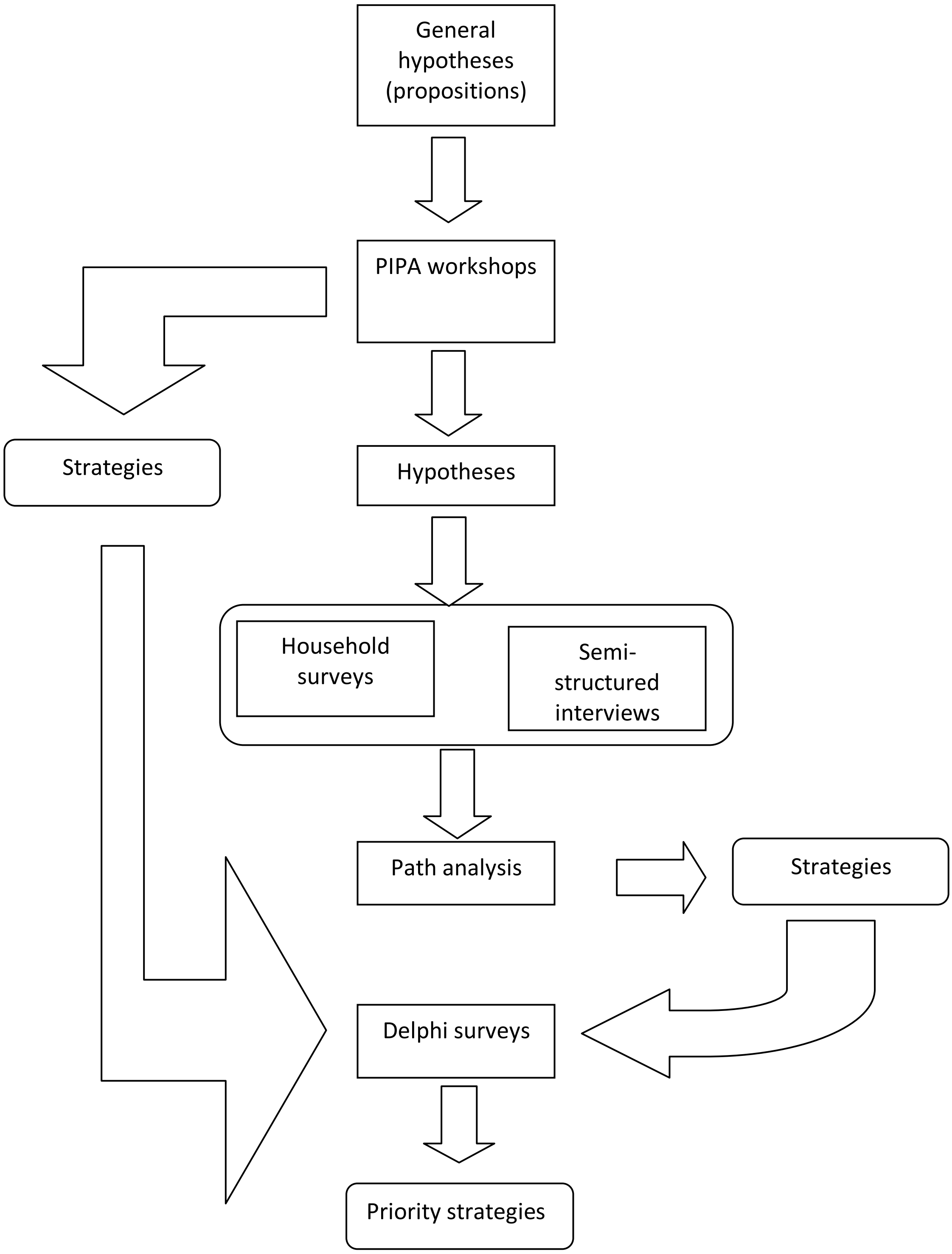
d. Surveys and semi-structured interviews are conducted to follow up the workshop results.

e. Cause-effect relationships among the variables are analysed using path analysis in order to generate some alternative strategies.

f. The Delphi method is applied in order to obtain experts' opinions on the selection of the alternative strategies.

g. PIPA concepts are utilised to construct an IP logic model that shows the impact pathway on increasing the incomes of small cacao producers that may lead to rural poverty alleviation.

Figure 1.1. Analytical Framework



1.5 Organisation of the Thesis

This thesis consists of nine chapters. This introductory chapter is followed by an overview of the cacao industry. The design of the study and a review of the conceptual framework and research methods applied in this study are described in Chapter 3. The description of the PIPA workshop is presented in Chapter 4. Chapter 5 provides a profile of the cacao industry in West Sumatra. Chapter 6 presents the application of path analysis of production constraints in the cacao industry, followed by path analysis of marketing constraints in Chapter 7. A potential strategy to improve cacao industry performance and implications for poverty alleviation are discussed in Chapter 8. A summary of the analyses undertaken and their implications for selecting cacao development strategies are presented in the last chapter.

Chapter 2

An Overview of the Cacao Industry in Indonesia

2.1 Introduction

The importance of the cacao industry to the Indonesian economy has been increasing since the 1980s. Its planted area has increased by seventeen-fold and cacao output has increased by twenty-four-fold in the past three decades. This, in turn, led Indonesia to be one of the main cacao producers in the world. As most Indonesian cacao is exported, an increasing trend in the price of cacao in the world market has increased the contribution made by cacao to export earnings.

In line with the development of the cacao industry in Indonesia, the contribution of this industry to West Sumatra's economy has been increasing. Its share of the total area of estate crops increased by six-fold between 2004 and 2010. Its growth in this province is much higher than in other provinces. As smallholders are the main cacao producers in West Sumatra, the development of this industry could have a positive impact on poverty reduction.

The aim of this chapter is to provide an overview of the cacao industry in Indonesia. The description emphasises the development of this industry in West Sumatra as the designated centre of production of cacao in Western Indonesia. The discussion begins with a description of the socioeconomic indicators of West Sumatra in Section 2.2, followed by an overview of the cacao industry in Section 2.3. This chapter ends with concluding remarks in Section 2.4.

2.2 Socioeconomic Indicators of West Sumatra

West Sumatra Province is located in the middle of Sumatra Island. It occupies an area of 42,297.30 square kilometres that consists of mountainous volcanic highlands formed by the Barisan mountain range that runs from Northwest to Southeast and an offshore island archipelago called Mentawai Islands. The Mentawai Islands municipality has the largest land area, followed by Pesisir Selatan and Pasaman (Figure 2.1). The elevation in the province ranges from 2 metres to 1,470 metres above sea level.

Figure 2.1. Map of West Sumatra

Source:Wikipedia (2012)

West Sumatra consists of twelve municipalities and seven cities. Since the implementation of Autonomy Law no. 22 in 1999, municipalities and cities have had more autonomy and responsibility in managing their own government and development. Based on the Regional Law of West Sumatra no. 10 year 2000, the lowest level of government in West Sumatra was designated *nagari*, replacing *desa* (village). *Nagari* was the traditional government system during the colonial and post-colonial period until 1983. It was based on Minangkabau's (original ethnic population of West Sumatra) law and customs called *adat*. In 1983 it changed to become *desa,* which was a uniform model of the lowest level of government throughout Indonesia in which the former *nagari* were split into several *desa*. In line with an imposed decentralisation system in Indonesia, in 2000 the government of West Sumatra decided to return to the *nagari* system.

The population of West Sumatra in 2010 was 4,845,998. It was not distributed evenly across all regions. The Mentawai Islands municipality had the lowest density, while Bukittinggi had the highest density (Table 2.1). Padang, the capital city of West Sumatra, had the largest population among the regions. Most of the population (73 per cent) live in rural areas in which agriculture is the main form of livelihood.

Table 2.1. Area and Population of West Sumatra in 2010

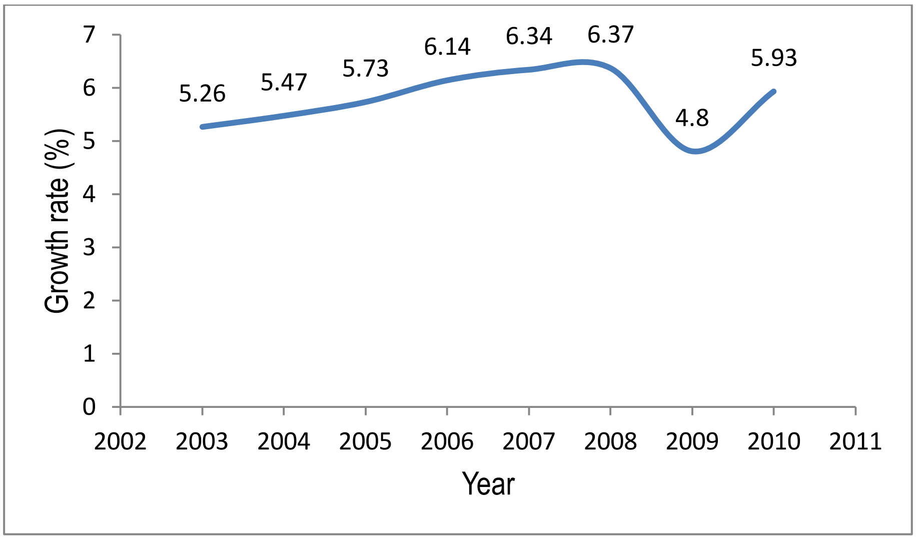
Municipality / City	Area (sq km)	Population
Mentawai Islands	6,011.35	76,421
Pesisir Selatan	5,794.95	429,699
Solok	3,738.00	348,991
Sawahlunto/Sijunjung	3,130.80	201,627
Tanah Datar	1,336.00	338,584
Padang Pariaman	1,328.79	390,204
Agam	2,232.30	455,484
50 Kota	3,354.30	348,249
Pasaman	4,447.63	252,981
Solok Selatan	3,346.20	144,236
Dharmasraya	2,961.13	191,277
Pasaman Barat	3,387.77	364,587
Padang*	694.96	833,584
Solok*	57.64	59,317
Sawahlunto*	273.45	56,812
Padang Panjang*	23.00	47,008
Bukittingi*	25.24	110,954
Payakumbuh*	80.43	116,910
Pariaman*	73.36	79,073
West Sumatra	42,297.30	4,845,998
Municipality / City	Area (sqkm)	Population
Mentawai Islands	6,011.35	76,421
Pesisir Selatan	5,794.95	429,699

*City

Source: BPS-Statistics West Sumatra (2010, 2011b)

In general, the economic growth rate of West Sumatra increased every year in the period from 2003 to 2008, when it reached a peak at 6.37 per cent before declining in 2009 (Figure 2.2). The significant decrease in the economic growth rate in 2009 was caused mainly by the earthquake devastation at the end of September 2009. However, the growth rate increased again to 5.93 per cent in 2010. BPS-Statistics West Sumatra (2011a) reported that the gross regional domestic product (GRDP) of West Sumatra in 2010 was Rp.87.22 trillion at current market prices (at the exchange rate of US$1 = Rp.8,125 on 31 May 2010). This was a slight increase from Rp.76.75 trillion in 2009.

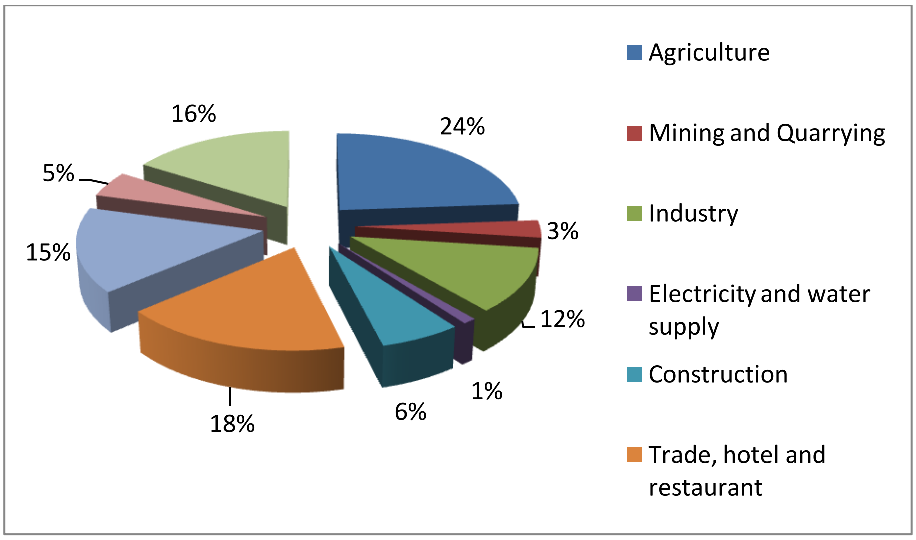
Figure 2.2. Economic Growth Rate of West Sumatra in the Period of 2003–2010



Source: Bank Indonesia Padang (2010); BPS-Statistics West Sumatra (2009, 2011a)

Similar to figures in previous years, West Sumatra's economy in 2010 was dominated by the agriculture sector, which accounted for 24 per cent of GRDP, followed by trade, hotel and restaurant (18 per cent), service (16 per cent) and transport and communication (15 per cent) (Figure 2.3). In line with its contribution to GRDP, the agriculture sector has an important role in terms of labour force absorption. It accounted for 44 per cent of employment in 2010, indicating that agriculture is the primary source of livelihood for the West Sumatran population. The agriculture sector, therefore, should be accorded considerable attention from the government in planning economic development.

Figure 2.3. Percentage of GRDP by Type of Industry in West Sumatra in 2010

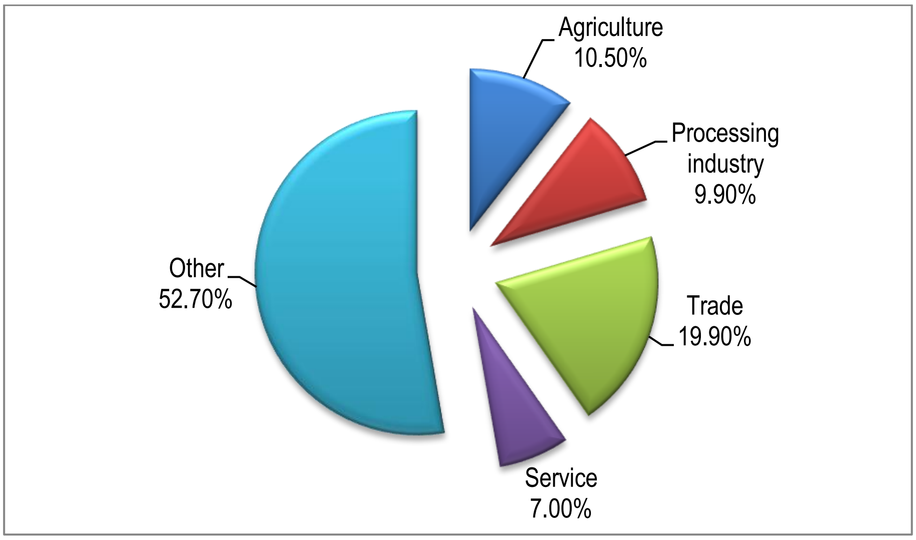


Source: BPS-Statistics West Sumatra (2011a)

Even though the agriculture sector has the largest contribution to West Sumatra's economy, this sector seems to lack support from financial services: credit directed to the agriculture sector was only 10.50 per cent of total credit in 2010 (Figure 2.4). This figure was much lower than that of the trade sector (19.90 per cent). It is common that farmers, particularly small-scale farmers, lack access to credit. BNI (2004) reported that most credit (80 per cent) went to large-scale industries while small- and medium-scale industries used only 15 per cent to 20 per cent of the total credit.

The main factors restricting access to credit of small-scale farmers are an inability to provide collateral and an inability to meet procedural requirements. On the other hand, banks find it difficult to provide credit for small-scale farmers because of high transaction costs and limitation of coverage area. Most banks are located in the capital cities of municipalities. As a result, farmers tend to use other sources of finance, which are more easily accessed, even though the interest rate is higher than that charged by banks.

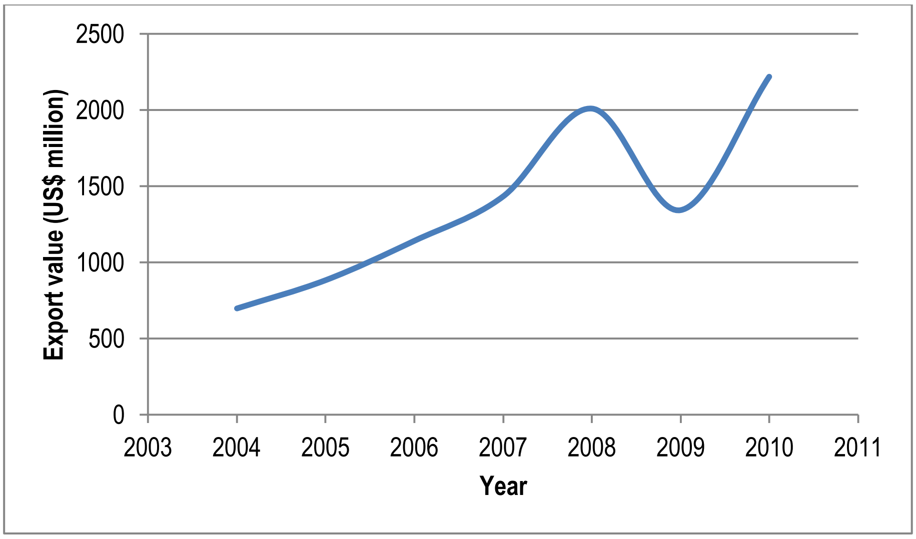
Figure 2.4. Percentage of Credit from Banks by Sector in West Sumatra in 2010



Source: Bank Indonesia Padang (2011)

There was an upward trend in the value of export commodities of West Sumatra in the period 2004–2010 (Figure 2.5). The export value increased from US$699.41 million in 2004 to US$2,219.59 million in 2010 with the average growth rate of 26 per cent per year. Even though the value decreased dramatically in 2009, it went up again in 2010. The cacao industry was ranked third in total export value.

Figure 2.5. The Value of Export Commodities of West Sumatra from 2004 to 2010



Source: Department of Cooperative Industry and Trade of West Sumatra (2011)

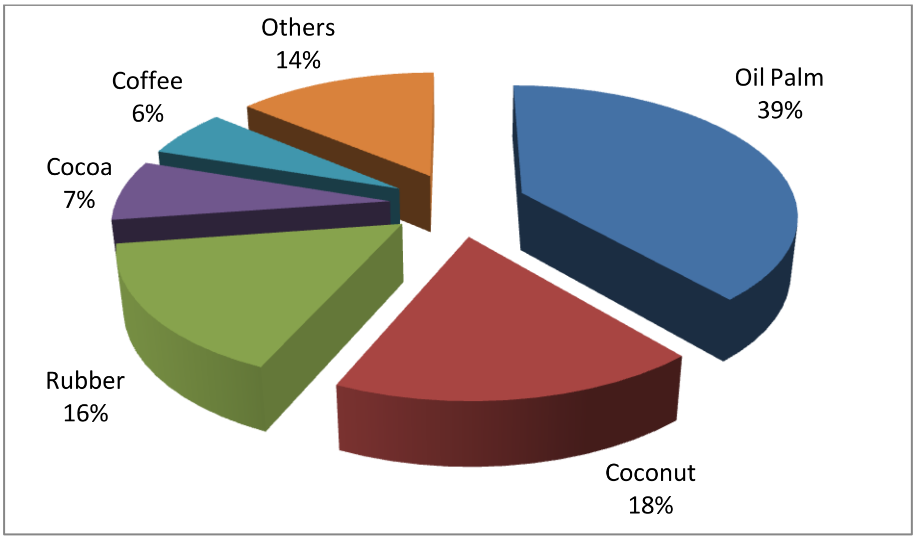
2.3 Trends, Issues, and Challenges in the Cacao Industry

This section provides an overview of cacao production, followed by a discussion about marketing challenges and the government interventions in the development of the cacao industry. Constraints facing Indonesian cacao industry are presented in the last part of this section.

2.3.1 Cacao production

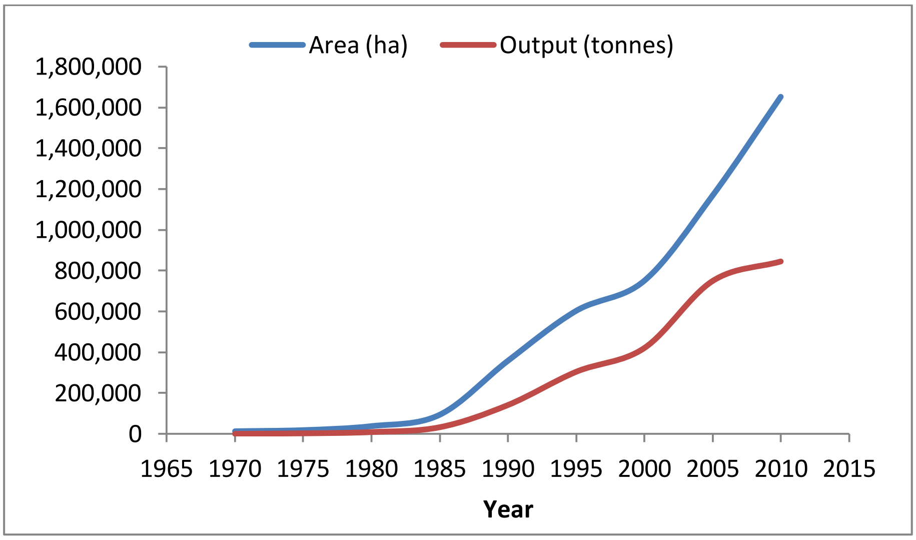
The cacao trees occupied the fourth biggest planted area among estate crops in Indonesia in 2009 (Figure 2.6). Their numbers have developed massively in Indonesia since the 1980s. The area of land under cacao trees increased from 92,797 ha in 1985 to 1,587,136 ha in 2009 (Figure 2.7), largely explaining the twenty-four-fold increase in cacao output during that period. Cacao output was 809,583 tonnes in 2009, of which 535,236 tonnes (66 per cent) were exported (Directorate General of Plantations of Indonesia, 2012b). The significant increase in production has led Indonesia to be the third largest cacao producer in the world since 2002 after Côte d'Ivoire and Ghana. The Indonesian cacao industry contributed about 15 per cent to total world production in 2009/2010.

Figure 2.6. Planted Area of Estate Crops in Indonesia in 2009



Source: Ministry of Agriculture Republic of Indonesia (2010)

Figure 2.7. Land Area and Production of Cacao in Indonesia from 1970 to 2010



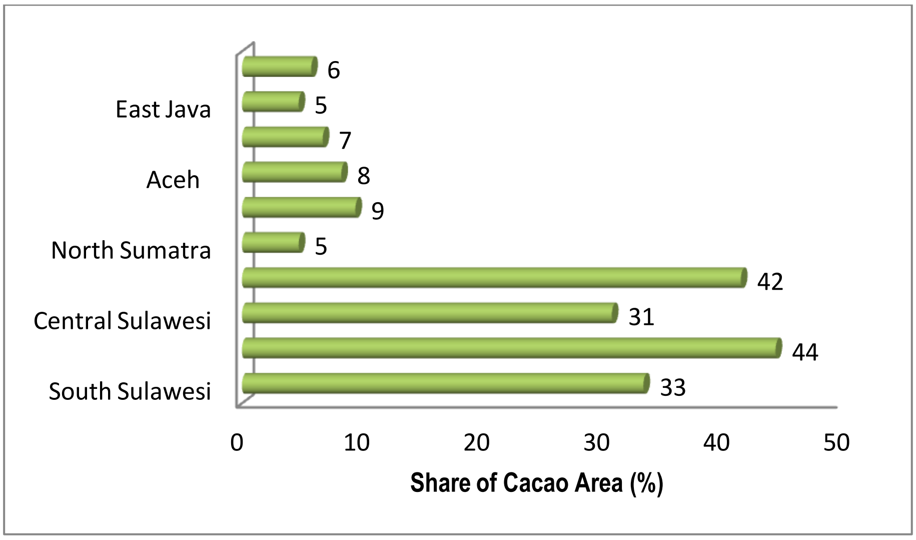
Source: Directorate General of Plantations of Indonesia (2012a)

Planted areas of cacao are spread all over Indonesia; however, most of them are in Eastern Indonesia, mainly in Sulawesi where they are the main estate crop. The share of cacao area among estate crops in the ten biggest cacao areas in Indonesia is illustrated in Figure 2.8. The cacao area in Southeast Sulawesi was the biggest share among estate crops area (44 per cent), followed by West Sulawesi (42 per cent). In Western Indonesia, West Sumatra had the biggest proportion of cacao area to total estate crops area, contributing 9 per cent.

The area of cacao trees has grown in West Sumatra since 1980. The planted area of cacao increased moderately in this province until 2005, when it reached 22,828 ha, but then grew significantly to 85,263 ha in 2010 (Figure 2.9). As a result, the cacao output doubled during this latter period.

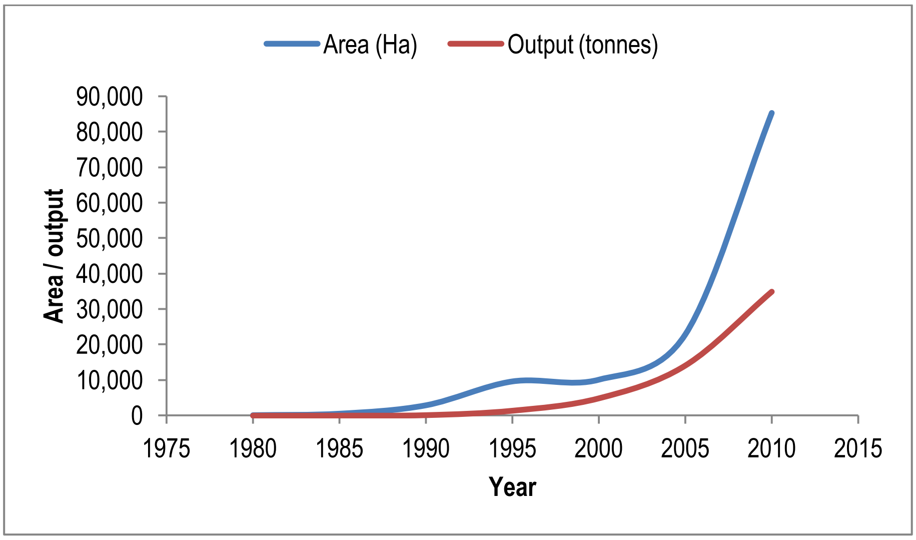
Even though the cacao area in West Sumatra was much less than the four provinces in Sulawesi in the period 2004–2009, it had the highest annual growth rate (57 per cent) among the top ten cacao areas (Figure 2.10). A significant increase in cacao area also occurred in East Java (36 per cent) and Aceh (29 per cent).

Figure 2.8. The Share of Cacao Area to Total Area of Estate Crops in Ten Provinces in 2009



Source: Ministry of Agriculture Republic of Indonesia (2010)

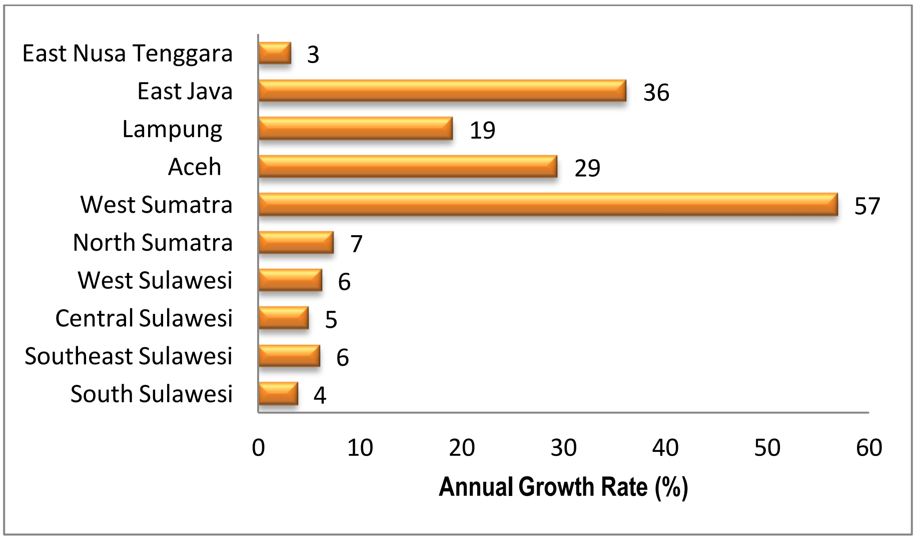
Figure 2.9. Land Area of Cacao Trees and Cacao Output in West Sumatra from 1980 to 2010



Source: Ministry of Agriculture Republic of Indonesia (2010)

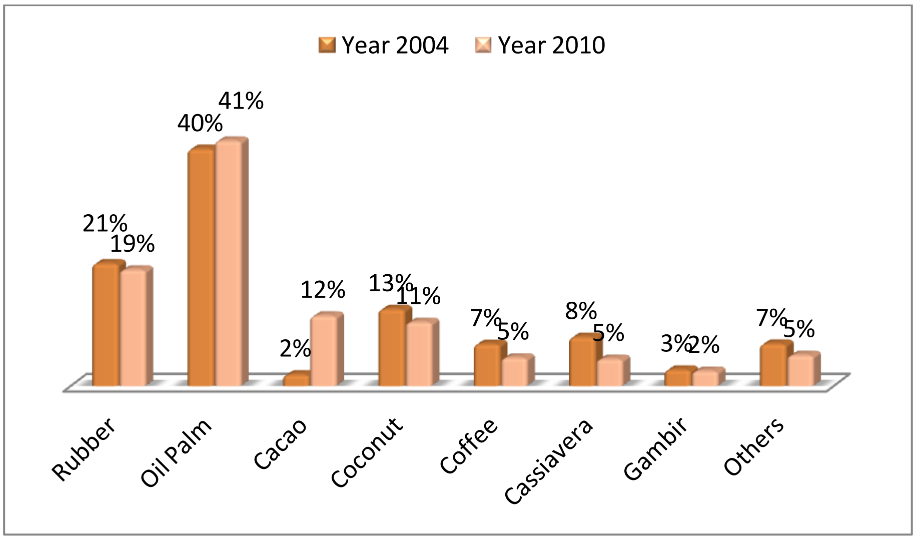
The share of cacao area to estate crops area in West Sumatra increased dramatically from 2 per cent to 12 per cent in the period 2004–2010 (Figure 2.11), while the share of most other estate crops decreased slightly. Oil palm had the highest share among the estate crops; however, its share grew slowly. Cacao area is expected to increase further as a result of the government program to develop cacao-coconut intercropping.

Figure 2.10. Annual Growth Rate of Cacao Area in Ten Provinces from 2004 to 2009



Source: Ministry of Agriculture Republic of Indonesia (2010)

Figure 2.11. Percentage of Estate Crops Area in West Sumatra in 2004 and 2010



Source: Department of Plantation of West Sumatra (2010)

Smallholders are the main cacao producers in West Sumatra. They contributed about 97 per cent of the cacao area in 2009, while about 3 per cent of planted area was owned by private estates. The Department of Plantation of West Sumatra (2010) reported that cacao farming was a source of income of 58,632 smallholders in West Sumatra in 2009.

The main varieties of cacao grown in Indonesia are *Forastero* (bulk cacao) and *Criollo* (fine cacao). *Forastero* is the most widely cultivated cacao variety in West Sumatra. De Almeida and Valle (2007) described the three main cacao varieties of *Criollo*, *Forastero* and

Trinitario as follows. *Criollo* produces thick pods and white or pinkish seeds that generate more flavoured seeds and fine chocolate. It is, however, highly susceptible to diseases. The *Forastero* variety is subdivided into Lower and Upper Amazonian *Forastero*s and produces around 80 per cent of the world output of cacao beans. The Upper Amazonian *Forasteros* are more genetically diversified and frequently used in breeding programs due to their vigour, precocity and disease resistance. The Forastero variety has high yields and resistance to diseases. *Trinitario* is a recent hybrid that originated from crosses between *Criollos* and Lower Amazonian *Forastero* genotypes or intermediate types.

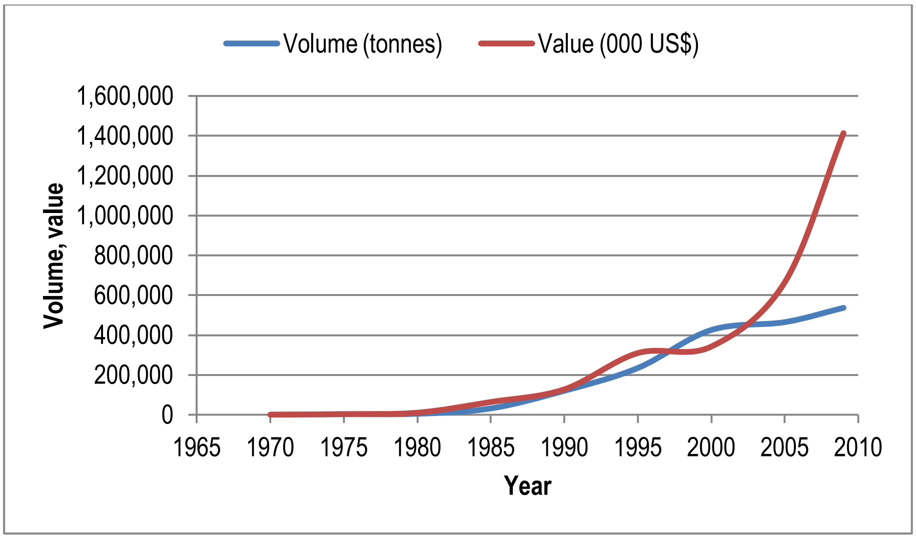
Commonly, cacao trees in West Sumatra are grown intercropped with other crops such as coconut, rubber, banana and durian. Duguma, Gockowski and Bakala (2001) pointed out that the major management requirements of cacao are shade control, weeding, pest and disease control, harvesting of pods and processing of beans. In West Sumatra, cocoa trees are mostly intercropped with coconut palms, which provide shade. According to Duguma et al. (2001), the role of shade in the management of a cacao-based agroforestry system is complex as it affects several other growth factors. It reduces light intensity, temperature, air movement and relative humidity, which all indirectly affect photosynthesis and the incidence of pests and diseases. Several reports suggest that optimal growth and productivity are promoted by a level of shading that allows 20 to 30 per cent of full light to reach the cacao. Depending on the age of the cacao tree, however, there could be a significant variation in the level of shade required. Belsky and Siebert (2003) stated that shade-grown tree crops provide small farmers with a number of advantages over crops grown in full sun. They tend to maintain productivity for longer periods, are less prone to insect and disease losses, and require less capital and fewer labour inputs than full-sun monocultures. Moreover, farms with mixed crops provide other valuable products when market prices of cacao are low. Farmers with shade-grown tree crops are generally less affected by market price fluctuations than those cultivated in full sun.

2.3.2 **Marketing challenges of the Indonesian cacao industry**

The Indonesian cacao industry has a comparative advantage in the world market in terms of ability to supply cacao beans in large quantity (ACDI/VOCA, 2005). There was an upward trend in export volume and values of Indonesian cacao in the period from 1970 to 2009 (Figure 2.12). There was a decrease in value of cacao beans between 1995 and

2000 while the export volume continued to increase. This implies that the price of cacao beans decreased in that period. However, the values went up significantly afterwards, while the export volume increased moderately. The Indonesian cacao industry has an opportunity to achieve a significant increase in values in order to maintain a comparative advantage and remain as the third biggest producer in the world.

Figure 2.12. Cacao Export Volume and Value from 2001 to 2009



Source: Directorate General of Plantations of Indonesia (2012b)

Three important factors providing an export opportunity for the Indonesian cacao industry in the world market are world demand, market share and the price of cacao. The World Cocoa Foundation (WCF, 2007) reported that the consumption growth rate of cacao (2.6 per cent) was higher than the production growth rate (2.3 per cent). World cocoa consumption, as measured by grindings of cocoa beans by the industry, continue to increase in 2012. Moreover, after a decline in cacao price from April to June 2012, the prices bounced back in July 2012 (ICCO, 2012).

Côte d'Ivoire, the largest cocoa producer in the world, experienced its lowest volume of cacao output in 2008/2009 for the past decade and lack of growth in the cacao output (ICCO, 2010). This could lower this country's contribution to the world market. As growth in production of Indonesian cacao is higher than that of world production, it enables Indonesia to capture a bigger share of the world market.

After two years of extensive preparation, the International Cocoa Organization (ICCO) concluded the International Cocoa Agreement on 25 June 2010. According to the ICCO (2011), the new agreement has objectives as follows: (1) strengthening cooperation between exporting and importing member countries and improving the performance of their cocoa economies through better project development and strategies for capacity-building,(2) implementing measures in order to increase the income of cocoa farmers and providing support to improve the functioning of cocoa economies of cocoa producers, (3) delivering better quality cocoa, supporting food safety issues, and encouraging social, economic and environmental sustainability that allow farmers to be rewarded for producing cocoa that meets ethical and environmental considerations.

2.3.3 **Development program of the Indonesian cacao industry**

The Indonesian Government has established short-, medium- and long-term programs in order to develop the cacao Industry. Its goal is to improve cacao productivity and quality, improve cacao pod borer control, increase farmers' incomes, and support cacao agribusiness development through encouraging input supply and improving processing industry capacity (Goenadi, Baon, Herman and Purwoto, 2005).

Djajusman (2007) reported that policy making and strategy selection on sustainability in the cacao industry in Indonesia has been directed towards:

a. Increasing yields through replanting and rehabilitating unproductive plantations, serving farmers with improved seed/clones, providing training and technical assistance for cacao farmers, and implementing good agricultural practice;
b. Quality improvement through developing post-harvest facilities and promoting the application of quality standards;
c. Improving the distribution mechanism through developing farmers' bargaining position to gain remunerative prices for better bean quality;
d. Developing local financial institutions to make loans more affordable to cacao producers;
e. Value-added enhancement through increasing the export of cacao derivatives/finished products, and by increasing and improving the performance of downstream firms.

To support the development of the cacao industry, the Indonesian Government has implemented a medium-term national program, *Gerakan Peningkatan Produksi dan Mutu Kakao Nasional* (the National Movement of Cocoa Production and Quality Improvement) or *Gernas Pro Kakao* for short. This program has been implemented since 2009. This program was initially implemented for three years (2009–2011), but the government decided to continue it until 2014. The program was targeted to cover 450,000 ha of cacao areas by 2011; however, it only achieved 321,040 ha and the remaining areas will be done in 2012–2014 (Agroindonesia, 2012a). The total fund to implement the program from 2009 to 2012 is estimated to be about Rp.3.2 trillion (Agroindonesia, 2012b).

In 2006 the Australian Centre for International Agricultural Research (ACIAR) implemented the Smallholder Agribusiness Development Initiative (SADI) program with the aim to improve rural sector productivity and growth in four Eastern provinces: East Nusa Tenggara, West Nusa Tenggara, South East Sulawesi and South Sulawesi. ACIAR (2008) noted that the SADI program played an important role in contributing to the revival of the cacao industry in Eastern Indonesia by providing expertise and technologies. It gave smallholder farmers more control over the long-term sustainability of their cacao production and restored the economic opportunities that cacao offered poor rural communities. The ACIAR-SADI program was expected to engender a more commercial mindset among smallholder farmers in Eastern Indonesia because it could lift smallholder farming from traditional subsistence levels to a more sustainable and more business-oriented agricultural economy. It was facilitated by a new framework of collaboration recently established among the different research and extension agencies, particularly in the cacao sector. This derived from the formation of the Cacao Sustainability Partnership (CSP), a forum through which the many stakeholders were able to synchronise the messages that were delivered to farmers.

CSP is a forum in which Indonesian cacao stakeholders discuss all aspects of the cacao rehabilitation program, including technical activities, research and farmer/community empowerment (ACIAR, 2008). In the period 2001–2005, many projects were funded by government agencies and private companies that aimed to improve cacao production by resolving pest and disease problems. However, these stakeholders worked independently, resulting in cacao farmers receiving different messages that made them confused about whose advice they should follow (ACIAR, 2008).

Cacao development provides a big chance to increase farmers' incomes and improve the welfare of their families in West Sumatra. This is because cacao could be intercropped on about 100,000 ha of existing coconut planted area. The government provided funds from the annual development budget to encourage cacao development. With coconut-cacao intercropping, farmers could get an additional income of Rp.13.32 million per year (Department of Plantation of West Sumatra, 2006).

Some cacao development programs have been implemented in West Sumatra involving 17 regencies. The programs consist of free seedlings for famers, training to control pests and diseases, and providing equipment for fermentation and processing cacao beans to become cacao paste (Department of Plantation of West Sumatra, 2009).

2.3.4 **Production and marketing constraints in the cacao industry**

Even though there has been an increase in cacao production resulting in Indonesia becoming the third largest producer of cacao in the world, empirical studies have found several problems facing the cacao industry. Low yields, low quality and marketing problems are the main constraints facing the Indonesian cacao industry that may slow increases in the incomes of cacao farmers.

Some empirical studies found that cacao yields in Indonesia could not achieve their potential yields (ACDI/VOCA, 2005; Sahara et al., 2005; Handayane, 2007). Improper use of fertilizer was identified as a cause of low production of cacao, while pests and diseases contributed to the problem of low production and low quality. Based on research by ACDI/VOCA (2005) and Handayane (2007), improper fermentation was identified as another cause of the low quality of cacao.

In terms of marketing conditions, previous studies found that a weak bargaining position, lack of access to financial support and receiving a less remunerative price for fermented cacao bean are problems facing Indonesian cacao farmers (Djajusman, 2007).

Previous studies identified those problems but did not specify cause and effect clearly. Moreover, there are some other possible factors affecting the production of cacao, such as lack of knowledge on agronomic practices and high production costs, which were not assessed in previous studies conducted in West Sumatra. This gap is filled in this study.

2.4 Concluding Remarks

The development of the cacao industry in West Sumatra promises to contribute to the improved economic condition of smallholders. Despite a lot of problems currently facing the industry, it provides a source of income for around 59,000 households in West Sumatra. When production constraints are solved and supply chain performance is improved, the cacao industry could have a great impact on the West Sumatra economy. Moreover, supporting government programs and appropriate market signals on cacao prices in the world market, offer opportunities that should be captured by the cacao industry to improve its performance.

Chapter 3

Methodology

3.1 Introduction

This study applied three types of data gathering methods: workshops, surveys, and semi-structured interviews. The workshops were conducted at the first stage of the study in three municipalities of West Sumatra. The results of the workshops were used as a guide to conduct surveys in the three municipalities. The application of the methods is described in this chapter.

This chapter starts with a description of the study area in Section 3.2, followed by the design of the study in Section 3.3. The literature on the methods of analysis is reviewed in Section 3.4. The concluding remarks are in Section 3.5.

3.2 Study Area

This study was conducted in West Sumatra province for two reasons. First, West Sumatra is designated as the production centre for cacao in Western Indonesia, and the province has experienced a significant increase in cacao areas and production in the past five years. Second, cacao development in this province has been mainly funded by the provincial and regency governments, indicating their strong interest in developing the cacao industry.

The municipalities of Solok, Padang Pariaman and Pasaman were first selected as the research locations. Due to the earthquake devastation in West Sumatra on 30 September 2009, where Padang Pariaman suffered the worst of its impact, 50 Kota was selected to replace Padang Pariaman. The selection of the locations was based on the distance to the export point in order to understand the issues regarding the cacao supply chain. Solok, 50 Kota and Pasaman represent close, middle and far locations to the market, respectively.

3.3 Design of the Study

This section describes how the research was conducted. It begins with a description of the data gathering, followed by a description of the method used in selecting samples. The data collection was conducted from September 2009 to January 2011. The period of analysis of the survey data was from June 2009 to May 2010.

3.3.1 **Data collection**

Workshops performed at the beginning of the study aimed to get a better understanding of the nature of the cacao industry from stakeholders' points of view and to construct a focus in this study. Household surveys and semi-structured interviews were conducted following the workshops in order to get detailed information on problems that were identified in the workshops. All information obtained from the workshops, surveys and semi-structured interviews was combined to develop some alternative strategies for cacao industry development. At the strategy formulation stage, a Delphi method was used to get information from experts in order to design potential strategies and rank the strategies based on their priorities.

Workshop

The PIPA approach was applied in conducting the workshops. This approach was used for two reasons. First, it provides an impact analysis by integrating program theory and network maps, which allows the researcher to investigate the potential contribution of cacao industry development to poverty alleviation, which is not covered by other participatory approaches. Second, it can also be used to establish stakeholders' relationships in cacao industry development. In using PIPA, this study defined goals, objectives, and core problems of the research. Poverty reduction was set as a goal, increasing farmers' income was an objective, and the low income of cacao farmers was a core problem.

The PIPA workshops were conducted in the three selected study areas (Solok, 50 Kota and Pasaman Municipality), which involved farmers, traders, input suppliers, village cooperatives and government officers. A metaplan approach was used to encourage all the participants to be involved. "The Metaplan technique is a tool to make group discussions more effective" (Metaplan GmBh, n.d.,p. 4). The workshop involved seven steps:

a. The participants brainstormed problems facing the cacao industry in West Sumatra. The problems were then grouped into four categories: production, marketing, capital, and institutional issues.

b. The participants voted on the problems and identified the three most important problems in each category of issues.

c. The participants were divided into three groups to discuss the four issues and consisted of a mix of stakeholders. Each group identified cause and effect for the three most important problems. They then arranged the cause and effect of the problems to allow them to construct a problem tree.

d. The solutions for the problem were identified and the priority solutions were selected.

e. The participants identified the requirements (conditions) to make the solutions viable.

f. All the group works were presented in a panel session.

g. The participants identified stakeholders in the cacao industry,and then drew the stakeholders' relationships and defined their roles.

The identified problems and their causes were investigated more in the surveys and semi-structured interviews.

Household surveys

The surveys were conducted in the three municipalities and involved farmers, village buyers and wholesalers. The aim of the surveys was to obtain information on the existing conditions of cacao farm production and the supply chain on an individual basis.

The data collected at farmers' level were:

a. Farmers' profile included age, education, household size, social status, experience on cacao farming, land size and status and total income.

b. Agronomic practices of cacao included planting (cacao varieties, age of trees, type of shade trees), fertilizing, pruning, weeding, pests and diseases control and harvest practices.

c. Post-harvest practices included method, material and equipment used for fermentation and drying.

d. Marketing practices included mode of selling, price of cacao beans and mode of payment, price setting, farmers' and buyers' relationships, and source of price and quality information.

e. Information and technology in cacao farming included source of information on cacao farming, farmers' access to extension services, and training attended by farmers.

f. Information on the financing of cacao farming included the source of financing and access to financial sources.

g. Perceptions about the cacao industry.

Village buyers and wholesalers (later called "marketing intermediaries") were included in the survey in order to understand the issues on cacao marketing along the supply chain. The focus of the investigation at the marketing intermediaries' level was on issues related to cacao farmers' conditions. The data collected on the marketing intermediaries were:

a. The marketing intermediaries' profile included age, education, household size and cacao trade experience.

b. The purchase profile included the status in buying cacao, the total purchase, price setting, buying price, and sources of information on price and quality of cacao beans.

c. The selling profile included the relationship with the main buyer, storage facilities, mode of selling, mode of payment and selling price.

d. Perceptions about the cacao industry.

Semi-structured interviews

Semi-structured interviews were conducted to get a better understanding of the issues in the cacao industry using an interview schedule. The interviews involved the solicitation of information and opinions from key informants who are stakeholders in the cacao industry. The key informants consisted of wholesalers and officers of local governments at the municipality level. The local government officers involved in this study were from the Department of Plantation (*Dinas Perkebunan*) and Department of Industry and Trade (*Dinas Perindustrian dan Perdagangan*).The exporters were initially included as key informants in this study. Attempts were made to obtain information about the marketing practices at the exporter level directly from the exporters; however, the interviews could not be conducted due to time constraints on the exporters. Therefore, information about marketing practices at the exporter level was obtained from the Department of Industry and Trade at the provincial level and wholesalers.

The information collected from the local government officers was about the implementation of the government programs designed to support the development of the cacao industry in the past five years and future programs. The information about the price of cacao beans and the grading system at the exporter level was obtained from wholesalers. The value and the volume of cacao beans exported were sourced from the Department of Industry and Trade.

Delphi survey

A Delphi Survey was another survey conducted in the last stage in this study following the household surveys and semi-structured interviews. The aim of the Delphi Survey was to assess the priority of the strategies based on experts' opinions. There were 12 respondents involved in this survey consisting of eight government officials and four academics.

The Delphi approach involved two rounds. The first-round was a brainstorming stage using a set of questionnaire. At this stage, the panellists were provided with a set of strategies, which were constructed on the basis of the workshops and path analysis results. They were invited to add some more strategies and develop required conditions for each strategy, which they thought, were important in the development of the cacao industry.

The second-round questionnaire was designed by collating the responses from the first-round. At this stage, the panellists were asked to rate the strategies and the required conditions to make the strategies viable. The second-round surveys resulted in some priority strategies for developing the cacao industry based on the experts' opinions.

3.3.2 Respondents and sampling method

A mix of groups of stakeholders participated in the PIPA workshops. They consisted of cacao farmers, village buyers, village cooperatives, input suppliers, government officers at the municipality level, and extension officers. The total number of participants involved in the workshops was 68participants.

Respondents involved in the household survey were cacao farmers, village buyers and wholesalers. At the farmer level, the population was cacao farmers who have harvested their cacao trees since 2009 in West Sumatra. A multistage sampling technique was used in selecting sample farmers. In the first stage, three municipalities, namely Solok, 50 Kota and Pasaman, were selected purposively based on their proximity to the export point. In the second stage, sub-districts with the largest area of cacao were selected from each municipality. Payuang Sakaki sub-district represented Solok, while 50 Kota and Pasaman were represented by Guguak and Bonjol sub-districts, respectively.

The population was first stratified by the location (close, middle and far from the export point). According to Bryman (2001), stratified sampling is a good technique in the case that the population can be easily identified and allocated to strata because it allows researchers to have well distributed samples in terms of the stratifying criterion. The populations in the three sub-districts were 315 farmers in Payuang Sakaki, 537 farmers in Guguak and 3,147 farmers in Bonjol. The respondents were selected in each sub-district using simple random sampling.

The total number of sample farmers involved was 100 cacao farmers.The size of the sample being set to 100 enabled us to use structural equation modelling (SEM). In the SEM literature, it is recognized that the SEM approach requires a large sample size. Ding, Verlicer and Harlow (1995, cited by Schumacker and Lomax, 2004, p. 46) noted that 100 to 150 samples is a satisfactory sample size for using SEM.

Of the 100 samples, 40 farmers were in Pasaman, and 30 farmers were in Solok and 50 Kota, respectively. The sampling ratio in Bonjol, Pasaman was small. This small sample size could represent cacao farmers in this location due to the homogeneity of the population. Most farmers grow cacao trees on hillsides with landholdings ranging from one to two hectares.

The selection of village buyers and wholesalers was based on their engagement with farmers. The number of village buyers operating in the study sites ranged from 10 to 14. This study involved nine village buyers from each sub-district, which is more than 50 per cent of the population. The total number of village buyers involved was 27. All nine wholesalers operating in the three research locations became respondents.

3.3.3 **Research instruments**

Various instruments were used to collect data. They consist of a list of questions in the workshop, three sets of questionnaires in household surveys, interview guides in in-depth interviews, and two sets of questionnaires in the Delphi survey.

A set of questions about constraints in the cacao industry was asked of the workshop participants who were also asked to identify the causes of and potential solutions to the problems. The questions in the workshop are presented in Appendix 3.1.

For the household surveys, sets of questionnaires were designed for farmers, village buyers and wholesalers. The farmers' questionnaire was applied to obtain information on farmers' conditions and activities. The questionnaire is provided in Appendix 3.2.

The village buyers' questionnaire (Appendix 3.3) contains information about marketing practices of village buyers. Information about marketing practices of wholesalers was obtained using the wholesaler's questionnaire (Appendix 3.4). Two sets of interview schedules (Appendix 3.5 and 3.6) were used to obtain information from key informants in semi-structured interviews.

As a Delphi survey was conducted in two rounds, two sets of questionnaires were used. In the first-round survey, the questionnaire was set up to allow the respondents to give their opinion and add alternative answers to the questions being asked and issues being raised. The questionnaire in the first round is presented in Appendix 3.7. In the second round, all the responses from the first round were collated and the respondents were asked to rank the answers. The respondents had a chance to change their answer in the second round. The questionnaire used in the second round is provided in Appendix 3.8.

3.4 Review of Selected Evaluation Methods

As indicated above, three methods of analysis were applied: PIPA approach, path analysis and the Delphi method. The application of the three methods was expected to contribute to the construction of appropriate intervention strategies to develop the cacao industry by involving cacao stakeholders. The literature review on the methods is presented in this section.

3.4.1 **Methods on identifying and prioritizing complex systems in program planning and evaluation**

The methods on identifying and prioritizing complex systems are based on evaluation theories. Christie and Alkin (2003) referred evaluation theories as models which provide guidance for evaluation practice. These theories deal with several aspects including focus and role of the evaluation, the framework for evaluation design and implementation, and the use of evaluation results. Lilja, Kristjanson, and Watts (2010) observed that the understanding of the complexity of poverty, equity, gender and social inclusion has increased recently that lead to high expectations on evaluations approaches that emphasised accountability to the poor and capacity building function. Lilja et.al noted that even though community and beneficiary participation is important in research processes and valuation, it is not sufficient to achieve desired social change and development outcomes. They argued that investments in research planning, implementation, and evaluation are required to deliver knowledge that addresses real needs of farmers and other poor people, facilitates their empowerment, and ultimately contributes towards improved livelihoods. The potential for evaluation utility, according to Rogers, Petrosino, Huebner and Hacsi (2000), can be increased by making explicit the underlying assumption about a program. There are various approaches are used for identifying and prioritizing complex systems in program planning and evaluation. Some of the approaches are discussed below.

In evaluation literature, the concept of program theory plays an important role in many evaluations. It is called in different terms in the literature such as programme logic (Funnell, 1997), theory-based evaluation or theory of change (Weiss, 1995, 1998), theory-driven evaluation (Chen, 1990), and theory-of-action (Parks and Schorr, 1997). While developing the program theory prior to the evaluation is considered most beneficial for predicting relationships, developing program theory at the end of the evaluation help explain observed casual relationships (McLaughlin and Jordan, 2004).

Funnell and Rogers (2011) defined program theory as an explicit theory or model to assess the contribution of an intervention to a chain of intended outcomes that has two components: a theory of change and a theory of action. The theory of change is about the drivers that generates changes. The theory of action explains how interventions work to activate the theory of change.

Chen (1990) referred to program theory as a specification approach to identify actions required to achieve the desired goals and other important impacts anticipated, and the strategies to generate the goals and impacts. Chen and Rossi (1992) stated that this approach is both prescriptive and descriptive in nature. Based on its prescriptive side, it identifies the required actions and their conditions to achieve the desired change. This part of program theory is called normative theory. The other part of program theory relates to the causal process underlying the program, called causative theory. It specifies the desired impacts, how to generate desired impacts, and how to generalize the evaluation results.

Chen (1990) stated that normative theory explains how to set the desired goals or outcomes and how to design and implement the actions. Chen noted that the normative theory can be derived from unexamined premises, assumptions, customary procedures, prior knowledge and theory. He argued that this theory provides a direction for program planning, formulation and implementation. Treatment, implementation environment and outcome are three domains of program theory that are relevant to normative theory.

Causative theory, according to Chen (1990), provides guidance to identify the conditions and their consequences to enable a program works. Chen listed impact, intervening mechanism and generalization as three basic domains of program theory dealing with causative theory. He stated that the causative theory is empirically based approach that signifies the empirical knowledge about the causal relationship between the action and the outcome. It identifies the foundation for causal mechanisms to construct the causal relationship between the treatment variable and outcome variable in a program. More specifically, causative theory covers issues such as: the kind of relationship that exists between the treatment and outcome, intervening factors that could be mediating the effect of the treatment on the outcome variables, and identification of contextual conditions for facilitating or inhibiting the causal relationship.

Chen (1990) argued that normative and causative theory should be used together to assess program effectiveness. He stated that the evaluation of normative theory needs assessment of consequences between the theoretical program structure and implemented program structure, which can be done even in the early stages. By strengthening the program structure and implementation processes, Chen believed that the evaluation of normative theory can provide timely information to help stakeholders diagnose implementation problems. He pointed out that the credibility of the program is enhanced when the treatment of a program is constructed and implemented appropriately. However, the evaluation of normative theory cannot assess program effectiveness. This missing link can be filled by causative theory.

An evaluation of causative theory identifies the impacts generated by the program and explains the process of generating the impacts (Chen, 1990). Chen noted that in evaluation, causative theory is useful to improve future programs. The evaluation can identify the weaknesses of the program causal mechanism and factors affecting program progresses and outcomes, and suggest possible strategies for improving these programs (Chen, 1990).

Program theory has been used over the past two decades by government and non-government organizations for planning, monitoring, and evaluating a program. Funnell and Rogers (2011) noted some benefits of this approach. It can generate a consensus among different groups of stakeholders or identify different views of stakeholders. It can help to improve plans, set realistic objectives and develop performance indicators. It can also be used to evaluate the implementation of a program and suggest an improvement.

Baldwin, Hutchinson, and Magnuson (2004) asserted program theory as way of linking practice and theory. They noticed that this approach links proximal (mediators) and distal program outcomes that explain how program components affect proximal outcomes and subsequently affect distal outcomes. In other words, this approach provides guidance for program application. As program theory emphasise on understanding how a program works and what makes it work, the theory-driven approach has developed to program evaluation (Sidani and Sechrest, 1999). A theory-driven approach to evaluation (TDE) is concerned on the development and empirical testing of conceptual models to understand the processes and mechanisms to achieve the goals of a program (Adedokun, Childress, and Burgess, 2011). The development and articulation of a clear program theory need to be addressed by theory-driven evaluation (Rosas, 2005).

For evaluation purposes, Funnell and Rogers (2011) argued that program theory can provide a guide to assess essential elements (intermediate outcomes) required to make a program work. It shows the causal processes that occur between a program and an intended outcome. Rogers et al. (2000) noted that program theory is similar to a logic model in terms of graphical representation of program functioning as conceptualized by the program stakeholders. Funnell and Rogers (2011) reviewed four ways of presenting program theory, namely, outcomes chain logic models, pipeline logic models, realist matrices and narratives. Outcomes chain logic models illustrate a chain from sequence results to outcomes. Pipeline logic models are a linear presentation of intervention where activities and outputs link inputs at one end to impacts at the other end. The realist matrices present program theory in a table format. A narrative explains the logical argument of a program in the form of a series of propositions about how inputs generate outcomes and how the process works to achieve the intended results. Funnell and Rogers (2011) believed that presenting program theory in the form of diagrams is not sufficient; therefore, a narrative should complement the diagrams for a clear explanation. They noticed that pipeline models have been widely adopted among the four approaches.

Birkmayer and Weiss (2000); Donaldson (2003); Hacsi (2000); and Huebner (2000) noted that the TDE has contributed in improving program conceptualizations, generating value for stakeholders, and improving evaluation design sensitivity. Although large number of publications explaining and promoting the benefits of theory-driven program development and evaluation, studies describing practical examples of how to implement TDE are limited (Donaldson and Gooler, 2002). Adekokun et.al (2011) noticed that most TDE are applied on large-scale experimental/quasi-experimental program evaluation designs, and very limited application on non experimental designs.

The hypothesis generated in program theory can be tested empirically. Chen and Rossi (1992) noted that structural equation modelling (SEM) has been increasingly used to test program theory. They observed that SEM is useful in the development and analysis of program theory for three reasons. First, it enables investigators identify causes and effects variables of in their model explicitly. Describing the relations among the variables in path diagram can simplify and comprehend program theories. Second, SEM can test theories and their complex effects in simple way. The relationships among variables are examined explicitly that can generate a greater precision about the influence of variables, which cannot be done with simple correlation or regression analysis. Third, SEM supports confirmatory analysis and associated practices of hypothesis testing and cross-validation. It provides a wide variety of statistical fit indices to test the overall fit of a particular model with the observed data. Moreover, SEM is easily applied to program theory.

In their study, Adekokun et.al (2011) applied TDE to demonstrate how evaluation practitioners can test logical and sequential relationships among tiers of outcomes of non experimental programs, especially programs with limited datasets. They focused on only mediation analysis using structural equation modelling, specifically path analysis, to examine the short, medium, and long-term relationships among the outcomes of an undergraduate internship program for Indiana.

There are various approaches that are developed based on concepts of program theory. Some approaches emerging in the evaluation literature are concept mapping, logic analysis, outcome mapping, theory-based stakeholder evaluation and participatory impact pathway analysis.

Concept mapping

Rosas (2005) refers to concept mapping as a multistep process that involves group process (brainstorming, sorting, and rating), multivariate statistical analyses (multidimensional scaling [MDS], hierarchical cluster analysis) and group interpretation of the conceptual maps produced. Shern, Trochim and LaComb (1995) identified the usefulness of concept mapping as a technique for explaining program theories and for identifying the key elements of a program and describing their relationships.

There are wide applications of concept mapping in the literature. Yampolskaya, Nesman, Hernandez and Koch (2004) described how this method was used for logic model development and articulation of a theory of change in assessing children's mental health services. Barth (2004) used concept mapping to identify dimensions for rating program quality. The use of this method to explicate underlying program theory in the context of family support programs was illustrated by Rosas (2005).

Rosas (2005) identified three main advantages of concept mapping: (1) it can be used to help improve design sensitivity in theory-driven evaluation; (2) it can improve program conceptualizations by representing complex relationships and provide sufficient analysis; and (3) it is a practical tool in building and maintaining good stakeholder-evaluator relations.

Four limitations of the application of concept mapping identified by Rosas (2005) are: (1) the concept maps themselves do not constitute theory; (2) the specific individuals who participate limit the breadth and depth of the conceptualizations that emerge from the concept-mapping process; (3) the prompt focused on theorizing about outcomes which is not a complete program theory; and (4) concept mapping requires a thorough understanding of multivariate analyses and graphical representation that cannot be accommodated by available software packages.

Logic analysis

Complex interventions are evolving systems that have constraints to make prediction impossible (Callaghan, 2008). An understanding of the program's logic of action is required to avoid complex evaluation design for a complex system (Rey, Brousselle, and

Dedobbeleer, 2011). Rey et.al. asserted that logic analysis offers simplifying evaluation design for a complex system by identifying either the critical conditions for achieving desired outcomes or alternative interventions for that purpose. It is a specific type of program theory evaluation based on scientific knowledge that offers method to evaluate the validity of the intervention's theory and identify alternatives to achieve the desired effects. This method belongs to theory-driven evaluation that can help to identify the important characteristics of the interventions to achieve the effects and critical conditions required to facilitate the implementation and produce the effects (Rey et.al., 2011).

Donaldson (2007) applied the concept of program theory evaluation to identify important components of the program and provide a framework to achieve desired effects. Rey et.al. (2011) observed that impact evaluations have recently applied intervention theory, which is central in prospective impact studies (Kautto and Similä, 2005). Contribution analysis by Mayne (2001; 2008) is one example of intervention theory that verifies the theory of change behind a programme and also takes into consideration other influencing factors.

Rey et.al. (2011) described two types of logic analysis (direct logic analysis and reverse logic analysis). Direct logic analysis assesses the design of the intervention and its appropriateness to achieve the desired effects. It provides an important framework to improve the intervention design and simplifies the complexity of the intervention by identifying the crucial characteristics of the intervention and the critical conditions for achieving the effects. On the other hand, reverse logic analysis entails prioritizing alternatives and identifying the critical conditions to successfully implement the alternatives to produce the intended effects.

Three steps of applying logic analysis are building the logic model of the intervention, developing the conceptual framework, and evaluating the theory of the intervention (Rey et al., 2011). Building the logic model involves selection the issues based on stakeholders' interests, objectives, or implementation difficulties encountered, while developing the conceptual framework is conducted based on existing scientific knowledge.

Evaluation program theory is the last stage of logic analysis. At this stage, the real intervention is compared with the conceptual model that results from consulting experts or from the literature analysis. In direct logic analysis, evaluation program theory is conducted by comparing the model of the intervention to the conceptual model to identify essential characteristics to ensure the intervention successfully follows the causal path toward the intended effects. In reverse logic analysis, evaluation program theory is a confirmation process whether the intervention being evaluated is appropriate (Brousselle and Champagne, 2011; Brousselle et al., 2007). The assessment of appropriateness of intervention in reverse logic analysis could be conducted with stakeholders (Rey et al., 2011). However, there is a constraint in involving stakeholders at this step because reverse logic analysis is mostly a summative exercise.

Rey et al. (2011) suggested that logic analysis should be conducted before launching other evaluation activities. Rey et al. asserted logic analysis as a useful tool for that provides a sound conceptualization and understanding of the intervention to stakeholders and enhances evaluators' knowledge about the strengths and weaknesses of the intervention's theory that enable them to choose the appropriate type of evaluation to conduct. It also provides useful information to improve actors' practices while setting the foundations for a valid and relevant subsequent evaluation project.

Outcome mapping

Earl and Carden (2002) and Buskens and Earl (2008) referred outcome mapping as an integrated planning, monitoring, and evaluation methodology, which has been developed by Canada's International Development Research Centre (IDRC) in collaboration with a number of organisations in Asia, Africa, and Latin America. This method considers the complexity of development processes and focuses explicitly on learning. It offers strategies to improve program's performance by focusing on behavioural change as the central concept of this method. According to Earl and Carden (2002), in outcome mapping the focus is towards achievement of outcomes instead of the achievement of development impacts. Outcome mapping is focus-oriented because (1) it is difficult to assess impact due to the complexity of the development process, (2) focusing assessment on long term development impacts does not necessarily provide the kind of information and feedback that programs require to improve their performance. However, it is emphasised that outcomes can improve the possibility of development impacts.

Earl and Carden (2002: p.519) listed three principles being the basis of outcome mapping: " planning for and assessing both external results and internal performance; the cyclical nature of planning, monitoring, and evaluation; and systematised self-assessment as a consciousness-raising, consensus-building, and empowerment tool for those working directly in a programme".

There are three stages in outcome mapping, namely intentional design, outcome and performance monitoring, and evaluation. According to Earl, Carden and Smutylo (2001), intentional design helps a program establish consensus on the macro level changes. It helps to create vision, define the program's boundary partners; define the changes need to achieved; and how the program will contribute to the change process. Outcome and performance monitoring provides a guidance for the ongoing monitoring of the progress of program's actions and the boundary partners in achieving outcomes. Evaluation planning facilitates the program identify evaluation priorities and develop an evaluation plan.

A facilitated workshop is conducted at the beginning of outcome mapping process to design a programme and monitoring system (Earl and Carden, 2002). It is followed by a series of self-assessment workshops to monitor change and refine strategies; with periodic evaluation studies are conducted. Earl and Carden stated that by involving self-assessment and reflection processes throughout the planning, monitoring, and evaluation stages, the outcome mapping approach promotes the development of programme learning. Moreover, a program should position itself as part of the change process, which enable it to explore its potential as change agent, and embrace complex reasoning and multiple logic systems (Earl and Carden, 2002).

Earl, Carden and Smutylo (2001) stated that for the outcomes of the program to be relevant and lead to long term, large scale, and sustainable benefits (to create impact), local ownership needs to become effective and dominant. They illustrated that in achieving impact the influence of external agencies is decreasing from inputs towards impact stage, while the influence of endogenous actors is increasing.

Outcome mapping can also be used as a project management or strategic planning tool (Buskens and Earl, 2008). Buekens and Earl described how outcome mapping can work together with emancipatory action research and enhance the effectiveness and quality of this form of action research. They noted the consistency of the outcome mapping with action research in terms of paradigmatic thinking, process management, and capacity level.

Nyangaga et al. (2012) applied outcome mapping to promote and then monitor changes in farmer management of health risks. They found that the application of outcome mapping helped the project and beneficiaries to identify important indicators of project impact. Outcome mapping accommodated the project to include communities in the research; and to identify and plan positive changes in behaviour. Findings revealed that contact farmers became aware of health risks of urban farming and also practiced behaviours to reduce health risks.

Nyangaga, Smutylo, Romney, and Kristjanson (2010) assessed the use of outcome mapping in five study-case projects. They found the useful of outcome mapping to identify and describe the strategies and actions that played important roles in the innovations achieved. They noted some successful strategies consisting of "the use of champions, jointly producing high-profile outputs that enhanced the status of local partners, multiple communication strategies, targeting ongoing policy processes, and strong emphases on and investment in capacity building" (Nyangaga et al., 2010: p.972).

As outcome mapping workshops should be conducted in participative way, which are often influenced by hierarchy and politics, a programme should carefully consider "who should participate and ensure that participants feel comfortable sharing their experiences (positive and negative), engaging in self-assessment, and brainstorming on how to move forward" (Earl and Carden, 2002: p.523). Earl and Carden (2002) suggested that a programme team need to be aware of equitable collaboration and acknowledging the complexity of existing relationships to promote the optimum space for critical assessment and learning. They asserted that outcome mapping does not work well for monitoring and evaluation if incentives and rewards are directed towards reporting for the purposes of accountability.

Theory-based stakeholder evaluation (TSE)

TSE is a new approach to program theory evaluation introduced by Hansen and Vedung (2010). This concept is different from other theory-based evaluation approaches in terms of combining program theory and stakeholder theory. While other theories consolidate the program perceptions of the various stakeholder groups into one unitary program theory, TSE keeps the program theories of the diverse stakeholder groups apart from each other. TSE is similar to the application of program theory by Vaessen (2006) and Friedman (2001).

To guide the systematic reconstruction and comparison of intervention theories, Hansen and Vedung (2010) recommended to use three specific analytical tools, namely principle of reason, tripartite scheme of analysis (consisting of situation theories, causal theories, and normative theories), and extended system model. They also inserted relevant actors into the reconstructed program theories.

Five steps in applying TSE (Hansen and Vedung, 2010): (1) drawing the intervention theory set in the program; (2) using the intervention theory to guide search and elaboration of an inclusive gross stakeholder list, relevant theories and findings from previous research; (3) selecting primary stakeholders, theories and previous empirical research to be included in the analysis; (4) eliciting and framing the intervention theory of primary stakeholders and of theories and findings from previous research; (5) comparing selected intervention theories of stakeholders and theories from research.

TSE method contributes to the development of program theory in terms of maintaining the different theories of diverse stakeholders. This tool helps the application of program theory in substantive and multilevel complexities and political conflicts inherent in the intervention system. The application of TSE model offers three potential advantages (Hansen and Vedung, 2010). First, when the various stakeholder intervention theories are finely traced, TSE can help decision makers to make the evaluation to follow the movement of each link in these chains of assumptions. Second, it enables stakeholders to improve their knowledge, inspiration, and understanding of each others' views and roles on the intervention system. Third, keeping the various stakeholder intervention theories on the intervention system can enhance democracy. This makes theory-based evaluation applicable in political context.

However, the application of TSE leads to the task of the evaluator to be more complex and demand more resource. The most significant lines of conflict associated with a specific intervention are difficult to determine (Hansen and Vedung, 2010).

Participatory impact pathway analysis (PIPA)

The PIPA method is a qualitative approach that was developed in a research development program named "The Challenge Program on Water and Food (CPWF)". Douthwaite et al. (2007a) stated that the CPWF program is designed to have a development impact on food security, poverty alleviation, improved health and environmental security. It was assessed in terms of its achievement to deliver development outcomes following its project's output. For this reason, a suitable method is required to meet this challenge, which is offered by PIPA.

The PIPA method provides a description of project strategies to bring about change that enhances existing project management tools such as logical framework (Douthwaite et al., 2009). This method was developed based on concepts related to program theory, which has been recognized by a particular branch of evaluation called "program theory evaluation" (Douthwaite, Kuby, Fliert and Schulz, 2003). The term of "program theory" is used interchangeably with "theories of action" and "impact pathways". Douthwaite et al. (2003) noted that the term, impact pathways, is more widely understood in agricultural research; therefore, it is used in the PIPA framework.

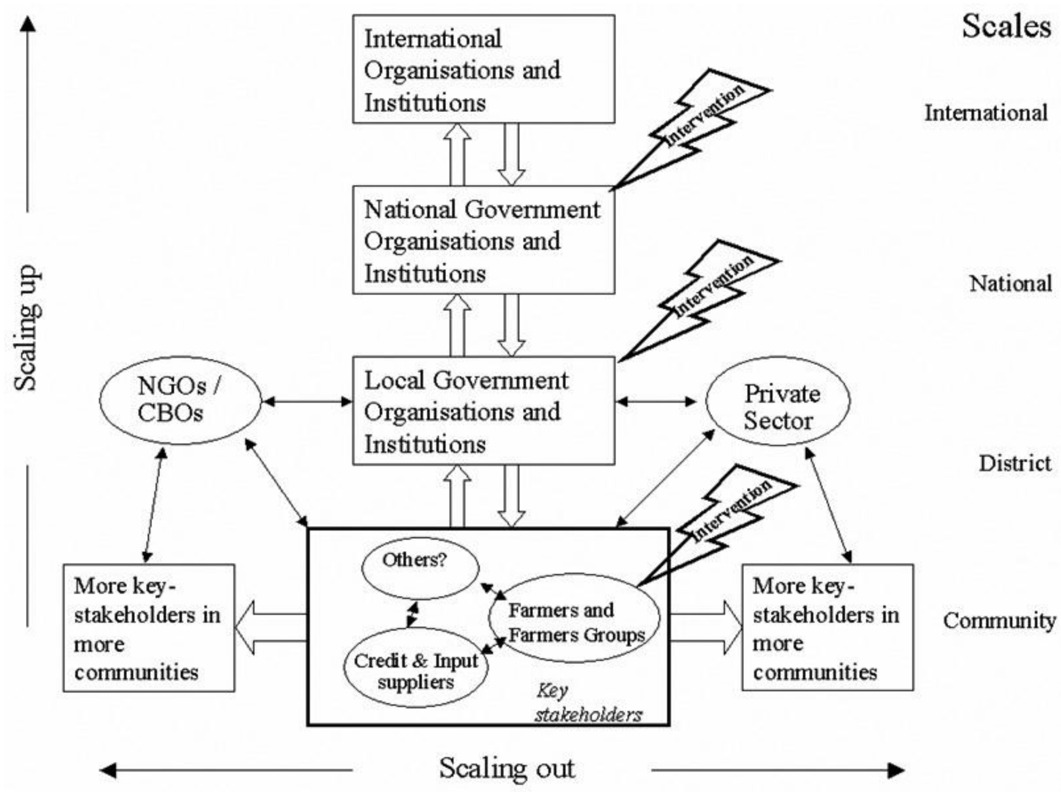
Douthwaite et al. (2007a) observed that program theory has been already used for research in a development context under the name of impact pathways (IP). They noted a number of benefits of this approach in research for development projects. Project staff will be able to articulate their implicit theories that can generate scientific theory. Subsequent monitoring and evaluation could become a tool in a research exercise that would generate a new knowledge because (a) it tests stakeholder-implicit theory that could create new scientific theory, and (b) it proves the validity of scientific theory in different setting. The project impact could be achieved because the involvement of causative theory in monitoring and evaluation encourages learning and change, and adaptive project management. The information results from monitoring and evaluation can be used to improve the causative theory and to link research outputs relates to developmental outcomes and impacts. This leads to the improvement of qualitative *ex-ante* and *ex-post* impact assessment.

Program theory evaluation has been applied to projects undertaken in research centres of the Consultative Group on International Agricultural Research (CGIAR). One program evaluation method used by the CGIAR is impact pathway evaluation (IPE). This approach was inspired by an evaluation model developed by GTZ (*Deutsche Gesellschaft für Technische Zusammenarbeit*) (GmbH) (Douthwaite et al., 2003). This approach was applied to assess the implementation of two programs: integrated *striga* control in Nigeria and integrated crop management for sweet potato in Indonesia (Douthwaite, Schulz, Olanrewaju and Ellis-Jones, 2007b).

Two types of adoption recognized in the IPE approach are scaling-out and scaling-up. Douthwaite et al. (2003) defined scaling-out as the horizontal spread of project outputs from farmer to farmer, community to community, within the same stakeholder groups. Scaling-up refers to a vertical institutional expansion, based largely on a desire or need to change the rules of the game. The development of scaling-up can be influenced by first-hand experience, word-of-mouth and positive feedback, from adopters, policy makers, donors, development institutions and the other stakeholders who share the same interest (Douthwaite et al. 2007a). The scaling-out and scaling-up process is presented in Figure 3.1.

The PIPA method is also developed based on the scaling-out and scaling-up concepts. This approach describes project impact pathways in terms of an IP logic model and network maps (Douthwaite et al., 2007a). Douthwaite et al. described the IP logic model as a flowchart that shows relationships between outputs and eventual developmental impacts. It starts with identifying a problem tree, which can be done in a workshop. “A problem tree is a visual problem-analysis tool used to identify problem situations and their key causes, starting with the root cause” (Douthwaite et al., 2007a, p.143). Douthwaite et al. noted that the problem tree is an excellent tool for clarifying, building and communicating the logical of a project.

Figure 3.1. The Concepts of Scaling-out and Scaling-up



Source: Adapted from Douthwaite et al. (2003, p. 247)

A network map provides additional information to construct the causative theory (Douthwaite et al., 2007a). PIPA uses network mapping to explore the relationship among stakeholders; and how the project contributes to change the existing network. Network maps are drawn for the current condition (at the beginning of the project) and for the future. The “future” network can help the project to achieve its eventual impact. The network maps complement the logical framework by providing additional information about the key stakeholders in order to achieve developmental impact (Douthwaite et al., 2007a).

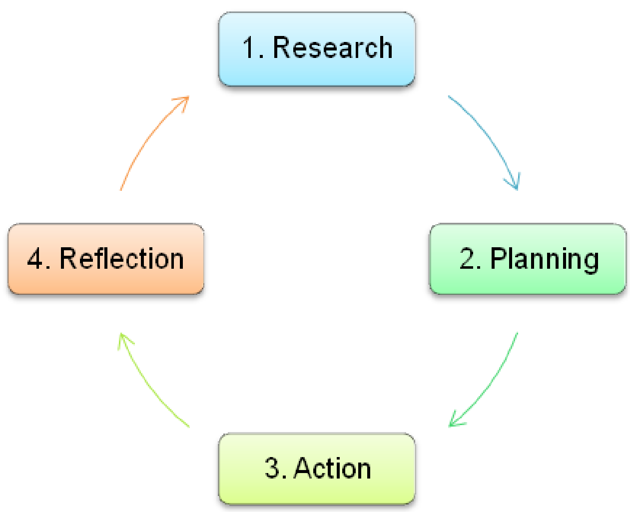
Logical framework and network maps are then integrated to develop an outcomes logic model. The outcomes logic model describes the project's medium-term objectives in the form of hypotheses (Douthwaite, Alvarez, Thiele and Mackay, 2008). It identifies the changes, stakeholders who need to change their knowledge, attitude and skills, and the required strategies to achieve these changes. The hypotheses in the outcomes logic model is the foundation for monitoring and evaluation (Douthwaite et al., 2008).The hypotheses measure relationships between key assumptions and the achievement of changes. The project strategies will deliver the desired changes if key assumptions in the hypothesis are met. To this happen, the prediction in the outcomes logic model *should* be SMART (specific, measurable, attributable, realistic and time-bound) (Douthwaite et al., 2008). In applying PIPA for *ex-ante* impact assessment, the workshop outputs should be the guidance to construct the underlying cause-effect sequence of outputs, adoption, outcomes and long-term impact in impact logic model (Douthwaite et al., 2008).

Douthwaite et al. (2007a) stated that the relationship between the outcomes in the IP logic model with the network maps is described by an impact narrative that accompanies a logical framework. Impact narrative is similar to performance stories, even though "impact narratives explain what is expected to happen while performance stories recount what has happened" (Douthwaite et al. 2007a, p. 139). Douthwaite et al. argued that the whole process of PIPA can improve program's theory to achieve impacts by making explicit project members' theories-in-use, that shows the relationship between program theory and theories of action. They suggested that the network maps and the outcomes should be utilized to integrate the IP logic model and network maps in the impact narratives. They observed that a negotiated process for developing IP model is an effective process to ensure that stakeholders' views are presented in driving the IP model, even though it is time-consuming and can be expensive. According to Douthwaite et al. (2007a), further quantification of likely impacts in PIPA is generated from extrapolation domain analysis and scenario analysis.

Douthwaite et al. (2007a) pointed out three contributions made by PIPA to research-for-development projects. First, with respect to evaluation and impact assessment, it contributes in terms of the explicit use of concepts from program theory and organizational learning to clarify and describe projects' impact pathways. A number of hypotheses and assumptions about how research will deliver the desired changes are the foundation in constructing impact pathways. The hypotheses and assumptions can be developed based on stakeholder-implicit theory or scientific theory that allows the research process to produce new knowledge and insights. Second, PIPA is a pioneer approach, which integrates concepts of program theory with extrapolation domain analysis and scenario analysis to produce a qualitative and quantitative *ex-ante* impact assessment approach. Third, it makes use of the networks concept. Network maps bring values that work to deliver impacts because they illustrate the multiple relations among stakeholders and the multiple ways of interaction, development and diffusion of ideas and technologies.

In the PIPA process, monitoring and evaluation of the project progress should be done by conducting reflection workshops, which implicate "the culmination of one set of experiential learning cycles" (Alvarez et.al., 2010:p. 953). In this way, PIPA monitoring and evaluation can contribute to action research (Douthwaite et al., 2008). Action research is a type of participatory action research (PAR). Kemmis and McTaggart (2003) stated that there are several approaches related to (PAR) such as participatory research, critical action research, classroom action research, and action learning. Weiner (2004) noted that critical action research (CAR) is a form of action research, which has a strong emphasis on participation, democracy, and social critique. It is an approach to empower people by involving them in a development process. Spriggs et al. (2004) described this method as a cycle of research, planning, action and reflection.

Figure 3.2. Critical Action Research Cycle



Source: Spriggs et al. (2004, p.3)

As the application of the CAR approach requires a long time that beyond the period of this study, only two stages (research and planning) of the PIPA process were used due to resource constraints and time limitation. The two stages performed ex-ante impact assessment in designing the strategy to develop the cacao industry. The implementation of the strategy and the reflection of the project as a feedback loop are left with stakeholders. These steps can be done for further research. The application of PIPA in this study and how it is different from the general PIPA process is described in Table 3.1.

Table 3.1. PIPA Process for the Cacao Industry

General PIPA process	**PIPA process for the cacao industry**
In the workshop	
Draw a problem tree. Draw an objective tree (optional).	Draw a problem tree.
Derive project output. Project output is something that a project produces that is used by others to address their problem.	Derive project output. Project output refers to strategy to solve the problems in the cacao industry.
Create a vision. Vision is outcomes and impacts of the project.	Create a vision. Outcomes and impacts (vision) were set by the researcher in advance. Thus visioning is not done during the workshop. Outcome is to increase the income of cacao farmers. Impact is to reduce poverty.
Draw a current and future network map. Network maps show key relationships between stakeholders. The network maps are drawn during the workshop by using cards in two steps: • Identify the stakeholders. • Draw relationships.	Draw a current and future network map. The researcher prepared the list of key stakeholders on flip chart paper before the workshop. During the workshop, the following steps were done: • Confirm the stakeholders. • Draw the relationships. • Confirm stakeholders' roles.
Develop an outcomes logic model. The outcomes logic model is developed by distilling and integrating the information from the problem trees, vision, identification of outputs and network maps. The outcomes logic model contains information about actors' need forchange in their practice, knowledge, attitude and skills to achieve the vision. It also describes the project strategies to achieve these changes. The outcomes logic model is the foundation for monitoring and evaluation. This activity is done during the workshop.	Develop an outcomes logic model. At this stage application of PIPA is modified in order to be applicable for this study. Actors in PIPA refer to stakeholders in the cacao industry, while project strategies refer to solutions for the problems raised during the workshop. The outcome logic model is developed by the researcher after the workshop.

Table 3.1. Continued

After the workshop	
General PIPA process	**PIPA process for the cacao industry**
Develop a monitoring and evaluation plan Monitoring and evaluation plan are developed after the workshop with three procedures: 1. Identify outcome targets, which are the main changes in KAS and practice that the project will work to achieve. 2. Identify milestones to achieve outcome targets. 3. Design periodic reflection workshops to evaluate project progress and make course correction.	Develop a monitoring and evaluation plan This study only follows the first procedure while procedures 2 and 3 will be developed by the project implementer, for example the government. The first procedure involves prioritization by using a scoring method. At this stage, an outcome logic model is developed by collating information from the workshop, household surveys, semi-structured interviews and Delphi surveys. The best set of strategies is selected to develop the cacao industry in West Sumatra.
Construct an impact pathway logic model as a form of ex-ante impact assessment.	Construct an impact pathway logic model as a form of ex-ante impact assessment for cacao industry development.

In essence, the core workings of PIPA approach integrate the principles behind evaluation theories, especially the logic analysis. It uses the stakeholder's implicit theory to construct hypothesis, which is the foundation of impact pathway. The construction of impact pathway allows us to simplify a complex system. Moreover, it enhances program theory by involving network mapping concept to guide how the relationship to be built in order to achieve the impact. Thus, PIPA provides a good and justifiable framework for this study.

The approaches for identifying and prioritizing complex systems in program planning and evaluation reviewed above are those under qualitative methods. Quantitative approaches have also made contribution in literature on project planning and evaluation. Some of the approaches are benefit cost analysis described by (Boadway, 2006), scoring model (see: Ndjeunga and Bantilan, 2009), and resource allocation tool (Dixon and Rovere, 2009).

3.4.2 **Path analysis**

Path analysis is a special case of an SEM, which was developed by Sewall Wright in the 1920s. It is a structural model that represents hypotheses about effect priority by involving observed variables (Kline, 2011; Wolfle, 1980), which is constructed based on the algebraic manipulation of standardized unidirectional path coefficients in systems of variables (Wright, 1965). This method is a method to decompose the correlations among variables (Kingsolver and Schemske, 1991). Kingsolver and Schemske stated that path analysis works based on a priori knowledge that is constructed in the form of a diagram with assumption of linear relationship among variables.

This method uses correlation coefficients and regression analysis to model more complex relationships among observed variables (Schumacker and Lomax, 2004). Duncan (1966) stated that the use of path analysis improves the rationale of conventional regression calculations. It is a useful tool in sociological problems involving the decomposition of a dependent variable. This modelling approach is also known as causal modelling, which is often drawn in the form of path diagrams with the advantage of a visual presentation of a complex argument (Biddle and Marlin, 1987; Li, 1975). Mitchell, (1992) noted that path analysis is a powerful tool to analyse observational data sets in ecology and evaluation.

Casual models inspired the development of SEM (Biddle and Marlin, 1987) through its integration with a confirmatory factor model (Schumacker and Lomax, 2004). Grace (2006, p. 10) defined SEM as “the use of two or more structural equations to model multivariate relationships”. Poon (2007) suggested SEM as an approach that can be used to verify substantive theories that is also applicable to estimate a model that involves various types of data. Many analysts have referred to SEM as a mathematical tool for drawing causal conclusions from a combination of observational data and theoretical assumptions (Pearl, 2011). Barrett (2007) referred to SEM as a modelling tool that fits models to data. Model testing is an important requirement to determine the fit of a model to data when using SEM.

Schumacker and Lomax (2004) pointed out some advantages of SEM. This method can be used to test complex phenomena. Greater recognition is given to the validity and reliability of observed scores from measurement instruments. It treats the measurement error and statistical analysis of data separately. It is also able to analyse multi-group and multi-level variables. Moreover, users can apply the method easily because most SEM software programs are based on Microsoft Windows.

Sobel (2008) argued that structural parameters should not be interpreted as effect. His argument was supported by Biddle and Marlin (1987) and Shipley (1999, p. 382). Biddle and Marlin stated that the SEM technique only provides associational or temporal relations among variables. They asserted that it cannot provide sufficient evidence to show causal relations, whereas some users presume this model to be able to prove such evidence. Therefore, the users of SEM sometimes misinterpret the findings. Shipley argued that "correlation does not imply causation but causation does imply correlation". This is the reason why some analysts, as listed by Pearl (2011), try to avoid the term, causality, by referring to covariance structure, regression analysis or simultaneous equations. However, Pearl (2011) noted that causal effect can be estimated from data without bias when all causal factors are estimable. Grace (2006) also noted some arguments against the causal interpretation of SEM but argued that it can support the argument for causal interpretation as it is built on the complete body of available knowledge. Biddle and Marlin (1987) provided several criteria to judge the success of SEM to confirm a causal model. They consist of the amount of variance explained in intervening and dependent variables, the significance of path coefficients in a path diagram, the relative sizes of regression coefficients, capturing of paths by intervening variables, the significance of measures of fit, the significance of covariance among disturbances, model comparisons and sample comparisons. Kelloway (1995) suggested that SEM can provide a causal inference if the temporal ordering of variables is demonstrated and all relevant causes have been incorporated. The application of statistical relationships to causal interpretation has frequented the social sciences literature since the 1960s and the ecological literature since the 1970s.

There are several sociological applications of SEM. Pajares and Miller (1994) used path analysis to test the predictive and meditational role of self-efficacy beliefs in mathematical problem solving. They stated that path analysis is appropriate in an investigation when social cognitive theory and previous findings have strong theoretical and empirical support for the hypothesized relationships.

Cziráky et al. (2005) combined the application of an SEM approach with cluster analysis in their study on regional development assessment. They found that combining formal structural equation methods and non-parametric classification methods, such as cluster analysis, enriches the methodological approach to classify the development of territorial units. However, they agreed that the use of SEM alone is still applicable for assessing regional development.

Hunn and Heath (2011) used path analysis to assess causal relationship between life circumstances and depression, and their sequent effect on employment and welfare use. They found that economic hardships and adverse life events have direct effects on depression. The depression reduces earnings and increases welfare use. Economic hardships and adverse life events reinforce the effect of depression, as mediator variable, on employment and welfare use. Another application of path analysis was used in the work of Lee, Weaver, and Hrostowski (2011) to test a conceptual model of the effect of work environment and psychological empowerment on worker outcomes in public child welfare. The application of path analysis has extended to deal with poverty issues. Arsyad and Kawamura (2009) used this method to assess their poverty causal model of cocoa smallholders in Indonesia. Said and Sallatu (2004) used it to examine structural causal model for poverty incidence.

SEM was used by Christensen et al. (1999) to assess the effects of age on anxiety and depression, and to examine whether age has direct effects on self-reporting of individual symptoms. They used two instruments (Goldberg scale and DSSI scale) to measure both depression and anxiety symptoms in order to capture the robustness of any age differences.

The SEM approach has also been applied in other disciplines such as environmental study (Leduc, Drapeau, Bergeron and Legendre, 1992), tourism (Gursoy, Jurowski and Uysal, 2002) and agriculture research (Asghari-Zakaria, Fathi, and Hasan-Panah, 2007; Dalkani, Darvishzadeh and Hassani, 2011; Das, Misra, Mahapatra, Gantayat and Pattnaik, 2010; Iriondo, Albert and Escudero, 2003).

3.4.3 **Delphi method**

The Delphi method is an approach to generate an effective group communication process in dealing with a complex problem (Linstone and Turoff, 2002). It was developed in 1951 at the Rand Corporation for the US Air Force. It is a decision analysis technique by involving experts' judgments. It structures a group communication process to deal with a complex problem that has been widely used for a forecasting procedure.

Bakus, Stillwell, Latter and Wallerstein (1982) noticed that the Delphi method is one of the most popular techniques of behavioural interaction in decision making to avoid dominant individuals, redundant material and group pressure. They realised that judgments and decisions made by groups provide more correct values or results than those made by individuals. The Delphi technique has been used to enhance effective decision-making in health and social care (Hasson, Keeney and McKenna, 2000). It is a group facilitation technique, which is an iterative multistage process, designed to transform opinion into group consensus. This method can be used to make effective decisions in situations where the availability information is insufficient (Hasson et al., 2000).

Linstone and Turoff (2002) classified the Delphi process into two methods of data gathering: conventional Delphi and real-lucre Delphi. The former approach is the paper-and-pencil version, which is commonly used. In this method, a questionnaire is designed and sent to a larger respondent group in the initial round. The responses of the initial round are summarised and used to construct a new questionnaire. The latter approach, sometimes called a Delphi conference, uses a computer program to collect the responses. This approach is faster due to saving time in summarising the results. However, characteristics of the communication have to be well defined before conducting the survey whereas, in a paper-and-pencil Delphi, it can be adjusted as a function of the group responses.

Blind, Cuhls and Grupp (2001) noted that the Delphi approach consisting of a survey conducted in two or more rounds provides the participants from the second round on with the results of the first or previous ones so that they can alter their original assessments. The survey is done anonymously using a questionnaire. Blind, Cuhls and Grupp (2001) felt that this method could make better use of group interaction mediated by a set of questionnaire. They stated that the Delphi method is especially useful for long-range forecasting (20–30 years), as expert opinions are the only source of information available.

The Delphi approach usually involves four phases (Linstone and Turoff, 2002). The first phase is to explore the subject under discussion, wherein each individual has a chance to give additional information that he or she thinks is important to the issue. The second phase is the process of reaching an understanding of how the group views the issue. If there is significant disagreement, it is then explored in the third phase to design the final evaluation. The final phase is conducted after all information are analysed.

Bakus et al. (1982) noted that the Delphi method is combined with many sophisticated decision analysis techniques included the use of probabilities and cross-impact analysis. Data analysis can involve both qualitative and quantitative methods (Hsu and Sandford, 2007). The qualitative method is needed when dealing with an initial survey using open-ended questions. The quantitative method can be used for subsequent survey rounds. At this stage, the surveys are to identify and hopefully achieve the desired level of consensus as well as any changes of judgments among panellists.

Hsu and Sandford (2007) noted that measures of central tendency (means, medians and modes) and level of dispersion (standard deviations and inter-quartile ranges) are the major statistics used in Delphi studies in order to present information concerning the collective judgments of respondents. Generally, the uses of median and mode are favoured. However, in some cases, the mean is also workable.

Hsu and Sandford (2007) reviewed a few methods to determine consensus in a Delphi method. Having 80 percent of subjects' votes fall within two categories on a seven-point scale is considered to achieve a consensus, with at least 70 percent of Delphi subjects with a median of 3.25 or higher to rate three or higher on a four-point Likert-type scale. Other alternative methods entail measuring the stability of subjects' responses in successive iterations.

Linstone and Turoff (2002) identified common causes of failure of a Delphi method: (1) over-specifying the structure of the Delphi questionnaire and not allowing for the contribution of the group's views; (2) assuming that Delphi method can replace all other human communications; (3) poor techniques of summarizing and presenting the group response; (4) ignoring disagreements, so that an artificial consensus is generated; (5) failure to recognize the respondents as consultants and properly compensating them for their time; and (6) not identifying respondent groups well.

Bakus et al. (1982) discussed another major method of group interaction called the nominal group technique (NGT). This method was developed by Delbecq and van de Ven in 1971 at the University of Wisconsin. The principal difference between Delphi and NGT is that Delphi requires anonymity whereas NGT allows face-to-face discussion among the group members. Moreover, NGT permits judgments to be made in the presence of other group members. They noted that the Delphi process is slower than the NGT process. However, the Delphi method may be the most practical method of processing group decisions when participants cannot meet together.

Bakus et al.(1982, p. 495) stated that the NGT process requires an active leader. They outlined the process of the NGT method as follows: “(1) individual group members make silent evaluations in the presence of the group; (2) individual judgments are presented to the group without discussion; (3) a group leader controls a group discussion to prevent dominance, to focus on relevant issues, and provide clarification; (4) Individuals have the opportunity to re-evaluate their ratings; 5) a mathematical aggregation of final individual judgments is made”.

Some of the problems of the NGT method are (Bakus et al., 1982, p. 495): the logistics and costs of assembling the decision-making group may create severe problems; the tendency for individuals with the highest social status or aggressiveness to dominate the scene in face-to-face encounters may create difficulties; and misunderstandings may occur among people of different languages and cultures.

3.5 Concluding Remarks

This chapter discusses the methods that are used in this study. A triangulation approach is adopted to gather information, a method commonly used in social sciences to cross-verify information from a number of sources. Workshops, surveys and semi-structured interviews are the three methods used in data collection. Two types of surveys conducted are household surveys and Delphi surveys. Various groups of stakeholders are involved in this study in order to get a range of views on the subject under the consideration.

While the PIPA method is the core approach in this study, two other methods of analysis (path analysis and Delphi method) are employed and are found to complement the PIPA method. This indicates that the application of the PIPA method, outlined in the next chapter, is a modified version. The aim of applying three different methods is to get a better understanding of the causes of problems in the cacao industry, their priorities for action, and the best approach to their solutions in order to design appropriate strategies to develop the cacao industry in West Sumatra.

Chapter 4

The PIPA Workshop on Developing the Cacao Industry in West Sumatra

4.1 Introduction

The workshop is the first stage in this study. It was done in a participative way in order to explore stakeholders' implicit theories, which can be defined as their personal beliefs, about the status and potential development of the cacao industry in West Sumatra. A participatory workshop is an important part of PIPA application. It allows us to explore the views of different groups of stakeholders (such as farmers, marketing intermediaries, input suppliers and government officials) about the cacao industry. This chapter provides an overview of the performance of the cacao industry, based on stakeholders' knowledge that led to the construction of a hypothesis in the form of a problem tree. The problem tree illustrates a theoretical perspective on the relationship among variables in a complex model.

The participatory workshops for the cacao industry in West Sumatra are described in this chapter. The description begins with the workshop profile in Section 4.2, followed by the detail of workshop results in Section 4.3. This chapter is concluded in Section 4.4.

4.2 Workshop Profile

At the beginning of the planning process for the participatory workshops, a permission letter from the provincial government was arranged by submitting an Ethics Approval Letter and a research proposal. This letter was then used to arrange for a permission letter from each municipal government. After receiving the letter, a preliminary visit was undertaken to the three research locations in order to arrange a workshop. A permit to conduct the workshop was obtained from the municipal governments. The Department of Plantation in each sampled municipality hosted the workshop. The office of the Department sent out invitations to the workshop participants, and provided a room and other workshop facilities.

The objective of the workshop was to get information on current issues in the cacao industry in West Sumatra. The workshop was intended to enable all stakeholders to express their views and ideas regarding the cacao industry. It involved representatives from government institutions (Department of Plantation and Department of Industry and Trade), farmers, traders and village cooperatives related to the cacao industry.

The selection was made of three municipalities with the aim of assessing the performance of the cacao industry in three different marketing areas based on distance to the export point. At first, research work was to have been conducted in Padang Pariaman, Solok and Pasaman municipalities, which were visited in September 2009. Among these three research locations; Padang Pariaman was to represent an area close to the export point and was the location with the most potential for the development of the cacao industry. The Government of Padang Pariaman has strongly supported the development of the cacao industry, having implemented a revitalisation program with a subsidised interest rate, an 800,000 free seedling program and construction of a cacao laboratory. Solok would represent a growing area midway from the export point, while Pasaman would represent areas furthest from the main business centre.

Unfortunately, a major earthquake occurred in West Sumatra on 30 September 2009, and Padang Pariaman and Padang suffered the worst of its impact. It was not possible to conduct research in Padang Pariaman after the earthquake. Therefore, 50 Kota was selected to be one of the research locations, representing a mid-way location from the export point of Padang (134 km).Solok became the closest area (64 km from Padang) and Pasaman remained the furthest area (169 km from Padang).

The first workshop was held in Solok on 6 November 2009, while workshops in Pasaman and 50 Kota were held on 19 November and 25 November, respectively. The total number of people attending the workshops was 68 people. The composition of workshop participants is presented in Table 4.1.

It was planned to have a higher proportion of farmers participating in the workshop, and therefore the invitation was sent at least to 10 farmers in each municipality. However, in 50 Kota only five farmers showed up while a greater number of Department of Plantation officers were interested in participating. The workshop in this municipality was still conducted for three reasons. First, farmers had representatives even though the composition was lower than the Department of Plantation officers. In addition, the different composition of participants in 50 Kota allows us to compare its effect on participants' opinion on the cacao industry with opinions in other municipalities. Second, the questions in the workshop dealt with a broader context of the cacao sector. Third, the workshop applied a participatory approach with the assumption that all participants would be involved without the dominance of a particular group of stakeholders.

Table 4.1. Workshop Participants in the Cacao Industry in West Sumatra

Participant	Solok	50 Kota	Pasaman
Farmers	9	5	22
Traders	3	1	2
Village cooperatives	2	1	1
Seedling suppliers	-	1	-
Department of Plantation officers	2	13	3
Department of Industry and Trade officers	1	-	1
Extension workers	1	-	-
Total	18	21	29

It was expected to have at least one person as a representative of each institution in every area; however, no Department of Industry and Trade representative attended the workshop held in 50 Kota. Only the workshop in 50 Kota was attended by a seedling supplier and a policy maker (Head of the Department of Plantation of 50 Kota). The only extension worker attending was at the Solok workshop.

Different compositions of participants in the workshops indicate different knowledge bases that may lead to the domination of a particular group in the workshop. However, the workshops in this study were set up using a strategy to allow all participants to be active in the workshops. Every participant had an equal chance to express his or her opinion. This can be seen in the video provided in Appendix. 4.1.

The conduct of the workshops was based on a metaplan process to encourage all participants to become actively involved. A metaplan is a technique for collecting ideas from a group of people using cards. It encouraged stakeholders to express their opinions in a participative way, to identify issues facing the cacao industry and to begin developing solutions to identified problems. A professional facilitator, who had extensive experience in USAID projects using a participatory approach, facilitated the workshop with the help of two assistants (a camera operator and a secretary).

The workshop schedule was divided into four sessions: an opening session, introductory session, information collection session and closing session. During the opening session, the Head of the Department of Plantation presented a brief introduction about the aim of the workshop. He also introduced the researcher to the participants. At the end of his presentation, the Head of the Department of Plantation officially announced the opening of the workshop.

At the introductory session, a presentation was given by the researcher, followed by a short discussion with participants, to provide an overview on the cacao industry and information about the objectives of the workshop. In this session, the facilitator and assistants were introduced.

At the beginning of the information collection session, the facilitator explained the procedure of the workshop, especially about the metaplan method and the role of working groups, and answered questions asked by participants. This session was divided into five phases.

Phase 1.Identifying problems in the cacao industry

In this first phase, the facilitator asked participants to identify problems facing the cacao industry. The question was: “What are the problems currently facing the cacao industry?”It is specific to the performance of the cacao industry in West Sumatra. Every participant wrote his/her idea on a card. Each card contained one idea with a maximum of seven words. Each participant could have more than one card. The cards were then attached to the wall.

When all cards were on the wall, participants were then asked to classify the problems into production, marketing, capital and institutional aspects. They identified the three most important problems in each aspect by voting.

Phase 2. Identifying cause, effect and solution for the identified problems

In this phase, participants were divided into groups based on the four aspects. Each group contained a mix of stakeholders.

The four questions guiding the work in this phase were:

- What are the causes of the problems?
- Draw a problem tree based on cause and effect of the problems.
- What should be done to solve the problems?
- Select the highest priority solution to solve the problems.

Participants worked intensively to identify cause, effect and solution for the three most important problems from their aspect. They then drew a problem tree by arranging problems, and their causes and effects. After that, they identified solutions for the identified problems. At the end of this phase, participants were asked to select the solution with the highest priority.

Phase 3. Identifying requirements for the priority solution

The two questions framed for this phase were:

- What requirements should be met to make the priority solution work?
- Who will be involved to encourage the priority solution to work?

In this phase, participants continued to work in their groups. They identified requirements to make the priority solution work well, and identified stakeholders who should be involved to generate the priority solution.

Phase 4. Panel presentation

All work done in the groups was presented in a panel session. Each group presented their work, which was followed by a short discussion to encourage and allow other groups to give comments. The aim of this discussion was to enhance and add to the ideas emanating from the group work. This discussion created a consensus among participants regarding problems, causes and solutions in cacao industry.

Phase 5. Stakeholder analysis

In this final phase, participants identified stakeholders in the cacao industry. The facilitator then validated the role of cacao industry stakeholders, set by the researcher, to participants and asked them to comment on that set of roles. Participants identified the current roles that are played by each stakeholder. They also identified future roles that they expect the stakeholders to fulfil to support cacao industry development. They then drew a map of current and future relationships of stakeholders in the cacao industry. Questions in this phase were:

- Who are the stakeholders in the cacao industry?
- What current actions do stakeholders take?
- What future actions should stakeholders take in order to support cacao industry development?
- Draw the current relationships among stakeholders.
- Draw future relationships among stakeholders in order to support the cacao industry development.

A consensus from participants was generated in this phase. All participants agreed on actions that each stakeholder should take and the networking that should occur to support the development of the cacao industry.

The workshop ended with a closing ceremony attended by the Head of the Department of Plantation. He reviewed the workshop activities and expressed his expectation on the development of the cacao industry. At the end of his presentation, the Head of the Department of Plantation officially announced the workshop closed.

4.3 Workshop Results

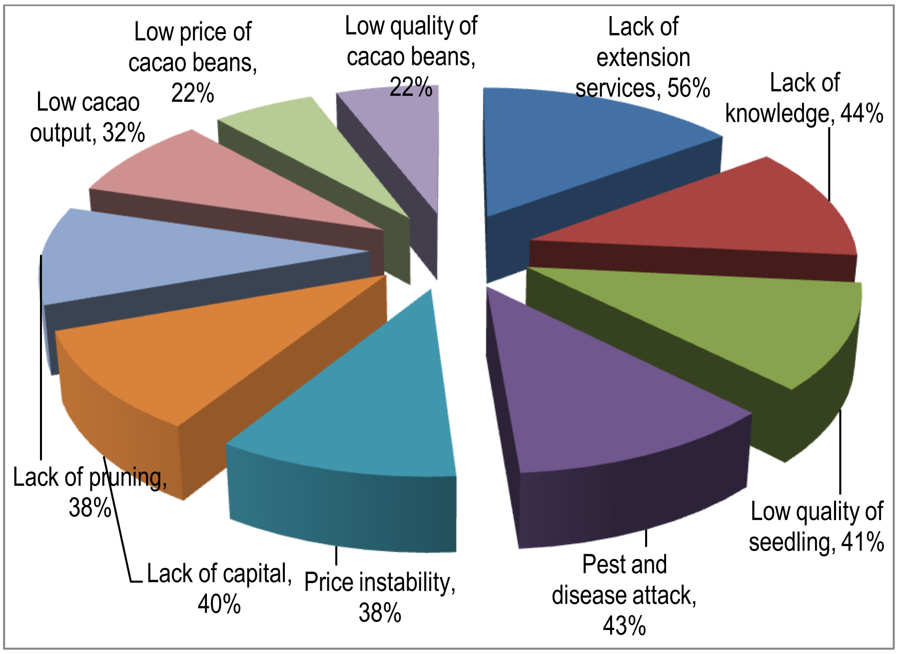
This section describes how the workshop results in the three municipalities can be reconciled with a PIPA process. It begins with problems and their causes identified during the workshops in Section 4.3.1 that also provides possible solutions for identified problems. Roles of stakeholders and their relationships are presented in Section 4.3.2.

4.3.1 **Problems and their causes in the cacao industry in West Sumatra**

In general, problems facing the cacao industry identified through the workshops in all research locations are the same: low production of cacao, low quality of cacao beans, low price of cacao beans, and price instability. However, the causes and solutions that were raised during the workshops varied between municipalities.

At the brainstorming stage, 25 problems were raised in the Solok workshop, 14 problems in the Pasaman workshop and 16 problems in the 50 Kota workshop. All issues that emerged at the brainstorming stage were called problems because participants had not yet identified cause-effect relationships among the issues. The participants then voted on the listed problems. Each participant could have multiple votes for the problem they faced. After omitting problems with zero votes in all three municipalities, 36 problems remained. These problems are considered to provide the potential constraints in cacao industry development in West Sumatra. The frequency distributions of the identified problems are presented in Appendixes 4.2 and 4.3. The percentages of the top ten problems are presented in Figure 4.1.

Figure 4.1. The Top Ten Problems Facing the Cacao Industry in West Sumatra



The workshop results show that there are seven problems facing the cacao industry that are identical in all three municipalities. They are “lack of farmers’ knowledge on agronomic practices”, “low quality of seedlings”, “pest and disease attack”, “price instability”, “lack of capital”, “low production” and “low quality of cacao beans”.

Even though “lack of extension services” in West Sumatra was not voted by participants as a problem in 50 Kota, it received the highest votes perceived by 56 per cent of total workshop participants. While no participants in Pasaman perceived that they faced a problem of low prices for cacao beans, this issue was raised in the workshops in Solok and 50 Kota. The participants in these two municipalities believed that the prices of cacao beans were controlled by traders that led to price instability. This condition was claimed to be a big problem in cacao marketing in 50 Kota. “Lack of pruning” was perceived to be an important production constraint in 50 Kota and Pasaman with a vote of 71 per cent and 38 per cent, respectively, while it did not receive a vote in Solok.

“Lack of knowledge on agronomic practices” was placed in the second rank as a problem facing cacao industry. It was voted by 44 per cent of the total participants. Pest and disease attack was perceived as another production constraint that received high votes (43 per cent) among identified problems.

The identified problems were then classified in terms of cause and effect relationships in order to construct a problem tree for the cacao industry in West Sumatra. The problem tree is illustrated in Appendix 4.4. Four main problems perceived to be causing low incomes among cacao farmers are low cacao output, low price of cacao beans, price instability and high production costs. The causes of the main problems are presented in Table 4.2.

The causes of the identified problems described are different across the municipalities. Only four causes are similar over all three municipalities: “pest and disease attack” and “low quality of seedlings” as causes of “low cacao output”; “low quality of cacao beans” as a factor causing a “low price of cacao beans at farm gate”; and “lack of capital” as a cause of price instability. This implies that either each municipality has different conditions or that participants have different perceptions about what are the main causes of their problems.

Table 4.2. Causes of Problems in the Cacao Industry in West Sumatra

Problems and causes	Solok	50 Kota	Pasaman
Low cacao output			
Pest and disease attack	✓	✓	✓
Lack of pruning		✓	✓
Low quality of seedlings	✓	✓	✓
Lack of fertilizer use			✓
Small landholding		✓	
Low price of cacao beans			
Low quality of cacao beans	✓	✓	✓
Marketing system: long marketing channel	✓		
Low bargaining power		✓	✓
No price and quality standard for cacao beans		✓	✓
Price instability			
No price and quality standard for cacao beans		✓	✓
Lack of capital	✓	✓	✓
High production cost			
High fertilizer cost			✓
High labour cost			✓

Even though there was no clear statement concerning the low price of cacao beans as an issue facing farmers during the brainstorming session in Pasaman, low quality of cacao beans and low bargaining power of farmers came up during the discussion about marketing issues, and may be indicators of this low price problem. “High production cost” was perceived as a problem facing the cacao industry only by participants in Pasaman. It was dropped from further analysis because it received a small percentage of votes.

Possible solutions for identified problems in cacao industry

As causes of the identified problems were different across the three municipalities, the solutions for those problems were also different. The solutions for the identified problems are presented in Table 4.3.

Table 4.3. Solutions for the Cacao Industry Problems in West Sumatra

Problems and causes	Solok	50 Kota	Pasaman
Problem: Low cacao output			
Cause 1: Pest and disease attack			
Solution:			
• Provide training and extension on biological control	✓	-	✓
• Credit program from the government	-		✓
Cause 2: Lack of pruning			
Solution:			
• Provide training on pruning	✓	-	-
Cause 3: Low quality of seedlings			
Solution:			
• Establish seedlings plant in each municipality	✓	✓	✓
Cause 4: Lack of fertilizer use			
Solution:			
• Provide more subsidized fertilizer for cacao farming	-	-	✓
• Provide training on how to make organic fertilizer	-	-	✓
Problem: Low price of cacao beans			
Cause 1: Low quality of cacao beans			
Solution:			
• Extension services to improve post-harvest practices	✓	-	-
• More market alternatives for fermented cacao beans	-	✓	-
Cause 2: Long marketing channel			
Solution:			
• Establish village cooperative	-	✓	✓
Cause 3: Low bargaining power			
Solution:			
• Establish village cooperative	-	✓	✓
• Provide credit for farmers	-	✓	-
Cause 4: No price and quality standard for cacao beans			
Solution:			
• Establish price and quality standards	-	✓	✓
Problem: Price instability			
Cause 1: No price and quality standard for cacao beans			
Solution:			
• Establish price and quality standards	-	✓	✓
Cause 2: Lack of capital			
Solution:			
• Coordination between government and bank to provide credit for farmers	✓	-	-
• Cooperation between farmers and investors in the form of a profit-sharing system	✓	-	-
• Farmer group should be more active to find out information about credit	✓	-	✓
• The government provides a credit program	-	✓	✓
• Establish local financial institution supported by the Department of Cooperative and Finance	-	✓	-

The identical solutions for the problem of low cacao output in the three municipalities are the provision of training and extension on biological control; and the establishment of a seedling plant in every municipality. Establishing a village cooperative and standards for price and quality become solutions to marketing problems in Pasaman and 50 Kota, while providing extension services to improve post-harvest activities and establishing a marketing contract between farmers and traders may be the solutions to those problems in Solok. Credit programs provided by the government are expected to be able to solve the problem of lack of capital facing farmers accompanied by the establishment of price and quality standard in order to improve marketing performance.

4.3.2 **Roles and relationships of stakeholders in the cacao industry**

This section begins with a description of the current roles of each group of stakeholders in the cacao industry. It is followed by a prescription of the roles the stakeholders should take in order to develop the cacao industry, described as future roles. In the last part of this section, current and future network maps are drawn to show the relationships among stakeholders.

Current roles of stakeholders in the cacao industry are presented Table 4.4. The preliminary lists of the roles were set before the workshop participants who then discussed them and confirmed their validity. Some additional roles were suggested during the workshop. The workshop identified that there were three industry stakeholder groups not previously included in the supply chain: exporters, processing firms and local financial institutions. Exporters operated only in the capital city of the province, while no processing firms had been established in West Sumatra. In general, all stakeholders play some of their roles but, interestingly, village buyers do not play their roles in all three municipalities. This condition would be a factor contributing to problems in the cacao marketing system. Wholesalers play some of their roles. In the three municipalities, extension officers do not make regular visits to farmers. This may be a cause of lack of farmers' knowledge on agronomic practices. While extension officers perform their other roles in Solok and Pasaman, they do nothing in 50 Kota. This is a big issue in 50 Kota.

Table 4.4. Current Roles of Stakeholders in the Cacao Industry

Stakeholder	Current role of each stakeholder in cacao industry	Solok	50 Kota	Pasaman
Cacao seedling suppliers	a. Supply sufficient quantity of cacao seedlings	-	-	-
	b. Supply good quality of cacao seedlings	✓	✓	✓
	c. Provide farmers with information on good-quality cacao seedlings	✓	✓	✓
	d. Provide good seedlings at affordable price	-	✓	-
	e. Control distribution of good-quality seedlings	-	-	-
Fertilizer and chemical suppliers	a. Supply sufficient quantity of fertilizers and chemicals	✓	-	✓
	b. Reduce marketing cost in order to provide reasonable price of input for farmers	✓	-	-
Farmers	a. Produce good quality of cacao beans	✓	-	-
	b. Follow recommended cacao farming practices	✓	✓	✓
	c. Grade their cacao beans	-	-	-
	d. Find price information from several sources	-	-	-
	e. Establish a strong farmer association	-	-	-
Village buyers	a. Set different price for different qualities of cacao beans	-	-	-
	b. Provide farmers with information on quality of cacao beans	-	-	-
	c. Obey grading rules	-	-	-
Wholesalers	a. Set different price for different qualities of cacao beans	✓	-	✓
	b. Provide farmers and village buyers with information on quality of cacao beans	-	-	-
	c. Develop domestic market	✓	✓	✓
	d. Improve marketing system to reduce marketing cost	-	-	-
Exporters	a. Set different price for different qualities of cacao beans b. Develop international market c. Price negotiation with importers d. Improve marketing system to reduce marketing cost	No exporters operate	No exporters operate	No exporters operate
Processing firms	a. Provide information on required quality of cacao beans to farmers b. Set different price for different qualities of cacao beans	No processing firms operate	No processing firms operate	No processing firms operate
Local financial institution	a. Disseminate information about available credit b. Provide credit with low interest rate c. Provide suitable credit scheme for farmers and village buyers	No local financial institution operate	No local financial institution operate	No local financial institution operate
Extension officers	a. Arrange regular visits	-	-	-
	b. Provide information on cacao quality	✓	-	✓
	c. Provide guidance on good cacao farming practices	✓	-	✓
	d. Improve knowledge about new technology on cacao farming practices	✓	-	✓
Government	a. Provide better road infrastructure	✓	✓	-
	b. Provide credit program for farmers	✓	✓	-
	c. Improve access of farmers to price information	✓	-	-
	d. Improve input distribution system	✓	✓	✓
	e. Facilitate coordination among relevant institutions	-	-	-
	f. Expand cacao area	-	✓	✓
	g. Control certified seedlings	-	-	-
	h. Establish regulation for good quality cacao	-	-	-

The form of government intervention in the cacao industry to generate development varies across the municipalities. Government intervention to support cacao industry development in Solok and 50 Kota seems greater than that in Pasaman. However, the cacao area in Pasaman is bigger than in the other two municipalities. This implies that the development of cacao farming in Pasaman is mostly an initiative of farmers.

The future roles stakeholders in order to improve cacao industry performance are described Table 4.5. The numbers of roles of stakeholders in 50 Kotaand Pasaman are more than the number in Solok. This is because there were some roles the participants added during the workshop in 50 Kota and Pasaman, while in Solok participants only confirmed the roles set by the researcher.

To illustrate the relationships among stakeholders engaged in the cacao industry, current and future network maps were drawn in the last session of the workshop. The current network map describes current key relationships between stakeholders, while the future network map shows how stakeholders should link together to achieve better performance of the cacao industry. Current network maps for each municipality are presented in Figures 4.2 to 4.4 for Solok, 50 Kota and Pasaman, respectively. There are some similar conditions prevailing in all three regions. First, processing firms do not exist; therefore, farmers cannot sell their cacao beans directly to the processing firms. Second, there is currently no direct relationship between farmers and exporters. Third, the government, extension officers and financial institutions currently provide support for farmers but it is not considered to be enough. Current stakeholders' relationships in Solok and Pasaman are the same, while they are quite different from those in 50 Kota.

Table 4.5. Future Roles of Stakeholders in the Cacao industry

Stakeholder	Future role of each stakeholder in cacao industry	Solok	50 Kota	Pasaman
Cacao seedling suppliers	a. Supply sufficient quantity of cacao seedlings	✓	✓	✓
	b. Supply good quality of cacao seedlings	✓	✓	✓
	c. Provide farmers with information on good cacao seedling	✓	✓	✓
	d. Provide good seedlings with affordable price	-	✓	✓
	e. Control distribution of good-quality seedlings	-	✓	-
Fertilizer and chemical suppliers	a. Supply sufficient quantity of fertilizers and chemicals	✓	✓	✓
	b. Reduce marketing cost in order to provide reasonable price of input for farmers	✓	✓	✓
Farmers	a. Produce good quality of cacao beans	✓	✓	✓
	b. Follow recommended cacao farming practices	✓	✓	✓
	c. Grade their cacao beans	✓	✓	✓
	d. Find price information from several sources	✓	✓	✓
	e. Establish a strong farmer association	-	✓	-
Village buyers	a. Set different price for different qualities of cacao beans	✓	✓	✓
	b. Provide farmers with information on quality of cacao beans	✓	✓	✓
	c. Obey grading rules	-	✓	-
Wholesalers	a. Set different price for different qualities of cacao beans	✓	✓	✓
	b. Provide farmers and village buyers with information on quality of cacao beans	✓	✓	✓
	c. Develop domestic market	✓	✓	✓
	d. Improve marketing system to reduce marketing cost	✓	✓	✓
Exporters	a. Set different price for different qualities of cacao beans	✓	✓	✓
	b. Develop international market	✓	✓	✓
	c. Price negotiation with importers	✓	✓	✓
	d. Improve marketing system to reduce marketing cost	✓	✓	✓
Processing firms	a. Provide information on required quality of cacao beans to farmers	✓	✓	✓
	b. Set different price for different qualities of cacao beans	✓	✓	✓
Local financial institution	a. Disseminate information about available credit	✓	✓	✓
	b. Provide credit with low interest rate	✓	✓	✓
	c. Provide suitable credit scheme for farmers and village buyers	✓	✓	✓
Extension workers	a. Arrange regular visits	✓	✓	✓
	b. Provide information on cacao quality	✓	✓	✓
	c. Provide guidance on good cacao farming practices	✓	✓	✓
	d. Improve knowledge about new technology on cacao farming practices	✓	✓	✓
Government	a. Provide better road infrastructure	✓	✓	✓
	b. Provide credit program for farmers	✓	✓	✓
	c. Improve access of farmers to price information	✓	✓	✓
	d. Improve input distribution system	✓	✓	✓
	e. Facilitate coordination among relevant institutions	-	✓	✓
	f. Expand cacao area	-	✓	✓
	g. Control certified seedlings	-	✓	-
	h. Establish regulation for good-quality cacao	-	✓	-

Figure 4.2. Current Network Map in the Cacao Industry in Solok

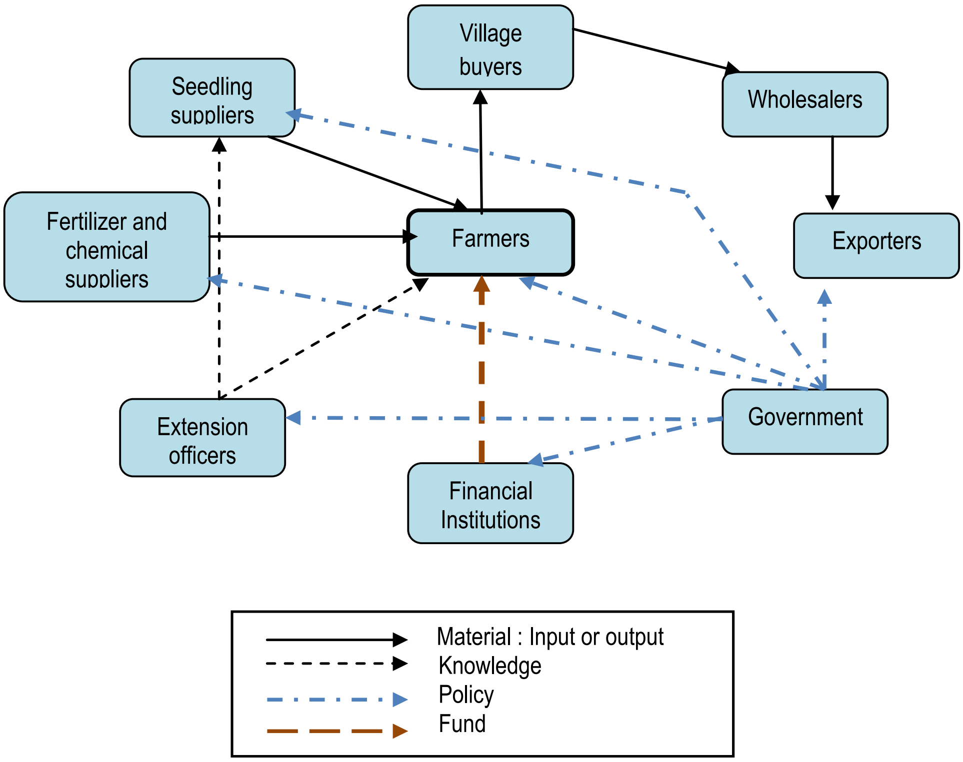


Figure 4.3. Current Network Map in the Cacao Industry in 50 Kota

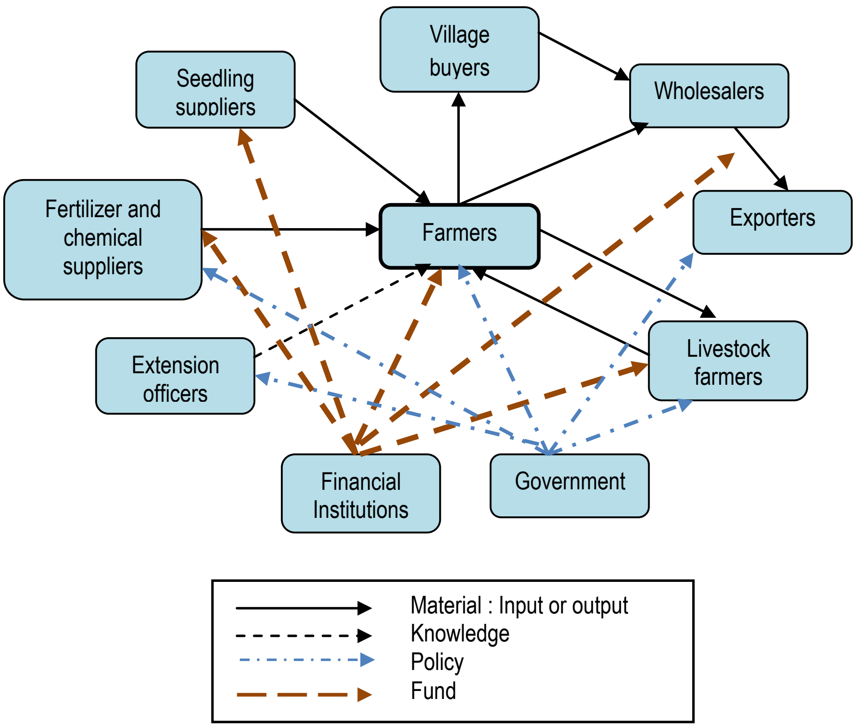
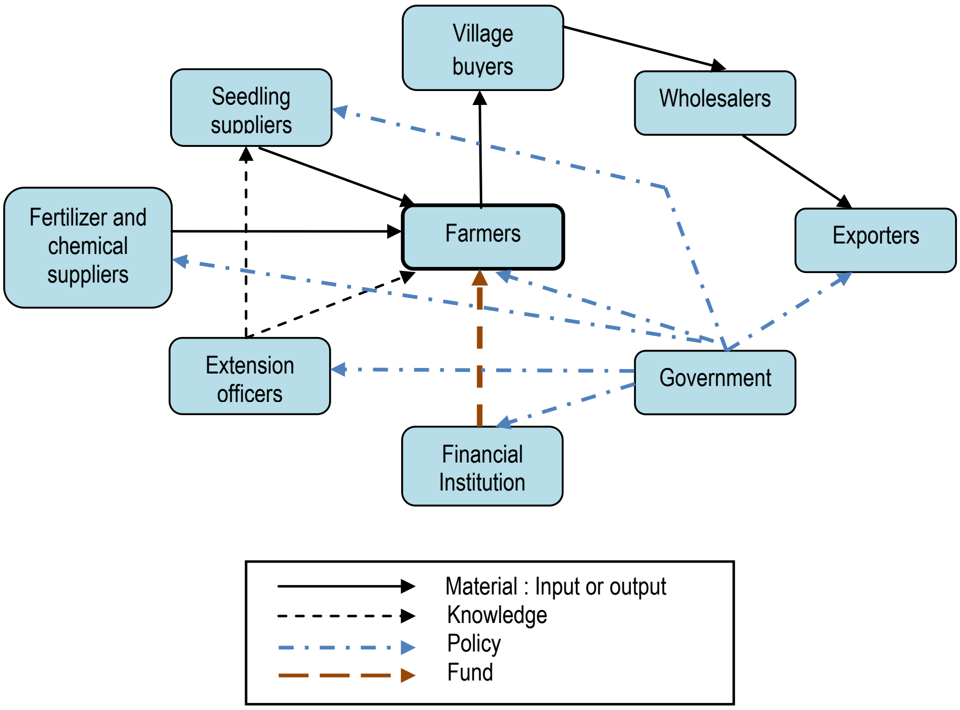


Figure 4.4. Current Network Map in the Cacao Industry in Pasaman



There is one more stakeholder in 50 Kota that does not appear in Solok and Pasaman. The cacao industry in 50 Kota involves cattle producers who provide manure for cacao farming and use the waste of cacao fruits as food for their livestock. In 50 Kota, financial institutions not only support farmers but support seedling suppliers, fertilizer and chemical suppliers, wholesalers and livestock farmers. Farmers in 50 Kota do not rely solely on village buyers to sell their cacao beans. They can also sell them to wholesalers as alternative buyers.

Future network maps (Figures 4.5, 4.6 and 4.7) exhibit relationships among stakeholders that differ from those in the current network maps. Participants expect exporters and processing factories to be more involved with farmers in the future. Thus, farmers have alternative buyers to whom they can sell their cacao beans and have an advantage regarding higher prices. Farmers can sale their cacao beans to buyers who offer higher price.

Figure 4.5. Future Network Map in the Cacao Industry in Solok

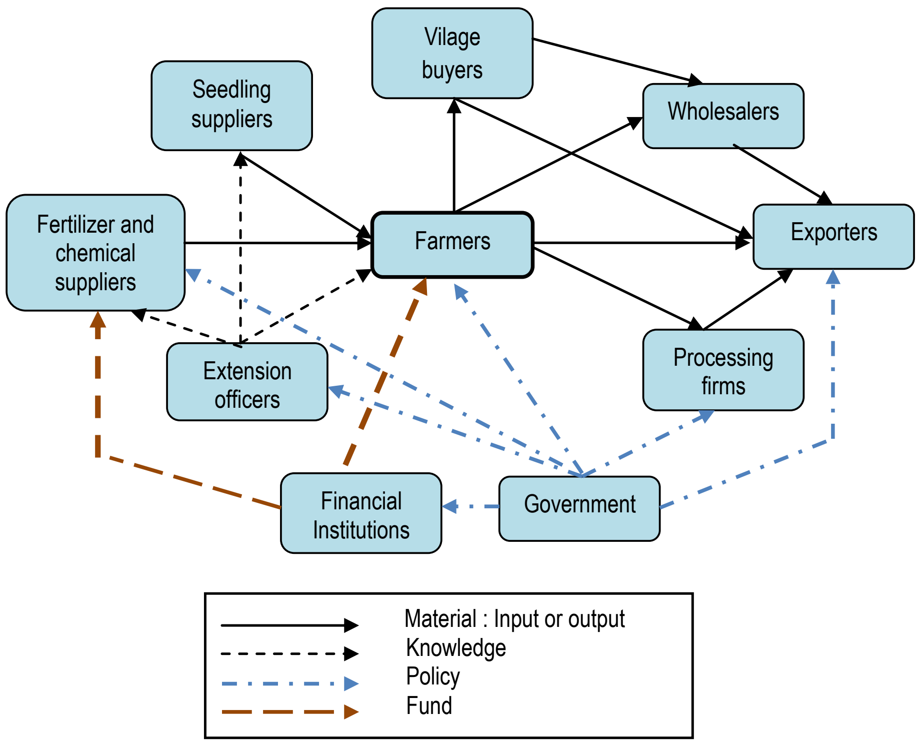
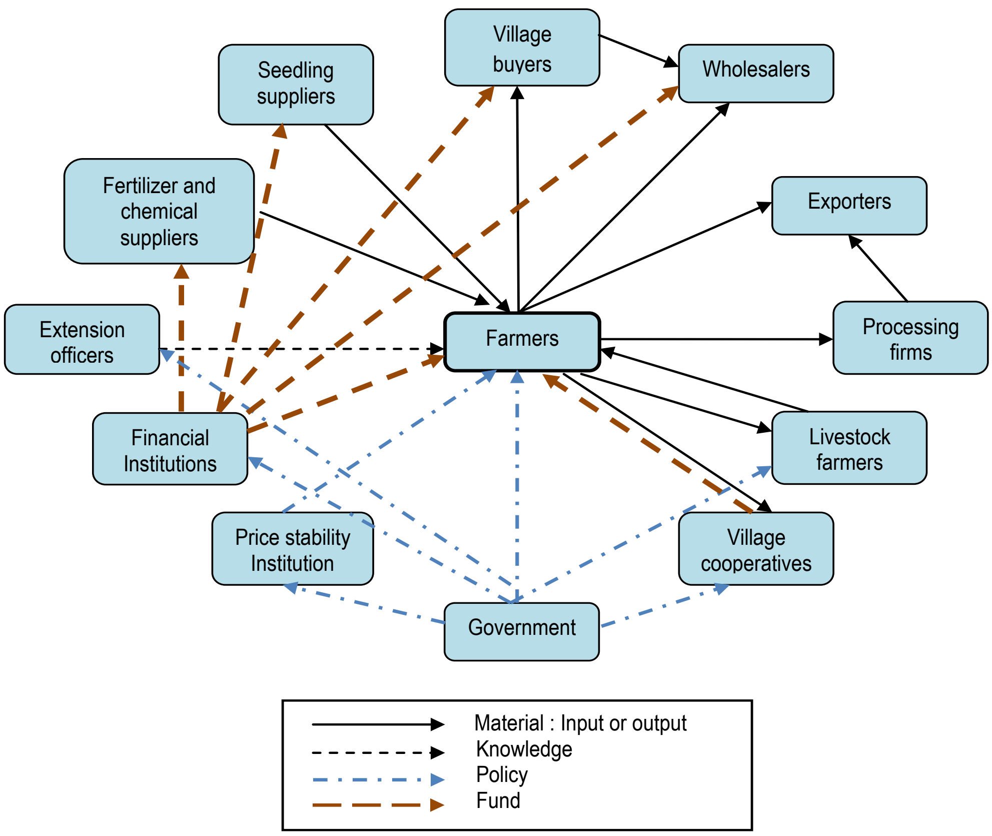


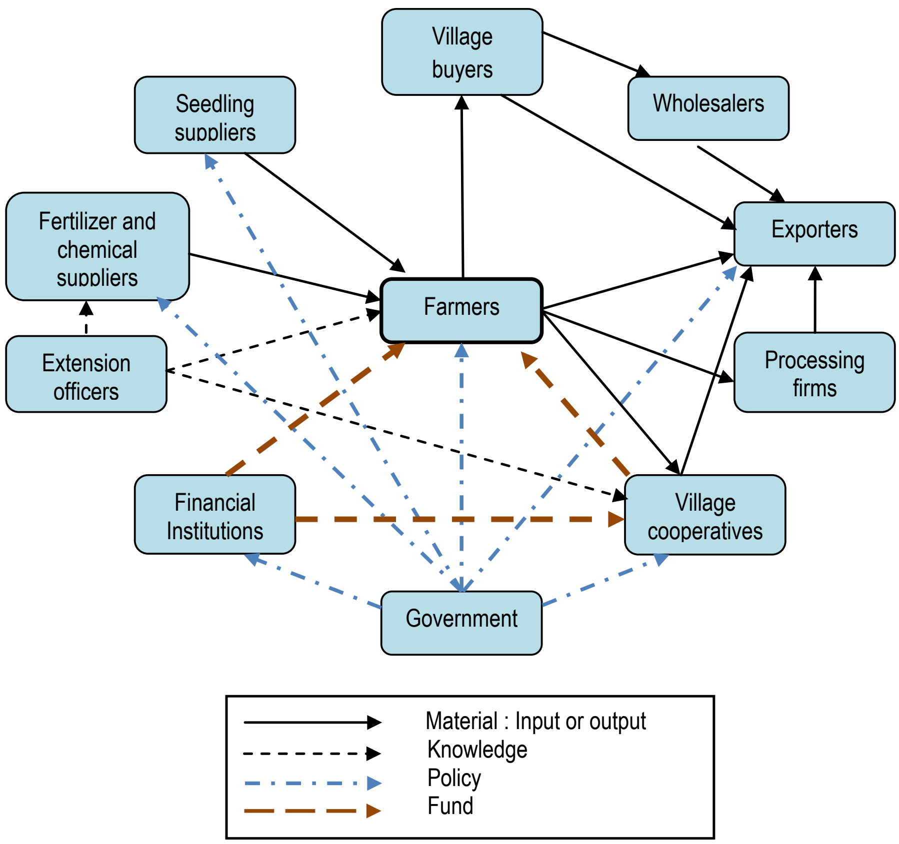
Figure 4.6. Future Network Map in the Cacao Industry in 50 Kota



Another important stakeholder that should be involved in the future is the village cooperative. The cooperative will support farmers to sell their cacao beans at reasonable prices and provide capital for farmers. Participants felt that village cooperatives should be supported by financial institutions, and that the government should support more stakeholders in the future.

In 50 Kota, financial institutions are expected to support more stakeholders to finance their business in order to develop cacao industry. A price stability institution was suggested as another important stakeholder that should be involved in the cacao industry in 50 Kota. This institution is expected to be able to discharge the function of price control to ensure market stability and enable farmers to plan their farming more effectively.

Figure 4.7. Future Network Map in the Cacao Industry in Pasaman



4.3 Concluding Remarks

Conducting workshops in the three municipalities provides overview on how stakeholders perceived the performance of the cacao industry in relation to the distance from the market. The results show that the main constraints facing the cacao industry in the three regions are similar, which were low cacao output, low quality of cacao beans, low price of cacao beans and price instability. However, there were differences in causes of the problems across the three research locations that also generated different solutions. Among the solutions, two identical solutions were indicated to address the problem of low cacao output: (1) establishing a seedling plant in every municipality to solve the problem of low quality of seedlings, and; (2) the provision of training and extension on biological control in order to encourage farmers to control pest and disease.

The results of the stakeholder analysis reveal that there was a gap in the current marketing chain due to lack of involvement of three industry stakeholder groups: exporters, processing firms and local financial institutions. The results indicate that stakeholders only perform some of their roles in current conditions. In order to improve cacao industry performance, it was felt that the three stakeholder groups should be involved and all stakeholders should undertake all of their roles.

It should be noted that the information obtained in this chapter is based on stakeholders' perceptions, mostly farmers. The information provides a foundation for discussion in the next four chapters (Chapters 5 – 8). It was used as a guide to conduct the household surveys described in Chapter 5. It also provided a foundation for data analysis on production constraints in the cacao industry, which is discussed in Chapter 6. The analysis of cacao marketing in Chapter 7 also utilised information presented in this chapter. The Delphi survey conducted in this study was guided by the information from the workshop results as discussed in Chapter 8.

Chapter 5

Profile of the Cacao Industry in West Sumatra

5.1 Introduction

The economic contribution of the cacao industry in West Sumatra has been increasing in terms of export earnings. As cacao trees are grown mostly by smallholder farmers, the cacao industry is expected to make a greater contribution to the development of the agricultural sector, particularly to increase farmers' incomes that would lead to poverty reduction.

This chapter provides a profile of the cacao industry in West Sumatra, which is divided into five sections. A description of farming practices by cacao smallholders in the province is presented in Section 5.2. The access by farmers to information and financial sources is described in Section 5.3, while a marketing profile of cacao beans is presented in Section 5.4. In Section 5.5, the implementation of government programs to support the development of the cacao industry is described and conclusions for this chapter are drawn in Section 5.6.

5.2 Profile of Smallholder Cacao Farming in West Sumatra

The cacao industry plays an important role in West Sumatran export earnings with a significant increase from US$11 million in 2007 to US$51 million in 2009. It was the third largest contributor to export earnings among agricultural commodities in West Sumatra.

The significant increase in the cacao industry's role in the economy of West Sumatra resulted from an increase of cacao production by 52 per cent between 2007 and 2009 (Table 5.1). In addition, the planted area of cacao increased by 55 per cent in that period. The cacao area spread all over West Sumatra where Pasaman municipality is the centre of cacao production, followed by Padang Pariaman and West Pasaman.

Table 5.1. Planted Area and Production of Cacao in West Sumatra in 2007 - 2009

Municipality / city	Planted area (ha)			Production (tonnes)		
	2007	2008	2009	2007	2008	2009
Agam	4,392	4,682	7,561	3,503	3,960	3,940
Pasaman	15,639	15,831	19,417	7,629	13,461	15,261
50 Kota	2,295	2,980	5,610	645	1,006	2,071
Tanah Datar	625	1,343	2,351	93	110	911
Padang Pariaman	6,001	15,669	18,187	2,538	4,874	5,683
S o l o k	2,573	2,573	3,114	459	871	1,138
Pesisir Selatan	1,221	1,663	3,143	371	510	931
Sijunjung	937	1,097	2,251	376	593	851
Padang*	268	375	836	48	137	335
Padang Panjang*	-	-	15	-	-	-
Payakumbuh*	222	287	1,084	73	172	279
Solok*	34	99	229	18	24	60
Sawahlunto*	1,820	2,412	3,124	296	769	1,247
Bukittinggi*	13	13	20	1	9	7
Pariaman*	106	126	515	32	88	145
Mentawai Islands	918	968	1,704	327	534	629
Solok Selatan	349	601	1,016	64	108	450
West Pasaman	8,387	9,754	12,661	4,124	4,786	5,551
Dhamas Raya	827	1,202	1,918	321	348	762
West Sumatra	46,627	61,675	84,254	20,917	32,359	40,250

*City

Source: Department of Plantation of West Sumatra (2009)

The profile of cacao farming described in this chapter is based on survey results in the three surveyed municipalities. The characteristics of the household heads are presented in Table 5.2.

Table 5.2. Characteristics of Cacao Farmers in West Sumatra in 2010

Farmer characteristics	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Sex (%)				
• Male (people)	53	57	93	70
• Female (people)	47	43	8	30
Age (%)				
• 20 - 30 years	3	3	15	8
• 31 - 40 years	43	23	20	28
• 41 - 50 years	37	23	23	27
• 51 - 60 years	7	30	25	21
• ≥ 61 years	10	20	18	16
Education (%)				
• No education	3			1
• Primary education	30	53	50	45
• Junior high school	27	20	23	23
• Senior high school	37	23	15	24
• Tertiary education	3	3	13	7
Landholding distribution (%)				
• < 1 ha	43	47	23	36
• 1 - 2 ha	40	37	53	44
• > 2 ha	17	17	25	20
Average landholding (ha)	1.78	1.32	2.37	1.87
• Irrigated land	0.40	0.30	0.51	0.41
• Dry land	1.38	1.02	1.85	1.46
Average number of family member (people)	**5**	**5**	**6**	**5**
• Children	2	1	2	2
• Adult	3	4	4	3
Average income from cacao (Rp/year)	13,341,800	21,208,000	15,280,150	16,477,000
Average income from other (Rp/year)	12,842,667	8,765,933	11,456,690	11,065,256
Average total income (Rp/year)	26,184,467	29,973,933	26,736,840	27,542,256
Income per capita (Rp/month)	510,329	612,477	619,954	584,823

Of the household heads interviewed, 70 per cent were male and 30 per cent female. The minimum age was 20 years and the maximum age 77 years, with a mean age of 47 years. Most sampled farmers (63 per cent) were in the age group of below 50 years old. This group of farmers have the physical capacity to run their farm. However, many of them (45 per cent) had a low level of formal education, with 1 per cent reported as having no formal education. This condition may limit their ability to adopt new methods to develop their cacao farm.

The area of land owned ranged from 0.1 ha to 11 ha with an average of 1.87 ha per household. A substantial proportion of farms (80 per cent) were 2 ha or less. It indicates that many cacao farmers in this region are land resource-poor.

Household gross income averaged Rp.27,542,256 per year or US $3,390 per year of which 60 per cent came from cacao farming. This reveals that cacao farming provides substantial support for farmers. With five family members on average, gross income per capita of cacao farmers was Rp.584,823 per month. Although the average value was higher than the poverty line used by Statistics Indonesia for rural areas in West Sumatra in 2010 (Rp.214,458 per month), about 25 per cent of cacao farmers were poor with a per capita income per month below the poverty line.

Farmers' average gross income from cacao farming was Rp.18,736,914 per hectare per year (at the average price of Rp.20,465 per kilogram of cacao beans). The gross income of cacao farmers in West Sumatra was higher than that of farmers in South East Sulawesi as studied by Sahara et al. (2005). The annual gross income of cacao farmers in South East Sulawesi was Rp.7,381,953 per hectare (at an average price of Rp.9,534 per kilogram of cacao beans).

A profile of cacao farming in West Sumatra is presented in Table 5.3. The area planted to cacao ranged from 0.10 ha to 10 ha with an average of 0.98 ha. Almost all farmers (98 per cent) grew cacao trees on their own land. About 55 per cent of them grew cacao trees on an area less than 1 ha. This means that most cacao farmers in this region are smallholder farmers.

As cacao farming developed significantly in the past decade, a majority of farmers had experience in cacao farming of ten years or less. This indicates that cacao farming is a new experience for farmers. Therefore, knowledge of agronomic and post-harvest practices is required to improve their capacity to manage cacao farms.

Table 5.3. Profile of Cacao Farming in West Sumatra

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Size of cacao farming (%)				
• < 1 ha	77	57	38	55
• 1 - 2 ha	20	37	55	39
• > 2 ha	3	7	8	6
Land status (%)				
• Owned land	100	97	98	98
• Sharecropping		3	2	2
Farmers' experience on cacao farming (%)				
• 1 - 5 years	40	10	33	28
• 6 - 10 years	50	17	45	38
• 11 - 15 years	0	27	13	13
• 16 - 20 years	7	30	5	13
• > 20 years	3	17	5	8
Variety of trees (%)				
• Forastero		73	73	51
• Hybrid (Jember, Inang Sari)	7	7	18	11
• ICS 100			3	1
• TS 858			3	1
• Do not know	93	20	5	36
Source of cacao seedlings (%)				
• Free from government	17	10	23	17
• Buy	17	50	43	37
• Free from others	67	23	23	36
• From own farm		17	13	10
Distribution of age of trees (%)				
• 2 - 7 years	67	23	78	58
• 8 - 11 years	13	30	8	16
• 12 - 16 years	13	27	3	13
• 17 - 20 years		13	5	6
• >20 years	7	7	8	7
Average number of trees per ha (trees)	522	579	608	574
Distance between trees (%)				
• 2 x 2 m²	20			6
• 2 x 3 m²	10	3	5	6
• 3 x 3 m²	50	43	28	39
• 3 x 3.5 m²	3			1
• 3 x 4 m²	10	13	28	18
• 3 x 5 m²		3	5	3
• 4 x 4 m²	7	13	18	13
• 4 x 5 m²		17	15	11
• 5 x 5 m²		7		2
• 5 x 6 m²			3	1
Intercropped plant (%)				
• Banana	3	10	25	14
• Coconut	7	30	8	14
• Rubber	7	3	18	10
• Coconut, durian		23		7
• Banana, rubber			15	6
• Durian, rubber			13	5
• Other crops	53	33	23	35
• Monocropped	30			9

Many farmers (36 per cent) did not know the variety of cacao seedlings they grew, indicating that farmers lacked knowledge on cacao seedlings. About 51 per cent of them grew *Forastero*. Only 17 per cent of farmers got cacao seedlings from the government program, while 37 per cent bought them and 36 per cent obtained them free from other farmers. Most cacao trees were of productive age and were grown intercropped with other tree crops such as banana, coconut, rubber, coffee and durian with an average of 574 cacao trees per hectare. Most of them were grown with the distance of 3 x 3 m^2.

Agronomic practices

The results of the survey show that 31 per cent of farmers in the three municipalities did not use fertilizers. "Expensive fertilizer" and "no effect on yields" were the main reasons given (Table 5.4). Most farmers applied fertilizer twice a year. Manure was the main fertilizer used. Some farmers used Urea, NPK, SP-36, organic fertilizer and Poscha. The average amount of manure used per hectare was 6,503 kg. About 1,200 kg/ha of SP-36 was used on average while the use of other fertilizers was less than 1,000 kg/ha. As can be seen in Table 5.4, inorganic fertilizers in Pasaman were more expensive than in Solok and 50 Kota. This is probably because the distance from Padang to Pasaman is further than that to the other municipalities, suggesting a higher cost to transport inorganic fertilizer to Pasaman.

The profile of pest and disease control in cacao farming in West Sumatra is described in Table 5.5. Most farmers (64 per cent) did not control pests and diseases, citing "expensive chemicals" (25 per cent) and "lack of knowledge" (16 per cent) as the main reasons. Yet about 41 per cent of farmers stated that their cacao trees were attacked by pests and diseases, and most farmers claimed to lose about 50 per cent to 75 per cent of their cacao production due to pest and disease attack. The main pest was cacao pod borer and the main disease was black pod. One-half of the farmers solved the problem by removing the infected pods without chemicals while some farmers used chemicals such as Decis, Pastax and Winder at an average cost of Rp.326,197 per hectare. Most farmers controlled pest and disease for cacao trees once a year, while some of them did it when there was an infestation.

Table 5.4. The Use of Fertilizer on Cacao Farms in West Sumatra

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Use of fertilizer (%)				
• Yes	63	87	60	69
• No	37	13	40	31
Reason for not using fertilizer (%)				
• Fertilizer is expensive	13	10	25	17
• Do not know how to do it			3	1
• It has no effect on yields	17		10	9
• Lack of labour	7			2
• Lack of capital			3	1
• Sloping land		3		1
Frequency of fertilizing per year (%)				
• Once	17	17	3	11
• Twice	20	57	43	40
• Three times	13	10	8	10
• More than 3 times	13	3	8	8
The main type of fertilizer used (%)				
• Urea	7	20	3	9
• SP-36	3			1
• NPK	3	3	33	15
• Manure	43	60	20	39
• Organic	7			2
• Poscha		3	5	3
Average quantity of fertilizer used (kg/ha)				
• Urea	119	183	20	151
• SP-36	1,200			1,200
• NPK	67	100	157	147
• Manure	947	12,322	1,857	6,503
• Organic	625			625
• Poscha		100	121	114
Average price of fertilizer (Rp/kg)				
• Urea	1,750	2,160	2,500	2,100
• SP-36	2,800			2,800
• NPK	2,800	3,200	3,119	3,103
• Manure	167	143	125	141
• Organic				
• Poscha		2,800	2,350	2,500

Almost all farmers weeded and pruned their cacao trees (Table 5.6). “No weeds” was the main reason for not weeding, while “no effect on yields” was the main reason for not pruning. Most farmers weeded their cacao trees from three times to four times a year and pruned twice a year. Some farmers used Roundup, Gramoxone and Prometon in weeding at an average cost of Rp.287,862 per hectare.

Table 5.5. Pest and Disease Control for Cacao Trees in West Sumatra

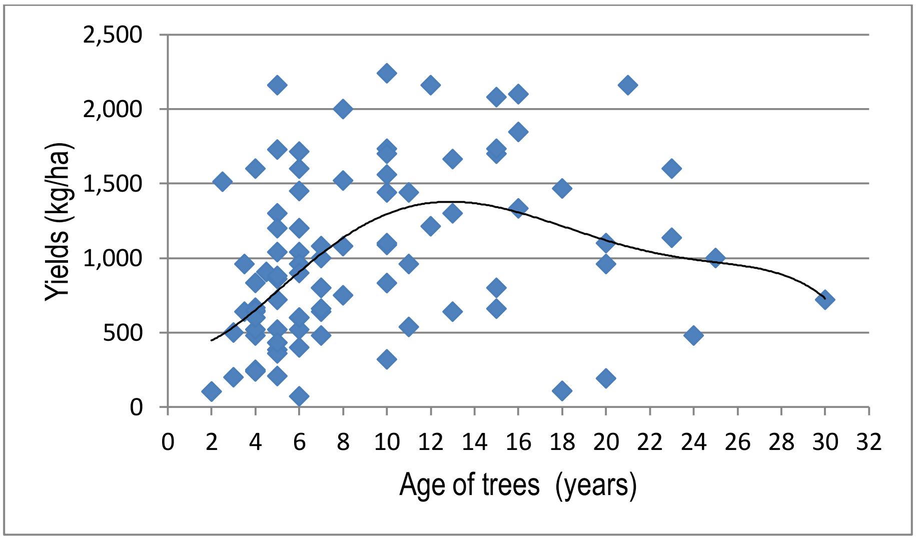
Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Control pests and diseases (P & D) (%)				
• Yes	13	40	50	36
• No	87	60	50	64
Reason for not controlling P & D (%)				
• Do not know how to do it	27	27		16
• Chemical is expensive	37	20	20	25
• Chemical is not available	3	3	3	3
• No infestation	7	7	3	5
• It has no effect on yields	7		20	10
• Lack of labour	3			1
• Lack of capital			5	2
• Other	3	3		2
Kind of P & D attack (%)				
• Cacao pod borer	3	20	10	11
• Black pod	3	30	33	23
• Red branch borer	0	3		1
• Do not know	7			2
• Fungi			10	4
Percentage of production loss due to P & D (%)				
• <25%			15	6
• 25% - 49%	3	7	18	10
• 50% - 75%	10	40	20	23
• >75%		7		2
The main chemical used to control P & D (%)				
• Decis		7		2
• Pastax	10		3	4
• Winder	3		10	5
• Biological control		7		2
• Theodan		3		1
• Capture 50 C		3		1
• No chemical used		20	28	17
• Record			8	3
• Ripcor and Tamaron			3	1
Average cost of chemicals to control P & D (Rp/ha)	252,000	108,462	504,329	326,197
• Decis		36,667		36,667
• Pastax	282,667		81,000	232,250
• Winder	160,000		4,869,250	3,927,400
• Biological control		145,000		145,000
• Theodan		30,769		30,769
• Capture 50 C		40,000		40,000
• Record			36,750	36,750
• Record and Tamaron			103,000	103,000
Frequency of controlling P & D (%)				
• Every week	3	3	3	3
• Fortnightly			10	4
• Once a month			18	7
• Four times a year		3	3	2
• Twice a year	3			1
• Once a year	7	33	8	15
• When there is infestation			10	4

Table 5.6. Weeding and Pruning Practices in Cacao Farming

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Weeding practices (%)				
• Yes	100	97	95	97
• No		3	5	3
Reason for not weeding (%)				
• It has no effect on yields			3	1
• No weeds		3	3	2
Frequency of weeding (%)				
• Every week	7	3	13	8
• Fortnightly	3	3		2
• Every month	10	13	23	16
• Six times a year	3	7	5	5
• Four times a year	33	20	23	25
• Three times a year	30	27	28	28
• Twice a year	10	17	3	9
• Once a year	3	7		3
• Three times for 5 years			3	1
The most chemical used for weeding (%)				
• Gramoxone			8	3
• Roundup	27	20	3	15
• Prometon			3	1
Average cost of chemical for weeding (Rp/ha)		130,000	348,286	287,862
• Gramoxone			403,810	403,810
• Roundup	368,494	130,000	480,000	280,530
• Prometon			50,000	50,000
Pruning practices (%)				
• Yes	97	97	90	94
• No	3	3	10	6
Reason not to prune (%)				
• No effect on yields	0	3	10	5
• Lack of labour	3			1
Frequency of pruning (%)				
• Twice a week			5	2
• Three times a month			3	1
• Once a month	20	17	8	14
• Every 2 months	3	7	13	8
• Four times a year	30	7	18	18
• Three times a year	20	10	13	14
• Twice a year	17	50	33	33
• Once a year	7	7		4

Cacao trees in West Sumatra were harvested throughout the year with two peak seasons. The first peak season is from March to May, while the second peak season begins in August and lasts until October. The yields of cacao trees ranged from 72 kg/ha to 2,240 kg/ha with an average of 899 kg/ha. The variation in yields results in part from differences in the age of cacao trees that farmers grow. The age of cacao trees ranged between 2 and 30 years old. Cacao trees start to bear pods at an age of three years and reach the full capacity between 10 and 16 years (Figure 5.1). At 17 years old, the yield of cacao trees starts to decrease. About 60 per cent of farmers produced cacao beans below 1,000 kg/ha per year. Therefore, yields of cacao trees in this region are considerably low.

Figure 5.1. Yields of Cacao Trees by Age of Trees (kg/ha/year)



Twenty five per cent of farmers did not harvest fully ripe pods (Table 5.7). About 16 per cent of farmers stated that squirrels often attack cacao trees with fully ripe pods; therefore, they had to harvest partially ripe pods or a mix of fully and partially ripe pods. Other reasons for not harvesting fully ripe pods were “need money soon” and “no price difference”.

Post-harvest practices

There are two main post-harvest activities in the cacao industry: fermentation and drying. A majority of farmers (64 per cent) fermented their cacao beans (Table 5.7). Interestingly, this figure is different among respondents in Solok, 50 Kota and Pasaman. Most farmers did the fermentation in Solok and Pasaman; on the contrary, only 30 per cent of farmers fermented their beans in 50 Kota. “Too time consuming” and “no price difference between proper fermented and improper fermented cacao beans” were the main reasons not to ferment cacao beans.

The number of days needed for fermentation ranged from one day to five days. Most farmers did it for two to three days. Gunnysacks were mainly used for fermentation. The fermented cacao beans were then dried. Farmers needed one to seven days to dry their cacao beans during the dry season and the length of time about doubled during the wet season. Most farmers dried their cacao beans for one to four days in the dry season and five to seven days in the wet season. All farmers dried their cacao beans even though some of them did not ferment the cacao beans before drying.

The cacao beans were dried in the sun. In this condition, the beans are not protected from the environment and are prone to attacks by insects, damage by animals and contamination with foreign materials, significantly impairing their quality.

Possibility to expand planted area of cacao

In terms of land area development for cacao, 36 per cent of farmers intended to increase the size of the cacao area in the next 12 months. The main reason offered for this decision was that “cacao is more profitable” and the second main reason was “growing cacao is easier” (Table 5.8).

Most farmers (60 per cent) intended to maintain the same size of cacao area. Few farmers (4 per cent) wanted to decrease the planted area, with “cacao is not profitable” given as the main reason. This reason contradicts the reason cited by farmers who wanted to increase the cacao area. Cacao may not be profitable when subject to substantial pest and disease attack, which can reduce yields significantly.

Table 5.7. Harvest and Post-Harvest Practices in Cacao Farming

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Average production (kg /ha)	909	1,142	711	899
Condition of pods harvested (%)				
• Fully ripe	90	43	88	75
• Partially ripe		10	5	5
• Mix of fully and partially ripe	10	47	8	20
Reason not to harvest fully ripe pods (%)				
• No price difference		13		4
• Need money soon	10		5	5
• Squirrel attack		43	8	16
Fermentation practices (%)				
• Yes	93	30	68	64
• No	7	70	33	36
Reason not to ferment (%)				
• Too time-consuming		27		8
• No price difference		27	33	21
• Delay in time of selling	7	7		4
• Do not know how to do it		3		1
• Small amount of cacao beans		3		1
• Need money soon		3		1
Days of fermentation (%)				
• One day	10	13	3	8
• Two days	47	3	18	22
• Three days	33	3	30	23
• Four days	3		15	7
• Five days		10	3	4
The main tool for fermentation (%)				
• Gunny sacks	83	20	48	50
• Wooden box	7	7	5	6
• Plastics	3	3		2
• Bucket			10	4
• Metal box from government			5	2
Days of drying (dry season) (%)				
• 1 - 4 days	100	93	88	93
• 5 - 7 days		7	13	7
Days of drying (wet season) (%)				
• 1 - 4 days		10		3
• 5 - 7 days	93	73	75	80
• 8 - 15 days	7	17	25	17

Table 5.8. Possibility to Expand Cacao Area

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Change of cacao area (%)				
• Increase	23	20	58	36
• Decrease		3	8	4
• No action	77	77	35	60
The first reason to increase area (%)				
• Cacao is more profitable	17	17	43	27
• Have other land that can be converted into cacao trees	7	3	15	9
The second reason to increase area (%)				
• Cacao is more profitable	7		5	4
• Have other land that can be converted into cacao trees	13	17	3	10
• Have other land currently used for other crops that can be intercropped with cacao trees			10	4
• Growing cacao is easier	3	3	23	11
• Increase income			15	6
• Produce early age			3	1
The main reason to decrease area (%)				
• Age constraint		3		1
• Cannot control pests and disease			3	1
• Cacao is not profitable			5	2

Perceptions of farmers on cacao farming

The perceptions of farmers on production and marketing in the cacao industry are presented in Table 5.9. The responses were classified into four categories: strongly disagree, disagree, agree and strongly agree. Category “neither agree nor disagree” was not used as a response in order to allow respondents to have a definite choice in expressing their opinion. Garland (1991) found that eliminating the mid-point category from Likert scales can minimise the social desirability bias of respondents.

Fifty one per cent of farmers disagreed that cacao yield in this region is low. Only 7 per cent strongly agreed. Most respondents (95 per cent) agreed that most farmers face pest and disease attacks. “Lack of knowledge of farmers on cacao agronomic practices” and “growing bad cacao seedlings” may relate to low yields and the persistence of pest and disease attacks on cacao trees.

"Lack of knowledge on agronomic practices" is related to lack of contact with extension services, cited by 70 per cent of farmers. It may be worsened by the "low education of farmers", stated by 72 per cent of farmers. "Hard to get good cacao seedlings" and "cannot afford to buy good seedlings" discouraged farmers to plant good-quality seedlings, which can lead to low yield and pest and disease attacks.

Table 5.9. Perceptions of Farmers on Cacao Industry Condition (%)

Statement	Strongly disagree	Disagree	Agree	Strongly agree
Cacao yield in this region is low.		51	42	7
Most cacao farmers face pest and disease attacks in this region.	1	4	84	11
There is a lack of contact with extension workers in this region.		21	67	12
Insufficient extension and training cause lack of knowledge on cacao agronomic practices.		19	70	11
Low education of farmers causes lack knowledge on agronomic practices.		24	72	4
Good quality of cacao seedlings is hard to get in this region.	1	48	50	1
Farmers grow low-quality cacao seedlings because they cannot afford to buy good-quality seedlings.	1	43	48	8
Farmers have enough knowledge on fermentation and drying activities.		53	45	2
Price of cacao beans received by farmers is low.	1	49	48	2
Low price received by farmer is due to low quality of cacao beans.		39	60	1
Low quality of cacao beans is due to improper fermentation.		43	57	
No difference in price between proper and improper fermentation of cacao beans causes farmers not to ferment their cacao beans properly.		4	84	12
The price of cacao beans increases and decreases all the time.		7	87	6
Farmers are not able to bargain on cacao price.		64	36	
Village buyers mix different qualities of cacao beans.		27	72	1
The new export tax on cacao beans is becoming a burden on cacao farmers.	27	28	38	7
The new export tax on cacao beans is becoming a burden on village buyers.	16	51	33	
The export tax generates a significant decrease in the cacao price at the farm gate.	2	21	77	
Farmers face lack of capital in this region.		12	65	23
Lack of farmers' capital is due to lack of access to credit.		26	53	21
Farmers have no collateral for getting credit because they grow cacao on communal land.		36	53	11
Farmers do not have enough information about credit procedures.		21	55	24

Most farmers (53 per cent) stated that they do not have enough knowledge on fermentation and drying. Therefore, farmers did not ferment their cacao beans properly, causing low quality of cacao beans as cited by 57 per cent of farmers. This, in turn, causes farmers to receive low prices even though they perceived to be able to bargain on the price. "No price difference between proper and improper fermentation of cacao beans" was another reason that discouraged farmers to do fermentation properly. This may have resulted from no grading practices by village buyers. Seventy three per cent farmers stated that village buyers mixed different qualities of cacao beans.

Most farmers (93 per cent) stated that the price of cacao beans fluctuated all the time. This perception may be related to the new export tax for cacao beans imposed in April 2010. Most farmers did not think that the new export tax burdened farmers and village buyers, even though 77 per cent agreed that it caused a significant decrease in the cacao price at the farm gate.

This study reveals that farmers believe that they face a lack of capital: 65 per cent agreed and 23 per cent strongly agreed. Lack of access to credit was cited as the cause of lack of capital. Most farmers agreed that growing cacao beans on communal land and not having collateral prevents them from getting access to credit. In addition, most agreed that they did not have enough information on credit procedures.

5.3 Farmers' Access to Information and Financial Sources

Farmers relied on various sources to obtain information on cacao production: parents, other farmers, extension officers, and training (Table 5.10). Other farmers were the most important source for agronomic practices. Training and extension officers also played an important role in providing information for farmers, while only a small number of farmers got information by reading material and from input suppliers.

Similar to agronomic practices, other farmers were the most important source of information on post-harvest practices, accounting for 82 per cent (Table 5.11). Extension officers were the second most mentioned source of information, followed by training. Some farmers did not get information on post-harvest practices from anywhere.

Table 5.10. Source of Information on Agronomic Practices in Cacao Farming (%)

Source of information	Fertilizing	Controlling P & D	Weeding	Pruning	Harvesting	Total
Parents	5	3	6	4	6	24
Other farmers	41	32	47	31	37	188
Extension officers	16	14	24	25	22	101
Training	26	29	4	27	20	106
Working experience on cacao plantation	2		1	2		5
Nowhere	8	19	15	7	12	61
Reading material	2	2	2	4	3	13
Input supplier		1	1			2

Table 5.11. Source of Information on Post-harvest Practices in Cacao Farming (%)

Source of information	Fermentation	Drying	Total
Parents	5	3	8
Other farmers	31	51	82
Extension officers	35	23	58
Training	16	14	30
Nowhere	13	9	22

This study found that some farmers had access to extension services and training. It is assumed that the more access they have to extension services and training the more knowledgeable they are. Access to extension services and training is described in Table 5.12.

Availability of extension officers, the frequency of visits by an extension officer and the frequency of farmers speaking to an extension officer are indicators to assess farmers' access to extension services, while access to training is assessed by the participation by farmers in training courses. Most farmers stated that an extension officer was available in their region and visited them once a month. However, only a small number of farmers used the opportunity to speak to the extension officer individually. In the future (the next 12 months), farmers pointed to extension officers as the second source of information to improve their knowledge on cacao farming, while other farmers would be the first source of information.

Only 34 per cent of farmers had participated in training courses in the past five years. Information covered in the training consisted of agronomic, post-harvest, processing and marketing practices. Farmers obtained most information about agronomic and post-harvest practices, while information on processing and marketing was obtained by a small number of farmers. On average, every farmer who participated in training obtained more than two items of information. Almost all of them got information about pruning and pest and disease control.

About 22 per cent of farmers had debts with the main buyer (Table 5.13). This result shows that having a debt with the main buyer may have restricted farmers from selling their cacao beans to other buyers. However, this financial relationship did not cause farmers to believe that they received a lower cacao price than other farmers. This result may be related to the time the main buyer set the price of cacao beans for farmers who borrowed money. All farmers stated that the price of their cacao beans was set at the time of selling.

Only four farmers obtained credit in the past two years. One of them got it from the government credit program for an amount of Rp.500,000, which was used to finance his cacao farming. Other farmers got credit from a bank for amounts ranging from Rp.5,000,000 to Rp.15,000,000. These farmers used the loan to buy household assets and finance their business.

Table 5.12. Access of Cacao Farmers to Extension Services and Training in West Sumatra (%)

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Availability of extension officer				
• Yes	97	57	68	73
• No	3	43	30	26
• Do not know			3	1
Frequency of visit of extension officer				
• Every week	13		8	7
• Fortnightly	23		15	13
• Every month	30	23	23	25
• Never	3			1
• Do not know	27	20	3	15
• Every 3 months		3		1
• Every 4 months		7		2
• Twice a year		3		1
• Every 2 months			5	2
• Unscheduled			5	2
• Every year			10	4
Frequency in speaking to the extension officer				
• Every visit			40	16
• Often	17	3	25	16
• Seldom	47	17		19
• Never	33	37	3	22
Source of information on cacao for the next 12 months				
• Parents		3	8	4
• Other farmers	67	57	60	61
• Extension officer	27	30	25	27
• Training		7	3	3
• Nowhere	7	3	5	5
Got training in the past 5 years				
• Yes	30	30	40	34
• No	70	70	60	66
Information obtained from training				
• Planting	20	23	35	27
• Fertilizing	23	23	38	29
• Pest and disease control	27	30	38	32
• Weeding	20	23	30	25
• Pruning	27	27	40	32
• Harvesting	20	20	35	26
• Fermentation	10	27	33	24
• Drying	10	23	38	25
• Processing	3		33	14
• Marketing	3	3	20	10

Table 5.13. Financial Issues with Cacao Farmers in West Sumatra

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Debt to the main buyer (%)				
• Yes	40	7	20	22
• No	60	93	80	78
Time for price setting (%)				
• At the time of selling	40	7	20	22
Receive lower price than other farmers due to indebtedness (%)				
• Yes	10			3
• No	30	7	20	19
The buyer allow farmers to sell to other buyers (%)				
• Yes	7	7	5	6
• No	33		15	16
Got credit in the past 2 years (%)				
• Yes	0	7	5	4
• No	100	93	90	94
Source of the largest loan (%)				
• Bank		3	5	3
• Government		3		1
Average amount of loan		2,750,000	12,500,000	7,625,000
The main usage of loan (%)				
• Finance cacao farming		3		1
• To buy household assets		3		1
• Finance business			5	2

Most farmers perceived that it was hard to access financial support from banks, village financial institutions, village cooperatives, government credit programs and wholesalers. On the contrary, they believed that the village buyer and village moneylender could be accessed easily. The perception of farmers in terms of access to financial sources is presented in Table 5.14.

Table 5.14. Perceptions of Cacao Farmers on Access to Financial Sources (%)

Financial sources	Very hard	Hard	Easy	Very easy
Bank	29	38	12	3
Village financial institution	4	25	6	
Village cooperative	8	35	17	
Government credit program	8	59	32	1
Village buyer		10	85	5
Wholesaler	16	17	22	1
Village moneylender		10	88	1

It is assumed that the procedures to obtain a loan make it hard to gain access to funds from a bank, village financial institution, village cooperative or government credit program. Moreover, it is common that collateral is necessary to get credit from a bank, village financial institution or government credit program. This requirement may restrict farmers from getting credit from these financial sources. As wholesalers are usually located in the capital city, it may contribute to less opportunity of farmers to borrow money from them.

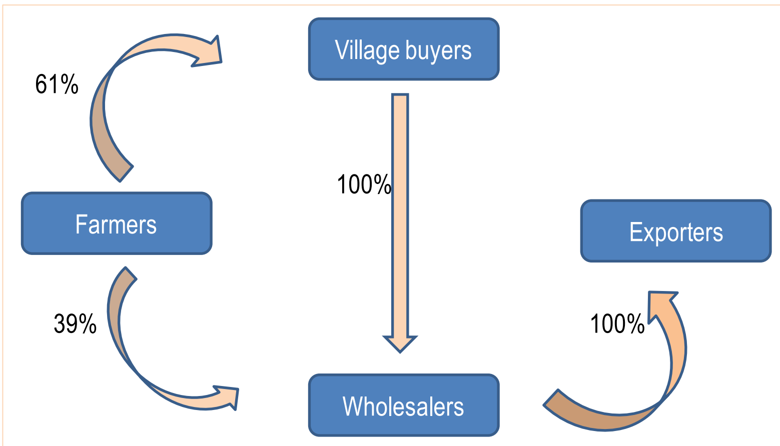
The cost of borrowing money from village buyers and village moneylenders can be higher than from other financial sources; however, farmers found it easy to access the loan from them because no procedure and no collateral are required.

5.4 Marketing Profile of Cacao Beans in West Sumatra

An efficient marketing system is an important condition that should be met to develop cacao agribusiness. This condition will enable farmers to gain satisfactory incomes and encourage them to grow commercial crops such as cacao. In West Sumatra, the supply chain of cacao beans is relatively short. Only four parties are involved: farmers, village buyers, wholesalers and exporters. Processing firms do not exist yet.

Figure 5.2 shows the supply chain of cacao beans. About 61 per cent of the total quantity of cacao beans was sold to village buyers, while 39 per cent of them were sold directly to wholesalers. Village buyers sold their cacao beans to wholesalers who usually are based in the capital city of the municipality. The end point of the marketing channel for cacao beans is at the exporter level located in the capital city of West Sumatra Province, Padang. There are two exporters in West Sumatra: CV Hasil Bumi Raya/CV Anom and CV Mekar Jaya. About 90 per cent of cacao beans produced in West Sumatra were exported by the former, while the rest were exported by the latter. Some wholesalers in West Sumatra sold their cacao beans to exporters located in Lampung and Medan.

Figure 5.2. Marketing Channel of Cacao Beans in West Sumatra



Farmers' marketing practices

Most farmers sold their cacao beans to a village buyer (76 per cent), even though they received a lower price than those who sold to wholesalers; yet only 24 per cent of farmers sold their product to wholesalers (Table 5.15). The difference in average price received by farmers from village buyers and wholesalers was Rp.2,349 per kg.

"Picked up" as the main mode of selling was the main reason why farmers preferred to sell their cacao beans to village buyers, whereas most famers had to deliver the product to wholesalers (Table 5.16). This is because village buyers live in the same village as farmers while wholesalers are based in the capital cities of municipalities. This condition made it more convenient for farmers to sell their cacao beans to village buyers than wholesalers, even though the price received from wholesalers was higher than from village buyers. In addition, selling to village buyers did not incur a transportation cost. This implies that village buyers play an important role in terms of providing marketing services for farmers who sell small amounts of cacao beans and transfer cacao beans from the farm gate to the capital city of the municipality. For small farmers, selling cacao beans to the city imposes higher transportation costs and possibly high transaction costs per kg given the small quantities they sell. Other strong reasons to choose village buyers over wholesalers were “family relationship”, “social relationship” and “can borrow money”. In some areas, only village buyers were available. “Prompt payment” and “good price” were the main considerations for farmers to choose a buyer as cited by 40 per cent and 28 per cent of farmers, respectively.

Table 5.15. Profile of Farm-Gate Sale of Cacao Beans

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Number of farmers who sold to (%):				
• Village buyers	80	70	78	76
• Wholesalers	20	30	23	24
Total of cacao beans sold by farmers (kg)				
• Village buyers	8,204	22,244	21,734	52,182
• Wholesalers	2,746	12,920	7,934	33,600
Average price received by farmers (Rp/kg)				
• Village buyers	19,333	20,786	19,742	19,901
• Wholesalers	21,667	23,222	21,667	22,250

Most farmers were satisfied with their transactions with the main buyer (Table 5.17). This seems to be the reason for farmers not to have changed the main buyer in the past five years and to maintain a long-term relationship. The numbers of buyers in operation were 16 in Solok, 13 in 50 Kota and 34 in Pasaman. These numbers were quite high, preventing buyers from exerting monopoly power in the market. This condition enabled farmers not to rely on a particular buyer because they had an opportunity to sell their cacao beans to other buyers. However, farmers relied on village buyers as a source of information about the price and the quality of cacao beans, which may weaken their bargaining position.

Table 5.16. Farmers' Reason in Selecting the Main Buyer and the Mode of Selling

Description	Main buyer		Total
	Village buyer	Wholesaler	
Reason to choose the main buyer (%)			
• Certainty of payment	4	2	6
• Good price	20	8	28
• Certainty of price	7	4	11
• Prompt payment	33	7	40
• Family relationship	6	1	7
• Accurate scale		1	1
• Good service	3	1	4
• Social relationship	1		1
• The only buyer	2		2
• Can borrow money	1		1
The mode of selling (%)			
• Picked up	67	4	71
• Delivered	9	20	29

The average price of cacao beans received by farmers ranged from Rp.16,500 to Rp.25,000 per kilogram. The price of cacao beans in 50 Kota was higher than in Solok and Pasaman. A higher number of farmers who were indebted to the main buyer in Solok could be a reason for this result (see Table 5.13), even though farmers perceived that they did not get a lower price due to indebtedness. Closer proximity to the market than Pasaman is the more likely cause of higher prices received by farmers in 50 Kota. Price became the main concern of farmers to change the buyer cited by 42 per cent of farmers.

Table 5.17. Marketing Profile of Cacao Beans in West Sumatra

Description	Solok N = 30	50 Kota N = 30	Pasaman N = 40	West Sumatra N = 100
Years of selling to main buyer (%)				
• < 5 years	73	67	70	70
• 5 - 10 years	27	30	20	25
• > 10 years		3	10	5
Satisfaction with the main buyer (%)				
• Always	47	80	35	52
• Often	53	20	30	34
• Seldom			30	12
• Never			5	2
Frequency changed the buyer in the past 5 years (%)				
• once	23	17	3	13
• two times	23	33	18	24
• three times	17	20	10	15
• five times			10	4
• never	37	30	60	44
Main reason of changing buyers (%)				
• Inadequate price	50	40	38	42
• Uncertain payment		10		3
• Social reason	13			4
• Small amount		10		3
• The main buyer did not come		10	3	4
The price farmers received (Rp/kg)				
• Lowest price	16,567	18,267	16,425	17,020
• Highest price	23,667	25,050	24,000	24,215
• Average price	19,800	21,517	20,175	20,465
Source of information on price (%)				
• Media		10		3
• Other farmers	3	3	13	7
• Extension workers	3			1
• Village buyers	83	57	68	69
• Wholesalers	10	27	20	19
• Exporters		3		1
Source of information on quality (%)				
• Media		3	8	4
• Other farmers	13	3	8	8
• Extension workers		17	18	12
• Village buyers	73	43	20	43
• Wholesalers	3	13	10	9
• Nowhere	10	17	35	22
• Indonesian Cacao Association		3		1
• Training			3	1

Village buyers' marketing practices

Most village buyers involved in this study were male (89 per cent) and were relatively young (56 per cent) as presented in Table 5.18. About 41 per cent of village buyers attained senior high school, while a small percentage of them did not get any formal education.

Buying cacao beans was not the main job for most village buyers, even though they were already involved in cacao marketing more than six years (66 per cent) and earned more than 50 per cent of their income from cacao marketing. "Higher profit than other commodities" was the main reason given for trading cacao beans. Most of them also grew cacao trees.

Most village buyers were independent buyers (93 per cent), while 7 per cent of them acted as a buying agent for wholesalers with an average agent fee of Rp.1,000 per kilogram (Table 5.19). This condition enables most of them to set the price, even though they were small traders with average purchase of 68 tonnes per year.

All cacao beans traded at the village buyer level were ungraded, with "most cacao beans have the same quality" given as the main reason for not grading cacao beans. The buying price of cacao beans at the village buyer level ranged from Rp.17,000 to Rp.26,000 per kilogram. Wholesalers were the main source of information on quality and price of cacao beans. Most village buyers stated that farmers have poor knowledge on quality of cacao beans, while they know the price well.

About 59 per cent of village buyers lent money to farmers. Even though they said that they did not charge a lower price to the borrowers, most of them (55 per cent) did not allow the borrowers to sell their cacao beans to other buyers. This result is confirmed by farmers' perceptions. Lending money to farmers benefits village buyers in terms of certainty of cacao beans supply.

Table 5.18. Characteristics of Village Buyers (%)

Village buyer characteristics	Solok N = 9	50 Kota N = 9	Pasaman N = 9	West Sumatra N = 27
Sex				
• Male (people)	67	100	100	89
• Female (people)	33			11
Age				
• 31 - 40 years	67	44	56	56
• 41 - 50 years	33	22	33	30
• 51 - 60 years		33	11	15
Education				
• No education			11	4
• Primary education	22	44	22	30
• Junior high school	33	11	33	26
• Senior high school	44	44	33	41
Buying cacao as the main job				
• Yes	11	89	22	41
• No	89	11	78	59
Years of buying cacao				
• 1 - 5 years	67	22	11	33
• 6 - 10 years	22	78	78	59
• > 10 years	11		11	7
Growing cacao trees				
• Yes	89	89	56	78
• No	11	11	44	22
Reason for buying cacao beans				
• Higher profit than other commodities	44	44	22	37
• Easier to buy and sell them than other commodities		22	22	15
• No other jobs	11	22	33	22
• Do not have access to land for farming		11	22	11
• Increase income	11			4
• Lots of cacao farming	11			4
• Small number of traders	11			4
• Trade other commodities	11			4
Proportion of income from trading cacao				
• < 25%	78	11		30
• 25% - 50%	11	22	44	26
• > 50%	11	67	56	44

Table 5.19. Purchase Profile of Village Buyers

Description	Solok N = 9	50 Kota N = 9	Pasaman N = 9	West Sumatra N = 27
Status in buying cacao (%)				
• Independent buyer	100	100	78	93
• Agent of wholesaler			22	7
Average amount of agent fee (Rp/kg)			1,000	1,000
Number of traders who buy cacao from farmers (people)				
• Village buyer	14	12	31	57
• Wholesaler	2	1	3	6
Average purchase of cacao beans per year (tonnes)	4	137	63	68
Able to set the price (%)				
• Yes	89	100	67	85
• No	11		33	15
Reason not to grade cacao beans (%)				
• Most cacao beans have the same quality	56	56	78	63
• Buyers do not pay higher price for good quality	44	44	22	37
Village buyer's buying price (Rp/kg)				
• The lowest buying price	17,000	17,667	17,556	17,407
• The highest buying price	22,667	25,889	25,889	24,815
• The average buying price	19,667	21,000	21,278	20,648
Source of information on the quality of cacao beans (%)				
• Other village buyers	11	22	44	26
• Extension workers	11	11		7
• Wholesalers	78	67	56	67
Farmers' knowledge on the quality of cacao beans (%)				
• Very poor	11			4
• Poor	78	89	89	85
• Good	11	11	11	11
Source of information on the price of cacao beans (%)				
• Other village buyers	11	11		7
• Wholesalers	89	89	100	93
Farmers' knowledge on the price of cacao beans (%)				
• Poor		22	44	22
• Good	100	78	56	78
Lending money to farmers (%)				
• Yes	67	56	56	59
• No	33	44	44	41
Borrowers get lower price (%)				
• Yes	11			4
• No	56	56	56	55
Allow borrowers to sell cacao beans to other buyers (%)				
• Yes			11	4
• No	67	56	45	55

All village buyers sold cacao beans to wholesalers. “Good price” was the main reason to choose the main buyer, followed by “prompt payment” (Table 5.20). Most village buyers have had a relationship with the main buyer for one to ten years and were satisfied with this relationship. This may be the reason why most of them maintained the relationship.

Most village buyers (78 per cent) kept the cacao beans for less than one week. This situation is probably related to lack of storage facilities. Therefore, most of them delivered cacao beans to wholesalers. The quality of cacao beans sold by village buyers can meet the buyer’s requirement and village buyers were also able to bargain on the price. The average selling price ranged from Rp.20,000 to Rp.28,000 per kilogram. Most village buyers stated that they got a higher price for good-quality cacao beans. Only a small proportion of village buyers sold their cacao beans to buyers other than the main buyer.

Perceptions by village buyers about the performance of the cacao industry in West Sumatra are presented in Table 5.21. Most village buyers (63 per cent) disagreed with the statement that “cacao yield in this region is low”, while they agreed that good quality of cacao beans is hard to get in this region. Sixty seven per cent of village buyers agreed that they received a low price and all stated that price fluctuates all the time. The low price was generated by low quality of cacao beans due to improper fermentation, stated by all village buyers. They admitted that farmers are discouraged to do fermentation properly because no there is no difference in price between proper and improper fermented cacao beans. They also stated that village buyers mixed different qualities of cacao beans. Even though it was not hard to transport cacao beans in this region, village buyers were not able to buy the quantity of cacao beans they wanted.

Table 5.20. Selling Profile of Village Buyers

Description	Solok N = 9	50 Kota N = 9	Pasaman N = 9	West Sumatra N = 27
Reason to choose the main buyer (%)				
• Certainty of payment	22	22	11	19
• Good price	56	33	11	33
• Certainty of price	11	33	11	19
• Prompt payment		11	67	26
• Trust	11			4
Years of relationship with the main buyer (%)				
• 1 - 5 years	78	33	33	48
• 6 - 10 years	11	67	67	48
• > 10 years	11			4
Satisfaction from the transaction (%)				
• Always	44	78	44	56
• Often	56	22	56	44
Frequency of changing buyer in the past 5 years (%)				
• Once	22			7
• Two times	33	11		15
• Three times			11	4
• Never	44	89	89	74
Have storage facilities (%)				
• Yes	33	22	44	33
• No	67	78	56	67
Time of holding cacao beans before selling (%)				
• < 1 week	89	78	67	78
• 1 - 2 weeks	11	22	33	22
Mode of selling				
• Picked-up	11	11		7
• Delivered	89	89	100	93
Selling price at village buyer level (Rp/kg)				
• The lowest selling price	19,833	20,000	20,556	20,130
• The highest selling price	24,556	28,167	26,333	26,352
• Average selling price	21,667	22,944	22,333	22,315
The quality of cacao beans meet buyer's requirement (%)				
• Yes	89	100	100	96
• Do not know	11			4
Ability to bargain (%)				
• Yes	100	89	89	93
• No		11	11	7
Reason not to bargain (%)				
• I tried but the buyer did not allow me to bargain			11	3
• Good price		11		4
Get higher price for good quality (%)				
• Always	11	67	56	44
• Often	89	33	33	52
• Seldom			11	4
Sell cacao beans to other buyer (%)				
• Yes, to other wholesaler	89		22	37
• No	11	100	78	63
Average proportion of cacao beans sold to other wholesalers (%)	22		30	24

Table 5.21. Perceptions of Village Buyers on the Cacao Industry (%)

Statement	Strongly disagree	Disagree	Agree	Strongly agree
Cacao yield in this region is low.	7	56	37	
Good quality of cacao beans is hard to get in this region.		41	59	
Price of cacao beans received by village buyers is low.		33	67	
Low price received by village buyers is due to low quality of cacao beans.			100	
Low quality of cacao beans is due to improper fermentation.			100	
No difference in price between proper and improper fermentation of cacao beans causes farmers not to ferment their cacao beans properly.			100	
The price of cacao beans increases and decreases all the time.			100	
Village buyers cannot bargain on cacao price.		96	4	
Buyers are able to buy as many cacao beans as they want in this region.	11	74	15	
It is hard to transport cacao beans in this region due to bad road infrastructure.	4	78	19	
Transportation cost is high in this region.		78	22	
Village buyers face a lack of capital in this region in order to operate efficiently.			89	11
Lack of village buyers' capital is due to lack of access to credit.		22	78	
Village buyers have no collateral for getting credit.		44	56	
Village buyers do not have enough information about credit procedures.		22	78	
Other village buyers mix different qualities of cacao beans.		7	93	
New export tax on cacao beans is becoming a burden on cacao farmers.			96	4
New export tax on cacao beans is becoming a burden on village buyers.		11	81	7
The export tax generates a significant decrease in the cacao price at the farm gate.		11	81	7

About 89 per cent of village buyers stated that they faced a lack of capital that constrained them to operate efficiently due lack of access to credit. “No collateral” and “not enough information about credit procedures” were the main constraints to get credit. This condition was worsened by the new export tax on cacao beans that was imposed in April 2010. Most village buyers (88 per cent) stated that the new export tax caused a significant decrease in the price of cacao beans at the farm gate that was burdened on farmers and village buyers.

5.5 The Implementation of the Government Program in the Past Five Years

Government policy and the regulatory framework are important factors in developing the cacao industry. Various programs have been implemented to support this development in West Sumatra in the past five years. The programs have consisted of the provision of cacao seedlings, training on agronomic practices and post-harvest practices, establishment of a cacao nursery, pest and disease management, and cacao processing. Most programs were funded by the municipal governments, which have shown their commitment to develop the industry. Some programs were funded by the provincial and central governments. The cacao development programs have been implemented extensively since 2006. The implemented programs in the three research locations are presented in Table 5.22.

The implementation of the government programs led to massive increases in planted area and production of cacao trees in the period of 2005–2010. Suitable climate and soil coupled with low cost of production have enabled smallholders to expand cocoa production at a very high rate in spite of declining world cacao prices in the 1980s and early 1990s (Akiyama and Nishio, 1996). The dominant cultural practice of cacao cultivation in West Sumatra of inter-cropping with existing tree crops such as coconut palm, durian tree and rubber enables cacao farming to be more adaptable. The existing trees are deliberately retained both for their economic value and to provide shade for the cacao trees. Cacao trees are easy to grow, yield relatively quickly and require less labour than the production of rubber, palm oil and palm kernel, making them more suitable for smallholders (Leiter and Harding, 2004).

Table 5.22. Programs for Cacao Development in the Past Five Years in West Sumatra

Program	Description	Solok	50 Kota	Pasaman
Cacao nursery establishment	Empowering farmer groups in cacao nursery to increase availability of good cacao seedlings. Distribution of cacao seedlings to expand cacao area.	✓	✓	✓
Propagation of cacao seeds, somatic embryogenesis (SE)	Seeds, SE become available for farmers to increase cacao production.			✓
Optimization of coconut land through intercropping with cacao	Encourage farmers to grow cacao intercropped with coconut trees.	✓	✓	
Extension and training for cacao farmers about superior seeds.	Improve farmer knowledge on cacao seeds quality.			✓
Macro climate modification	Improve the productivity and quality of cacao beans.			✓
Plot demonstration for maintenance of cacao trees	Improve farmer knowledge and enable them to grow cacao trees properly as recommended.		✓	✓
Development of main plantation of cacao	Encourage farmers to grow good cacao seedlings.		✓	
Farmer field school	Improve knowledge of farmers on agronomic practices.		✓	
Training on agronomic practices	Improve knowledge of cacao farmers on agronomic practices.	✓	✓	✓
Producing compost	Increase cacao production.	✓		
Training on fertilizing	Increase cacao production.	✓		
Training on pest and disease management	Improve farmers' knowledge on pest and disease management.		✓	
Propagation of biological agents	Propagate biological agents to become available for farmers to control pests and diseases.		✓	
Training on pruning cacao trees	Increase cacao production.	✓		
Building farm roads	Create access to farm location.	✓		
Training on post-harvest practices	Improve knowledge of cacao farmers on post-harvest practices in order to improve the quality of cacao beans.	✓	✓	✓
Provision of drying equipment	Encourage farmers to dry cacao beans properly in order to improve the quality of cacao beans.	✓		
Provision of fermentation equipment	Encourage farmers to ferment cacao beans properly in order to improve the quality of cacao beans.	✓		✓
Establishment of cacao processing plant	Develop cacao agribusiness and increase value added of cacao beans.			✓
Improvement of operation of cacao processing plant	Optimize the use of available processing equipment.			✓
Agricultural product exhibition	Promote agricultural products to open up market opportunities.		✓	✓
Development of market information system at the farmer level	Improve market information for farmers.			✓

The provision of cacao seedlings

The government of West Sumatra has encouraged farmers to grow cacao trees by providing them with cacao seedlings. The focus of this program is the distribution of free cacao seedlings and cacao seeds to farmers. It was supported by the establishment of a cacao nursery in order to make good cacao seedlings more widely available. Seedlings in this nursery are primarily raised for free distribution to small farmers. The program is being conducted through farmer groups to provide support to farmers as a means of increasing their access to good cacao seedlings. This activity was done by providing support for farmers groups to produce a good quality of cacao seedlings. This program was implemented in all research locations.

The objective of this program is to expand the cacao area and to increase cacao yields through the adoption of improved cacao seedlings. The program has been conducted by the Department of Plantation at the municipality level since 2005. The expansion of cacao area was also achieved by encouraging farmers to grow cacao trees on existing areas of coconut palms as an intercropping system. Micro-climate modification was the technology conducted only in Pasaman that aimed to increase production and improve the quality of cacao beans.

This study found that about 17 per cent of cacao farmers who obtained cacao seedlings from the government program achieved higher yields than those who bought or received seedlings from other farmers. This suggests that cacao seedlings provided by the government were of superior quality and that greater support is required to encourage farmers to use good seedlings. Based on in-depth interviews with government officers at the Department of Plantation of 50 Kota, it was stated that there was willingness by farmers to plant good cacao seedlings; however, their cacao nursery cannot meet the demand for good-quality cacao seedlings.

Among all programs implemented in West Sumatra, the provision of cacao seeds and seedlings is the dominant program because the cacao industry in this province is at an early stage of development and cacao has received more attention as a potential export commodity since 2005.

Training on agronomic and post-harvest practices

The improvement of knowledge of farmers on cacao farming in West Sumatra has been done mainly in four forms of activity: plot demonstrations, farmer field schools, training and extension services on agronomic practices, and post-harvest handling. These programs are valuable to support the cacao seedlings program. The core of these programs was the development and dissemination of information on fertilizing, pruning, pest and disease management, harvesting and fermenting. Their objective is to promote greater knowledge of farmers in adapting effective cultural practices in order to increase the quantity and improve the quality of cacao beans produced.

Plot demonstrations were aimed to improve farmers' ability to grow cacao trees properly as recommended and shown in the demonstrations. This method of information dissemination was used by the government in two research locations: 50 Kota and Pasaman. Training on agronomic and post-harvest practices was conducted in all research locations. In Pasaman, farmers were also provided with knowledge on cacao seeds quality that was not conducted in Solok or 50 Kota.

Farmer field schools were operated intensively only in 50 Kota from 2005 to 2009. However, a key informant at the Department of Plantation of 50 Kota stated that not all farmers can apply the knowledge they obtained from attending a farmer field school. This constraint arises due to the lack of affordability of farmers to buy inputs. They faced a lack of capital to utilise the knowledge they gained on cacao farming.

Kalinda, Shute and Filson (1998) stated that agricultural training has a strong influence on a farmer's ability to seek the relevant information for making production decisions. ACDI/VOCA (2005) found that one of the major challenges facing the cacao industry in Indonesia is to build effective service provision mechanisms that can deliver improved technologies and training to all cacao producers. They identified effective solutions to cope with this problem; but the way to institutionalise information and technology services for farmers is still a big challenge.

Pest and disease management

The objective of this program is to improve the quantity and quality of smallholder-grown cacao through the adoption of effective pest and disease management practices. The activity includes developing biological agents to control pests and diseases on cacao farms. In 50 Kota, the biological agents developed for three years were *Trichoderma* and *Beuveria*.

Cacao processing

In addition to programs to increase cacao production, programs were also conducted on post-harvest practices in order to improve the quality of cacao and to increase its value added. Product innovation was done through the implementation of fermentation and drying, and processing cacao beans to produce cacao products such as cocoa powder and cocoa butter.

To support post-harvest practices, the government provided farmers with fermentation and drying equipment. This program is expected to be able to encourage farmers to improve the quality of cacao beans by fermenting and drying the beans properly. Twenty five units of fermentation equipment and 25 units of drying equipment were provided in Solok and 40 units of fermentation equipment were provided in 50 Kota. However, interview results reveal that this equipment was not used well. No price difference between proper fermentation and improper fermentation of cacao beans is the main reason to discourage farmers to ferment their cacao beans properly.

A cacao processing plant was also established to increase the value added of cacao beans to capture higher prices in order to develop cacao agribusiness in Pasaman. Unfortunately, the processing machine cannot be used properly due to a machine capacity problem, even though there was a program conducted to optimise the use of the machine in 2009 and 2010.

5.6 Concluding Remarks

In this chapter, the profile of the cacao industry in West Sumatra is presented, which shows that the cacao industry plays an important role in increasing farmers' income. It has made a major contribution to total household incomes even though most farmers grow cacao trees on only small areas of land. This indicates a big potential for the cacao industry to increase farmers' income but the economic condition of smallholders may constrain them from grasping this opportunity. Farmers face a range of constraints that restrict their ability to increase the quantity and quality of cacao output.

The information presented in this chapter is used for further analysis in Chapters 6 and 7, which discuss constraints in production and marketing in the cacao industry.

Chapter 6

Production Constraints in the Cacao Industry in West Sumatra

6.1 Introduction

Low yields and low quality of cacao beans were identified as the main problems in the cacao Industry in West Sumatra during the PIPA workshop as described in Chapter 4. Those problems were confirmed by the results of the surveys conducted in three municipalities, which are discussed in Chapter 5. A number of identified factors affecting these two problems that arose during the workshop were then traced in the survey for data triangulation purposes.

This chapter provides an empirical analysis to determine the effects of the identified factors on cacao production performance. The aim of the analysis is to assess the effects of these factors on the gross income of cacao farmers. The analysis is based on a cause-and-effect model drawn as a problem tree in the PIPA workshop. Consequently, a specific method is required to assess cause-and-effect relationships among all variables in the model simultaneously. Path analysis offers the required method for this study.

Path modelling in this study is considered a complementary method to PIPA. While PIPA focuses on constructing a problem tree and the use of qualitative data, path modelling allows data to be analysed quantitatively based on the problem tree being modelled using the PIPA method.

Use of the path analysis method in model estimation is discussed in Section 6.2. The results are discussed in Section 6.3 and the chapter ends with a concluding remark in Section 6.4.

6.2 Application of Path Analysis of Cacao Production

This study applies the path analysis to determine the main constraints facing the cacao industry in West Sumatra. A path analysis is used in this study for four reasons. First, this study involves a problem tree that illustrates cause-and-effect relationships among variables, which can be assessed by path analysis. Second, all variables in the model are observed variables, which is one of the characteristics of path modelling. Third, path analysis provides the means to decompose the effects of variables that enables us to assess the indirect effects of exogenous variables on endogenous variables that are transmitted through intervening variables. Fourth, the correlation of the variables can be estimated simultaneously.

Model specification

Path analysis begins with a base model, which is formulated on prior information. At this stage, variable relationships are specified to decide which particular variables causally affect other particular variables. The variables involved in path analysis are called measured variables because they are directly measured representing the data; they are also called observed or manifest variables. The measured variables can be categorical, ordinal or continuous variables (Kline, 2011).

There are three types of variables involved in path analysis: independent variables, intervening variables and dependent variables. The general formula showing the relationships between a dependent variable and a set of determinant (independent and intervening) variables is presented in equation (6.1) (Greene, 1997).

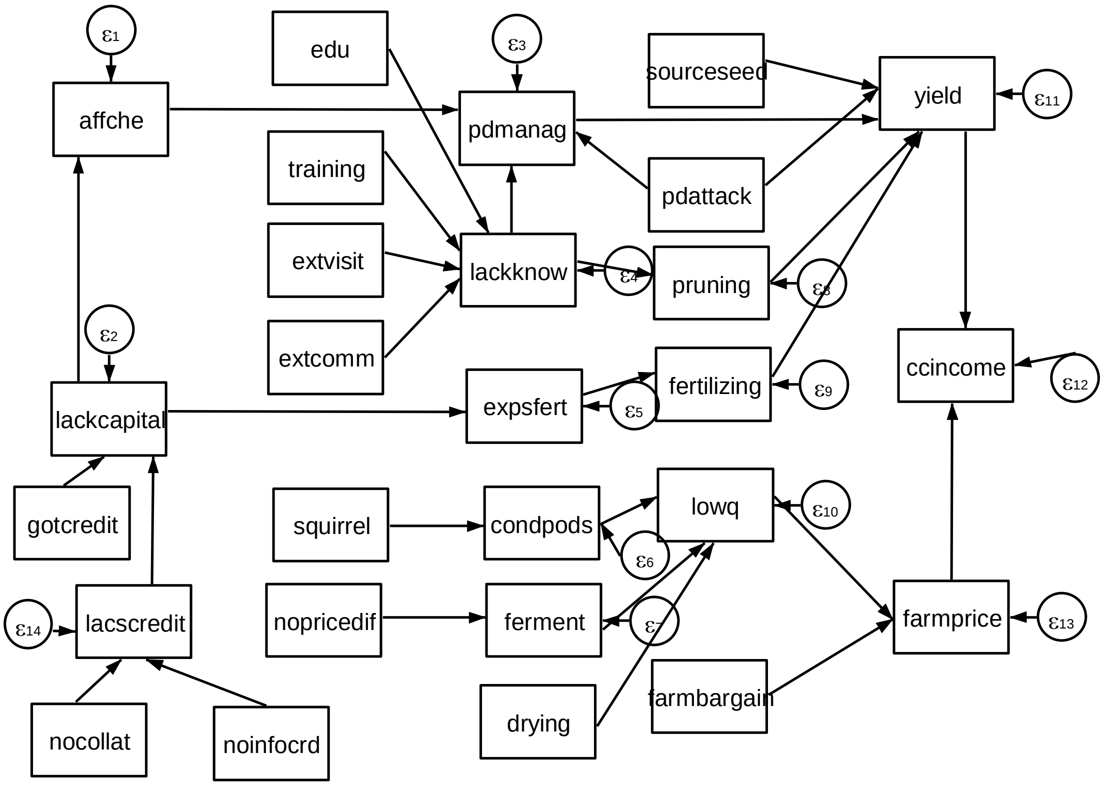
$$y_i = x'_i \beta + \varepsilon_i \qquad (6.1)$$

where y_i refers to an observed dependent variable, α_i represents an intercept, x refers to a vector of determinant variables, β represents a corresponding vector of coefficients (βs) that empirically link y_i to the elements in x, and ε_i represents random errors associated with the dependent variable.

The relationships among variables in SEM can be visualized with a diagram (Kline, 2011). In the diagram, observed variables are represented with squares or rectangles and latent variables are represented by circles or ellipses. A line with a single arrowhead, which relates a variable to another, represents the hypothesized directional effect. The covariance between independent variables is drawn as a curved line with two arrowheads.

The base model in this study is based on the problem tree generated in the PIPA workshop. It concerns the effect of changes in cacao production performance on the gross income of cacao farmers. The base model for cacao production is illustrated in Figure 6.1.

Figure 6.1. Base Model for Cacao Production



All variables in the model in Figure 6.1 are drawn with a rectangle because they are observed variables. Errors are drawn in circles because they are latent variables. The model has unidirectional relationships and no correlated disturbances; therefore, it is considered as a recursive model.

Cacao income is at the end of the pathway in the model. It is measured in terms of revenue from selling cacao beans. Even though the magnitude of the relationship between yield and farm income is known, the involvement of farm income in the model is for completeness to show the pathway from production performance to the economic condition of farmers.

There are 27 measured variables involved in the model, which consist of dependent, independent and intervening variables. A description of the variables is presented in Table 6.1.

Table 6.1. Description of Variables in the Path Model of Cacao Production

Variable	Description	Unit
ccincome	Farmers' gross income from cacao farming	Rupiah / ha
conpods	Condition of pods harvested	1 = partially ripe; 2 = mix of partially and fully ripe 3 = fully ripe
drying	Drying practices	Number of days
edu	Education	1 = no education; 2 = primary education; 3 = junior high school; 4 = senior high school: 5 = tertiary education
expsfert	Expensive fertilizer	1 = fertilizer is expensive; 0 = otherwise
extcomm	Communicate with extension officer	1 = never; 2 = sometimes; 3 = often; 4 = every visit
extvisit	Extension visits	Frequency of visits per year
farmbargain	Farmer's ability to bargain	1 = no; 2 = yes
farmprice	Price received by farmers	Rupiah / kg
ferment	Fermentation practices	Number of days
fertilizing	Fertilizing practices	2 = yes; 1 = no
gotcredit	Got credit in the past 2 years	2 = yes; 1 = no
lackcapital	Lack of capital	1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree
lackknow	Lack of knowledge	1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree
lacscredit	Lack of access to credit	1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree
lowq	Low quality of cacao beans	1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree
nocollat	No collateral	1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree
noinfocrd	Not enough information on credit	1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree
nopricedif	No price difference	1 = no price difference; 0 = otherwise
pdattack	Pest and disease attack	2 = yes; 1 = no
pdmanag	Pest and disease management	2 = yes; 1 = no
pruning	Pruning practices	2 = yes; 1 = no
sourceseed	Source of seedling	1 = from government; 0 = otherwise
squirrel	Squirrel attacks	1 = squirrel attack; 0 = otherwise
training	Got training in the past 5 years	2 = yes; 1 = no
unaffche	Unaffordable to buy chemicals	1 = unaffordable to buy chemical ; 0 = otherwise
yield	Total yield	Kilograms/ ha

The logic and relationships of variables in the model are described as follows. In the model, five variables (source of cacao seedlings, pest and disease management, pest and disease attack, pruning practices and fertilizing practices) were presumed to influence the yield of cacao trees. Based on workshop results, low quality of cacao seedlings used by farmers emerged as one of factors affecting cacao output in West Sumatra. This is supported by a statement by Hebbar (2007) that most world cacao producers are facing lack of disease-tolerant cultivars or clones. A free cacao seedling program was expected to be able to provide a good seedling quality. Thus, participating farmers who got cacao seedlings from the government program may produce more yields than non-participating farmers.

Pest and disease management contributes to increase cacao output because it can prevent cacao trees from contracting pest and disease infection. However, farmers may not manage pests and diseases because they cannot afford to buy chemicals due to lack of capital. Thus, pest and disease attack can reduce cacao output. It is common that farmers manage pest and disease if there is pest and disease infestation.

Pruning can enhance air circulation (Duguma et al. 2001) and create better-lit farming conditions, which are not preferred by the cacao pod borer (ACDI/VOCA, 2005). In addition, pruning enables farmers to see and harvest all cacao pods. Therefore, pruning practices support higher yields. Lack of pruning practices by farmers was perceived by workshop participants as another factor contributing to low cacao output.

Lack of knowledge due to low education, lack of training, lack of extension visits and lack of communication with extension officers was presumed to contribute to a lack of pest and disease management and lack of pruning practices by West Sumatran farmers. Abdelgalil and Cohen (2007) found that farming knowledge is one of the factors determining farmers' productivity. Abbate (2007) found that about 60 per cent of cacao farmers in Central Sulawesi did not attend any training program. Most farmers are assumed to lack knowledge on agronomic practices due to lack of access to training and extension services. It is common that cacao farms are not supported with adequate technical infrastructure in cacao-producing countries (Hebbar, 2007). If farmers get access to necessary technical support in the form of training courses and local consulting services, they can improve their farm management in order to increase productivity and income

(Abbate, 2007). Training can provide farmers with information on good management for their farms. Therefore, access to training is important for farmers to get the knowledge.

Some studies used frequent extension contact as a variable to measure the impact of agricultural extension on farmers' performance (Avenson, 1998; Nambiro et al. 2006). Extension services can be seen as a substitute for and complement to farmers' skill, reflecting farmers' schooling (Avenson, 1998). Contact with extension services enables farmers to get more knowledge on farm practices, which will affect their farm performance. Lack of access to extension workers and other crop-related information contributes to the low yields (Alwang and Marió, 2008).

Improper use of fertilizer may reduce production because soil does not obtain the nutrients it needs to support plant growth. Application of fertilizer such as urea, potassium chloride and tri-sodium phosphate can encourage healthier cacao trees that are more resistant to cacao pod borer; however, many farmers cannot regularly afford to purchase fertilizer (ACDI/VOCA, 2005). If farmers use fertilizer, they are assumed to have higher yields.

Lack of capital appeared as a constraint for farmers to buy fertilizer and chemicals that subsequently affects farmers' fertilizing and pest and disease management practices. "Did not get credit" and "lack of access to credit" were two possible causes of lack of capital. "No collateral" and "lack of information on credit" were perceived by stakeholders in the workshops as factors contributing to "lack of access to credit".

Low price of cacao beans received by farmers was a marketing issue raised in PIPA workshops. Two perceived causes were low quality of cacao beans and low bargaining power of farmers. The quality of cacao beans may be influenced by condition of pods harvested, fermentation and drying practices. The workshop participants cited that some farmers faced squirrel attack that forced them to harvest unripe pods. They also observed that no price difference between proper and improper fermented beans discouraged farmers from doing fermentation properly.

The system presented in Figure 6.1 can be written in structural equations, which consist of 14 equation sets. Equations (6.2) – (6.6) and equations (6.9), (6.10), (6.12) and (6.15) describe factors contributing to the yield of cacao beans. Equations (6.7), (6.8) and (6.11) formulate factors affecting the quality of cacao beans. Equations (6.12) - (6.14) relate to factors affecting the gross income of cacao farmers.

$$unaffche = \alpha_1 + \beta_1\, lackcapital + \varepsilon_1 \quad (6.2)$$
$$lackcapital = \alpha_2 + \beta_{21}\, gotcredit + \beta_{22}\, lacscredit + \varepsilon_2 \quad (6.3)$$
$$pdmanage = \alpha_3 + \beta_{31}\, unaffche + \beta_{32}\, lackknow + \beta_{33}\, pdattack + \varepsilon_3 \quad (6.4)$$
$$lackknow = \alpha_4 + \beta_{41}\, training + \beta_{42}\, extvisit + \beta_{43}\, extcomm + \beta_{44}\, \mathrm{edu} + \varepsilon_4 \quad (6.5)$$
$$expspfert = \alpha_5 + \beta_5\, lackcapital + \varepsilon_5 \quad (6.6)$$
$$condpods = \alpha_6 + \beta_6\, squirrel + \varepsilon_6 \quad (6.7)$$
$$ferment = \alpha_7 + \beta_7\, nopricedif + \varepsilon_7 \quad (6.8)$$
$$pruning = \alpha_8 + \beta_8\, lackknow + \varepsilon_8 \quad (6.9)$$
$$fertilising = \alpha_9 + \beta_9\, expsfert + \varepsilon_9 \quad (6.10)$$
$$lowq = \alpha_{10} + \beta_{101}\, condpods + \beta_{102}\, ferment + \beta_{103}\, drying + \varepsilon_{10} \quad (6.11)$$
$$yield = \alpha_{11} + \beta_{111}\, sourceseed + \beta_{112}\, pdmanag + \beta_{113}\, pdattack + \beta_{114}\, pruning + \beta_{115}\, fertilising + \varepsilon_{11} \quad (6.12)$$
$$ccincome = \alpha_{12} + \beta_{121}\, yield + \beta_{122}\, farmprice + \varepsilon_{12} \quad (6.13)$$
$$farmprice = \alpha_{13} + \beta_{131}\, lowq + \beta_{132}\, farmbargain + \varepsilon_{13} \quad (6.14)$$
$$lacscredit = \alpha_{14} + \beta_{141}\, nocollat + \beta_{142}\, noinfocrd + \varepsilon_{14} \quad (6.15)$$

where:

α_i refers to the intercept for associated with the i^{th} -dependent variable

i is the first subscript to identify the dependent variable in the equation which has a value of 1,2,3,...

β_{ij} represents the path coefficient that links the i^{th} dependent variable and the j^{th} independent variable.

j is the second subscript to identify the variable whose direct effect on the dependent variable in the equation which has a value of 1,2,3,...

ε_i is the error associated with the i^{th} dependent variable.

In the structural model, an independent variable in an equation can be a dependent variable in another. For example, *lackcapital* (lack of capital) is an independent variable in the equation (6.2) while it is a dependent variable in the equation (6.3). Path analysis enables us to assess the effect of *lacscredit* (lack of access to credit) and *gotcredit* (got credit in the past two years) on *unaffche* (unaffordable to buy chemicals) that is transmitted through the variable *lackcapital* as an intervening variable in the model. The effect of all variables in the model on the income of cacao farmers, in turn, can be assessed simultaneously. This effect is discussed when interpreting the results. The next step in path analysis is to estimate the base model.

Preliminary analysis of path modelling

The recursive path model of the cacao industry in West Sumatra was estimated using *Stata* Version 12. *Stata* is a statistical package that can be used to manage, analyse and graph data (StataCorp, 2011). The level of multicollinearity in the model was measured using the variation inflation factor (VIF). A model is considered to have high multicollinearity when the value of VIF greater than 10 (El-Dereny and Rashwan, 2011) or correlation among the exogenous variables is greater than 0.9 (Grewal, Cote, and Baumgartner, 2004). *Stata* results show that VIF values for all variables in the model are below 4, indicating that multicollinearity is not a problem in the model. The results of multicollinearity tests are provided in Appendix 6.1.

The result of the maximum likelihood estimation for the base model is drawn in Appendix 6.2. The estimated coefficients in the result are unstandardized coefficients. The numbers near to the arrows are path coefficients between the variables, while error values are located close to the error terms. For endogenous variables, intercepts are written in the rectangles. For exogenous variables, means and variances are written on the top and on the bottom in rectangles, respectively. The descriptions of individual coefficients and z–values are presented in Table 6.2.

The *Stata* results in Table 6.2 and Appendix 6.2 identify some insignificant variables. There are two categories of insignificant variables in the model: (i) variables that do not have a significant relationship with all other variables; and (ii) variables that do not have a significant relationship with some variables while correlating significantly with other variables. The variables in the first category are *gotcredit, extvisit, extcomm, edu, pruning* and *farmbargain*. The variables in the second category consist of *lackknow, pdattack, pdmanag, condpods, ferment and lowq.* At the model modification stage, the variables in the first category are considered to be removed from the model, while those in the second category remain in the model.

Table 6.2. Maximum Likelihood Estimates of the Base Model for Cacao Production

Endogenous variable	Exogenous variable	Path coefficient (β)	z-value
unaffche	*lackcapital*	0.27*	3.74
	constant	-0.56*	-2.48
pdmanage	*unaffche*	-0.24*	-3.82
	lackknow	0.06	1.20
	pdattack	0.73*	13.10
	constant	0.23	1.39
lackcapital	*lacscredit*	0.53*	7.98
	gotcredit	0.22	1.15
	constant	1.30*	4.32
expsfert	*lackcapital*	0.18*	2.80
	constant	-0.37	-1.86
lackknow	*training*	-0.26*	-2.16
	extvisit	-0.01	-1.16
	extcomm	0.04	0.84
	edu	0.01	0.27
	constant	3.18*	14.08
condpods	*squirrel*	-0.87*	-8.65
	constant	2.87*	71.41
ferment	*nopricedif*	-2.14*	-7.03
	constant	2.14*	15.35
yield	*pdmanag*	-1.60	-0.88
	pruning	-0.74	-0.34
	fertilizing	2.87*	2.55
	sourceseed	2.66*	2.00
	pdattack	0.77	0.44
	constant	6.21	1.39
pruning	*lackknow*	-0.02	-0.37
	constant	1.99*	15.28
fertilizing	*expsfert*	-0.84*	-9.77
	constant	1.84*	50.42
lowq	*condpods*	0.19	1.88
	ferment	0.03	0.91
	drying	-0.12*	-2.35
	constant	2.46*	7.02
farmprice	*lowq*	0.02	0.60
	farmbargain	0.002	0.04
	constant	1.98*	12.97
ccincome	*yield*	2.04*	91.18
	farmprice	9.90*	17.43
	constant	-19.87*	-17.73
lacscredit	*nocollat*	0.27*	2.84
	noinfocrd	0.57*	6.45
	constant	0.48*	2.13

*significant at α = 0.05 using a two-tailed test

Model fit

Before interpreting the results of the path analysis, the original model is first assessed to determine whether the model fits the data. If the model does not acceptably fit the data, the hypothesized relationship cannot be examined. On the contrary, if the model has an acceptable fit, the path coefficients can be interpreted.

The goodness of fit of the model is tested using the root mean squared error of approximation (RMSEA), comparative fit index (CFI) and Tucker Lewis index (TLI). Many SEM analysts have used these indices to assess model fit. According to Kline (2011), RMSEA is scaled as a badness-of-fit index and follows the theory of a non-central chi-squared distribution. Its value is sensitive to degrees of freedom and sample size. The greater the degrees of freedom and the larger the sample size, the smaller the value of RMSEA is, where a zero value of RMSEA indicates the best fit and value ≤ 0.05 may indicate good fit. To assess a model as a good fit, the values have to be ≤ 0.05 for the lower bound (close-fit hypothesis) and < 0.10 for the upper bound (poor-fit hypothesis). Streiner (2006) categorized values of RMSEA over 0.10 as a bad fit, values less than 0.08 as a reasonable fit, and values less than 0.05 indicating a good fit.

CFI is an incremental fit index that compares a model with a statistical baseline model (Kline, 2011). Its values range between 0 and 1, and a value close to 1 indicates a good fit of the model (StataCorp, 2011), where a value > 0.90 is considered as a good fit (Feldman and Bolino, 1999; Lester, 2009). Many analysts (e.g. Feldman and Bolino, 1999; Iriondo, Albert and Escudero, 2003; Mulaik, 2009) noted that CFI is more reliable to assess the model fit for a small sample because it is not sensitive to sample size. TLI includes a correction for model complexity. A model is considered well-fitting if the TLI value is greater than 0.9.

Values of fit statistics for the base model are presented in Table 6.3. CFI and TLI tests indicate that the base model is a poor fit. The value of the RMSEA is 0.074 that indicates reasonable fit. However, the upper bound of RMSEA was not constructed in the test. This may indicate model that has a poor fit. To improve the goodness of fit, the model needs to be modified.

Table 6.3. Values of Fit Statistics for the Base Model

Index	Value	Interpretation
CFI	0.870	Poor fit
TLI	0.854	Poor fit
RMSEA	0.074	Reasonable fit

Model respecification

The modification of a model can be done by removing insignificant variables and eliminating paths from the model (model trimming) or by building some more paths in the model (model building). Model trimming is done by constraining free paths to zero. Model building is done by specifying previous zero paths as free parameters. The aim of trimming and building models is to find a good model that fits the data, and can be justified based on theoretical perspectives (Kline, 2011, p. 214).

In this study, model modification begins with building the model based on a modification indices test. StataCorp (2011) referred to modification indices as score tests (Lagrange multiplier tests) for the statistical significance of the omitted paths. They provide a suggestion for an additional path in order to improve the goodness of fit of a model. If a path with a high value of modification index is added to the model, it can generate a large improvement in overall fit (Kline, 2011, p. 217).

Many additional paths were suggested by the modification indices test in order to improve the model fit. However, some of them did not make sense from a theoretical perspective. Therefore, only paths supported by theory were considered to be added in the model. The possible paths suggested by modification indices are presented in Table 6.4.

The modification index of all paths listed in Table 6.4 is significant at the 0.05 level, corresponding to a $\chi^2(1)$ value of 3.84.It approximates the change in the model's goodness of fit if the path were added. EPC stands for expected parameter change. It approximates the value of the parameter if the path were added, which is reported in unstandardized (column 4) and standardized (column 5) units.

Table 6.4. Modification Indices for the Cacao Production Path Model

Endogenous variable	Exogenous variable	Modification Index	EPC	Standardized EPC
pdmanag	*training*	5.22	0.13	0.13
condpods	*pdmanag*	4.32	-0.17	-0.16
	extcomm	4.06	0.07	0.15
	pdattack	4.91	-0.17	-0.17
	farmbargain	5.06	0.26	0.17
ferment	*extcomm*	6.84	0.29	0.21
farmprice	*lackcapital*	4.70	-0.08	-0.22

The modification indices test shows that the path from *extcomm* to *ferment* has the largest change in the observed χ^2 value (6.84). If this path were added to the base model, it would generate a large improvement. In addition, it has the highest standardized EPC. Other paths with a modification index ≥ 5 were also added to the model. They were the paths from *training* to *pdmanag* and from *farmbargain* to *condpods*.

At the same time, variables that are not statistically significant were removed from the model. There are six insignificant variables in the base model: *gotcredit*, *extvisit*, *edu*, *extcomm*, *pruning* and *farmbargain*. However, only the first three variables were removed from the model. The variable *pruning* was retained in the model because theoretically pruning practices have a strong effect on the yield of cacao trees. The variables *extcomm* and *farmbargain* were retained because they can potentially improve the model fit by building a path to *ferment* and *condpods*, respectively. Paths from *extcomm* to *lackknow,* from *pdattack* to *yield,* and from *lackknow* to *pruning* were also removed because the relationships between them were found not to be statistically significant. Even though the effects of *lowq* and *farmbargain* on *farmprice* were not significant, their paths to *farmprice* were kept in the model because these two variables are determinant factors for the price received by farmers from an economic perspective. The path from *pdmanag* to *yield* was also retained, even though its relationship was not significant, because *pdmanag* is an intervening variable. The estimation result of the modified model is presented in Appendix 6.3.

This model, named “Model 1”, had a better fit to the data than the base model. The CFI and TLI values increased to 0.898 and 0.884, respectively, which indicated a poor fit.

Values of approximate fit indexes for the model presented a mixed picture. The value of the RMSEA was 0.073, and the close-fit hypothesis was rejected based on the value of the lower bound of the 90 per cent confidence interval (0.056). However, the upper bound of the RMSEA was 0.089, meaning that the poor-fit hypothesis was rejected. In other words, the RMSEA value was only consistent with the close-fit hypothesis, while it was not consistent with the poor-fit hypothesis. According to Kline (2011, p. 206), this "mixed outcome is more likely to happen in smaller sample size". Increasing the sample size may obtain more precise results. To improve the goodness of fit, the model needs to be modified.

To improve the goodness of fit of Model 1, three additional paths, suggested by modification indices were built in the model: *pdattack* → *condpods; extcomm* → *condpods; and lackcapital* → *farmprice*. At first, the path from pdmanage to condpods was also added in the model. However, it increased the value of RMSEA. Moreover, the relationship between these variables was found to be insignificant. For these reasons, the path was removed.

The second modification generates Model 2, which is illustrated in Appendix 6.4. Based on the model fit index test, Model 2 is better than the previous two models. The values of the fit indexes for all models are compared in Table 6.5.

Table 6.5. Comparison of Fit Statistics for the Cacao Production Model

Index	Base Model	Model 1	Model 2
CFI	0.877	0.898	0.910
TLI	0.862	0.884	0.896
RMSEA	0.074	0.073	0.069
Lower bound	0.000	0.056	0.052
Upper bound	.	0.089	0.086

Model 2 has the highest value of CFI (0.910) and TLI (0.896); and has the lowest value of RMSEA (0.069). It implies that Model 2 is the best-fit model among the three models. There is a significant increase in the value of CFI and TLI and both indexes provided a satisfactory fit for Model 2. Even though the RMSEA test indicates a reasonable fit for Model 2, its value decreases meaning that the model is giving a better fit. Based on these results, Model 2 is used for further analysis.

6.3 Interpretation of Results

To see the effect of individual variables in the structural model, the descriptions of individual coefficients and z-values are presented in Table 6.6.

Model 2 shows that the effects of cacao yield and price at the farm gate on farmers' gross income from cacao farming are positive and significant, as expected. The path coefficient of 2.04 between yield and gross cacao income means that a 1 point increase in the output of cacao trees increases gross cacao income by 2.04 points. As the unit of production in the model is scaled in 100 kilograms and the unit of gross cacao income is scaled in millions of rupiahs, the result can be interpreted as a 1 kg increase in production leads to an increase in gross cacao income of Rp.20,400. With Rp.20,400, poor farmers can buy about 2.5 kilograms of rice (the price of rice in 2010 = Rp.8000 per kg) that can feed four people for two days.

The path coefficient from farm price to gross cacao income is 9.90, which suggests that a Rp.1 increase in farm price causes an increase in gross cacao income of Rp.990 because the price in the model is scaled in ten thousands of rupiahs. This figure suggests that smallholder farmers perceive support to increase the production of cacao trees and cacao market improvement are critical requirements to increase their income.

Of all the path coefficients from the determinant variables to yield of cacao trees, only those from source of cacao seedlings ($\beta = 2.61$, $z = 1.97$) and fertilizing practices ($\beta = 2.84$, $z = 2.52$) are significant at the 0.05 level, whereas pruning practices and pest and disease management have insignificant effects. This figure indicates that farmers consider that cacao seedlings received from the government program are of better quality than those from other sources. Those farmers who received cacao seedlings from the government program attained higher yields than those who received seedlings from other sources.

Table 6.6. Maximum Likelihood Estimates of Model 2 for Cacao Production

Endogenous variable	Exogenous variable	Path coefficient (β)	Standardized path coefficient	z-value
unaffche	*lackcapital*	0.27*	0.35	3.74
	constant	-0.56*		-2.48
pdmanage	*unaffche*	-0.23*	-0.22	-3.80
	lackknow	0.08	0.09	1.68
	training	0.13*	0.13	2.35
	pdattack	0.73*	0.78	13.50
	constant	-0.01		-0.07
lackcapital	*lacscredit*	0.53*	0.62	7.85
	constant	1.56*		7.71
expsfert	*lackcapital*	0.18*	0.27	2.80
	constant	-0.37		-1.86
farmprice	*lackcapital*	-0.08*	-0.23	-2.28
	lowq	0.04	0.10	0.98
	farmbargain	0.03	-0.04	0.41
	constant	2.15*		12.95
lackknow	*training*	-0.24*	-0.21	-2.10
	constant	3.24*		20.34
condpods	*extcomm*	0.08*	0.18	2.49
	squirrel	-0.80*	-0.60	-8.40
	pdattack	-0.17*	-0.18	-2.41
	farmbargain	0.22*	0.15	2.10
	constant	2.53*		10.54
ferment	*extcomm*	0.29*	0.21	2.71
	nopricedif	-2.09*	-0.56	-7.11
	constant	1.56*		6.18
yield	*pdmanag*	-0.95	-0.08	-0.89
	fertilizing	2.84*	0.25	2.52
	sourceseed	2.61*	0.19	1.97
	pruning	-0.70	-0.03	-0.32
	constant	6.39		1.43
fertilizing	*expsfert*	-0.84*	-0.70	-9.77
	constant	1.84*		50.42
lowq	*condpods*	0.19	0.18	1.88
	ferment	0.03	0.09	0.91
	drying	-0.12*	-0.23	-2.35
	constant	2.46*		7.02
ccincome	*farmprice*	9.90*	0.19	17.43
	yield	2.04*	0.98	91.18
	constant	-19.87*		-17.73
lacscredit	*nocollat*	0.27*	0.25	2.84
	noinfocrd	0.57*	0.56	6.45
	constant	0.48*		2.13

*significant at α = 0.05 using a two-tail test

About 51 per cent of farmers commented that good cacao seedlings were hard to get in their region. Furthermore, the prices of cacao seedlings were considered expensive by farmers; therefore, they planted low-quality seedlings (cited by 56 per cent of farmers). The price of a good seedling produced by PT Inang Sari (a certified cacao breeder located in West Sumatra) is Rp.3,500. To grow cacao trees on one hectare, farmers need to buy approximately 1,000 seedlings, at a cost of Rp.3,500,000, while the price of a local cacao seedling is Rp.2,000. This cost difference is the reason why farmers prefer to buy local seedlings.

Farmers believe that fertilizing practices play an important role in increasing the yield of cacao beans, yet about 31 per cent of the sample farmers did not fertilize their cacao trees. "Fertilizer is expensive" was the main reason given for not fertilizing. This variable has a strong negative relationship (β = -0.84,z = -9.77) with the variable of fertilizing practices. It implies that farmers did not fertilize their cacao trees because they perceived fertilizer to be too expensive.

Lack of capital, identified as an issue by farmers in the workshop, is assumed to be related to the opinion held by farmers that "fertilizer is expensive". The test reveals a significant relationship between farmers' opinion that "fertilizer is expensive" (*expsfert*) and the variable *lackcapital*, with a path coefficient (β) of 0.18 and z value of 2.80. This implies that lack of capital is a factor affecting the affordability of farmers to buy fertilizers. Many studies (e.g. Ahluwalia, 1990; Debroy, 2004; Dorward et al., 2004; Bhutto and Bazmi, 2007; Coughlin, 2011) found that lack of access to credit was the main cause of lack of capital facing small farmers. Therefore, access to credit is included in the model to show its relationship with lack of capital. The results reveal that lack of access to credit is significantly correlated to lack of capital (β = 0.53, z = 7.85).

There are two factors affecting lack of access to credit (*lacscredit*) in the cacao industry: lack of collateral (*nocollat*) and information on credit (*noinfocrd*). These two factors are significantly correlated to lack of access to credit with path coefficients for *nocollat* and *noinfocrd* of 0.27(z = 2.84) and 0.57 (z = 6.45), respectively.

The infestation of pests and diseases in West Sumatra does not have a significant effect on cacao production according to farmers. This implies that this problem was not as serious as in Sulawesi. It is a surprising result given that 41 per cent farmers reported that they faced this problem and 25 per cent farmers claimed to have lost cacao output of more than 50 per cent. Further research is needed to examine this discrepancy between the model and survey results.

About 34 per cent cacao farmers controlled pests and diseases when there was an infestation, while only 2 per cent farmers did it for prevention purposes. It is proved that the variable of pests and disease management (*pdmanage*) has a significant correlation with the variable of pest and disease attack (*pdattack*) (β = 0.73, z = 13.50). It indicates that attacks by pests and diseases increased farmers' willingness to manage their control.

Most farmers (64 per cent) did not manage pests and diseases, even though there were occurrences on the farms of 7 per cent of farmers. As "unaffordable to buy chemical" was the main reason offered for not controlling pests and diseases, this variable was included in the model. The result shows a significant relationship between pest and disease management and unaffordable to buy chemicals (*unaffche*) (β = -0.23, z = -3.80). It implies that farmers do not manage pests and diseases with chemicals because they believe that they cannot afford to buy them. Training (*training*) has a significant direct effect on pest and disease management (β = 0.13, z = 2.35), indicating that farmers are more likely to manage pests and diseases if they receive training.

Initially, the low quality of cacao beans and bargaining power of farmers were hypothesized to have negative and positive relationships, respectively, with on-farm price in the original model. However, these variables were found not to have significant relationships. This implies that farmers hold the view that the cacao price they receive is affected by factors that are not included in the model, most obviously by exogenous factors related to spatial price formation.

The coefficient of the additional path from lack of capital to farm price, as suggested by modification indices, has a significant direct effect at α = 0.05 (β = -0.08; z = -2.28). The relationship between these two variables is relevant to the survey result that 22 per cent of farmers had debts from the main buyer. This condition is presumed to have an effect on the price received by these farmers. More discussion on this issue is presented in Chapter 7.

The issue identified in the workshop that low quality of cacao beans is a production problem in the cacao industry was confirmed by most respondents (61 per cent) in the survey. The statistical test shows that among the three possible causes, only the number of drying days (β = -0.12,z = -2.35) was thought by farmers to contribute significantly to the low quality of cacao beans. Results show that the variables, condition of pods harvested and fermentation practices, do not significantly cause low-quality cacao beans according to the farmers. The sign of the path coefficient from the number of drying days (*drying*) to low quality of cacao beans (*lowq*) is negative, which is in line with expectations. The negative coefficient means that farmers expect a longer drying period to lead to a better quality of cacao beans.

The effects of the condition of pods harvested and fermentation practices on low quality of cacao beans do not have the expected sign. The positive signs mean that farmers perceive that harvesting riper the pods lowers the quality of cacao beans and a longer fermentation period leads to a lower quality of cacao beans. These results contradict the theoretical perspective and need further investigation.

The main reason for harvesting unripe pods proffered by 25 per cent of sample farmers was squirrel attack. Data analysis shows a significant relationship between squirrel attack and the condition of pods harvested (β = -0.80, z = -8.40) with the expected negative sign on the path coefficient. It can be interpreted that the occurrence of squirrel attack discourages farmers from harvesting ripe pods. It means that attention should be paid to this issue; otherwise, it threatens the volume and quality of output of cacao beans.

Building the additional paths to relate the variables *pdattack*, *extcomm* and *farmbargain* to *condpods* resulted in an improvement in model fit where all the new variables significantly affected the decision by farmers on when to harvest their pods. The results reveal that pods are subject to attacks by pests and diseases, causing farmers to harvest unripe pods (β = -0.17, z = -2.41). This decision is plausible because farmers worry about the spread of the infestation of pests and diseases to healthy pods that would cause greater losses, as long as cacao beans coming from the unripe pods could be sold at the same price.

The significant effect of extension communication (*extcomm*) on the condition of pods harvested (*condpods*) (β = 0.08,z = 2.49) indicates that farmers who had intensive communication with extension officers harvested fewer unripe pods. Intensive communication with extension officers allowed farmers to get more information about the characteristics of proper ripe pods. This, in turns, influenced their harvesting practices. About 22 per cent of farmers obtained information on harvesting practices from extension officers; other farmers were the most important source of information on harvesting.

In the final model (Model 2), farmers considered their ability to bargain on price significantly affects the condition of pods they harvested (β = 0.22, z = 2.10). Farmers who are able to bargain with buyers on cacao price tend to harvest riper pods. In this case, cacao beans from ripe pods should be of better quality than those from unripe pods.

There is an interesting point regarding fermentation practices, even though it does not affect the quality of cacao beans significantly. In the model, fermentation practices deal with the incentive of a price difference between proper fermentation and improper fermentation of cacao beans. The test proves that farmers identified a strong negative relationship between fermentation practices and the variable of no price difference (β = -2.09, z = -7.11). This estimate means that farmers will increase the period of fermentation by two days if there is a price difference between appropriately and inappropriately fermented cacao beans. In other words, the proper fermentation technique would be adopted if there were a higher price received for appropriately fermented cacao beans.

Finally, results show that farmers believe that communication with extension officers (*extcomm*) brings about a positive impact on fermentation practices (*ferment*) (β = 0.29, z = 2.71). The more intensive the communication with extension officers the more effectively the fermentation is carried out. In the survey, it was found that extension officers were the most important source of information on fermentation, cited by 35 per cent of farmers. This implies that extension officers play an important role in improving the quality of cacao beans.

Decomposition of effects of predictor variables on cacao income

Effects can be direct or indirect. Direct effect refers to the effect of one variable on another without involving intervening variables. Indirect effect is the effect of one variable on another, which is transmitted through intervening variables. The sum of direct and indirect effects is defined as the total effect. Alwin and Hauser (1975, pp. 38-39) noted that “a total effect tells us how much change in a consequent variable is induced by a given shift in an antecedent variable, irrespective of the mechanisms by which the change may occur”. Indirect effects show how intervening variables influence the change in other variables, which in turn change the consequent variable.

For the purpose of comparing the predictive power of the predictor variables, the estimation result should be presented in the form of standardized coefficients. Kline (2011, p. 21) noted that unstandardized regression coefficients cannot be used to compare the effect of predictor variables in the model because they reflect the scales of their respective predictors with different raw score metrics. The standardized estimates of the effects of predictor variables on cacao income are presented in Table 6.7.

Standardized total effects with values less than 0.10 are considered to be small, and therefore only values greater than 0.10 are discussed in this section. As can be seen in Table 6.7, out of all the variables considered, yield has the strongest effect on cacao income (0.976). The second most important variable is fertilizing practice (0.246), followed by farm price (0.186), source of seed (0.183) and expensive fertilizer (-0.172). While the total effects of fertilizing practice, source of seed and fertilizer expense are constructed by indirect effects, the total effects of farm price and yield on farmers’ gross income were due solely to a direct causal effect.

The effect of fertilizing practices on farmers’ gross income is mediated by yield. This total effect (0.246) can be computed by decomposing the indirect effects. To make the computation easy to follow, the direct effect of one variable on another needs to be shown. The direct effect of fertilizing practices on yield is 0.252 and the direct effect of yield on cacao income is 0.976. Based on these values the results indicate that of the total effect of fertilizing practices on farmers’ gross income, 0.246 (= 0.252 x 0.976) is directly transmitted by yield.

Similar to fertilizing practices, the variable, source of seed, is also mediated via the direct effects of yield on cacao income. The direct effect of source of seed on yield is 0.188.

Therefore, the total effect of source of seed on cacao income directly transmitted by yield is 0.183 (= 0.188 x 0.976).

Table 6.7. The Effects of Predictor Variables on Farmers' Gross Income

Endogenous variable	Exogenous variable	Standardized direct effect	Standardized indirect effect	Standardized total effect	z-value
ccincome	*unaffche*	-	0.018	0.018	3.80
	pdmanag	-	-0.081	-0.081	-0.89
	lackcapital	-	-0.082	-0.082	-3.30
	expsfert	-	-0.172	-0.172	-9.77
	farmprice	0.186	-	0.186	17.43
	lackknow	-	-0.008	-0.008	-1.68
	condpods	-	0.003	0.003	1.88
	ferment	-	0.001	0.001	0.91
	yield	0.976	-	0.976	91.18
	fertilizing	-	0.246	0.246	2.52
	lowq	-	0.018	0.018	0.98
	lacscredit	-	-0.051	-0.051	-7.85
	training	-	-0.009	-0.009	-0.81
	extcomm	-	0.001	0.001	0.85
	squirrel	-	-0.002	-0.002	-0.86
	nopricedif	-	-0.001	-0.001	-0.66
	drying	-	-0.004	-0.004	-0.90
	sourceseed	-	0.183	0.183	1.97
	pdattack	-	-0.064	-0.064	-0.89
	pruning	-	-0.031	-0.031	-0.32
	farmbargain	-	0.008	0.008	0.43
	nocollat	-	-0.013	-0.013	-1.88
	noinfocrd	-	-0.029	-0.029	-2.33

The effect of expensive fertilizer on cacao income has a longer pathway than other variables. It is mediated by fertilizing practices and yield. The total effect of -0.172 (= -0.699 x 0.252 x 0.976) is transmitted via the effect of fertilizing practices on yield and its subsequent effect on farmers' gross income.

The decomposition effects of predictor variables on yield and farm-gate price are presented in Table 6.8. Among the predictor variables, only fertilizing practices (0.252), source of seed (0.188) and expensive fertilizer (-0.176) have standardized effect values greater than 0.10. The effects of fertilizing practices and source of seed on yield are direct effects, while the effect of expensive fertilizer on yield is mediated by fertilizing practices.

Lack of capital and lack of access to credit have stronger effects on farm-gate price than other variables, with total coefficients of -0.227, and -0.140, respectively (Table 6.8). Lack of capital affects farm price directly, while the effect of lack of access to credit on farm price is an extension pathway from the lack of capital pathway. The effect of lack of access to credit on farm-gate price is directly transmitted by lack of capital.

Table 6.8. The Effects of Predictor Variables on Yield and Farm-Gate Price

Endogenous variable	Exogenous variable	Standardized direct effect	Standardized indirect effect	Standardized total effect	z-value
Yield	*unaffche*		0.018	0.018	3.80
	pdmanag	-0.083		-0.083	-0.89
	lackcapital		-0.041	-0.041	-2.41
	expsfert		-0.176	-0.176	-9.77
	lackknow		-0.008	-0.008	-1.68
	fertilizing	0.252		0.252	2.52
	lacscredit		-0.025	-0.025	-7.85
	training		-0.009	-0.009	-0.81
	sourceseed	0.188		0.188	1.97
	pdattack		-0.065	-0.065	-0.89
	pruning	-0.032		-0.032	-0.32
	nocollat		-0.006	-0.006	-1.38
	noinfocrd		-0.014	-0.014	-1.53
farmprice	*lackcapital*	-0.227		-0.227	-2.28
	condpods		0.018	0.018	1.88
	ferment		0.008	0.008	0.91
	lowq	0.096		0.096	0.98
	lacscredit		-0.140	-0.140	-7.85
	extcomm		0.005	0.005	0.85
	squirrel		-0.011	-0.011	-0.86
	nopricedif		-0.005	-0.005	-0.66
	drying		-0.022	-0.022	-0.90
	pdattack		-0.003	-0.003	-0.82
	farmbargain	0.040	0.003	0.043	0.43
	nocollat		-0.035	-0.035	-1.73
	noinfocrd		-0.079	-0.079	-2.07

6.4 Concluding Remarks

This chapter presented the application of structural equation modelling, in a path analysis framework, to study farmers' views on causal relationships in cacao production. The aim was to identify the main constraints that cacao farmers believe they face in West Sumatra. Two production issues analysed in this study were low yield of cacao trees and low quality of cacao beans. The analysis was conducted to identify factors that are influential in these issues by assessing the cause-and-effect relationships and to assess how these variables had an impact on farmers' gross income.

The yield of cacao trees was hypothesized to have a direct effect on farmers' gross income while the effect of the quality of cacao beans was transmitted through prices received by farmers. Findings reveal that farmers expected both the yield of cacao trees and prices they received to affect their gross income significantly. The analysis shows that the effect of yield on farmers' gross income is higher than that of the price received by farmers.

Of the four variables (source of cacao seedlings, fertilizing practices, pruning practices and pest and disease management) presumed to be correlated to the yield of cacao trees, only the source of cacao seedlings and fertilizing practices have statistically significant effects that are in line with the expected direction of causation. Lack of capital was found to be a critical factor that farmers thought indirectly affects their fertilizing practices and management of pests and diseases.

The quality of cacao beans and the ability of farmers to bargain on the price of cacao beans were presumed to affect farm-gate price. However, the two variables are not significantly correlated to farm-gate price. This finding indicates that famers consider farm-gate price to be influenced by factors not covered in the analysis.

As well as confirming a number of expected causal relationships, the results yielded some unexpected findings. They provide support for further government study of the case for intervention where existing conventional wisdom is substantiated, and for further research where it is not to determine whether the reason for the odd result lies with an exaggerated view of a problem in cacao production or a problem in model specification.

Chapter 7

Marketing Issues in the Cacao Industry in West Sumatra

7.1 Introduction

Progress in expanding cacao production should be accompanied by marketing development. These two elements cannot be separated in developing the cacao industry. The discussion about cacao production and constraints facing cacao farmers are presented in Chapter 6. The connection between cacao farming and marketing occurs when farmers sell their cacao beans. A variable discussed in Chapter 6 that linked farmers to markets was the price received by farmers. Since the two predetermining variables (low quality of cacao beans and farmers' ability to bargain), which were factors influencing farmers' incomes, did not have significant effects on prices received by farmers as analysed in Chapter 6, other factors are explored in this chapter. The concern that farmers received a low price for their cacao beans arose in the PIPA workshop as discussed in Chapter 4.

The structure of this chapter is similar to Chapter 6. Path analysis was again applied in identifying factors affecting the price of cacao beans received by farmers. The path models for cacao marketing were also estimated using *Stata* Version 12.

In Chapter 6, the price received by farmers was related to factors influencing production that to some extent could be controlled by farmers. In this chapter, the discussion is concerned with other factors related to the buyers' side that are beyond the control of farmers. The application of path analysis of cacao marketing from the farmers' perspective is described in Section 7.2, followed by path analysis for cacao marketing from the buyers' perspective in Section 7.3. The analysis is concluded in Section 7.4.

7.2 Application of Path Analysis of Cacao Marketing from the Farmers' Perspective

The relationships between variables in cacao marketing from the farmers' perspective are illustrated in Figure 7.1. They concern the factors affecting the price of cacao beans received by farmers. The model contains 13 variables with unidirectional paths, which are characteristic of a recursive model. A description of the variables is presented in Table 7.1.

Figure 7.1. Base Model for Cacao Marketing from the Farmers' Perspective

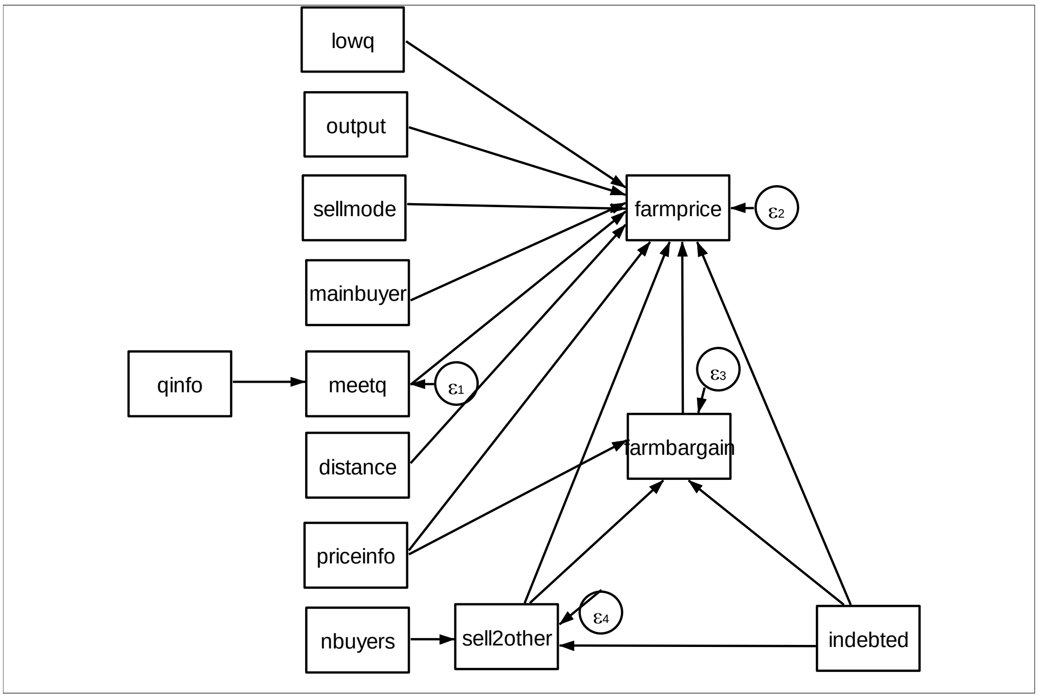


Table 7.1. Description of Variables in the Cacao Marketing Model from the Farmers' Perspective

Variable	Description	Unit
distance	Distance of village to export point	km
farmbargain	Ability to bargain	1 = no ; 2 = yes
farmprice	Price received by farmers	Rupiah / kg
indebted	Indebted to main buyer	1 = no ; 2 = yes
mainbuyer	Main buyer	1 = village buyer; 2 = wholesaler
meetq	Quality meets the buyers' requirement	1 = no ; 2 = yes
nbuyers	Number of buyers in the village	people
lowq	Low quality of cacao beans	1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree
output	Total output sold	Kilograms
priceinfo	Source of price information	1 = the main buyer; 0 = otherwise
qinfo	Source of quality information	1 = the main buyer; 0 = otherwise
sell2other	Ability to sell to other buyers	1 = no ; 2 = yes
sellmode	Mode of selling	1 = picked up; 2 = delivered

The path model in Figure 7.1 can be written in four sets of structural equations. Equation (7.1) presents the relationship between "sources of quality information" and the variable "quality meets the buyers' requirement". Equation (7.2) describes factors contributing to the price received by farmers. Equation (7.3) formulates factors affecting the ability of farmers to bargain on price, and equation (7.4) relates to factors affecting the ability of farmers to sell their cacao beans to buyers other than the main buyer.

$$\begin{aligned}
&\textit{meetq} &&= \alpha_1 + \beta_1 \textit{qinfo} + \varepsilon_1 && (7.1)\\
&\textit{farmprice} &&= \alpha_2 + \beta_{21}\,\textit{lowq} + \beta_{22}\textit{output} + \beta_{23}\textit{sellmode} + \beta_{24}\,\textit{mainbuyer} && (7.2)\\
& &&+ \beta_{25}\textit{meetq} + \beta_{26}\textit{distance} + \beta_{27}\textit{priceinfo} + \beta_{28}\textit{sell2other} &&\\
& &&+ \beta_{29}\textit{farmbargain} + \beta_{210}\textit{indebted} + \varepsilon_2 &&\\
&\textit{farmbargain} &&= \alpha_3 + \beta_{31}\,\textit{sell2other} + \beta_{32}\,\textit{priceinfo} + \beta_{33}\,\textit{indebted} + \varepsilon_3 && (7.3)\\
&\textit{sell2other} &&= \alpha_4 + \beta_{41}\,\textit{nbuyers} + \beta_{42}\,\textit{indebted} + \varepsilon_4 && (7.4)
\end{aligned}$$

where:

α_i refers to the intercept associated with the i^{th} dependent variable.

i is the first subscript to identify the dependent variable in the equation, which has a value of 1,2,3,...

β_{ij} represents the path coefficient that links the i^{th} dependent variable and the j^{th} independent variable.

j is the second subscript to identify the variable that has a direct effect on the dependent variable in the equation, which has a value of 1,2,3,...

ε_i is the error associated with the i^{th} dependent variable.

Preliminary analysis of the path model of cacao marketing from the farmers' perspective

Before we estimated the base model, a multicollinearity test was conducted. As the VIF values for all variables in the model are below 3, multicollinearity is not a problem in the model. The results of the multicollinearity test are provided in Appendix 7.1.

The result of the maximum likelihood estimation of the base model is drawn in Appendix 7.2. The numbers near to the arrows are path coefficients between the variables, while error values are located close to the error terms. For endogenous variables, intercepts are written in the rectangles. For exogenous variables, means and variances are written on the top and on the bottom in rectangles, respectively. The description of individual coefficients and z–values is presented in Table 7.2.

Table 7.2. Maximum Likelihood Estimates of the Base Model for Cacao Marketing from the Farmers' Perspective

Endogenous variable	Exogenous variable	Path coefficient (β)	z-value
farmprice	*meetq*	0.120*	3.37
	farmbargain	-0.027	-0.55
	sell2other	0.020	0.43
	mainbuyer	0.117*	2.09
	output	-0.001	-0.17
	lowq	-0.012	-0.33
	priceinfo	-0.069	-1.80
	distance	-0.001*	-2.35
	sellmode	0.069	1.42
	indebted	-0.004	-0.09
	constant	1.893*	9.21
meetq	*qinfo*	0.342*	3.56
	constant	1.383*	22.76
farmbargain	*sell2other*	0.037	0.40
	priceinfo	-0.009	-0.13
	indebted	-0.056	-0.58
	constant	1.889*	7.37
sell2other	*nbuyers*	0.027*	3.57
	indebted	-0.554*	-7.02
	constant	2.234*	18.33

*significant at $\alpha = 0.05$ using a two-tail test.

The coefficients of most variables in the model had expected signs. Only the path coefficient from *farmbargain* and *output* to *farmprice* had an unexpected sign. Among the ten variables presumed to affect farm price, only three variables (*meetq, mainbuyer,* and *distance*) had a significant relationship with farm price (Table 7.2). While all predictor variables of *meetq* and *sell2other* were significant, *farmbargain* did not have any significant variables. Ten paths of insignificant variables were considered to be removed from the model. However, before revising the base model, it needed to be assessed whether it fits the data.

The model fits in the cacao marketing model from the farmers' perspective

The model fit test for the base model in Appendix 7.1 using CFI, TLI and RMSEA indicated that the model was a poor fit. The values of CFI and TLI for the model were lower than 0.90 and the value of the RMSEA was 0.091. Values of fit statistics for the base model are presented in Table 7.3. In order to improve the goodness of fit, the base model needed to be respecified.

Table 7.3. Values of Fit Statistics for the Base Model of Cacao Marketing from the Farmers' Perspective

Index	Value	Interpretation
CFI	0.826	Poor fit
TLI	0.719	Poor fit
RMSEA	0.091	Poor fit
Lower bound	0.048	
Upper bound	0.131	

Model respecification for cacao marketing model from the farmers' perspective

The modification of the base model began with a modification indices test. The possible paths suggested by modification indices are presented in Table 7.4.

Seven paths were suggested by the modification indices test to improve model fit. However, some of them did not make sense from a theoretical perspective. Therefore, only two paths were added in the base model. The additional paths were from distance (*distance*) to meet quality requirement (*meetq*) and from source of quality information (qinfo) to ability to bargain (*farmbargain*). The hypothesis for the *distance* and *meetq* relationship was that the farther the location of cacao farming from the export point the more difficult it is to meet the quality requirement. As dryness was the main indicator for judging the quality of cacao beans, discussed in Chapter 6, it was presumed that the buyers required a high dryness level of cacao beans from farther locations to enable them to maintain the quality of cacao beans when they transported them.

Table 7.4. Modification Indices for Path Model of Cacao Marketing from the Farmers' Perspective

Endogenous variable	Exogenous variable	Modification index	EPC	Standardized EPC
farmprice	*qinfo*	6.061	-0.093	-0.235
meetq	*farmprice*	16.106	1.701	0.661
	mainbuyer	11.617	0.381	0.326
	output	5.627	0.009	0.224
	distance	7.635	-0.004	-0.261
	indebted	4.676	-0.247	-0.205
farmbargain	*qinfo*	4.112	0.141	0.212

The effect of *qinfo* on *farmbargain* was hypothesized to be that when farmers receive information on quality of cacao beans from the main buyer, they were likely to be able to bargain on their price. The estimate reveals that *qinfo* significantly influenced *meetq*. This result indicates that the quality of cacao beans sold by farmers met the main buyers' requirement when farmers received information on quality from that buyer. Thus, farmers were able to bargain on the price of cacao beans. Involving the two additional paths in the model generated "Model 1", which is presented in Appendix 7.3.

Model 1 had a better fit to the data than the base model. Its CFI and TLI values increased to 0.921 and 0.856, respectively. The value of the RMSEA was 0.065. The model was categorized as a good fit according to CFI and as a reasonable fit based on TLI and RMSEA. However, the upper bound of the RMSEA was still high (0.112) meaning that the poor-fit hypothesis was not rejected. This result shows that further respecification of the model needs to be done to improve the goodness of fit.

It was mentioned in Chapter 6 that model modification in SEM could be done by building and trimming the model. Building the model was conducted to improve the base model based on modification indices. Trimming Model 1 by removing paths of insignificant variables was expected to improve the model.

There were nine paths of insignificant variables in the model. However, only four paths were removed from the model. They were the paths from *output* and *indebted* to *farmprice*; and the paths from *sell2other* and *priceinfo* to *farmbargain*. The paths from *farmbargain* and *sell2other* to *farmprice* were retained in the model because they have significant relationships with other variables. When the paths from *sellmode* to *farmprice* and from *indebted to farmbargain* were removed from the model, it resulted in worse goodness of fit. Therefore, they were kept in the model. The new model derived from Model 1 was called "Model 2", which is illustrated in Appendix 7.4.

Based on the model fit index test, Model 2 was better than the previous two models. The values of the fit indexes for all models are compared in Table 7.5.

Table. 7.5. Comparison of Fit Statistics of Cacao Marketing Model from Farmers' Perspective

Index	Base Model	Model 1	Model 2
CFI	0.826	0.921	0.939
TLI	0.719	0.856	0.899
RMSEA	0.091	0.065	0.058
Lower bound	0.048	0.000	0.000
Upper bound	0.131	0.112	0.107

Model 2 had the highest value of CFI and TLI; and had the lowest value of RMSEA (Table 7.5). It implies that Model 2 was the best-fit model among the three models. There was a substantial increase in the values of CFI and TLI. A CFI value of 0.939 indicated that Model 2 was a good fit. Even though TLI and RMSEA values indicated that Model 2 were reasonable fit, the model was getting a better fit. Therefore, Model 2 was used for further analysis.

Interpretation of results for the cacao marketing model from the farmers' perspective

The estimation results of Model 2 are presented in Table 7.6. They show that the farm-gate price was significantly influenced by variables *meetq, mainbuyer,* and *distance,* while the variables *farmbargain, sell2other, lowq, priceinfo* and *sellmode* did not affect it significantly. The variable "quality meets the buyers' requirement" had an expected positive and significant effect on the price of cacao beans received by farmers with a path coefficient of 0.120 and z-value of 3.42. It implies that farmers believed that if they were to sell cacao beans that met the quality required by buyers, they would receive a higher price.

Table 7.6. Maximum Likelihood Estimates of Model 2 of Cacao Marketing from the Farmers' Perspective

Endogenous variable	Exogenous variable	Path coefficient (β)	z-value
farmprice	*meetq*	0.120*	3.42
	farmbargain	-0.027	-0.55
	sell2other	0.022	0.54
	mainbuyer	0.117*	2.15
	lowq	-0.010	-0.31
	priceinfo	-0.070	-1.81
	distance	-0.001*	-2.34
	sellmode	0.069	1.43
	constant	1.883*	10.98
meetq	*qinfo*	0.350*	3.81
	distance	-0.003*	-2.44
	indebted	-0.183	-1.64
	constant	2.057*	9.79
farmbargain	*qinfo*	0.125	1.92
	indebted	-0.095	-1.24
	constant	1.946*	19.46
sell2other	*nbuyers*	0.027*	3.57
	indebted	-0.554*	-7.02
	constant	2.234*	18.33

*significant at $\alpha = 0.05$ using a two-tail test.

An insignificant correlation between farmers' ability to bargain and the price they receive, which was consistent with the result in Chapter 6, indicates that whether or not farmers are able to bargain, the price they receive remains the same. In other words, farmers who are able to bargain do not receive a higher price than those who are unable to bargain. This result suggests that farmers have low bargaining power.

The opportunity of farmers to sell their cacao beans to buyers other than the main buyer does not significantly affect the price they receive ($\beta = 0.022$, $z = 0.64$). It means that farmers do not believe that the price at the farm gate can increase even though they are free to sell their cacao beans to their preferred buyer. This condition implies that the farm-gate price has been set and it is beyond the farmers' capacity to change it.

The relationship between the main buyer and the farm-gate price is significant with a path coefficient of 0.117 and z value of 2.15. The positive coefficient means that if farmers are correct in their perception, they receive a higher price when they sell cacao beans to wholesalers than when they sell them to village buyers. As the price of cacao beans in the model is scaled in ten thousands of rupiahs, the result can be interpreted that farmers assess that wholesalers set the farm-gate price of cacao beans at Rp.1,170 per kilogram higher than do village buyers. The survey results found that 24 per cent of farmers sold cacao beans to wholesalers at an average price of Rp.22,250 per kilogram, while 76 per cent of them sold cacao beans to village buyers at an average price of Rp.19,901 per kilogram.

The negative sign of the coefficient between quality of cacao beans and farm-gate price is insignificant. This result indicates that farmers believe that the quality of cacao beans does not affect the price received for them.

The source of price information does not affect the farm-gate price significantly at 0.05 significance level ($\beta = -0.070$, $z = -1.81$). The negative coefficient indicates that farmers expect that those who get information on price from the main buyer receive a lower price than those who get their information from other sources. If this were true, it would mean that farmers are disadvantaged in selling their cacao beans to the main buyer if they relied on that buyer for price information.

The effect of distance from export point on the price at the farm gate is significant with the expected negative sign of the path coefficient ($\beta = -0.001$, $z = -2.34$). It means that farmers estimate that the farther their location from the export point, the lower the price they receive. This figure implies a price deduction for the extra transport costs. The value of the path coefficient suggests that the price of cacao beans decreases by Rp.10 for every kilometre from the export point.

Distance from export point (distance) also has a negative and significant effect on farmers' perceived ability to meet required quality. It indicates that buyers require better quality for cacao beans coming from a farther location in order to maintain the average quality of cacao beans at the export point.

Most farmers (71 per cent) sold cacao beans on their farm, while 29 per cent of farmers delivered them to the buyers in the hope of receiving a higher price. However, the insignificant estimation result shows that there is no significant difference in price between the picked-up and delivered modes of selling.

Farmers are confident that they can meet the quality of cacao beans required by the main buyer when they obtain the information on the quality from this person. This correlation is supported by the estimation results in which *qinfo* has a significant effect on *meetq* with a path coefficient of 0.350 and z-value of 3.81.

Obtaining information on the quality from the main buyer presumed to enable farmers to have bargaining power. However, the estimation result shows an insignificant relationship between these two variables.

Indebtedness is presumed to have a negative influence on farmers' bargaining power. However, the insignificant path coefficient for this relationship indicates that farmers do not view it as important. Indebtedness, in fact, restrains farmers' ability to sell their cacao beans to buyers other than the main buyer, which is indicated by the estimation result with a path coefficient of -0.554 and z-value of -7.02. If farmers' perceptions are correct, it means that if they borrow money from the main buyer, they have to sell their cacao beans to this buyer.

Farmers believe that the number of buyers operating in a farmer's location is another variable that significantly affects the ability of farmers to sell their cacao beans to buyers other than the main buyer ($\beta = 0.27$, $z = 3.57$). The positive coefficient between *nbuyers* and *sell2other* suggests that the more buyers are operating in a farmer's location, the more chance farmers have to sell their cacao beans to buyers other than main buyer.

Decomposition of effects of predictor variables on farm-gate price

As the model involves intervening variables, the effects need to be decomposed into direct and indirect effects. The decomposition method provides information about the effect of a variable on another through intervening variable. The estimation results for the decomposition of effects are presented in standardized values in order to allow comparison of the effects among variables in the model. To identify the more important effects in the model, this study follows the criterion by Burridge and Schwabe (1977) in which a direct or indirect effect of at least 0.30 standard units is considered a major causal effect in the model. The standardized estimates of the effects of predictor variables on farm-gate price are presented in Table 7.7.

Most variables in the model influence the farm-gate price directly, while three variables affect it indirectly and only one variable has a direct and indirect effect. Among the predictor variables, *meetq* has the highest standardized total effect (0.300) on farm-gate price and contributes a strong effect in the model, followed by distance (-0.273), and main buyer (0.250). Even though *qinfo* does not have an important effect in terms of its standardized coefficient, it has significant indirect effect on farm-gate price.

Table 7.7. The Effects of Predictor Variables on the Farm-Gate Price

Endogenous variable	Exogenous variable	Standardized direct effect	Standardized indirect effect	Standardized total effect	z-value
farmprice	*meetq*	0.300	-	0.300*	3.42
	farmbargain	-0.043	-	-0.043	-0.55
	sell2other	0.046	-	0.046	0.54
	mainbuyer	0.250	-	0.250*	2.15
	lowq	-0.025	-	-0.025	-0.31
	qinfo	-	0.095	0.095*	2.22
	priceinfo	-0.158	-	-0.158	-1.81
	distance	-0.205	-0.068	-0.273*	-3.08
	nbuyers	-	0.013	0.013	0.54
	sellmode	0.156	-	0.156	1.43
	indebted	-	-0.066	-0.066	-1.17

7.3 Path Analysis of Cacao Marketing from the Buyers' Perspective

Respondents considered as buyers in this analysis are marketing intermediaries who bought cacao beans from farmers. They consist of village buyers and wholesalers. The cacao marketing model from the buyers' perspective is illustrated in Figure 7.2 and involves 15 variables. In the diagram, the buying price and selling price are in the centre of the model. Buying price is the price paid by marketing intermediaries to farmers while selling price is the price received by village buyers from wholesalers and by wholesalers from exporters.

In the base model, *buyprice* is the variable that links buyers to farmers. The buying price at the marketing intermediary level was presumed to be determined directly by five variables. The selling price was presumed affected directly by seven variables and indirectly by two variables. These nine variables indirectly influenced marketing intermediaries to set their buying price via the selling price. A description of the variables is presented in Table 7.8.

Figure 7.2. Base Model of Cacao Marketing from the Buyers' Perspective

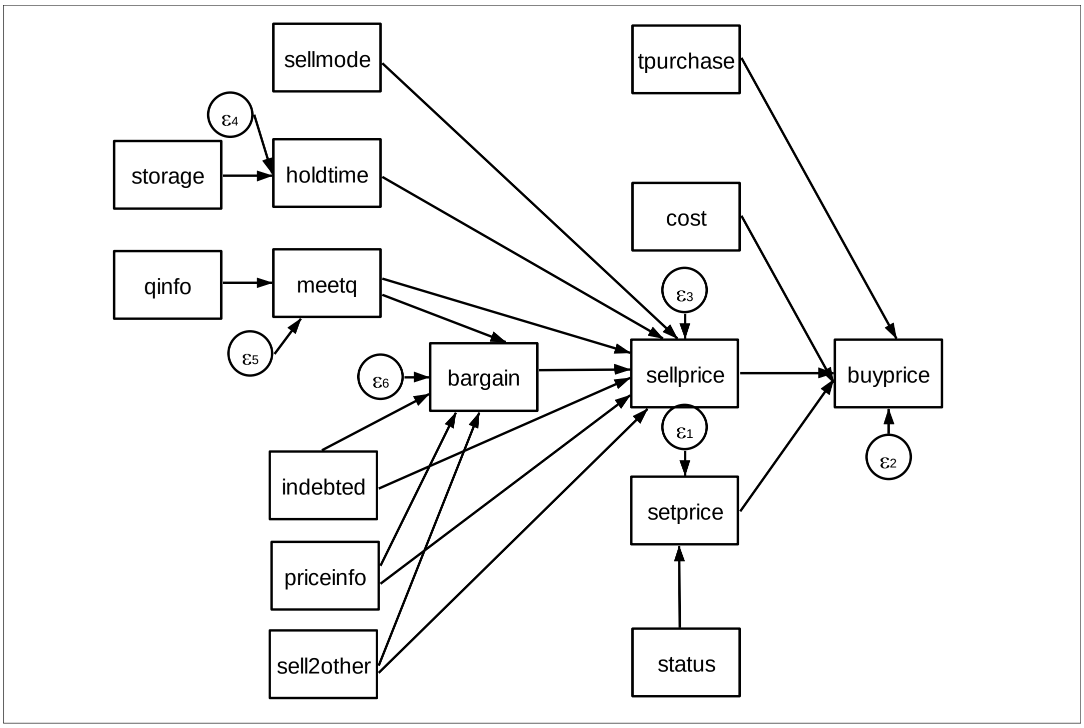


Table 7.8. Description of Variables in the Cacao Marketing Model from the Buyers' Perspective

Variable	Description	Unit
bargain	Ability to bargain	1 = no ; 2 = yes
buyprice	Buying price	Rupiah / kg
cost	Marketing cost	Rupiah / kg
holdtime	Time to hold cacao beans before selling	1 = < 1 week; 2 = 1 - 2 weeks; 3 = > 2 weeks
indebted	Indebted to the main buyer	1 = no ; 2 = yes
meetq	Ability to meet required quality	1 = no ; 2 = yes
priceinfo	Source of price information	1 = the main buyer; 0 = otherwise
qinfo	Source of quality information	1 = the main buyer; 0 = otherwise
sell2other	Ability to sell to other buyers	1 = no ; 2 = yes
sellmode	Mode of selling	1 = picked up; 2 = delivered
sellprice	Selling price	Rupiah / kg
setprice	Ability to set buying price	1 = no ; 2 = yes
status	Trading status	1 = independent; 0 = otherwise
storage	Have storage facilities	1 = no ; 2 = yes
tpurchase	Total purchase in one year	tonne

The relationships among variables in the path model in Figure 7.2 can be written in structural equations which consist of six equation sets. Equations (7.5) and (7.6) describe factors contributing to the buying price. Equations (7.7) – (7.10) relate to factors affecting the selling price.

$$setprice = \alpha_1 + \beta_1 status + \varepsilon_1 \quad (7.5)$$

$$buyprice = \alpha_2 + \beta_{21}\, setprice + \beta_{22}\, sellprice + \beta_{23}\, tpurchase + \beta_{24}\, cost + \varepsilon_2 \quad (7.6)$$

$$sellprice = \alpha_3 + \beta_{31}\, holdtime + \beta_{32}\, bargain + \beta_{33}\, meetq + \beta_{34}\, sellmode - \beta_{35}\, priceinfo + \beta_{36}\, indebted + \beta_{37}\, sell2other + \varepsilon_3 \quad (7.7)$$

$$Holdtime = \alpha_4 + \beta_{41}\, storage + \varepsilon_4 \quad (7.8)$$

$$meetq = \alpha_5 + \beta_5 qinfo + \varepsilon_5 \quad (7.9)$$

$$bargain = \alpha_6 + \beta_{61}\, meet + \beta_{62}\, priceinfo + \beta_{63}\, indebted + \beta_{64}\, sell2other + \varepsilon_6 \quad (7.10)$$

where:

α_i refers to the intercept associated with the i^{th} dependent variable

i is the first subscript to identify the dependent variable in the equation, which has value of 1, 2, 3, ...

β_{ij} represents the path coefficient that links the i^{th} dependent variable and the j^{th} independent variable.

j is the second subscript to identify the variable that has a direct effect on the dependent variable in the equation, which has a value of 1, 2, 3, ...

ε_i is the error associated with the i^{th} dependent variable.

Preliminary analysis of the path model of cacao marketing from the buyers' perspective

The result of multicollinearity test for path model of cacao marketing from the buyers' perspective show that the model does not have multicollinearity problem indicated by VIF values of the variables less than 2 (Appendix 7.5). The result of the maximum likelihood estimation of the base model is illustrated in Appendix 7.6 and the description of individual unstandardized coefficients is presented in Table 7.9.

There were ten insignificant variables in the initial model. They can be divided into two categories. The first category is variables which did not have a significant relationship with any variables in the model. This category includes variables *setprice, tpurchase, cost, bargain, meetq, sellmode, sell2other* and *qinfo*. The second category was insignificant variables that correlated significantly with some other variables. This category includes *priceinfo* and *indebted*. The variables in the first category could be removed from the model, while those in the second category may be remained in the model. Most exogenous variables had expected signs while some (*setprice, meetq, sell2other* and *qinfo)* did not hold expected signs.

The base model needs to be assessed whether or not it fits the data. The model fit test for the base model in Figure 7.2 using CFI, TLI and RMSEA indicated that the model was a poor fit. The values of CFI and TLI for the model were much lower than 0.90 and the value of RMSEA was very high (0.174). Values of fit statistics for the base model are presented in Table 7.10. The test suggests model respecification to improve the goodness of fit.

Table 7.9. Maximum Likelihood Estimates of the Base Model for Cacao Marketing from the Buyers' Perspective

Endogenous variable	Exogenous variable	Path coefficient (β)	z-value
buyprice	*setprice*	-0.002	-0.05
	sellprice	0.714*	5,02
	tpurchase	0.001	1.54
	cost	-0.014	-1.60
	constant	0.531	1.65
setprice	*status*	0.412	1.89
	constant	1.500*	7.08
sellprice	*holdtime*	0.074*	2.52
	bargain	0.040	0.56
	meetq	0.119	1.32
	sellmode	0.019	0.32
	priceinfo	-0.082*	-2.31
	indebted	-0.097*	-2.17
	sell2other	-0.058	-1.76
	constant	2.086*	7.92
holdtime	*storage*	0.500*	3.31
	constant	0.556*	2.33
bargain	*meetq*	-0.090	-0.39
	priceinfo	-0.049	-0.54
	indebted	-0.162	-1.49
	sell2other	-0.065	-0.81
	constant	2.430*	4.75
meetq	*qinfo*	-0.045	-0.82
	constant	2.000*	45.96

*significant at α = 0.05 using a two-tail test.

Table 7.10. Values of Fit Statistics for the Base Model of Cacao Marketing from the Buyers' Perspective

Index	Value	Interpretation
CFI	0.505	Poor fit
TLI	0.330	Poor fit
RMSEA	0.174	Poor fit
Lower bound	0.127	
Upper bound	0.220	

Model respecification for cacao marketing model from buyers' perspective

Maximum likelihood estimation indicates some insignificant variables that can be removed to improve the model fit. However, before removing some variables, the modification indices test was applied. In this way, there was a chance insignificant variables were able to improve the model fit by building paths if they remained. The possible paths suggested by modification indices are presented in Table 7.11.

Table 7.11. Modification Indices for the Path Model of Cacao Marketing from the Buyers' Perspective

Endogenous variable	Exogenous variable	Modification Index	EPC	Standardized EPC
setprice	*cost*	3.853	0.061	0.317
	indebted	12.250	-0.634	-0.698
holdtime	*tpurchase*	5.092	0.001	0.362
	sell2other	4.331	-0.333	-0.304
bargain	*status*	5.705	0.487	0.486
	sellmode	5.757	0.326	0.393

Of the six paths suggested by the modification indices test to improve model fit, some did not make sense from a theoretical perspective. Therefore, only three paths were added to the base model. The additional paths were from *indebted* to *setprice*, from *tpurchase* to *holdtime* and from *status* to *bargain.*

The modification indices test shows that the path from *indebted* to *setprice* had the largest change in the observed χ^2 value (12.250). If this path were added to the base model, it would generate a large improvement. In addition, it had the highest standardized EPC. The two other additional paths also had a large modification index (> 5) with high standardized EPC (> 0.30). Estimation results of the revised model called "Model 1" are presented in Appendix 7.7.

Model 1 also needs to be assessed in terms of goodness of fit in order to guide us to choose the best model. Based on the model fit test, Model 1 had a better fit to the data than the base model. Its CFI and TLI values increased to 0.716 and 0.592, respectively. The value of RMSEA decreased to 0.136. However, the model was still in the poor fit category according to the three model-fit tests. Therefore, further revision of the model was required.

The revision of Model 1 was conducted by removing paths of some insignificant variables. The removed paths were from *sellmode* to *sellprice*, from *status* to *setprice*, and from *priceinfo, indebted, sell2other* and *meetq* to *bargain*. As *sellmode* did not connect to other variables in the model, it was totally removed from the model. Although *cost* had an insignificant effect on *buyprice* and did not have a significant correlation to other variables in the model, it was retained because it theoretically has a strong relationship with *buyprice*. The revision of Model 1, called "Model 2", is illustrated in Appendix 7.8.

To select the best model for cacao marketing from the buyers' perspective, the fit statistics have to be compared. The comparison of the values of fit index for all models is presented in Table 7.12. They show that Model 2 was much better than the previous two models. The values of the three model fit tests indicate that Model 2 was a good fit and was the best-fit model among the three models. Its CFI and TLI values were close to 1 and its RMSEA value was much lower than 0.05. For these reasons, Model 2 was used for further analysis.

Table. 7.12. Comparison of Fit Statistics for the Cacao Marketing Model from the Buyers' Perspective

Index	Base model	Model 1	Model 2
CFI	0.505	0.716	0.996
TLI	0.330	0.592	0.995
RMSEA	0.174	0.136	0.014
Lower bound	0.127	0.080	0.000
Upper bound	0.220	0.187	0.110

Interpretation of results for the cacao marketing model from the buyers' perspective

The estimates for Model 2 of cacao marketing from the buyers' perspective are presented in Table 7.13. Most variables are significant with expected signs. Among the four predictor variables of *buyprice*, only variable *sellprice* has significant relationship with *buyprice.* The coefficient of 0.714 between these variables means that every Rp.1 increase in the selling price of marketing intermediaries increases the buying price by Rp.0.714.

Model 2 shows that, according to the buyers, indebtedness significantly affects the ability of marketing intermediaries to set the price (β = -0.568, z = -4.80). The negative path coefficient for this relationship means that marketing intermediaries are not able to set the buying price if they borrow money from the main buyer. However, this condition does not reflect on buying price, which is proved by the insignificant correlation between ability to set the price and buying price.

Buyers believe that the variable *tpurchase* does not significantly influence *buyprice*. If they are correct, this result indicates that large-scale buyers do not set higher buying prices than small buyers. However, large-scale buyers can hold cacao beans for a longer time when there is no promising selling price. This condition is proved by the significant relationship between *tpurchase* and *holdtime* (β = 0.001, z = 2.44) and its subsequent effect on *sellprice* (β = 0.075, z = 2.55). Marketing intermediaries consider that their ability to hold cacao beans for a longer time is significantly influenced by the storage facilities they have (β = 0.345, z = 2.24).

Table 7.13. Maximum Likelihood Estimates of Model 2 for Cacao Marketing from the Buyers' Perspective

Endogenous variable	Exogenous variable	Path coefficient (β)	z-value
buyprice	*setprice*	-0.002	-0.05
	sellprice	0.714*	5,02
	tpurchase	0.001	1.54
	cost	-0.014	-1.60
	constant	0.531	1.65
setprice	*indebted*	-0.568*	-4.80
	constant	2.535*	18.01
sellprice	*holdtime*	0.075*	2.55
	bargain	0.049	0.75
	meetq	0.116	1.29
	sellmode	0.019	0.32
	priceinfo	-0.081*	-2.28
	indebted	-0.094*	-2.14
	sell2other	-0.060	-1.83
	constant	2.107*	8.25
holdtime	*tpurchase*	0.001*	2.44
	storage	0.345*	2.24
	constant	0.691*	3.03
bargain	*status*	0.471*	3.20
	constant	1.500*	10.50
meetq	*qinfo*	-0.045	-0.82
	constant	2.000*	45.96

*significant at α = 0.05 using a two-tail test.

The negative path coefficient between *cost* and *buyprice* suggests that the higher the marketing cost the lower the buying price, but this relationship is not statistically significant. Path coefficients from *bargain* and *meetq* to *sellprice* are positive. They indicate that the ability to bargain and meet required quality enable marketing intermediaries to receive a higher price. Nevertheless, those exogenous variables do not significantly affect the selling price. Moreover, the effect of an intermediary's ability to sell to other buyers on selling price does not have the expected sign. Their relationship is also not significant.

Estimation results show that the source of price information significantly affects the selling price with a path coefficient of -0.081 and z-value of -2.28. The negative coefficient implies that when marketing intermediaries obtain information on price from their main buyer, they expect to receive a lower price. This condition shows that the main buyer gets an advantage deriving from the limitation of marketing intermediaries to obtain information on price from other sources. In addition, the opportunity of marketing intermediaries to receive a higher price is, they believe, restricted by their indebtedness to the main buyer (β = -0.094, z = -2.14).

Marketing intermediaries believe that their status significantly affects their ability to bargain, with a path coefficient of 0.471 and z-value of 3.20. This figure indicates that independent marketing intermediaries have more ability to bargain than those who act as the buying agents of wholesalers.

The source of quality information was presumed to influence the ability of a marketing intermediary to meet quality of cacao beans required by firms that buy from this intermediary, but it proved not to be the case on the basis of the statistical test. It means that even though quality information was obtained from the main buyer, it will not necessarily guarantee that the quality of cacao beans meets the quality required by that main buyer.

Decomposition of effects of predictor variables on buying price

There are 13 variables presumed to affect marketing intermediaries' buying price that consist of three variable having a direct effect, nine variables having an indirect effect, and one variable having both effects. The standardized estimates of the effects of predictor variables on buying price are presented in Table 7.14.

Among all exogenous variables in the model, the variable sellprice had the highest total effect (0.670) on buyprice, followed by tpurchase (0.285), holdtime (0.220), priceinfo (-0.192), cost (-0.184), indebted (-0.182), sell2other (-0.161) and meetq (0.109).

Table 7.14. Effects of Predictor Variables on the Marketing Intermediaries' Buying Price

Endogenous variable	Exogenous variable	Standardized direct effect	Standardized indirect effect	Standardized total effect	z-value
buyprice	*holdtime*	-	0.220	0.220	2.55
	setprice	-0.006	-	-0.006	-0.05
	bargain	-	0.064	0.064	0.75
	sellprice	0.670	-	0.670	5.02
	meetq	-	0.109	0.109	1.29
	tpurchase	0.205	0.079	0.285	2.14
	cost	-0.184	-	-0.184	-1.60
	status	-	0.030	0.030	0.72
	priceinfo	-	-0.192	-0.192	-2.08
	indebted	-	-0.182	-0.182	-1.55
	sell2other	-	-0.161	-0.161	-1.72
	storage	-	0.073	0.073	1.60
	qinfo	-	-0.015	-0.015	-0.68

The total effects of *sellprice* and *cost* on *buyprice* were due solely to the direct causal effect. The total effects of *holdtime, priceinfo, sell2other* and *meetq* on *buyprice* were mediated by *sellprice*. The effect of indebtedness on buying price was partly transmitted by selling price and another part through the variable "ability to set price". The total effect of indebtedness on buying price (-0.182) can be computed by decomposing the indirect effects. The direct effects of indebtedness on selling price and selling price on buying price were -0.276 and 0.670, respectively. Based on these values, the effect of indebtedness on the buying price via selling price was -0.185 (= 0.276 x 0.670). In the same way, the effect of indebtedness on the buying price via *setprice* can be calculated as -0.625 x -0.006 = 0.004.

The effect of total purchase on buying price involved two pathways. The first pathway was via *holdtime* and its subsequent effect on *sellprice* and *buyprice*, while the second pathway was a direct effect. The direct effects of *tpurchase* on *holdtime* and *holdtime* on *sellprice* were 0.362 and 0.3275, respectively. Thus, the effect of total purchase on buying price through the first pathway was 0.079 (= 0.362 x 0.3275 x 0.670).

7.4 Concluding Remarks

This chapter contains a discussion of identified issues in cacao marketing from two perspectives: the farmers' perspective and the buyers' perspective. The core issue discussed is related to the price of cacao beans received by farmers and factors affecting it.

From the farmers' perspective, the findings reveal that farmers have little power in marketing transactions. They could not push the price up even though they felt they were able to bargain on the price, they were unable to sell their cacao beans to buyers other than main buyer and they delivered cacao beans to the buyers' place. Their position, in fact, is worsened by their dependence on the main buyer to obtain information on prices of cacao beans. Moreover, the distance of the location from the export point also causes them to receive a lower price.

However, there is an opportunity for farmers to receive a higher price through selling cacao beans with the quality required by the main buyer and selling them to wholesalers. Obtaining the information on the quality from the main buyer enabled farmers to meet the required quality.

From the buyers' perspective, the selling price of marketing intermediaries is the only factor significantly affecting their buying price. The study results indicate that marketing intermediaries increase the price they pay to farmers if they receive a higher price for their cacao beans. Four significant factors influencing the price received by marketing intermediaries are time of holding cacao beans, source of price information, indebtedness and ability to sell their cacao beans to buyers other than their main buyer.

Findings show that marketing intermediaries' selling price is lower if they have a debt to the main buyer and rely on the main buyer for price information. This condition subsequently influences their decision to set the buying price. On the other hand, marketing intermediaries capable of financing their business from internal sources who obtain pricing information from other sources and who are able to hold the products for a long time receive a higher price for their cacao beans. The estimation results reveal that the bigger the scale of business of marketing intermediaries, the greater is their ability to hold the product for a longer time. This condition is proved by the statistical relationship between total purchase volume and having storage facilities that enable them to hold cacao beans for long time.

Chapter 8

A Potential Strategy to Improve Cacao Industry Performance and Implications for Poverty Alleviation

8.1 Introduction

A strategy formulation to improve cacao industry is described in this chapter. It is constructed by reconciling results from the workshop, path analysis and Delphi survey. The issues of production and marketing identified in Chapters 6 and 7 provide a foundation in formulating the strategy.

The key issues in cacao production identified in Chapter 6 relate to the yield of cacao trees and quality of cacao beans. Factors that were revealed to be connected to the yield of cacao trees are the quality of cacao seedlings, fertilizing practices, pest and disease management; and capital availability for farmers. Harvesting, drying and fermentation practices were found to be correlated to the quality of cacao beans.

The price of cacao beans received by farmers was the main marketing issue discussed in Chapter 7. It was assessed from two perspectives: farmers' perspective and buyers' perspective. Factors perceived to be affecting the price of cacao beans at the farm gate from the farmers' perspective were: bargaining power of farmers, the location of farmers from the export point, source of information on price and quality of cacao beans, the required quality of cacao beans, scale of business of the main buyer, ability to sell cacao beans to buyers other than the main buyer, indebtedness to the main buyer and the number of buyers. Marketing intermediaries perceived that their buying price was affected by their bargaining power, selling price, the time to hold cacao beans, source of price information, indebtedness, storage facilities and the status of their transaction.

The results of the PIPA workshop described in Chapter 4 offered some strategies to address the identified issues on cacao production and marketing. These strategies were then validated with a Delphi survey. The results of the Delphi survey are now used to formulate the potential strategy using the PIPA approach.

This chapter starts with an analysis of the Delphi survey in Section 8.2. The Delphi results used to develop a potential strategy in the form of an IP logic model are discussed in Section 8.3. Concluding remarks on the main implications drawn from the study are made in Section 8.4.

8.2 Delphi Survey

A Delphi survey was conducted in this study to validate the research findings on production and marketing issues in the cacao industry in West Sumatra. The aim of the use of this method is to obtain the experts' opinion on strategies for cacao industry development using a structured questionnaire. The questionnaire was designed based on production and marketing issues identified in earlier chapters.

According to Hasson et al. (2000), the Delphi method is a group facilitation technique that involves an iterative multistage process that transforms individual opinion into group consensus. As an iterative process, the application of the Delphi method in this study involved two-round surveys. The first round was conducted to obtain the experts' opinion on given strategies. They were also invited to add some more strategies and develop conditions needed to make the strategies viable. In the first-round questionnaire, the respondents were provided information about the aim of the research and about production and marketing issues facing the cacao industry that emanated from the path analysis. The first-round responses were collated in order to produce the second-round questionnaire.

In the second-round questionnaire, the respondents were asked to rate the list of strategies and conditions required on a five-point Likert-scale. The scale used was with a minimum score of 1 accounting for the strategies rated as not important and 2 denotes less important strategies. Important, highly important and most important strategies are symbolized by 3, 4 and 5, respectively. A total of 15 panellists agreed to participate in the survey; however, only 12 respondents returned the questionnaire. The largest group of panellists were government officers (67 per cent) who are decision makers at the municipality level and the rest (33 per cent) were academics who are active in research on economic development. The results of the strategy rating are presented in Table 8.1.

Table 8.1. Potential Strategies in Developing the Cacao Industry in West Sumatra

Code	Strategy	Mean	Rank
Objective 1	To encourage farmers to grow good-quality cacao seedlings.		
1.1	The government should facilitate farmers to establish a cacao nursery in farmer groups by providing superior cacao seeds.	3.67	2
1.2	The government should establish seedling nurseries in each municipality.	3.42	3
1.3	The government provides subsidized cacao seedlings for farmers and credit for operational cost for the first year of planting with subsidized interest rate.	3.42	3
1.4	Improving farmers' knowledge on good-quality seedlings through training and extension services.	4.33	1
Objective 2	To encourage farmers to use fertilizers.		
2.1	The government should simplify procedures for farmers to get subsidized fertilizers.	3.42	3
2.2	The Department of Plantation should provide training for farmers on composting.	3.75	2
2.3	Encourage farmers to do integrated cacao and cattle farming in which cattle farming is the source of organic fertilizers and cacao farming as source of fodder.	4.08	1
Objective 3	To make capital available to small farmers for cacao industry development.		
3.1	The government should facilitate farmer groups to establish a village cooperative that can function to provide capital for farmers.	4.00	2
3.2	As collateral is one of the causes that restrains farmers to access credit, the government should provide a guarantee for farmers to enable them to get credit from a financial institution.	3.50	3
3.3	Loans should be available to farmers at subsidized interest rates and optimize the application of revitalization credit.	3.33	5
3.4	Banks should distribute brochures to farmer groups to make information about credit more available for farmers.	3.42	4
3.5	The processing industry should be involved to provide capital to enable farmers to buy inputs within a contract system where farmers should provide cacao beans with required quality for the processing industry.	4.17	1
Objective 4	To encourage farmers to manage pests and diseases.		
4.1	The Department of Plantation should provide training for farmers on biological control of pests and diseases.	4.67	1
4.2	The government should provide subsidized chemicals.	3.25	4
4.3	Reading material on pest and disease management should be made available to farmers.	3.75	3
4.4	Extension visits should be more intensive.	4.42	2
Objective 5	To increase prices received by farmers.		
5.1	Farmers should establish a village cooperative that enables them to sell cacao beans in large amount to big buyers, exporters or processing industries.	4.08	3
5.2	Farmers should obtain the right information on the cacao bean quality required by buyers.	4.50	1
5.3	The government should provide price information to farmers through online sms.	3.92	5
5.4	A formal contract should be made between farmers and exporters or processing industries.	3.50	6
5.5	Farmers should improve the quality of cacao beans through proper drying practices, harvesting ripe pods and proper fermentation.	4.25	2
5.6	Alternative markets for fermented cacao beans should be made available.	4.00	4

The mean is used to assess the priority of the strategies. A strategy with a high mean suggests a high priority for that strategy to address the issues under study. The strategies are ranked in terms of the mean into four scales:

- 4.50 – 5.00: most important strategy
- 4.00 – 4.49: strategy of medium importance
- 3.50 – 3.99: reasonably important strategy
- < 3.50: less important strategy.

All indentified strategies have a mean greater than 3, indicating that respondents perceived them to be important.

The objective to encourage farmers to grow good-quality cacao seedlings received varied results. For example, panellists perceived “improving farmers’ knowledge on good-quality seedlings through training and extension services” to be a strategy of medium importance with a mean of 4.33. “Facilitating farmers to establish a cacao nursery in farmer groups by providing superior cacao seeds” was regarded as a reasonably important strategy (mean of 3.67), while “The government should establish seedling nurseries in each municipality” received a low priority (mean of 3.42).

Based on experts’ opinion, in order to achieve the objective to encourage farmers to use fertilizers, “encourage farmers to do integrated cacao and cattle farming in which cattle farming is a source of organic fertilizers and cacao farming as source of fodder” was considered to be a strategy of medium importance (mean of 4.08) and “providing training for farmers on composting” with a mean of 3.75 was perceived as a reasonably important strategy. The other strategy “to simplify procedures for farmers to get subsidized fertilizers” was considered a less important strategy.

The strategy with the highest score to achieve the objective to improve the availability of capital to small farmers for cacao industry development was “the involvement of the processing industry to provide capital to enable farmers to buy inputs within a contract system where farmers should provide cacao beans with required quality for the processing industry” with a mean of 4.17. “The intervention of the government to facilitate farmer groups to establish a village cooperative that can function to provide capital for farmers" obtained the second highest score (mean of 4.00). However, panellists rated them as strategies of only medium importance. This result suggests that farmers' empowerment to provide capital by themselves is a priority strategy to make capital available to farmers. This strategy offers sustainability of capital availability for farmers with less government intervention.

"The provision of training for farmers on biological control of pests and diseases" was perceived to be the most important strategy to encourage farmers to manage pests and diseases with a mean of 4.67. "More intensive extension visit" was placed a medium priority strategy, while the remaining strategies were considered as reasonable and less important strategies.

"Farmers should obtain the right information on the cacao bean quality required by buyers" was assessed as the top priority strategy with a mean of 4.50 in order to increase the price of cacao beans received by farmers. The panellists rated "improving the quality of cacao beans through proper drying practices, harvesting ripe pods and proper fermentation", "establishing farmers' cooperative" and "availability of alternative markets for fermented cacao beans" as strategies of medium importance. The other two strategies were rated as reasonably important strategies.

The results indicate that quality is the most important factor influencing the farm-gate price. Lack of information on the quality of cacao beans at the farmers' level is the critical factor that restrained farmers from receiving a higher price. Therefore, providing information on quality for farmers and to motivate them to improve the quality of cacao beans are the main strategies to increase the price of cacao beans at the farm gate. They should be accompanied by establishing farmers' cooperatives that allow farmers to sell cacao beans in large amounts to big buyers.

The discussion above can provide the most important strategy that will support the cacao industry development based on experts' opinion. For the strategy formulation stage, the strategy with the highest score is selected for each objective. The strategies with the highest score for the five objectives are:

- Objective 1: “improving farmers’ knowledge on good-quality seedlings through training and extension services”.

- Objective 2: “encouraging farmers to do integrated cacao and cattle farming in which cattle farming is a source of organic fertilizers and cacao farming as source of fodder”.

- Objective 3: “the involvement of processing industry to provide capital to enable farmers to buy inputs within a contract system where farmers should provide cacao beans with required quality for the processing industry”.

- Objective 4: “the provision of training for farmers on biological control of pests and diseases” and “more intensive extension visit”.

- Objective 5: “Farmers should obtain the right information on the cacao bean quality required by buyers”.

In order to make the selected strategies viable, several conditions are required, as presented in Table 8.2. The required conditions were selected based on the highest score. The three highest scores were selected as the conditions that will support the successful implementation of the strategy chosen.

“Provide training on side grafting technique for farmers”; “the government creates a demonstration plot of cacao trees using good quality cacao seedlings” and “extension workers’ knowledge is improved” are rated as the three important conditions that are required to make the strategy “Improving farmers’ knowledge on good-quality seedlings through training and extension services” viable.

Training in side grafting is the most important condition to improve farmers’ knowledge that in turn encourages them to grow good-quality cacao seedlings. The side grafting technique, according to ACDI/VOCA (2005), is a method to improve the genetic stock of cacao and increase resistance to pests and diseases. They noted some benefits of side-grafting are as follows: (1) the most productive trees can be selected and allow farmers to propagate them without extensive replanting; (2) trees that are prone to disease can be selected; (3) it saves much time to rehabilitate aging orchards; (4) cocoa pod borer can be eliminated because of much reduced canopies and shade in side-grafting practices; (5) it contributes to forest conservation by preventing farmers to open up new land for rehabilitation purposes; (6) it generates better tree structure.

A plot demonstration may be an effective technique to train farmers because they can see and follow the instructions clearly on how to grow good cacao seedlings properly. Moreover, as extension officers play an important role to improve farmers' knowledge, their knowledge should improve first.

When farmers are encouraged to engage in cacao-cattle integrated farming to enable them to use fertilizers for cacao trees, the panellists opined that the government should be able to control the implementation of the program. This program would be implemented successfully if farmers can see that this form of integrated farming would increase their profit. Moreover, the program should be complemented by the provision of livestock and infrastructure to produce organic fertilizers, impartation of farmers' knowledge on entrepreneurship and the provision of guidance and technical assistance to farmers.

The panellists considered that two important conditions are required to support the involvement of the processing industry to provide capital for farmers. They are dissemination of information on grading standards to farmers and the establishment of farmer groups (with means of 4.67 and 4.50, respectively). They should be accompanied by the establishment of a local processing industry.

"The provision of natural pesticide and herbicide", "availability of extension officers for estate crops" and "improving knowledge of extension officers" were thought to be the main conditions that need to be in place to support the strategy "provision of training for farmers on biological control of pests and diseases". These conditions can allow farmers to manage pests and diseases.

Table 8.2. Required Conditions with the Three Highest Scores for the First Rank Strategy

Code	Strategy / Condition	Mean	Rank
Objective 1	To encourage farmers to grow good-quality cacao seedlings.		
1.4	Farmers' knowledge is improved on good-quality seedlings through training and extension services.		
1.4.1	Training is provided on side grafting technique for farmers.	4.17	1
1.4.3	The government creates a demonstration plot for cacao trees using good quality cacao seedlings.	3.83	3
1.4.4	Extension officers' knowledge is improved.	3.92	2
Objective 2	To encourage farmers to use fertilizers.		
2.3	Farmers are encouraged to integrate cacao and cattle farming in which cattle farming is the source of organic fertilizers and cacao farming is a source of fodder.		
2.3.3	Farmers' profit increases.	4.25	2
2.3.4	Livestock and infrastructure are provided to produce organic fertilizers.	4.00	3
2.3.5	The government has the power to control the implementation of the program.	4.42	1
2.3.6	Knowledge on entrepreneurship is imparted to farmers.	4.00	3
2.3.8	Guidance and technical assistance are available to farmers.	4.00	3
Objective 3	To make capital available to small farmers for cacao industry development.		
3.5	The processing industry should be involved to provide capital to enable farmers to buy inputs within a contract system where farmers should provide cacao beans with required quality for the processing industry.		
3.5.3	A processing industry is established.	4.42	3
3.5.5	Grading standards are disseminated to farmers.	4.67	1
3.5.9	Farmer groups have been established.	4.50	2
Objective 4	To encourage farmers to manage pests and diseases.		
4.1	The Department of Plantation should provide training for farmers on biological control of pests and diseases.		
4.1.1	There is provision of natural pesticides and herbicides.	4.25	1
4.1.5	Extension officers for estate crops are available in the plantation area.	4.08	2
4.1.6	Extension officers' knowledge is improved.	4.00	3
Objective 5	To increase prices received by farmers.		
5.2	Farmers should obtain the right information on the cacao bean quality required by buyers.		
5.2.1	A policy is implemented to establish a grading standard and system of price differentials by grade.	4.58	1
5.2.2	Facilities for extension officers are improved.	4.08	3
5.3.3	Grading standards are disseminated to farmers.	4.50	2
5.4.4	Extension officers' knowledge is improved.	4.08	3

The quality of cacao beans was considered as the critical issue regarding farm-gate price. Therefore, panellists considered that farmers should obtain the right information on the cacao bean quality required by buyers. "A policy on grading standard and system of price differentials by grade" together with "dissemination information on grading standard to farmers" were perceived as the most important conditions to make the information on the quality of cacao beans available for farmers. As extension officers play an important role in disseminating such information to farmers, extension officers' knowledge and facilities should be improved to enable them to work effectively.

8.3 Application of the PIPA approach to strategy formulation

A strategy formulation using the PIPA approach involves three steps. The first step is to construct an outcome logic model that provides information about the actors who need to change their knowledge, attitude and skills (KAS); and the project strategies to support the changes to achieve the development objective. The second step is identifying outcome targets. Outcome targets are the objectives of the project with a specific timeline. For this study the second step is skipped. This step is left to stakeholders when they design a program for developing the cacao industry. The third step is to construct an impact pathways (IP) logic model that presents the chain of outcomes that link outputs to eventual development impacts. An outcomes logic model for the cacao industry was constructed based on the Delphi survey results. It is presented in Table 8.3.

Four groups of stakeholders need to be involved in implementing the selected strategies. They are farmers, extension officers, the processing industry and the government. Some groups of stakeholders such as input suppliers, marketing intermediaries, exporters and financial institutions are involved based on the strategies selected by the panellists, 67 per cent of whom are government officials.

Every group of stakeholders needs to play their roles as presented in column 2 in Table 8.3, which is called "change in practice" in PIPA literature. Several KASs need to be realised in order to support the changes in practice presented in column 3. Column 4 provides information on strategies regarding change in practice and KAS. The information provided in columns 3 and 4 is derived from the results of the Delphi survey on identified strategies and conditions to be in place to make the strategies viable.

Table 8.3. Outcomes Logic Model for the Cacao Industry in West Sumatra

Actors who are expected to change	Change in practice	Change in knowledge, attitude and skill required to support this change	Project strategies to bring about these changes in KAS and practice
Farmers	Grow good quality of seedlings	Knowledge and skills on side grafting technique Knowledge and skills on proper agronomic practices for good quality cacao seedlings	Encourage farmers to grow good quality of cacao seedlings by improving farmers' knowledge on good-quality seedlings through training and extension services
	Fertilize cacao trees properly	Knowledge and skills on cacao-cattle integrated farming Knowledge and skills to produce organic fertilizers Knowledge and skills on entrepreneurship	Encourage farmers to use fertilizers through cacao-cattle integrated farming
	Manage pests and diseases	Knowledge and skills on biological control	Encourage farmers to manage pests and diseases through training in biological control of pests and diseases
	Improve the quality of cacao beans	Knowledge and skills on grading standard Establish farmers' group	The provision of capital for farmers by involving processing industry to provide capital for farmers within a contract system The right information on the cacao bean quality required by buyers is available for farmers in order to increase farm-gate price
Extension officers	Provide guidance and technical assistance for farmers on: • side grafting technique • agronomic practices for good quality cacao seedlings • cacao-cattle integrated farming • biological control	Knowledge and skills on: • side grafting technique • agronomic practices for good quality cacao seedlings • cacao-cattle integrated farming • biological control	Improve the capacity of extension officers to provide guidance and technical assistance for farmers
	Provide information on the quality of cacao beans and grading standard	Knowledge and skills on quality of cacao beans and grading standard.	Improve the capacity of extension officers to provide information on quality of cacao beans and grading standard

Table 8.3. Continued

Actors who are expected to change	Change in practice	Change in knowledge, attitude and skill required to support this change	Project strategies to bring about these changes in KAS and practice
Processing industry	Provide capital for farmers within a contract system	-	Improve farmers' affordability to buy inputs and to improve quality of cacao beans
Government	Provide training and extension services for farmers on side grafting technique and agronomic practices for good-quality seedlings	-	Encourage farmers to grow good quality of cacao seedlings by improving farmers' knowledge on good-quality seedlings through training and extension services.
	Create a demonstration plot for cacao trees using good-quality cacao seedlings		
	Provide livestock and infrastructure for farmers to produce organic fertilizers	-	Encourage farmers to use fertilizers through cacao-cattle integrated farming
	Control the implementation of the program properly		
	Facilitate extension officers to provide guidance and technical assistance for farmers on cacao-cattle integrated farming		
	Provide training for farmers on entrepreneurship		

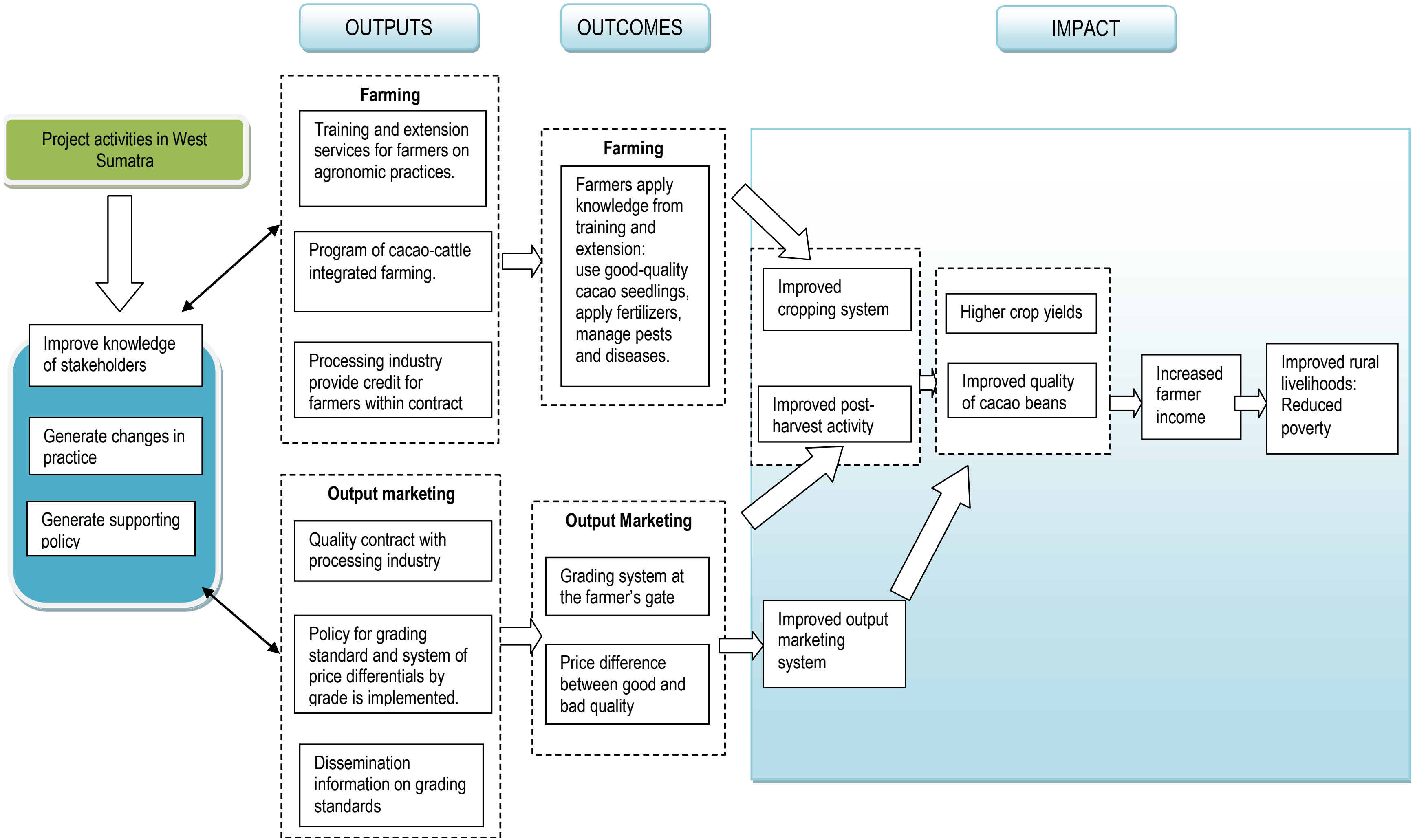
Table 8.3. Continued

Actors who are expected to change	Change in practice	Change in knowledge, attitude and skill required to support this change	Project strategies to bring about these changes in KAS and practice
Government	Provide training on biological control of pests and diseases for farmers and extension officers Provide natural pesticide and herbicide Recruitment of extension officers for estate crops	-	Encourage farmers to manage pests and diseases
	Facilitate farmers to establish farmers' group Establish a processing industry Implement a policy to establish a grading standard and system of price differentials by grade Provide training for extension officers in grading standards Encourage extension officers to disseminate information on grading standards to farmers by improving facilities for extension officers	-	Increase the price of cacao beans received by farmers through improving the quality of cacao beans

The last step for the PIPA application is to construct an IP logic model that shows potential strategies for cacao industry development and their impact on farmers' economic condition that leads to poverty alleviation. The IP logic model is presented in Figure 8.1.

The model illustrated in Figure 8.1 indicates that the potential strategies are complementary. In cacao farming, improving the knowledge of farmers on agronomic practices is the main strategy to encourage farmers to grow good-quality cacao seedlings and to manage pests and diseases.

Figure 8.1. Impact Pathway Logic Model for the Cacao Industry in West Sumatra



To apply the knowledge obtained from training and extension services, farmers need capital to buy inputs. However, lack of capital proved to be a problem restraining farmers from obtaining high output from cacao trees for several reasons. It influenced the affordability of farmers to buy fertilizers, which are an important input to increase cacao production. In fact, it had significant indirect effect on fertilizing practices. Furthermore, lack of capital was a predictor variable for affordability of farmers to buy chemicals to control pests and diseases. Its indirect effect on pest and disease management, mediated by the variable of affordability of farmers to buy chemicals, was statistically significant.

As the findings reveal that good-quality seedlings were costly for farmers, lack of capital may influence farmers' decisions to grow low-quality seedlings with a cheaper price. For these reasons, lack of capital should be solved in order to support strategies to increase cacao production. The strategy "involving processing industry to provide capital for farmers" offers a solution to this problem.

Coughlin (2011) argued that capital scarcity is one of the major obstacles for farmers to accept and implement extension messages, even though these messages are considered technologically and economically appropriate. Ahluwalia (1990) stated that access to credit is a key requirement to upgrade the income potential of any production enterprise. The availability of capital through the provision of affordable credit to small farmers can enhance the productivity of the agriculture sector (Bhutto and Bazmi, 2007).

A program of cacao-cattle integrated farming is considered to be a supporting policy to develop the cacao industry. Cattle farming is a source of organic fertilizers for cacao trees while cacao farming produces fodder for the cattle. This form of integrated farming offers two benefits: to encourage farmers to apply fertilizers to increase the output of cacao trees and to generate an additional source of income. This farming system can reduce dependence on inorganic fertilizers and decrease production cost.

The impact pathway conducted in this study is constructed to achieve short-term impacts to increase cacao farmers' income, while the long-term impact (poverty reduction) is beyond the scope of this study. The short-term impact is an intermediate outcome in the PIPA approach. Therefore, the output of this study is an outcome logic model that leads to strategy formulation. The application of knowledge obtained from training and extension services and the use of inputs properly by utilizing the capital provided are the most likely ways to improve the cacao cropping system that can result in higher crop yields in the short term.

The establishment of contracts between firms in the processing industry and farmers' groups is another short-term measure that is expected to bring about an improvement in the quality of cacao beans. While the processing industry provides capital for farmers to finance cacao farming, farmers supply the required quality of cacao beans. This contract could encourage farmers to improve their post-harvest practices in order to produce good-quality cacao beans to meet the contract requirements.

A policy for grading standards and the implementation of a system of price differentials by grade was suggested by experts in the Delphi survey in order to improve the quality of cacao beans. When the policy is established, information on the grading standard and pricing system by grade should be disseminated to farmers.

The implementation of this strategy can support the establishment of a grading system at the farmers' level. As a result, the price paid will be different between good-quality and bad-quality cacao beans. This, in turn, leads to marketing system improvement. Improvement in the quality of cacao beans generates a higher price for farmers.

Higher crop yields and better quality of cacao beans can increase farmers' gross income. This condition could have an impact on the rural economy and eventually have an impact on poverty alleviation.

8.4 The Development of the Cacao Industry and Poverty Alleviation

This section discusses how the development of the cacao industry has a potential impact on poverty alleviation. The discussion begins with a picture of the poverty in West Sumatra in the first part of this section, followed by an overview of the role of agriculture growth in poverty alleviation in the second part. The implications for how the development of the cacao industry has a potential impact on poverty alleviation are deliberated on in the last part of this section.

8.4.1 **Poverty incidence**

In terms of monetary context, poverty can be defined as the condition of people who cannot afford to fulfil their basic needs due to lack of adequate income. This definition only partly fulfils the meaning of poverty. It is now realized that poverty is multidimensional in nature. It is not only a matter of monetary assessment; it deals with the failure of several kinds of basic capabilities, which refer to freedom and opportunities to achieve well being (Osmani, 2003). ADB (2003, p. 5) defined poverty as "a deprivation of essential assets and opportunities to which every human is entitled". By this definition, poverty is measured in terms of income, employment and wages; access to basic education, health care, nutrition and water sanitation; and participation in making decisions for their lives. In line with the definition of poverty, the measurement of poverty also varies. However, the ADB noticed that the adequate consumption of food and other essentials remain the most broadly used standards for measuring poverty.

Hussain (2003) reviewed four poverty measurements used in Indonesia: the criterion according to Sajogyo, the Central Bureau of Statistics (BPS), World Bank and the criterion of the national family planning coordinator institution (BKKBN). Sajogyo determined a poverty limit using a kilogram unit of rice equivalent per person per year. Based on this criterion, he classified the community into four groups: very poor, poor, almost poor and not poor. Units of rice used to classify the urban community are higher than those in rural areas. BPS defined an alternative measure of the poverty line based on consumption levels to satisfy basic needs (food and non-food) calculated for rural and urban areas separately. The poverty level was measured by comparing the consumption level to the poverty line (minimum expenses per person per month). The World Bank defined the poverty line based on income per capita per year.

BKKBN divided prosperity stages of households into five categories: pre-prosperous family, prosperous I family, prosperous II family, prosperous III family, and prosperous plus family (Cahyat, 2004). Pre-prosperous families have the characteristic not being able to fulfil basic needs such as food, clothing, housing, health care and religious knowledge. Prosperous I families are the families that could fulfil their minimum basic needs but have not yet fulfilled all of their social and psychological needs, such as education, family planning, social interactions and transportation. Prosperous II families are the families that could fulfil their basic needs and their social and psychological needs, but have not been able to fulfil all of their developmental needs, such as those related to savings and information access. Prosperous III families are the families that could fulfil their basic needs, social and psychological needs, and developmental needs, but are unable to provide a maximum contribution to the community, such as regularly giving material and fund contributions for social interests, and actively participating in social institutions or social, religious, sports and educational organizations and other related matters. Prosperous plus families are the families that could fulfil their basic needs, social and psychological needs, and developmental needs and, furthermore, they could make contributions to their society on a regular basis.

Based on the poverty measurement by BPS, the poverty line in West Sumatra in 2010 was Rp.262,173 per capita per month in urban areas and Rp.214,458 per capita per month in rural areas (BPS-Statistics Indonesia, 2010). Based on this measurement, about 9.50 per cent of the West Sumatra population were poor in 2010. This figure was higher than the proportions in Riau and Jambi where the poor accounted for 8.65 per cent and 8.05 per cent, respectively. However, the percentage of poor people in West Sumatra decreased significantly compared with the figure in 2006, which was 12.51 percent (BPS-Statistics West Sumatra, 2010). In 2010, the number of poor people in rural areas (323,843 people) in this province was threefold the number in urban areas (106,181 people).

The number of households based on the BKKBN criterion in 2008 is presented in Table 8.4. About 33 per cent of households in West Sumatra were in the category of pre prosperity (very poor) and prosperity I (poor). Pesisir Selatan municipality had the highest number of households in these two categories, followed by Padang city, Padang Pariaman municipality and Solok municipality.

The elimination of poverty is a key concern of all poor countries. It is also the central objective of the Millennium Development Goals to halve the poverty rate by 2015 (Laderchi, Saith and Stewart, 2003). To support this aim, many international agencies are currently conducting projects regarding poverty issues. For example, the Asian Development Bank has established a policy to allocate at least 40 per cent of all public sector lending to poverty intervention since 1999 (Perez-Corral, 2001).

Table 8.4. Number of Households by the Level of Prosperity in West Sumatra in 2008

Municipality / City	Number of households by the level of prosperity					
	Pre prosperity	Prosperity I	Prosperity II	Prosperity III	Prosperity plus	Total
Mentawai Islands	8,204	4,330	1,951	1,031	321	15,837
Pesisir Selatan	15,175	29,439	34,975	20,169	2,238	101,996
Solok	11,373	19,159	19,453	31,654	2,792	84,431
Sawahlunto/Sijunjung	4,894	10,129	13,920	17,532	1,498	47,973
Tanah datar	5,080	21,307	27,954	32,251	1,182	87,774
Padang Pariaman	10,118	21,683	28,297	25,383	1,443	86,924
Agam	3,008	27,048	36,850	34,123	2,156	103,185
50 Kota	6,628	21,872	27,081	32,372	1,002	88,955
Pasaman	3,968	19,743	19,050	13,386	1,260	57,407
Solok Selatan	2,354	9,004	11,575	10,220	1,506	34,659
Dharmasraya	5,181	6,515	17,961	11,991	3,319	44,967
Pasaman Barat	7,961	22,736	25,799	12,439	4,573	73,508
Padang*	4,349	34,785	55,570	55,619	13,136	163,459
Solok*	951	2,320	3,931	4,845	814	12,861
Sawahlunto*	512	3,428	4,715	5,113	230	13,998
Padang Panjang*	215	1,413	3,573	3,510	901	9,612
Bukittingi*	950	4,354	5,744	9,265	859	21,172
Payakumbuh*	877	5,576	5,958	13,991	485	26,887
Pariaman*	1,495	6,379	5,702	5,034	214	18,824
West Sumatra	93,293	271,220	350,059	339,928	39,929	1,094,429

*City

Source: BPS-Statistics West Sumatra (2008)

The Government of Indonesia has launched several poverty alleviation programs. Sumarto and Suryahadi (2003) reviewed four major poverty reduction programs that were implemented in Indonesia. The presidential instruction on disadvantaged villages (IDT–*Inpres Desa Tertinggal*) program was one of the major programs, which was launched in 1993 with the objective of reducing poverty in less developed villages across Indonesia. The implementation of this program was complemented by less developed village infrastructure development (P3DT) and the IDT nutrition for schoolchildren programs. The national family planning coordinating body (BKKBN) implemented a family welfare development program (TAKESRA/KUKESRA). This second major program was a saving scheme for poor people in order to improve their access to credit. Income-generating projects for marginal farmers and the landless (P4K-*proyek peningkatan pendapatan petani kecil*) were part of another major program with the aim to increase incomes of small farmers and improve their access to credit. Access to financial resources for the poor was also improved by utilising micro finance programs that had been in place, such as subdistrict credit institutions (BKK- *badan kredit kecamatan*) and village rice storage facilities (LPN-*lumbung pitih nagari*). The fourth major program noted by Sumarto and Suryahadi was an urban poverty reduction program (P2KP-*Program Pengentasan Kemiskinan Perkotaan*) and subdistrict development program (PPK-*program pengembangan kecamatan*). These programs employed a participatory approach to improve community and local government participation in development projects.

After the economic crisis rocked Indonesia in 1997, the Indonesian Government developed a large-scale program called the “social safety net program” to respond to economic problems facing the Indonesian community. The program included a cheap rice program (OPK-*operasi pasar khusus*), employment creation program (*program padat karya*), scholarships and block grants to schools, social safety nets program in the health sector and community empowerment program (Sumarto and Suryahadi, 2003).

Swastika (2005) observed that most poverty alleviation programs provided the poor with soft credit or revolving funds that aimed to improve their capacity to run their businesses. He stated that these efforts, however, were not sustainable in that they could not generate capital accumulation. He also observed that some of the poor used the credit for consumption that made them unable to repay their loans.

In early 2003, the Government of Indonesia developed a national poverty reduction strategy (National PRS) by involving stakeholders from both government and non-government institutions (Suharyo et al. 2006). This approach has been internationally implemented related to development assistance and debt to poor countries. Driscoll and Evans (2005) noted that this approach has a greater contribution to aid effectiveness, good governance and poverty reduction in developing countries.

Since the implementation of regional autonomy, the role of regional (province and municipality) governments in poverty reduction has become more crucial, as most public services and various policies that directly affect community life are now under the authority of the municipal governments (*pemerintah kabupaten dan kota*). Suharyo et al. (2006) stated that considering this crucial role, various initiatives have been launched to strengthen the capacity of regional governments in reducing poverty in their respective area.

Andrianto et al. (2006) found that poverty programs conducted centrally required complicated administration and procedures that officials were unwilling to meet. The programs often failed to reach their targets or to meet local priorities. There was disproportionate assistance received by communities in that program where remote areas received less benefit. Andrianto et al. (2006) pointed out that some causes of the failure of poverty programs are:

- some projects were not relevant locally
- the lead institution could not work well due to lack authority, funding and capabilities
- information was lacking to develop the program
- there was a lack of poor people's participation.

To counter these weaknesses, Andrianto et al. (2006) suggested that the programs should be coherent, simple strategies, facilitating communities' participation, revitalizing coordination with funding and stronger leadership, and improving the capacity of districts and communities to monitor government program impacts on poverty.

A successful story of a poverty alleviation program in Indonesia occurred between 1976 and 1996. The poverty rate decreased significantly from 40.1 per cent (54.2 million people) in 1976 to 11.3 per cent (22.5 million people) in 1996 due to high economic growth (Swastika 2005). This high economic growth was generated by a development strategy that focused on industrialization (Sumarto and Suryahadi 2003). The aim of this strategy was to increase productivity of the industrial sector, which expected to "pull out people from the low productivity agricultural sector" to enable them to escape from poverty (Sumarto and Suryahadi 2003, p.1).

However, in 1999 the number of poor people in Indonesia increased significantly to 23.4 per cent (48 million people) due to the economic crisis and El Niño facing Indonesia during the period of 1997-1999 (Swastika 2005). This condition doubled the number of poor people in urban areas, while there was a 75 per cent increase in the rural poor (Sumarto and Suryahadi, 2003). This indicates that emphasizing industrialization as a development strategy should have been questioned.

Sumarto and Suryahadi (2003) found two reasons for the industrialization strategy failure. First, the expansion of the industrial sector led to a decline in the contribution of the agricultural sector to the economy (GDP), while the movement of people from the agricultural sector into the industrial sector was slow because the industrial sector could not absorb a larger fraction of the workforce. Second, in fact agricultural growth had a higher impact on poverty reduction than industrial growth. These findings have important implications for policy to eliminate poverty in Indonesia and other developing countries (Sumarto and Suryahadi, 2003).

For the agricultural sector, the government proposed a program of pro-poor growth and rural development to reduce the poverty rate. Anríquez and Stamoulis (2007) defined pro-poor growth as an increase in average income and purchasing power that is accompanied by an improvement in the distribution of income. ADB (2006) stated that pro-poor growth and rural development and the Vision for Rural Indonesia in 2020 would require concerted efforts across a wide range of areas. To increase effective incomes and food demand and availability, agricultural productivity and economic growth must be broad-based and rapid, and investments must be made in physical infrastructure such as roads and irrigation, and in agricultural research and extension. Governance and civil society, human resources and entrepreneurship, and education and health must improve. Environmental and natural resource policies must be encouraged for long-term sustainability. To achieve the Vision for Rural Indonesia in 2020, the Ministry of Agriculture (MOA) implemented an Agriculture and Rural Development strategy that focuses on six priority areas (ADB, 2006):

- human resource development and entrepreneurship
- social capital
- agricultural productivity
- agribusiness and farming systems and rural industrial clusters

- growth and productivity in the rural nonfarm economy
- natural resource management.

In order to achieve these aims, the central, provincial and regency governments, along with the private sector and civil society organizations, should support the program (ADB, 2006).

8.4.2 The role of agricultural development in poverty alleviation

Economic growth is one of the sources of poverty reduction, but the effect of economic growth on poverty reduction depends on how the economic growth is defined. Adams(2004) found that economic growth measured by changes in mean income (consumption) had greater impact on poverty reduction than by changes in GDP per capita. Balisacan, Pernia and Asra (2003) found that overall income growth had a strong impact on poverty reduction with an elasticity of 0.7 in Indonesia. This significant impact relates to the nature of economic growth in Indonesia, which is based on labour-intensive industry and agriculture.

Anríquez and Stamoulis(2007) posited that agriculture is a key sector to promote development because it has the highest backward linkages at earlier stages of development. This suggests that agriculture as a development strategy can indirectly have a multiplier effect on the rest of the economy. Johnston and Mellor (1961 in Anríquez and Stamoulis, 2007, p. 8) pointed to four roles of agriculture on development. It provides food necessary for a growing economy to accommodate the increase in demand for food as income increases. Agricultural exports generate the foreign exchange necessary to import capital goods. Agriculture can generate the saving mass for capital accumulation required by non-agricultural sector needs. The development of the agricultural sector can contribute to development of the local market for the non-agricultural sector.

The linkages proposed by Johnston and Mellor remain relevant for developing economies with a large primary sector. Anríquez and Stamoulis (2007) noted that successfully industrialized countries started their economic development with fast agricultural expansion by increasing productivity. However, this school of thought on the role of agriculture in development was not accepted by the structuralist school, known as the Prebisch-Singer hypothesis. The hypothesis as described by Anríquez and Stamoulis(2007) posited that the income elasticity of demand for export commodities produced by developing countries was inelastic, whereas it was elastic for industrial goods produced by the developed countries. Therefore, the price of the primary commodities exported by developing countries tended to fall relative to the price of the industrial goods imported by these same countries in the long run. The structuralist school argued that specializing and exporting these primary commodities would be a constraint on development.

However, this school of thought had a weakness due to its reliance on the primary commodity and the industrial/manufacture price index used as deflator and availability of price time series data. Anríquez and Stamoulis (2007) stated that the hypothesis did not apply for most commodities. In the short run, most commodity prices were pro-cyclical. In the long run, some commodity real prices were non-stationary and thus moved around a stable mean, while other commodities showed once-off price falls in the early 1920s and 1980s, and some other commodities showed an upward trend such as the relative price of meat. Therefore, the Prebisch-Singer hypothesis may apply to explain the failed development experience of any one particular country, dependent on a particular commodity, but it cannot be generalized to all developing countries and to all commodities (Anríquez and Stamoulis, 2007).

The contribution of agricultural growth to poverty alleviation has been well known and approved in many developing countries. Previous studies reveal that agricultural growth brought more positive impact on the poor than other sectors. An increase in yield by 1 per cent reduced the proportion of people living on less than \$1 per day by between 0.6per cent and 1.2 per cent in studies by Thirtle, Lin and Piesse(2003) and Wadsworth(2004). Hossain(2001) stated that agriculture's role in poverty alleviation depends on the stage of economic development. The effect would be substantial at low levels of income, where food production is a major source of employment and income. According to Krongkaew (1985), in the case of a dualistic economy where agriculture forms a relatively large contribution but is a backward sector compared with the progressive commerce and industry sectors, economic development would be configured by a transformation from a predominantly agricultural economy to a predominantly industrial economy. However, agriculture's importance as a source of livelihood and its poverty-reducing role decline with economic prosperity (Hossain, 2001).

Anríquez and Stamoulis (2007, pp. 16-17) identified four main contributions of agricultural growth to poverty alleviation:

1. “Directly increasing the income/own consumption of small farmers”
   Since smallholders lack access to land endowments and other assets, agricultural expansion creates an opportunity for them to get benefits when land distribution is equitable. They also benefit from technological progress with respect to capital and land utilization that is labour intensive (own family labour).

2. “Indirectly by reducing food prices”
   Access to food is one of the main measurements of poverty. It depends on the purchasing power of the poor. Therefore, a decrease in food prices increases the purchasing power of the poor by increasing real income. That, in turn, improves the welfare of the poor.

3. “Indirectly by increasing the income generated by the non-farm rural economy”
   The rural non-farm economy generally provides goods and services required by the farm economy. Income generated by agriculture will be spent on goods and services produced in the rural non-farm sector that improve the non farm economy and pulls households tied to this sector out of poverty. The degree of agricultural growth impact on the rural economy is influenced by the connection of the rural economy to urban markets. In isolated rural economies, the non-farm sector depends heavily on agricultural productivity, income and demand.

4. “Indirectly by raising employment and wages of the unskilled”
   As agriculture usually employs unskilled labourers, most of whom are poor, its growth will increase demand for unskilled labour that pushes up their wages. An increase in unskilled wages in agriculture will encourage an increase in

the wages of unskilled labourers in urban areas. This, in turn, will increase the income of the poor, which is a channel to escape from poverty.

The development of rural areas, according to Anríquez and Stamoulis (2007), has multiple potential avenues for poverty reduction. It not only reduces poverty at its very source but also has the potential to increase employment opportunities in rural areas, reduce regional income disparities thereby stemming premature rural-urban migration, preserve the rural landscape, and protect indigenous culture and tradition. Rahman and Westley (2001) noted that rural development is believed to be the only way to reach the international poverty reduction targets by 2015.

However, these potentials have yet to be realized at the national and international levels. In fact, public policies and investments in developing countries have historically focused development initiatives more on the industrial, urban and service sectors than on the agricultural and other rural sectors (Anríquez and Stamoulis, 2007). Anríquez and Stamoulis observed that there has been a decline in the availability of public resources for agriculture and rural development in the past 20 years. Between 1983 and 1987 and 1998 and 2000, the annual average allocations of Official development assistance for agriculture in the least developed and other low-income countries fell by 57 per cent and a similar trend also occurred in the disbursement of international loans (Anríquez and Stamoulis, 2007). Realizing the failure of past paradigms, national and international institutions have recently committed to pay greater attention to the role of agriculture in development and poverty reduction, as for instance in the Millennium Development Goals and the Poverty Reduction Strategies at country level (Anríquez and Stamoulis, 2007).

Historically, the agricultural sector had proved its contribution to poverty alleviation in Indonesia, particularly during the economic crisis that hit Indonesia in 1998. At the time, there was a dramatic increase in the export value of agricultural commodities that led to a significant increase in incomes of smallholders. Therefore, the agricultural sector is strongly believed to be a leading sector and a path to escape from poverty.

The ADB (2002) noticed that agricultural growth as the centre of rural development had been the key to reduce poverty in Indonesia. Rapid growth in agricultural production and the resulting job creation in off-farm employment in agricultural processing, transport and trade contributed to a decline in poverty during the 1970s. Stagnation in the agricultural economy in the mid-1980s also led to a low impact on poverty reduction. It was proved that the agricultural sector functioned as a safety net for other sectors during economic crises.

The ADB (2006) revealed that rapid agricultural growth had a major contribution to significant poverty reduction in Indonesia from the 1980s until 2002. Sumarto and Suryahadi (2003) found that, during the period of 1984-1996, the contribution of agricultural growth to total poverty reduction was 66 percent. Its contribution was not only in reducing rural poverty (74 percent) but also in urban poverty reduction (55 percent). In addition, during the 1998 economic crisis, agriculture provided a safety net to workers shifting out of declining sectors (ADB, 2002).

Anríquez and Stamoulis (2007) found that in Indonesia agricultural forward linkages were stronger than backward linkages. These linkages were also the highest among other countries involved in that study. The strategy of industrialization therefore can be more effective if it develops industries that have strong links with the agricultural sector, such as the agro-industries, so that industrial growth will have a bigger impact on reducing poverty (Sumarto and Suryahadi, 2003).

8.4.3 **The potential role of the development of the cacao industry on poverty alleviation**

Cacao farming has been recognised to be associated with rural poverty in West Sumatra on three forms of evidence: income per capita, size of landholding and the proportion of household income expenditure on food. As described in Chapter 5, about 25 per cent of cacao farmers in West Sumatra face absolute poverty with per capita income below the poverty line.

Norton, Alwang and Masters (2006) noted that the average per capita income is an indicator widely used to measure development even though it is an inadequate measure due to its failure to capture the multidimensional nature of development. They noted other indicators such as level of living index proposed by Bennet in 1951, which weighted 19 indicators, and the human development Index used by the United Nations Development Program, which includes life expectancy, education and income to weight the index.

Norton et al. (2006) stated that as average per capita income is highly correlated with many of the indicators, it is frequently used as a first approximation to the signals of underdevelopment (Norton et al., 2006). This implies that development is partly related to poverty reduction; therefore, "it is possible for poverty to decrease in a country during the development process..." (Norton et al., 2006, p. 17).

As indicated in Chapter 5, most cacao farmers in this province are smallholders with small landholdings, which is another piece of evidence of poverty incidence in the cacao industry. The third piece of evidence is that 64 per cent of sampled cacao farmers spent more than 50 per cent of their household income on food (Table 8.5), while cacao farming contributed about 60 per cent to household income.

These figures indicate that the development of the cacao industry has a potential contribution to poverty alleviation. It is not just to reduce poverty at its source; it also has potential to develop the rural economy through its multiplier effects. As the majority of the poor of West Sumatra live in rural areas, the development of the cacao industry could have a great impact on poverty alleviation.

Table 8.5. The Proportion of Household Income of Cacao Farmers on Food Expenditure (%)

Proportion of income spent on food	Solok	50 Kota	Pasaman	West Sumatra
	n = 30	n = 30	n = 40	n = 100
≤ 25%	3	3	8	5
26 - 49%	63	20	15	31
50 - 75%	33	77	60	57
≥ 76%	0	0	18	7

Irz, Colin and Wiggins(2001) described the impact of agricultural growth on poverty in terms of three subsequent effects: farm, rural and national economy. They noted that there are two impacts of agricultural growth within the farm economy, namely farmers' income (a direct impact) and labour market. The effect of farm production growth on poverty depends on the degree of engagement of the rural poor in the farm sector and the extent to which output growth raises incomes. Even though the majority of the world's poor live in rural areas, it does not necessarily mean that they are farmers. The more the poor are engaged in the farm sector, the greater the effect of production growth on poverty. When increased output drives down product prices, or costs of production rise as the demand for inputs increases, the rise in gross margins may be small. In the case of land scarcity, increased returns to agriculture may be reflected in higher land rents. If the land does not belong to the poor, the benefits from higher rents could seriously undermine the contribution to poverty reduction.

In the cacao industry, most of West Sumatra's cacao growers are the owners of the cultivated areas (see Chapter 5). Therefore, an increase in cacao output can directly benefit cacao farmers in increasing gross incomes under conditions of constant output and input prices. For cacao development to occur, the poor farmers should operate in an environment in which it is easy to get full access to the knowledge and credit needed to adopt technical innovations to increase farm production. This study suggests three strategies to improve the cropping system in the cacao industry in order to increase cacao output. The strategies include the provision of training and extension services on agronomic practices to improve farmers' knowledge, developing cacao-cattle integrated farming program, and the involvement of processing industry to provide credit to farmers. Irz et al. (2001) argued that technology and policies should not be biased against smallholders in order to maximize the direct impact of agricultural growth on poverty.

The other contribution of agricultural growth within the farm economy is through the labour market (Irz et al. 2001). Its effect on poverty reduction is determined by the degree of dependency of the rural poor on labouring. Greater agricultural production due to either expanded cultivated areas or an increase in cropping frequency can increase the demand for labour in rural areas. However, the demand for labour can be preserved depending on the nature of the new technology used. A new crop technology may reduce the use of labour on the farm; for example, the use of machinery may substitute for human labour. It may also induce a change in the composition of output towards more or less labour-intensive crops. As cacao farming is labour-intensive farming, the development of the industry could generate an increase in the demand for labour.

Agricultural production growth should have effects on non-farm sectors in the rural economy through a series of linkages (Irz et al. 2001). These linkages include backward and forward linkages in the supply chain. An increase in farm production could engender an increase in the demand for inputs and services. It may also increase the demand for processing, storage and transportation services for agricultural products. It also generates consumption linkages as farmers and farm labourers spend their increased incomes on goods and services in the local rural economy. Irz et al. (2001) reported findings of previous studies that the effect of increased farm output through consumption linkages was 75 per cent or more. They observed that the effect of production growth on these linkages was influenced by factors such as the amount of rural infrastructure, rural population density, the need for immediate and local processing of farm products, the nature of technical change in farming, and the tradability of both farm output and the goods and services demanded by farming communities.

Irz et al. (2004) argued that an increase in farm output could influence the national economy. It could decrease food prices that benefit consumers. As the rural and urban poor spend a greater proportion of their income on food than the rich do, they benefit relatively more. This effect on the national economy depends on the tradability of farm products and its price and income elasticity of demand.

According to the ADB (2002), recently improved terms of trade, a depreciated currency, deregulation and farmer support programs initiated after the financial crisis offer poor farmers in Indonesia an opportunity to improve incomes through the adoption of innovative production and marketing methods. The government had increasingly provided public good support for non-rice crops, while additional support was needed to target village-level public investments to the needs of poor farmers, to increase the availability of technologies needed by poor farmers, and to increase access by poor farmers to information to support agricultural production and marketing innovations (ADB, 2002).

Improving the supply chain system is another important intervention in developing the cacao industry. Establishment of a contract system between cacao farmers and the processing industry, establishment of a grading standard system and price differentials by grade, and dissemination of information on the grading system are potential strategies, perceived by experts, to improve the supply chain system in the cacao industry in West

Sumatra. Rahman and Westley (2001) argued that better access for the poor to assets, improved technology and markets, and reform of institutions through decentralisation and devolution, are the key interventions to support rapid reduction of poverty. Improving information flows can improve the efficiency of marketing and allocation of productive resources; therefore it is noted as one of the keys to agricultural development (Norton et al., 2006). Norton etal. noted that land tenure systems, input and credit policies, and pricing policies are required incentives together with education, improved technology, irrigation systems, roads, market infrastructure and other investments to increase agricultural output.

Arsyad (2010) analysed the correlation between cacao production and poverty in Desa Compong, South Sulawesi, using path analysis. This study found a strong correlation between the orientation of cacao production in agricultural economic activity and poverty reduction with a path coefficient of 0.557. It indicated that encouraging farmers to engage with cacao farming could bring positive impact on poverty reduction.

Based on the discussion above, the findings of this study have important implications for policies aimed at eliminating poverty in West Sumatra. The improved performance of the cacao industry through better cropping and marketing systems is expected to have an impact on cacao farmers' income. This, consequently, could lead to a significant reduction in poverty.

8.5 Concluding Remarks

Most potential strategies proposed in this study emphasize a sustainability approach. Farmer empowerment becomes the core of the strategies. Such strategies include the provision of training and extension services for farmers, a program of cacao-cattle integrated farming and a contract system between farmer groups and the processing industry. The implementation of the strategies needs government intervention at the starting stage. When a condition of sustained improvement in the performance of farmers is established, intervention by the government can be removed.

The policy of grading standards and a system of price differentials by grade is the only strategy that needs government intervention in terms of regulation that controls the marketing system of cacao beans.

Chapter 9

Summary, Implications and Conclusions

9.1 Introduction

This chapter presents a summary of the major results, discussion of their implications and some conclusions. An overview of the study is presented in Section 9.2 followed by a summary of the results in Section 9.3. Research implications are discussed in Section 9.4. An overview on the contribution of the study is presented in Section 9.5.

9.2 Overview of the Study

This study was inspired by a significant expansion of the cacao area in West Sumatra particularly since 2004. This province had the highest annual growth rate of cacao area in the period 2004- 2009. A threefold increase in the cacao area during this period generated a threefold increase in cacao output. As these statistics indicate, the increase in cacao output was mainly due to area expansion, which indicates that any technological improvement applied to cacao farming was limited. As a result, the yield of cacao trees in West Sumatra has remained low and has only reached about 60 per cent of yield capacity, despite the implementation of several government programs to support the development of the cacao industry since 2005.

Most cacao producers in West Sumatra are smallholder farmers who are poor, and who grow cacao trees on a small area of land ranging from 1 ha to 2 ha. As the demand for and price of cacao beans and other cacao products are promising in international markets, there is an opportunity to develop the cacao industry and to increase farmers' income, so they can escape from poverty. In order to capture this opportunity, it is important to understand the current problems facing the cacao industry. Therefore, this study was conducted with three objectives. The first objective is to identify constraints on smallholders producing cacao in West Sumatra. The second objective is to develop a strategy to alleviate the constraints identified that leads to rural poverty alleviation. The third objective is to assess the effectiveness of PIPA in designing the strategy to improve the performance of cacao producers in West Sumatra. Detailed discussion about the background of this study is presented in Chapter 1.

An overview of the cacao industry and the role of the industry in rural development and poverty alleviation is provided in Chapter 2, where the development of the cacao industry in terms of area and output is described. Issues and challenges in cacao production and marketing, and the role of the cacao industry in rural development, are discussed.

The identification of constraints in the cacao industry was conducted in this study using three methods: participatory impact pathway analysis (PIPA), path analysis and the Delphi method. The theoretical framework in the application of the methods is reviewed in Chapter 3 where the design of the research, study location, sampling method, and data analysis are described.

The first step in applying PIPA was to conduct workshops in three municipalities in West Sumatra that involved different group of stakeholders. The workshops allowed the researcher to draw the initial problem tree, which is the main outcome of the workshops. It illustrates cause and effect relationships among variables in the study. The results of the workshops provided guidance to conduct a survey that formed the basis for model formulation for the path analysis.

The process and the results of the workshops are described in Chapter 4. The results of the workshops consisted of problem identification, and causes and possible solutions for the identified problems. Stakeholders' relationships in the form of network mapping were described in the last section of Chapter 4.

For triangulation purposes, surveys were conducted in the three municipalities. The design of the questionnaire in the survey was guided by workshop results. The descriptive analysis of data from the survey is presented in Chapter 5. It consists of agronomic and post-harvest practices of cacao farming, access to extension services, training and financial services. Marketing practices of cacao farmers and the practices of marketing intermediaries are also described.

Path analysis is the method used to analyse data from the survey. It is a quantitative method that provides statistical inference about relationships between variables in a complex model. The use of path analysis in this study complements the PIPA approach. While PIPA method emphasizes a qualitative approach to assess the relationships among variables in the model, path analysis provides a quantitative assessment of these relationships.

The application of this method to identify production constraints in the cacao industry is discussed in Chapter 6. Marketing issues in the cacao industry are identified in Chapter 7. The results of the path analysis together with workshop results enabled the construction of some alternative strategies for the development of the cacao industry. The strategies were then assessed by experts through a Delphi survey.

Chapter 8 provides a description of strategy formulation using the Delphi and PIPA methods. The Delphi method was used at the stage of the selection of alternative strategies by involving the government officials and academics. It is a method to obtain the opinion of experts on the object under study. The survey was conducted in two rounds using a structured questionnaire. In the first round, the experts were given a set of strategies and were asked to add some more strategies and provide conditions required to make the strategies viable. In the second round, they were asked to rate the strategies and their conditions.

The strategies selected from the Delphi method were then used to construct an outcome logic model, which is the second step of the PIPA application. The outcome logic was followed by identifying outcome targets and constructing an impact logic model. The impact logic model is the final output of the PIPA application.

9.3 Summary of Results

This section summarizes the results from the application of the three methods: PIPA, path analysis and the Delphi approach. The PIPA method was applied in the first and the last stages of this study. A description of the results is presented according to the stages of the study.

PIPA workshop results

The workshops were conducted in Solok, 50 Kota and Pasaman municipalities that involved 68 participants. Most participants were farmers (53 per cent) and Department of

Plantation officials (26 per cent). The conduct of the workshops was based on a meta-planning process to encourage all participants to become actively involved.

In the workshops, participants were asked to identify problems and causes of the problems facing the cacao industry. A problem tree was drawn by arranging problems and causes to show cause-and-effect relationships. The participants developed solutions for the identified problems. In the last session of the workshop, the participants were asked to draw a network map in order to show the relationships between cacao industry stakeholders.

The workshop results reveal that low outputs of cacao trees, low quality of cacao beans, low prices of cacao beans at the farm gate and price instability were identified as the main constraints facing the cacao industry in West Sumatra. Pest and disease attack, low quality of seedlings and lack of fertilizer used emerged as the main causes of low output of cacao trees. The participants assumed that the low quality of cacao beans was caused by no fermentation, no drying and pest and disease attack. Low quality of cacao beans came out as a cause of the low price of cacao beans at the farm gate together with a long marketing channel, low bargaining power of farmers, and no price and quality standards. Price instability was thought to be caused by unscrupulous trading, irregular supply of cacao beans by farmers, no price and quality standards, and lack of capital.

Two identical solutions came out across the three municipalities: (1) establishing a good seedling nursery in every municipality to solve the problem of low quality of seedlings; and (2) providing extension and training for farmers in order to improve their knowledge of agronomic practices. Other solutions varied across the municipalities.

Exporters, processing firms and local financial institutions did not exist in any of the research sites, an absence that was thought to generate a gap in the current supply chain. The involvement of the three stakeholder groups was expected to contribute to an improvement in cacao industry performance.

Survey results

Findings from the survey show that most cacao farmers were poor, as indicated by their small landholdings of 2 ha or less. The average size of land devoted to cacao farming was 0.98 ha. However, cacao farming made a major contribution to total household incomes.

The economic condition of farmers could affect their agronomic practices, particularly fertilizing and pest and disease management. Nearly one-half of the farmers did not fertilize their cacao trees. Most farmers did not control pests and diseases. This fact may contribute to pest and disease attacks on cacao trees.

The yield of cacao trees was low with an average yield of 899 kg/ha. Some farmers achieved a yield of their cacao trees of more than 2000 kg/ha, indicating that there is potential to increase cacao output through the application of improved technology.

Some farmers did not harvest fully ripe cacao pods. This practice can cause low quality of cacao beans. Post-harvest practices such as fermentation and drying can also affect the quality of cacao beans. Some farmers did not ferment their cacao beans while all of them dried their cacao beans. The number of days for fermentation and drying varied.

Village buyers were found to play an important role in cacao marketing. Most farmers sold cacao beans to these buyers even though they received lower prices than for beans sold to wholesalers. The fact that village buyers live in the same location as farmers prevents farmers from transporting their cacao beans to the capital city where wholesalers are located. Moreover, farmers perceived that they were satisfied with the transactions with prompt payment as the main reason given in choosing the main buyer.

Main buyers were the main source of information on the price and quality of cacao beans that may influence farmers' bargaining power. No grading system existed at the farmer and village buyer levels in the supply chain, with "most cacao beans have the same quality" given by village buyers as the main reason for not grading cacao beans.

Village buyers are small buyers with limited capital to finance their business. They bought cacao beans for quick turnover due to limited storage facilities. They found it hard to purchase a good quality of cacao beans due to improper fermentation.

The government programs implemented in West Sumatra were mainly directed to the expansion of planted areas. This is because this industry is at an introductory phase, having received much attention from the government since 2005. Most of the programs focused on cacao seeds and seedling distribution that was followed by technical assistance on agronomic practices, particularly through training.

Path analysis

Path analysis enabled an assessment of the relationships among variables drawn in the problem tree that was produced in the PIPA workshop. This method was used to analyse production and marketing issues in the cacao industry. The data analysed were derived from surveys that were conducted in the three municipalities.

The low yield of cacao trees and low quality of cacao beans were the main problems identified as facing the cacao industry. Path analysis was conducted to identify factors causing these problems by assessing their cause-and-effect relationships and to assess how these variables had an impact on farmers' gross income.

The results reveal that the yield of cacao trees and prices received by farmers significantly affect the farmers' gross income from the viewpoint of farmers. The effect of the quality of cacao beans, which was presumed to be transmitted through prices received on farmers' gross income, was found not to be significant.

Estimation results of farmers' perceptions show that the source of cacao seedlings and fertilizing practices had significant correlations to the yield of cacao trees with the expected direction of causation, while pruning practices and pest and disease management did not correlate to the yield. Fertilizing practices and pest and disease management were perceived to be influenced indirectly by lack of capital.

The variable "the price of cacao beans received by farmers" was involved in the analysis of both production and marketing issues. In the production issues, it was connected to the quality of cacao beans that had a sequential link to production practices. It was then assessed in terms of its impact on farmers' gross income. In the marketing issues, it was assessed in terms of specific factors in price determination from the farmer's and buyer's perspective.

In terms of marketing issues from a farmer's perspective, the findings reveal that farmers considered that they had low power in marketing transactions. Even though farmers perceived that they were able to bargain on the price, able to sell their cacao beans to buyers other than main buyer and delivered cacao beans to the buyer's place, they could not get a higher price. Their dependence on the main buyer to obtain information on the price of cacao beans also worsened their position. Moreover, the price received by farmers was influenced by the distance of farmers' location to the export point.

However, selling cacao beans of the quality required by the main buyer and selling them to wholesalers were perceived by farmers to be an opportunity to receive a higher price. Meeting the quality required by the main buyer can be achieved by obtaining information on the quality from the main buyer.

From the buyer's perspective, the buying price of marketing intermediaries is the variable linked to the price received by farmers. It was significantly influenced by marketing intermediaries' selling price. Buyers increased the price they paid to farmers if they received a high price for their cacao beans. Four significant factors influencing the price received by marketing intermediaries are time for holding cacao beans, source of price information, indebtedness and ability to sell their cacao beans to buyers other than main buyers.

Findings show that marketing intermediaries who had a strong capability to finance their business obtained pricing information from sources other than the main buyer and were able to hold the products for a long time received a higher price. This condition consequently influenced their decision to set the buying price. The estimation results reveal that the ability to hold the product for a longer time was affected by the business scale of marketing intermediaries.

Delphi survey

The Delphi survey involved 12 panellists and resulted in priority accorded to some strategies that can support cacao industry development. The panellists perceived all strategies as important, indicated by a mean score of greater than 3 out of 5. "Improving farmers' knowledge on good-quality seedlings through training and extension services" was perceived as a strategy of medium importance to encourage farmers to grow good-quality cacao seedlings.

Based on experts' opinion in order to encourage farmers to use fertilizers, "encourage farmers to do integrated cacao and cattle farming in which cattle farming is a source of organic fertilizers and cacao farming as source of fodder" received the highest mean score among the potential strategies. However, it was considered as a strategy of medium importance and other strategies were perceived as reasonably important and less important strategies.

"The intervention of the government to facilitate farmer groups to establish a village cooperative that can function to provide capital for farmers" and "the involvement of processing industry to provide capital to enable farmers to buy inputs within a contract system where farmers should provide cacao beans with required quality for the processing industry" were assessed as two strategies of medium importance to improve the availability of capital to small farmers. These favoured strategies offer sustainability of capital availability for farmers by empowering them to provide capital with less involvement of the government.

"The provision of training for farmers on biological control of pests and diseases" was perceived to be the most important strategy to encourage farmers to manage pests and diseases. This strategy is most likely to reduce farmers' dependency on chemicals, which were considered expensive. The most important strategy to increase the price of cacao beans at the farm gate was "to make information on the quality of cacao beans available for farmers".

All the selected strategies have some conditions that need to be met to make them viable. The experts also rated the conditions to select the most required conditions to support the success of the strategies.

The information obtained from the Delphi survey was used to construct an outcome logic model and an impact logic model. These two models focused on the strategies and required conditions with the highest scores.

9.4 Research Implications

The application of the PIPA approach in this study enables us to draw up potential strategies to develop the cacao industry in West Sumatra. Implementation of path analysis and the Delphi method enhanced the PIPA approach to select the highest priority strategies. However, the data used in this study have three limitations. The limitations of this study and research implications are discussed in this section.

The first limitation concerns production constraints in which some data were based on farmers' perceptions. The variable "application of inputs" such as fertilizers and chemicals used was only measured based on whether or not farmers applied the inputs in cacao farming. It was not measured in terms of the quantity used. Further research can enhance the results of this study by involving the quantity measurement for input application in order to give results that are more empirical.

The second limitation is that all the variables involved in the SEM analysis are observed variables. Therefore, path analysis is the only method that can be used to analyse data with an SEM approach. In fact, the variable "quality of cacao beans" in path analysis could be treated as a latent variable in the model because a grading system did not exist at the farmers' level. Hence, this variable can be constructed in the model by involving causal and reflective indicators. In this study, "condition of pods harvested", "fermentation practices" and "drying practices" could be designated as causal indicators for "quality of cacao beans", while "farm-gate price" acts as a reflective variable. Involving latent variable provides an opportunity to use multiple indicators and multiple causes(MIMIC) modelling, which is a more advanced type of SEM method. However, the nature of the data used in this study restrained us from using this method. We only had one reflective variable; while the literature suggests that the application of MIMIC modelling needs at least two reflective variables. Therefore, it is possible to use MIMIC modelling by involving additional reflective variables in any further research.

The reconciliation of the strategies between farmers' views and experts' views is challenging and requires further consideration. The experts consisting of government officials in majority could be making biased judgments on the strategies explored by farmers. They may think of the additional work demands they will face when they rate the strategies selected by farmers.

The implication of this research is that the cacao industry can develop through intervention in the production and marketing systems. The provision of training and extension services to improve farmers' knowledge on agronomic practices, particularly on cultivating good-quality cacao seedlings and pest and disease management, is one of the interventions in improving cropping system. Further research is needed on how to make these services more effective than they have been to date.

Encouragement of farmers to use organic fertilizers through integrated cacao and cattle farming is another intervention in the cropping system that requires further research on optimal fertilizer input use. This strategy can bring about impacts on increasing yields of cacao trees. Apart of that, it can reduce the dependence of farmers on organic fertilizers.

The results of this study suggest that capital is an important factor for farmers to adopt new technologies in the production system. Therefore, all stakeholders expressed strong support for making capital more readily available to farmers.

Market certainty provides support for improving the quality of cacao beans. It can be realized by providing quality information on cacao beans for farmers and establishing a contract system between farmers and processing industry. This strategy should be supported by the government in its policy formulation.

The potential strategies generated in this study were not assessed in terms of required resources. Thus, benefit-cost analysis would be needed to give a better picture of economic and social impacts of the potential strategies recommended for consideration in this study.

The efficacy, effectiveness and impact of the strategies developed using the modified PIPA approach can be further analysed using the CAR approach. This method also emphasizes stakeholders' participation, and providing researchers with a chance to work with stakeholders to design a plan of action to improve stakeholders' lives. Spriggs, Chambers and Kayrooz (2004) stated that researchers have to act as facilitators in the application of critical action research in which the stakeholders have the power to direct the process and will be the owner of any changes resulting from the process. Spriggs et al. used this method to improve the fresh produce supply chain in PNG.

9.5 Contributions of the Study

There are three main contributions made in this study. First, it provides a farm-level analysis of a production system in the cacao industry. The economic condition of farmers is an important factor that should be considered in terms of implementing a program that entails adopting improved technologies.

Second, this study contributes to the development of a PIPA approach by involving path analysis and the Delphi method that can complement the PIPA approach when dealing with applied research for development.

The combination of PIPA, path analysis and Delphi method in this study provides the potential for PIPA to be applied to non-experimental program evaluation designs. This study contributes to the practical testing of program conceptual models by using actual data to demonstrate the specification and estimation of the logical chain of complex relationships among program outcomes.

The use of path analysis and Delphi method extends the applicability of PIPA in designing and prioritizing development strategies. Path analysis is a useful tool to test theory generated by PIPA and provides validation of the theory. Delphi method is a tool for the priority assessment of alternative strategies.

Finally, the results obtained in this study provide guidance to help policy makers to plan programs and to improve the implementation of current programs in order to develop the cacao industry, improve the economic condition of poor farmers and enable them to escape from poverty.

9.6 Lesson Learned

The PIPA approach was used in this study as a method of ex-ante impact assessment to design a development strategy for the cacao industry. It was found that this approach is useful because it provides structure for analysing complex problems that enables policy makers to trace the performance of the cacao industry in whole supply chains. The impact pathway logic model, as the main component of PIPA, explores the process of achieving impacts by showing the intermediate outcomes.

Developing program theory by engaging local cacao stakeholders as a form of bottom-up process provides an opportunity for community empowerment. The process allows problems to be identified at their source by helping stakeholders to express their views. Therefore, the development program and accompanying strategies to develop the cacao industry as an outcome of PIPA process will be relevant to a variety of local situations.

The method applied in the workshops worked well to encourage the different groups of stakeholders to fully participate. It enabled participants to share their views and contribute to developing the problem tree that was the basis for impact logic model formulation for cacao industry development.

However, the use of PIPA in designing a development program for cacao industry has some limitations. First, at the beginning of the workshop, some participants did not know how to use the card properly to express their ideas. They wrote a lot of information on the card that made the card unable to be seen properly. To make it work, the card was revised. It happened because not all participants had experience in attending a participative workshop. Therefore, clear information should be provided for the participants at the beginning of the process.

A second limitation deals with organising the workshops. Participants at the workshops were predominantly farmers. The composition of the participants had been set up with the Department of Plantation in every research location which agreed to send invitations to all participants. The compositions of the participants in Solok and Pasaman were as planned. However, it was different in 50 Kota where only a small number of farmers turned up. Based on this experience, the researcher should have contacted the participants to confirm their participation.

Third, the IP logic model could not accommodate the synthesis of all the information obtained in the field. An explanatory narrative should be made clearer to explain the whole picture of the research process.

Fourth, potential problems come from model respecification in path analysis. The statistical suggestion cannot be fully accommodated because failure to include appropriate variables leads to theoretical bias. To avoid the bias, omitting or including new variables in the model should be undertaken carefully. The modification should be based on a theoretical perspective.

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List of Appendixes

Appendix 3.1. List of Questions in the Workshops

WORKSHOP QUESTIONS

1. What are the problems that cacao industry faces currently?
2. Group the problems into technical, institutional and marketing aspects.
3. What are causes of the problems?
4. What is the core problem in every aspect?
5. Write a problem tree by placing the core problem in the middle.
6. Transform the problem tree to be an objective tree.
7. Who are stakeholders in cacao agribusiness?
8. Draw the current relationship among stakeholders.
9. Draw future relationships among stakeholders in order to support cacao agribusiness development.
10. What current action do stakeholders take?
11. What future action should stakeholders take in order to support cacao agribusiness development?
12. What strategies should be done to achieve the objectives in the short term?
13. Rank the strategies based on their importance to improve cacao agribusiness.
14. Take the three most important strategies.
15. What requirements should be met to make the important strategies work?
16. Rank the requirements based on their importance to encourage the strategies to work.
17. Who will be involved in that strategy?

Appendix 3.2. Survey Questionnaire: Farmer

No. Questionnaire

SURVEY QUESTIONNAIRE
Potential of Cacao Agribusiness for Poverty Alleviation in West Sumatra

Farmer

A. General information

A1.	Name of respondent (household head)	
A2.	Sex 01. Male 02. Female	
A3.	Age of respondent	
A4.	The highest level of respondent's educational attainment 01. No education 02. Primary school 03. Junior high school 04. Senior high school 05. Tertiary education	
A5.	Number of children in the family (under 17 years old and not married)	
A6.	Number of adult in the family (including respondent)	
A7.	Land phone number	
A8.	Mobile phone number	
A9.	Email address	
A10.	Total of own irrigated land	ha

A11.	Total of own dry land	ha
A 12.	Sub district (*kecamatan*) and municipality (kabupaten) 01. Payung Sakaki (Solok) 02. Bonjol (Pasaman) 03. Guguk (50 Kota)	
	Village (nagari)	
	Date	/ /2010
	Enumerator’s name	
	Enumerator’s signature	

This questionnaire aims to identify factors affecting cacao agribusiness development in West Sumatra and the potential impact of the development on poverty alleviation. Those factors are assessed in terms of farming condition, marketing condition, supporting policy and poverty incidence.

Respondents, involved in this study, are only those who harvested their cacao trees at least for 1 year.

B. Farming Condition

The questions below are to find out the level of cacao production, agronomic practices (fertilizing, pest and diseases control, weeding and pruning), the use of inputs (seedlings, fertilizers and chemicals), farmers' knowledge on agronomic practices (access to training and extension services), experience in cacao farming, and the possibility to expand land area.

B1. How many parcels of cacao farming do you have?	B2. Land area	B3. What is the status of the land? 01. Owned land, **go to B5** 02. Rented 03. Sharecropping / profit sharing 04. Other (________________), **go to B5**	B4. How much is the rent or profit sharing per year? (Rp)	B5. What is the variety of your cacao trees? 01. Forastero 02. Criollo 03. Trinitario (hybrid) 04. Other (____________________) 05. Do not know	B6. Total production in the past 12 months (kg)
1	(ha)				
2	(ha)				
3	(ha)				
4	(ha)				
5	(ha)				

Parcel	B7. Where did you get cacao seedlings? 01. Free seedlings from the government 02. Buy 03. Free seedlings from others 04. Other (_____________)	B8. How old are the cacao trees?	B9. How many trees are in the parcel?	B10. How far is the distance between trees?	B11. What is the major shade tree for cacao trees? 01. No shade tree 02. Coconut tree 03. Other (______________)
1					
2					
3					
4					
5					

Fertilizing

Questions below are about fertilizing activities and the use of fertilizer for cacao trees in ***the parcel from which the most cacao produced*** *in the period of June 2009 – May 2010.*

F1. Did you use fertilizer? 01. Yes, **go to F3** 02. No, **go to F2**	F2. What is the main reason not to fertilize your cacao trees? 01. Fertilizer is expensive 02. It is not available on time for application 03. Do not know how to use it properly 04. It has no effect on yields 05. Other (______________) **Go to PD1**	F3. How many times did you fertilize your cacao trees? 01. Once 02. Twice 03. Three times 04. > 3 times	F4. What the main kind of fertilizer did you use? 01. Urea 02. TSP 03. SP-36 04. KCL 05. NPK 06. ZA 07. Manure 08. Other (____________)	F5. Quantity of the main fertilizer used (kg or litre)	F6. Price of the main fertilizer (Rp / kg or litre)	F7. Where did you get most information on fertilizing? 01. Parents 02. Other farmers 03. Extension workers 04. Training 05. Other (________)

Pest and Disease Control

Questions below are about pest and disease control and the use of chemicals to control pest and disease in ***the parcel from which the most cacao produced*** *in the period of June 2009 – May 2010.*

PD1. Did you control pests and diseases for your cacao trees? 01. Yes, **go to PD3** 02. No, **go to PD2**	PD2. What was the main reason not to control pest and diseases? 01. Do not know how to do it 02. Chemical is expensive 03. Chemical is not available 04. There is no infestation 05. It has no effect on yields 06. Other (____________) **Go to W1**	PD3. Were your cacao trees attacked by pests or diseases? 01. Yes 02. No, **go to W1** 03. Do not know, **go to W1**	PD4. What was the percentage of production loss due to all pests and diseases? 01. < 25% 02. 25% - 49% 03. 50% - 75% 04. > 75%	PD5. How often did you control for pests and diseases? 01. Every week 02. Fortnightly 03. Once a month 04. Other (__________)

PD6. What was the most important chemical you used to control pests and diseases? 01. Decis 02. Dithane 03. Antracol 04. Sputnex 05. Dipho 06. Other (______________)	PD7. How much was the cost of the chemical to control pest and disease? Rp	PD8. What was the main kind of pest or disease that cause loss of production? 01. Cacao pod borer 02. Black pod 03. Animal damage 04. Other (_________) 05. Do not know	PD9. Where did you get most information on pest and disease control? 01. Parents 02. Other farmers 03. Extension workers 04. Training 05. Other (________________)

Weeding

This section is about weeding activities and the use of chemicals for weeding in ***the parcel from which the most cacao produced*** *in the period of June 2009 – May 2010.*

W1. Did you weed the cacao parcel? 01. Yes, **go to W3** 02. No, **go to W2**	W2. What was the main reason not to weed? 01. Do not know how to do it 02. It is expensive 03. It has no effect on yields 04. Other (_____________) **Go to P1**	W3. How often did you weed the cacao trees? 01. Every week 02. Fortnightly 03. Once a month 04. Other (__________)	W4. Did you use chemicals to weed? 01. Yes, **go to W5** 02. No, **go to W7**	W5. What was the most important chemical you used for weeding? 01. Herbatop 02. Gramoxone 03. Round up 04. Ronstar 05. Other (________)	W6. How much was the cost of chemical for weeding? Rp	W7. Where did you get most information on weeding? 01. Parents 02. Other farmers 03. Extension workers 04. Training 05. Other (_______)

Pruning

This section is about pruning activities in ***the parcel from which the most cacao produced*** *in the period of June 2009 – May 2010.*

P1. Did you prune your cacao trees? 01. Yes, go to P3 02. No, go to P2	P2. What was the main reason not to prune cacao trees? 01. Do not know how to do it 02. It is expensive 03. It has no effect on yields 04. Other (_____________) Go to H1	P3. How often did you prune cacao trees? 01. Once a month 02. Every two months 03. Other (_______________)	P4. Where did you get most information on pruning? 01. Parents 02. Other farmers 03. Extension workers 04. Training 05. Other (_______________)

Harvesting

This section is about harvesting activities in ***the parcel from which the most cacao produced*** *in the period of June 2009 – May 2010.*

H1. What condition of pods did you harvest? 01. Fully ripe, go to H3 02. Partially ripe 03. Mix of fully and partially ripe	H2. What was the main reason not to harvest fully ripe pods? 01. No price difference for cacao beans coming from fully ripe and partially ripe pods 02. Needed money soon 03. Other (______________)	H3. How often did you harvest? 01. Weekly 02. Fortnightly 03. Monthly 04. Other (____________)	H4. Where did you get most information on harvesting? 01. Parents 02. Other farmers 03. Extension workers 04. Training 05. Other (_______________)

Post-Harvest

This section is about post-harvest activities for total production of ***the parcel from which the most cacao produced*** *in the period of June 2009 – May 2010.*

PH1. Did you ferment your cacao beans? 01. Yes, **go to PH3** 02. No, **go to PH2**	PH2. What is the main reason not to ferment your cacao beans? 01. Too time-consuming 02. No price difference between fermented and non fermented cacao beans 03. Delay in time of selling 04. Other (_____________) **Go to PH7**	PH3. How many days did it take for a typical fermentation?	PH4. What main tool did you use for fermentation? 01. Gunny sacks 02. Wooden box 03. Other (___________)	PH5. What main chemical did you use for fermentation? 01. Yeast 02. Other (____________) 03. None	PH6. What was the total cost for fermentation? (Rp)

PH7. Did you dry your cacao beans? 01. Yes, **go to PH9** 02. No, **go to question PH8**	PH8. What was the main reason not to dry your cacao beans? 01. Too time consuming 02. No price difference between dried and wet cacao beans 03. Delay in time of selling 04. Other (___________) **Go to L1**	PH9. How many days did it take for a typical drying? 01. Two days 02. Three days 03. Four days 04. Other (________)		PH10. How did you dry your cacao beans? 01. Put them under sunlight 02. Roast them 03. Other (_______)	PH11. What was the total cost for drying? (Rp)	PH12. Where did you get most information on fermentation and drying? 01. Parents 02. Other farmers 03. Extension workers 04. Training 05. Other (___________)	
		Wet season	Dry season			Fermentation	Drying

Labour Cost

This section is about the number of family and hired labourers involved in cacao farming, and labour cost for **the *parcel from which the most cacao produced*** in the *period of June 2009 – May 2010.*

Type of labour	L1. Number of man days in fertilizing	L2. Number of man days in pests and diseases control	L3. Number of man days in weeding	L4. Number of man days in pruning	L5. Number of man days in harvesting	L6. Number of man days in fermenting	L7. Number of man days in drying	L8. Wage of hired labour per man-day (Rp)
Family labour								
FM. Male								
FF. Female								
FC. Children								
Hired labour								
HM. Male								
HF. Female								
Cost of contract labour (Rp)								

C. Marketing Conditions

This section aims to find out quality and price of cacao beans, price formation, and access to price and quality information of cacao beans at the farm gate in the period of June 2009 – May 2010.

C1. How much was the highest price of your cacao beans? (Rp / kg)	C2. How much was the lowest price of your cacao beans? (Rp / kg)	C3. How much was the average price of your cacao beans? (Rp / kg)	C4. How many buyers are operating in your area who buy cacao beans from farmers?	C5. Who was the main buyer of your cacao beans? 01. Village buyer 02. Wholesaler 03. Exporter 04. Processing firm 05. Other (___________)	C6. What was the reason to choose this main buyer? 01. Certainty of payment 02. Good price 03. Certainty of price 04. Prompt payment 05. Advance payment 06. Family relationship 07. Other (__________)

C7. For how many years have you sold cacao beans to this main buyer?	C8. Were you satisfied with the transaction with this main buyer? 01. Always 02. Often 03. Seldom 04. Never	C9. Did you have the opportunity to sell cacao beans to an alternative buyer? 01. Yes 02. No 03. Do not know	C10. How many times did you change buyer in the past five years? 01. One 02. Two times 03. Three times 04. Other (________) 05. Never, go to C12	C11. What was the main reason for changing buyer? 01. Inadequate price 02. Uncertain payment 03. Social reason 04. Buyer went out of business 05. Other (___________)	C12. How did you sell most of your cacao beans? 01. Picked up 02. Delivered

C13. What mode of payment did you receive for most of your cacao beans? 01. Cash 02. Credit	C14. Were you able to bargain on the price of cacao beans? 01. Yes, go to C16 02. No, go to C15	C15. What was the main reason for not bargaining? 01. Borrowed money from the buyer 02. Sell small quantity 03. Do not know market price 04. Do not have alternative buyer 05. I tried but the buyer did not allow me to bargain 06. Other (_________)	C16. Did your buyer grade your cacao beans? 01. Yes 02. No, go to C21 03. Do not know, go to C21	C17. What basis for grading cacao beans did your buyer use? 01. Colour 02. Size 03. Dryness 04. Colour and size 05. Colour and dryness 06. Size and dryness 07. Colour, size and dryness 08. Other (_________) 09. Do not know	C18. What percentage of your cacao beans' grade was? 01. Grade A 02. Grade B 03. Grade C 04. Do not know
					Grade A: %
					Grade B: %
					Grade C: %

C19. Did the quality of most cacao beans meet the buyer's requirements? 01. Yes 02. No 03. Do not know	C20. Did you get a higher price for good quality? 01. Always 02. Often 03. Seldom 04. Never	C21. Where did you get most information on the price of cacao beans? 01. Media 02. Other farmers 03. Extension workers 04. Village buyers 05. Wholesalers 06. Exporters 07. Other (___________) 08. Nowhere	C22. Where did you get most information on the quality of cacao beans? 01. Media 02. Other farmers 03. Extension workers 04. Village buyers 05. Wholesalers 06. Exporters 07. Other (___________) 08. Nowhere

D. Possibility to Expand Planted Area for Cacao

This section is about the possibility to expand the area of the cacao farm.

<table>
<tr>
<td>D1. Do you intend to change the size of your cacao area in the next 12 months?
01. Yes, go to D2
02. No, go to D1</td>
<td>D2. How are you going to change the size of your cacao area?
01. Increase the land area, go to D3
02. Decrease the land area, go to D4</td>
<td colspan="2">D3. What are two main reasons to increase cacao land area?
01. Cacao is more profitable
02. Have other land that can be converted into cacao trees
03. Have other land currently used for other crops that can be intercropped with cacao trees
04. Growing cacao is easier
05. There is a possibility to get finance from the government
06. Can afford to buy more land
07. The rent is cheap
08. Possibility to have inherited land
09. Other (________________)</td>
<td>D4. What is the main reason to decrease cacao land area?
01. Cacao is not profitable
02. Cannot use the land anymore due to heritage reason
03. Cannot afford to buy inputs for cacao farming
04. Other (__________________)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</table>

E. Farmers' Knowledge on Agronomic Practices

This section is about experience in cacao farming and access by farmers to knowledge on agronomic practices.

E1. How old were you when you worked in cacao farming for the first time?	E2. What are the two most important reasons for planting cacao? 01. Easy to grow 02. Higher price than price of other annual crops 03. Heritage land 04. Other (_________________) 05. Do not know	E3. Was annual crop extension worker allocated in this region in the last 12 months? 01. Yes 02. No, go to E6 03. Do not know, go to E6	E4. How often did the extension worker visit this village in the last 12 months? 01. once a week 02. fortnightly 03. once a month 04. other (_________) 05. never, go to E6 06. Do not know, go to E6	E5. How often did you speak to the extension worker about cacao in the last 12 months? 01. Every visit 02. often 03. seldom 04. never	E6. Where will you access most information to develop your cacao farm in the next 12 months? 01. Parents 02. Other farmers 03. Extension workers 04. Training 05. Other (___________)
	Reason 1:				
	Reason 2:				

E7. Have you got training on cacao farming in the last five years? 01. Yes 02. No, go to Fi1	E8. What kind of information did you get on training? *(Tick the box)*		E9. Who was the sponsor of the training? 01. Dept. of Plantation 02. Dept. of Industry and Trade 03. Other (_________) 04. Do not know
	01. Planting		
	02. Fertilizing		
	03. Pest and disease control		
	04. Weeding		
	05. Pruning		
	06. Harvesting		
	07. Fermentation		
	08. Drying		
	09. Processing		
	10. Marketing		
	11. Other (_________)		

F. Farmers' Financial Issue and Access to Credit

This section is about farmer's financial issues and access to credit.

Fi1. Did you borrow money from the main buyer before selling your cacao beans in the past 12 months? ***(Refer to C5)*** 01. Yes 02. No, **go to Fi5**	Fi2. When was the price of cacao beans set? 01. Before selling 02. At the time of selling	Fi3. Was the price you received lower than other farmers due to indebtedness to the buyer? 01. Yes 02. No 03. Do not know	Fi4. Did the buyer allow you to sell cacao beans to other buyers? 01. Yes 02. No 03. Do not know	Fi5. Did you borrow money or get credit in the past two years? 01. Yes 02. No, **go to Fi9**

Fi6. What was the source of the largest loan? 01. Commercial bank 02. Village financial institution 03. Village cooperative 04. Government credit program 05. Village buyer 06. Wholesaler 07. Exporter 08. Processing firm 09. Village money lender 10. Other (_______________)	Fi7. How much did you borrow for the largest loan? (Rp)	Fi8. What was the main usage of the largest loan? 01. Finance cacao farming 02. To buy asset for business 03. Education 04. Health 05. Household basic need 06. House building/renovation 07. To buy household asset (vehicle, electrical appliances) 08. To pay debt 09. Other (_______________)

Fi9. How easy is it to get access to the following financial sources? (***Tick the box***)

Financial source	01 Very hard	02 Hard	03 Easy	04 Very Easy
Fi9.a. Commercial bank				
Fi9.b. Village financial institution				
Fi9.c. Village cooperative				
Fi9.d. Government credit program				
Fi9.e. Village buyer				
Fi9.f. Wholesaler				
Fi9.g. Exporter				
Fi9.h. Processing industry				
Fi9.i. Village moneylender				

G. Perceptions

Give perceptions on the following statements.
(Tick the box)

Code	Statement	01 Strongly disagree	02 Disagree	03 Agree	04 Strongly agree
G1.	Cacao yield in this region is low.				
G2.	Low yield of cacao causes low income of cacao farmers.				
G3.	Most cacao farmers face pest and disease attack in this region.				
G4.	There is a lack of contact with extension workers in this region.				
G5.	Insufficient extension and training cause lack of knowledge on cacao agronomic practices.				
G6.	Low education of farmers causes lack knowledge on agronomic practices.				
G7.	Good quality of cacao seedlings is hard to get in this region.				
G8.	Farmers grow low quality of cacao seedlings because they cannot afford to buy good quality seedlings.				
G9.	Farmers have enough knowledge on fermentation and drying activities.				
G10.	Price of cacao beans received by farmers is low.				
G11.	Low price received by farmer is due to low quality of cacao beans.				
G12.	Low quality of cacao beans is due to improper fermentation.				
G13.	No difference in price between proper and improper fermentation of cacao beans causes farmers not to ferment their cacao beans properly.				
G14.	The price of cacao beans increases and decreases all the time.				
G15.	Farmers are not able to bargain on cacao price.				
G16.	Village buyers mix different qualities of cacao beans.				
G17.	New export tax on cacao beans is becoming a burden on cacao farmers.				
G18.	New export tax on cacao beans is becoming a burden on village buyers.				
G19.	The export tax generates a significant decrease in the cacao price at the farm gate.				
G20.	The supply of cacao beans decreased significantly due to the earthquake devastation in this region.				
G21.	The price of cacao beans increased after the earthquake devastation.				
G22.	Farmers face lack of capital in this region.				
G23.	Lack of farmers' capital is due to lack of access to credit.				

Answer the questions below in the box provided.

G24. What is the most important cause of low yields in this region? 01. Pest and disease 02. Low quality of cacao seedlings 03. Lack of fertilizer use 04. Other (____________) 05. Do not know	G25. What is the most important cause of pest and disease attack? 01. Lack of knowledge on agronomic practices 02. Lack of facility to control pests and diseases 03. Lack of pruning 04. Lack of shade trees 05. Other (____________) 06. Do not know	G26. What is the most important cause of lack of extension services? 01. Insufficient number of extension workers 02. Lack of facility for extension workers 03. Lack of extension workers' ability and experience 04. Other (____________) 05. Do not know	G27. What is the most important cause of price change in this region? 01. Buyers' attitude 02. Change in yield of cacao 03. Lack of farmer's association 04. Lack of farmers' capital 05. Other (____________) 06. Do not know	G28. What is the most important cause of lack of access to credit? 01. Lack confidence of bank and investor to lend money to farmers 02. No collateral 03. Complicated procedures 04. Other (__________) 05. Do not know

G29. What is the most important cause of low bargaining position of farmers? 01. Lack of information on cacao price 02. Debt to buyers 03. Other (____________) 04. Do not know	G30. What other constraints do you face in cacao farming?

H. Poverty Incidence

Po1. What are sources of household income (all family members)? **(Tick the box)**		Po2. How much did all family members earn in 2009? (Rp)	Po3. What was the percentage of your income for each expenditure type below in 2009? (%)		F4. What kind of assets do you have?	
01. Cacao farming			a. Food		Type of asset	Total number
02. Other dry land			b. Clothing		Car	
03. Irrigated land			c. Education		Motor bike	
04. Livestock			d. Health		No of adult cattle	
05. Poultry			e. Entertainment			
06. Small shop			f. Transportation			
07. Transportation			g. Saving/investment			
08. Other			Total	100		

Details of the main buyer

Name	
Address	
Phone	

Appendix 3.3. Survey Questionnaire: Village buyer

No. Questionnaire

QUESTIONNAIRE

Potential of Cacao Agribusiness for Poverty Alleviation in West Sumatra

Village Buyer

I. General information

A1.	Name of respondent	
A2.	Sex : 01. Male 02. Female	
A3.	Age of respondent	Years
A4.	The highest level of respondent's educational attainment 01. No education 02. Primary school 03. Junior high school 04. Senior high school 05. Tertiary education	
A5.	Is buying cacao your main job? 01. Yes 02. No	
A6.	When did you buy cacao beans for the first time?	
A7.	Have you done this activity continuously since then? 01. Yes, go to A9 02. No, go to A8	
A8.	How many years did not you buy cacao beans?	Years

A9.	Do you also grow cacao trees? 01. Yes 02. No	
A10.	What is the main reason to buy cacao beans? 01. Higher profit than other commodities 02. Easier to buy and sell them than other commodities 03. No other jobs 04. Do not have access to land for farming 05. Other (______________)	
A11.	What is the proportion of income from cacao trading to total household income? 01. < ¼ 02. ¼ - ½ 03. > ½	
A12.	Land phone number	
A13.	Mobile phone number	
A14.	Email address	

A15. Sub district (*kecamatan*) and municipality (kabupaten) 01. Payung Sakaki (Solok) 02. Bonjol (Pasaman) 03. Guguk (50 Kota)	
Date	/ /2010
Enumerator's name	
Enumerator's signature	

This questionnaire aims to identify factors affecting cacao agribusiness development in West Sumatra and the potential impact of the development on poverty alleviation. Those factors are assessed in terms of farming condition, marketing condition, supporting policy and poverty incidence.

J. Marketing Profile

The questions below are to find out the trading conditions of cacao beans, marketing cost, and access to price information.

Purchase profile

This section aims to find out the quantity and quality of purchased cacao beans, buying price, price formation, and access to price information of cacao beans at the village buyer level. The information in the purchase profile is assessed in the period of June 2009 – May 2010.

<table>
<tr><td>Pu1. What is your status in trading cacao?
01. Independent trader, go toPu4
02. Agent of exporter
03. Agent of wholesaler
04. Agent of processing firm</td><td>Pu2. What main kind of agent fee did you receive?
01. Fixed amount
02. Percentage</td><td>Pu3. What was the usual agent fee you received?
(Rp/kg or %)</td><td colspan="2">Pu4. Did the following firms or people buy cacao beans from farmers in this region (district)?
01. Yes
02. No</td><td>Pu5. What is the approximate number of those buyers in this region?</td></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td>Pu4.a. Other village buyers</td><td></td><td></td></tr>
<tr><td>Pu4.b. Wholesalers</td><td></td><td></td></tr>
<tr><td>Pu4.c. Exporters</td><td></td><td></td></tr>
<tr><td>Pu4.d. Processing firms</td><td></td><td></td></tr>
</table>

Pu6. What was your total purchase of cacao beans for the year? (tonnes)	Pu7. Were you able to set the buying price? 01. Yes, **go to Pu9** 02. No, **go to Pu8**	Pu8. Who did set your buying price? 01. Wholesale 02. Exporter 03. Processing firm 04. Do not know	Pu9. Did you grade the cacao beans you bought? 01. Yes, **go to Pu11** 02. No, **go to Pu10**	Pu10. What was the main reason not to grade cacao beans? 01. Most cacao beans have the same quality 02. Buyers do not pay higher price for good quality 03. Do not know how to grade them 04. Other (__________) **Go to Pu14 on "ungraded" row**	Pu11. When did you grade the cacao beans? 01. At the time of buying 02. After buying 03. Other (______)

Pu12. What proportion of the total purchase was for that grade?		Pu13. What are the characteristics of that grade?		
		Pu13a. Number of beans per 100 grams	Pu13b. Moisture content (%)	Pu13c. Percentage of waste materials (%)
Pu12a. Grade A	__________%			
Pu12b. Grade B	__________%			
Pu12c. Grade C	__________%			
Pu12d. Ungraded	___________%			

Grade	Pu14. How much was the lowest buying price for that grade? (Rp / kg)	Pu15. How much was the highest buying price for that grade? (Rp / kg)	Pu16. How much was the average buying price for that grade? (Rp / kg)
A			
B			
C			
Ungraded			

Pu17. Where did you get most information about the quality of cacao beans? 01. Media 02. Other village buyers 03. Extension workers 04. Wholesalers 05. Exporters 06. Other (_________)	Pu18. What do you think of farmers' knowledge on the quality of cacao beans? 01. Very poor 02. Poor 03. Good 04. Very good	Pu19. Where did you get most information on the price of cacao beans? 01. Media 02. Other village buyers 03. Extension workers 04. Wholesalers 05. Exporters 06. Other (_____________)	Pu20. What do you think of farmers' knowledge on the price of cacao beans? 01. Very poor 02. Poor 03. Good 04. Very good	Pu21. Did you lend money to farmers before harvesting? 01. Yes No, **go to Mc1**

Pu22. How many farmers borrowed money from you in this region?	Pu23. When was the price of cacao beans set for the borrowers? 01. Before the time of buying 02. At the time of buying 03. Other (________)	Pu24. Was the gross cacao price, paid to the borrower, lower than that to other farmers? 01. Yes 02. No, **go to Pu26**	Pu25. What was the percentage of price reduction for the borrowers?	Pu26. Did you allow the borrowers to sell their cacao beans to other buyers? 01. Yes 02. No
			%	

Marketing costs

Questions in this section ask about village buyers' marketing activities and marketing costs in the period of June 2009 – May 2010.

Code	Mc1. Did you do the following activities in marketing cacao beans? 01. Yes 02. No		How many tonnes of cacao beans were treated for your activities?	Mc2. How much was the cost for those activities? Rp
Mc1.a.	Grading		____________________ tonnes	Rp. ___________________
Mc1.b.	Drying		____________________ tonnes	Rp. ___________________
Mc1.c.	Transportation		____________________ tonnes	Rp. ___________________
Mc1.d.	Loading		____________________ tonnes	Rp. ___________________
Mc1.e.	Packing		____________________ tonnes	Rp. ___________________
Mc1.f.	Other (__________)		____________________ tonnes	Rp. ___________________

Selling profile

This section aims to find out seller and buyer relationship, total sale of cacao beans, price setting and selling price in the period of June 2009 – May 2010.

S1. Who was the main buyer of your cacao beans? 01. Wholesaler 02. Exporter 03. Processing firm 04. Other (__________)	S2. What was the main reason to choose this buyer? 01. Certainty of payment 02. Good price 03. Certainty of price 04. Prompt payment 05. Advance payment 06. Family relationship 07. Other (________)	S3. For how many years have you sold cacao beans to this buyer?	S4. Were you satisfied with the transactions with this buyer? 01. Always 02. Often 03. Seldom 04. Never	S5. How many times did you change buyer in the last five years? 01. One 02. Two times 03. Three times 04. Other (________) 05. Never, **go to S7**	S6. What was the main reason for changing the buyer? 01. Inadequate price 02. Uncertain payment 03. The buyer went out of business 04. Social reason 05. Other (___________)

S7. What was the total quantity of cacao beans sold for the year? (tonnes)	S8. Do you have cacao storage facilities? 01. Yes 02. No	S9. How long were most cacao beans held before selling? 01. < 1 week 02. 1 – 2 weeks 03. > 2 weeks – 1 month 04. > 1 month	S10. How did you sell most of the cacao beans? 03. Pick-up 04. Delivery	S11. How much is the average price difference between picked-up and delivered? (Rp/kg)	S12. What mode of payment did you receive for most cacao beans? 01. Cash 02. Credit

S13. Did the main buyer grade your cacao beans? 01. Yes 02. No, **go to S19**	S14. What proportion of the total sold was for that grade?		S15. How much was the lowest selling price for that grade? (Rp / kg)	S16. How much was the highest selling price for that grade? (Rp / kg)	S17. How much was the average selling price for that grade? (Rp / kg)	S18. Did the quality of most of your cacao beans meet buyer's standard? 01. Yes 02. No 03. Do not know
	S14a. Grade A					
	S14b. Grade B					
	S14c. Grade C					
	S14d. Ungraded					

S19. Were you able to bargain on the price of cacao beans? 03. Yes, **go to S21** 04. No, **go to S20**	S20. What was the main reason for not bargaining? 01. Borrowed money from the buyer 02. Sell small quantity 03. Do not know market price 04. Do not have alternative buyer 05. I tried but the buyer did not allow me to bargain 06. Other (_______)	S21. Did you get a higher price for good quality? 01. Always 02. Often 03. Seldom 04. Never	S22. Did you sell your cacao beans to buyers other than your main buyer? 01. Yes 02. No		S23. What was the sale percentage of your cacao beans to those buyers?
			S22a. Wholesaler		
			S22b. Exporter		
			S22c. Processing firm		
			S22d. Other (_________)		

K. Financing

This section is about village buyer's financial issues and access to credit.

C1. Did you borrow money from the main buyer before the time of selling in the last 12 months? 01. Yes 02. No, **go to C6**	C2. When was the price of cacao beans set? 01. Before the time of selling 02. At the time of selling 03. Other (_____________)	C3. Was the price you received lower than other village buyers due to your indebtedness to the main buyer? 01. Yes 02. No, **go to C5** 03. Do not know, **go to C5**	C4. What was the percentage of price reduction for your cacao beans? (%)	C5. Did the buyer allow you to sell cacao beans to other buyers? 01. Yes 02. No 03. Do not know

C6. Did you borrow money or get credit in the last two years? 01. Yes 02. No, **go to C10**	C7. What was the source of the largest loan? 01. Commercial bank 02. Village financial institution 03. Village cooperative 04. Government credit program 05. Wholesaler 06. Exporter 07. Processing firm 08. Village money lender 09. Other (________________)	C8. How much did you borrow for the largest loan?	C9. What was the usage of the largest loan? 01. Household basic needs 02. Education 03. Health 04. House building/renovation 05. To buy household asset (vehicle, electrical appliances) 06. To pay debt 07. Finance cacao trading 08. Agricultural investment 09. To buy asset for business 10. Other (_______________)
		Rp.	

C10. How easy is it to get access to the following financial sources? (***Tick the box***)

Financial source	01 Very hard	02 Hard	03 Easy	04 Very Easy
C10.a. Commercial bank				
C10.b. Village financial institution				
C10.c. Village cooperative				
C10.d. Government credit program				
C10.e. Wholesaler				
C10.f. Exporter				
C10.g. Processing industry				
C10.h. Village money lender				

L. Perceptions

Give perceptions on the following statements.
(Tick the box)

Code	Statement	01 Strongly disagree	02 Disagree	03 Agree	04 Strongly agree
D1.	Cacao yield in this region is low.				
D2.	Good quality of cacao beans is hard to get in this region				
D3.	Price of cacao beans received by village buyers is low.				
D4.	Low price received by village buyers is due to low quality of cacao beans.				
D5.	Low quality of cacao beans is due to improper fermentation.				
D6.	No difference in price between proper and improper fermentation of cacao beans causes farmers not to ferment their cacao beans properly.				
D7.	The price of cacao beans increases and decreases all the time.				
D8.	Village buyers cannot bargain on cacao price.				
D9.	Buyers are able to buy as many cacao beans as they want in this region				
D10.	It is hard to transport cacao beans in this region due to bad road infrastructure				

D11.	Transportation cost is high in this region				
D12.	Village buyers face a lack of capital in this region in order to operate efficiently				
D13.	Lack of village buyers' capital is due to lack of access to credit.				
D14.	Village buyers have no collateral for getting credit				
D15.	Village buyers do not have enough information about credit procedures.				
D16.	Other village buyers mix different qualities of cacao beans.				
D17.	New export tax on cacao beans is becoming a burden on cacao farmers				
D18.	New export tax on cacao beans is becoming a burden on village buyers				
D19.	The export tax generates a significant decrease in the cacao price at the farm gate				

Answer the questions below in box provided.

D20. What is the most important cause of low yields in this region?	D21. What is the most important cause of price change in this region?	D22. What is the most important cause of lack of access to credit?	D23. What is the most important cause of low bargaining position of village buyers?
01. Pest and disease 02. Low quality of cacao seedlings 03. Other (____________) 04. Do not know	01. Irregular supply of cacao beans from farmers 02. Lack of village buyer's association 03. Lack of village buyers' capital 04. Other (____________) 05. Do not know	01. Lack of confidence by banks and investors to lend money to village buyers 02. No collateral 03. Complicated procedures to obtain loan 04. Other (__________) 05. Do not know	01. Lack of information on cacao price 02. Debt to buyers 03. No alternative buyers 04. Immediate sale 05. Small operation 06. Other (____________) 07. Do not know

D24. What other constraints do you face on cacao marketing?

Detail of the main buyer

Name	
Address	
Phone	

Appendix 3.4. Survey Questionnaire: Wholesaler

No. Questionnaire

QUESTIONNAIRE

Potential of Cacao Agribusiness for Poverty Alleviation in West Sumatra

Wholesaler

A. General information

A1.	Name of respondent	
A2.	Sex : 01. Male 02. Female	
A3.	Age of respondent	Years
A4.	The highest level of respondent's educational attainment 01. No education 02. Primary school 03. Junior high school 04. Senior high school 05. Tertiary education	
A5.	When did you buy cacao beans for the first time?	
A6.	Have you done this activity continuously since then? 01. Yes, go to A8 02. No, go to A7	
A7.	How many years did not you buy cacao beans?	
A8.	What is the main reason to trade cacao beans 01. Higher profit than other commodities 02. Easier to buy and sell them than other commodities 03. No other jobs 04. Have inheritance firm	

	05. Other (_____________)	
A9.	Land phone number	
A10.	Mobile phone number	
A11.	Email address	
A12.	Municipality (kabupaten) 01. Solok 02. Pasaman 03. 50 Kota	

Date	/ /2010
Enumerator's name	
Enumerator's signature	

This questionnaire aims to identify factors affecting cacao agribusiness development in West Sumatra and the potential impact of the development on poverty alleviation. Those factors are assessed in terms of farming condition, marketing condition, supporting policy and poverty incidence.

B. Marketing Profile

The questions below are to find out the trading conditions of cacao beans, marketing cost, and price setting.

Purchase profile

This section aims to find out the quantity and quality of purchased cacao beans, buying price, and price formation of cacao beans at the wholesale level. The information of purchase is assessed in the period of June 2009 – May 2010.

<table>
<tr><td colspan="2">Pu1. What is the approximate number of the following cacao buyers in this region (municipality)?</td><td>Pu2. What was your total purchase of cacao beans for the year?
(tonnes)</td><td colspan="2">Pu3. Did you buy cacao beans from farmers / village buyers?
01. Yes
02. No</td><td>Pu4. What was the percentage purchase of cacao beans from them for the year?</td><td>Pu5. Did you differentiate your buying price to farmers / village buyers on the basis of quality?
01. Yes
02. No</td></tr>
<tr><td>Pu1.a. Village buyers</td><td></td><td rowspan="4"></td><td rowspan="2">Pu3a. Farmers</td><td rowspan="2"></td><td rowspan="2">Pu4a. ____________%</td><td rowspan="2">Pu5a. ___________</td></tr>
<tr><td>Pu1.b. Wholesalers</td><td></td></tr>
<tr><td>Pu1.c. Exporters</td><td></td><td rowspan="2">Pu3.b. Village buyers</td><td rowspan="2"></td><td rowspan="2">Pu4b. ____________%</td><td rowspan="2">Pu5b. ___________</td></tr>
<tr><td>Pu1.d. Processing firms</td><td></td></tr>
</table>

Pu6. Did you grade the cacao beans you bought? 01. Yes, **go to Pu8** 02. No, **go to Pu7**	Pu7. What was the main reason not to grade cacao beans? 01. Most cacao beans have the same quality 02. Buyers do not pay higher price for good quality 03. Do not knot now how to grade them 04. Other (__________) **Go to Pu11 on "ungraded" row**	Pu8. When did you grade the cacao beans? 01. At the time of buying 02. After buying 03. Other (______)	Pu9. What proportion of the total purchase was for each grade?	
			Pu9a. Grade A	____________%
			Pu9b. Grade B	____________%
			Pu9c. Grade C	____________%
			Pu9d. Ungraded	____________%

Grade	Pu10. What are the characteristics of each grade?			Pu11. How much was the lowest buying price for each grade? (Rp / kg)	Pu12. How much was the highest buying price for each grade? (Rp / kg)	Pu13. How much was the average buying price for each grade? (Rp / kg)
	Pu10.a. Number of beans per 100 grams	Pu10.b. Moisture content (%)	Pu10.c. Percentage of waste materials (%)			
A						
B						
C						
Ungraded						

<table>
<tr>
<td>Pu14. Where did you get most information about the quality of cacao beans?
01. Media
02. Exporters
03. Reading materials
04. Internet
05. Other (_________)</td>
<td>Pu15. Where did you get most information on the price of cacao beans?
01. Media
02. Exporters
03. Internet
04. Other (_____________)</td>
<td colspan="2">Pu16. Did you lend money to farmers or village buyers before the time of selling?
01. Yes
02. No, go to Pu22</td>
<td>Pu17. How many farmers / village buyers borrowed money from you in this region?</td>
</tr>
<tr>
<td rowspan="2"></td>
<td rowspan="2"></td>
<td>Pu16a. Farmers</td>
<td></td>
<td>Pu17a. _____________</td>
</tr>
<tr>
<td>Pu16b. Village buyers</td>
<td></td>
<td>Pu17b. _____________</td>
</tr>
</table>

<table>
<tr>
<td colspan="2">Pu18. When was the price of cacao beans set for the borrowers?
01. Before the time of buying
02. At the time of buying
03. Other (________)</td>
<td>Pu19. Was the gross cacao price paid to the borrower lower than that to others?
01. Yes
02. No, go to Pu21</td>
<td>Pu20. What was the percentage of price reduction for the borrowers?
(%)</td>
<td>Pu21. Did you allow those borrowers to sell their cacao beans to other buyers?
03. Yes
04. No</td>
</tr>
<tr>
<td>Pu18a. Farmers</td>
<td></td>
<td>Pu19a. __________</td>
<td>Pu20a. __________ %</td>
<td>Pu21a. __________</td>
</tr>
<tr>
<td>Pu18b. Village buyers</td>
<td></td>
<td>Pu19b. __________</td>
<td>Pu20b. __________ %</td>
<td>Pu21b. __________</td>
</tr>
</table>

<table>
<tr>
<td>Pu22. Did you use weighing equipment?
01. Yes
02. No</td>
<td>Pu23. Did you have cacao storage facilities?
01. Yes
02. No</td>
<td>Pu24. How did you organize the transport of cacao beans you bought?
01. Rented vehicle
02. Own vehicle
03. Did not need transport because cacao beans were delivered</td>
<td>Pu25. Did you employ workers in cacao trading activities?
01. Yes
02. No, go to Mc1</td>
<td>Pu26. How many workers did you employ for the year?</td>
</tr>
<tr>
<td rowspan="2"></td>
<td rowspan="2"></td>
<td rowspan="2"></td>
<td rowspan="2"></td>
<td>Pu26a. Full time ________</td>
</tr>
<tr>
<td>Pu26b. Part time ________</td>
</tr>
</table>

Marketing costs

Questions in this section are about marketing activities and marketing costs in the period of June 2009 – May 2010.

Mc1. Did you do the following activities in marketing cacao beans? 01. Yes 02. No		Mc2. How many tonnes of cacao beans were treated for your activities for the year? (tonnes)	Mc3. How much was the cost for those activities excluding labour? Rp
Mc1a. Grading		Mc2a. ________________	Mc3a. ________________
Mc1b. Drying		Mc2b. ________________	Mc3b. ________________
Mc1c. Transportation		Mc2c. ________________	Mc3c. ________________
Mc1d. Loading		Mc2d. ________________	Mc3d. ________________
Mc1e. Storage		Mc2e. ________________	Mc3e. ________________
Mc1f. Packing		Mc2f. ________________	Mc3f. ________________
Mc1g. Other (________)		Mc2g. ________________	Mc3g. ________________

Selling profile

This section aims to find out seller and buyer relationships, total sales of cacao beans, price setting and selling price in the period of June 2009 – May 2010.

S1. Who was the main buyer of your cacao beans? 01. Exporter 02. Processing firm 03. Other (__________)	S2. What was the main reason to choose this buyer? 01. Certainty of payment 02. Good price 03. Certainty of price 04. Prompt payment 05. Advance payment 06. Family relationship 07. Other (________)	S3. For how many years have you sold cacao beans to this buyer?	S4. Were you satisfied with the transactions with this buyer? 01. Always 02. Often 03. Seldom 04. Never	S5. Did you have a selling contract with this buyer? 01. Yes 02. No	S6. How many times did you change buyer in the last five years? 01. One 02. Two times 03. Three times 04. Other (________) 05. Never, **go to S8**

S7. What was the main reason for changing the buyer? 01. Inadequate price 02. Uncertain payment 03. The buyer went out of business 04. Social reason 05. Other (___________)	S8. What was the total cacao beans sold for the year? (tonnes)	S9. How long were most cacao beans held before selling? 01. < 1 week 02. 1 – 2 weeks 03. > 2 weeks – 1 month 04. > 1 month	S10. How did you sell most of the cacao beans? 01. Picked-up 02. Delivered	S11. How much is the average price difference between picked-up and delivered? (Rp/kg)	S12. What mode of payment did you receive for most cacao beans for the year? 01. Cash 02. Credit

S13. Did the main buyer grade or regrade your cacao beans? 01. Yes 02. No, **go to S15 on "ungraded" row**	S14. What was the total sale for each grade to this main buyer for the year? (tonnes)		S15. How much was the lowest selling price for each grade? (Rp / kg)	S16. How much was the highest selling price for each grade? (Rp / kg)	S17. How much was the average selling price for each grade? (Rp / kg)	S18. Did the mix of grades of your cacao beans meet the buyer's requirements? 01. Yes 02. No 03. Do not know
	S14a. Grade A					
	S14b. Grade B					
	S14c. Grade C					
	S14d. Ungraded					

S19. Were you able to bargain on the price of cacao beans? 01. Yes, **go to S21** 02. No, **go to S20**	S20. What was the main reason for not bargaining? 01. Borrowed money from the buyer 02. Do not know market price 03. Do not have alternative buyer 04. I tried but the buyer did not allow me to bargain 05. Other (________)	S21. Did you get a higher price for good quality? 01. Always 02. Often 03. Seldom 04. Never	S22. Did you sell your cacao beans to buyers other than your main buyer? 01. Yes 02. No		S23. What was the sale percentage of your cacao beans to those buyers? (%)	
			S22.a. Exporter		S23.a. Main buyer	
					S23.b. Exporter (other than the main buyer)	
			S22.b. Processing firm		S23.c. Processing firm (other than the main buyer)	
					Total	100 %

C. Perceptions

Give perceptions on the following statements.
(Tick the box)

Code	Statement	01 Strongly disagree	02 Disagree	03 Agree	04 Strongly agree
C1.	Cacao yield has declined in the past five years in this region.				
C2.	Good quality of cacao beans is hard to get in this region.				
C3.	Price of cacao beans is low.				
C4.	Low price is due to low quality of cacao beans.				
C5.	Low quality of cacao beans is due to improper fermentation.				
C6.	There is no difference in price between properly fermented and improperly fermented cacao beans in this region.				
C7.	The price of cacao beans increases and decreases all the time.				
C8.	I can buy as many cacao beans as I want in this region.				
C9.	I find it is hard to transport cacao beans in this region due to bad road infrastructure.				
C10.	My transportation cost is high in this region.				
C11.	Village buyers mix different qualities of cacao beans.				
C12.	The export tax generates a significant decrease in the cacao price I receive from processors and exporters.				
C13.	The new export tax will support processing industry development.				
C14.	The new export tax will encourage exporters to purchase more processed cacao products.				
C15.	Village buyers have enough information on the price of cacao beans.				
C16.	Village buyers do not have enough knowledge on the quality of cacao beans.				
C17.	Village buyers can grade cacao beans well.				
C18.	I am satisfied with my transactions with village buyers.				

Answer the questions below in box provided.

C19. What is the most important factor of reducing yields in this region? 01. Pest and disease 02. Low quality of cacao seedlings 03. Other (____________) 04. Do not know	C20. What is the most important cause of price change in this region? 01. Irregular supply of cacao beans from farmers 02. Irregular demand from buyers 03. Change in exchange rate 04. Changes in the world cacao price 05. Other (____________) 06. Do not know	C21. What other constraints do you face on cacao marketing?

C22. How easy is it to get access to financial institutions (bank)? 01. Very hard 02. Hard 03. Easy 04. Very easy	C23. What factors contribute to that condition?

D. Assets

This section is about assets used in marketing activities in the period of June 2009 – May 2010.

D1. Did you own the following assets in marketing activities? 01. Yes 02. No		D2. When did you buy or build it?	D3. How much did it cost you?	D4. What is the approximate current value of the asset?
Storage				
Truck				
Other (_______)				

Details of the main buyer

Name	
Address	
Phone	

Details of village buyers

No	Name	Address	Phone
1			
2			
3			

Appendix 3.5. Interview Guide: Department of Industry and Trade

INTERVIEW GUIDE

Potential of Cacao Agribusiness for Poverty Alleviation in West Sumatra

Department of Industry and Trade

A. Key Informant Profile

A1.	Name of respondent	
A2.	Job Position	
A3.	Municipality (*kabupaten)* 01. Solok 02. Pasaman 03. 50 Kota	
A4.	Land phone number (work)	
A5.	Mobile phone number	
A6.	Email address	
A7.	Date	......../......../2010

This questionnaire aims to identify factors affecting cacao agribusiness development in West Sumatra and the potential impact of the development on poverty alleviation. Those factors are assessed in terms of farming condition, marketing condition, supporting policy and poverty incidence.

B. Marketing of Cacao Products

This section aims to find out the marketing profile of cacao products produced in each municipality assessed in the period of June 2009 – May 2010, number of processing firms and government's policy regarding marketing of cacao products .

B1. Does the grading of cacao beans take place at the following levels? (Tick the box)		B2. Why is there no grading system at the farmer level?	B3. Do farmers have low bargaining power in marketing their cacao beans? 01. Yes 02. No, go to B6	B4. What is the most important cause of the low bargaining power of farmers? 01. Need money soon 02. No alternative market 03. No farmer association 04. Other (___________)
Farmer level	Go to B3			
Village buyer level				
Wholesaler level				
Exporter level				

B5. What is the solution to the problem of low bargaining power of farmers?	B6. Do the following people lack access to credit? 01. Yes 02. No, go to B9		B7. What is the most important cause of the lack of access to credit? 01. No collateral 02. Difficult procedure 03. No local financial institution 04. Other (__________)	B8. How to improve access by these people to credit?
	Farmers			
	Village buyer			

B9. How many cacao-processing firms were operating in this municipality for the year?		B10. How many workers are involved in all of those firms?	B11. What kinds of cacao products were produced in this region for the year? (Tick the box)		B12. What was the proportion of the products exported?	B13. Will export quantity of cacao products increase in the next two years? 01. Yes 02. No	B14. What conditions will increase export for cacao products in the next two years?
B9a. Big scale firms			B11a. Cacao beans		%		
B9b.Medium scale firms			B11b. Cocoa powder		%		
B9c. Small scale firms			B11c. Cocoa butter		%		
B9d. None, go to B11a			B11d. Cocoa cake		%		
			B11e. Other (_______________)		%		
					None, go to B16		

B15. What requirements does a firm have to meet to export a product?	B16. What are the main factors preventing the export of cacao beans and cocoa products?		B17. What government support is provided for the export promotion of cacao products?
	Cacao beans	Cocoa products	

B18. Will demand for cacao products change in the domestic market in the next two years? 01. Decrease 02. Increase 03. Constant	B19. What factors will affect change in demand for cacao products?

C. Program to Support Cacao Agribusiness Development in the Past Five Years

Program	C1. What government programs supported cacao agribusiness development in the past five years?	C2. What was the objective of the program?	C3. When was the program implemented?	C4. What organizations were involved?
01				
02				
03				
04				
05				

Program	C5. What was budget for the program?	C6. What was the source of funds?	C7. How many beneficiaries were involved?		C8. What were the main constraints to implement the program?
01	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (___________)		
02	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (___________)		
03	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (___________)		
04	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (___________)		
05	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (___________)		

Program	C9. What are indicators of the impact of the program?
01	
02	
03	
04	
05	

D. Current Program to Support Cacao Agribusiness Development

Program	D1. What current government programs support cacao agribusiness development?	D2. What is the objective of the program?	D3. When was the program implemented?	D4. What organizations are involved?
01				
02				
03				

Program	D5. What is the budget for the program?	D6. What is the source of funds?	D7. How many beneficiaries are involved?		D8. What are the main constraints to implement the program?
01	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (__________)		
02	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (__________)		
03	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (__________)		

E. New Government Programs to Support Cacao Agribusiness Development in the Next Two Years

Program	E1. What are the new government programs to support cacao agribusiness development in the next two years?	E2. What is the objective of the program?	E3. When will the program be implemented?	E4. What organizations will be involved?
01				
02				
03				

Program	E5. What is the budget for the program?	E6. What will be the source of funds?	E7. How many beneficiaries will be involved?		E8. Rank programs with 1 highest priority.
01	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (__________)		
02	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (__________)		
03	Rp.		Cacao farmers		
			Village buyers		
			Village cooperative		
			Other (__________)		

F. Perceptions

Give perceptions on the following statements.
(Tick the box)

Code	Statement	01 Strongly disagree	02 Disagree	03 Agree	04 Strongly agree
F1.	The supply of cacao beans has declined in the past five years in this region.				
F2.	Good quality of cacao beans is hard to get in this region.				
F3.	Low quality of cacao beans is due to improper fermentation.				
F4.	There is no difference in price between proper and improper fermentation of cacao beans in this region.				
F5.	The price of cacao beans increases and decreases all the time.				
F6.	The price of cacao beans received by farmers is low in this region.				
F7.	Farmers have enough information on the price of cacao beans.				
F8.	Farmers do not have enough knowledge on the quality of cacao beans.				
F9.	Village buyers do not have enough information on the price of cacao beans.				
F10.	Village buyers have enough knowledge on the quality of cacao beans.				
F11.	Village buyers can grade cacao beans well.				
F12.	Wholesalers do not have enough information on the price of cacao beans.				
F13.	Wholesalers have enough knowledge on the quality of cacao beans.				
F14.	Wholesalers can grade cacao beans well.				
F15.	The new export tax is implemented well.				
F16.	The new export tax will support processing industry development.				
F17.	The new export tax will encourage exporters to purchase more processed cacao products.				
F18.	The supply of cacao beans decreased significantly due to the earthquake devastation in this region.				
F17.	The price of cacao beans increased after the earthquake devastation.				
F18.	It is easy to get farmers to participate in a program.				
F19.	Farmers are able to apply the new knowledge they get from the program well.				
F20.	My institution does not find any problem in coordinating with other institutions / organizations to implement the programs.				

F21.	My institution is able to evaluate and monitor the programs well.				
F22.	All programs implemented by my institution can achieve their objectives.				

G. Strategic Activities to Develop the Cacao Industry

What activities should be done to develop cacao industry?

Code	Problem	Answer	What is the most important activity should be done to solve this problem?	What condition should be met to enable the activity succeed?	Who should be involved in that activity? 01. Cacao farmers 02. Dept. of Plantation 03. Dept. of Industry and Trade 04. Traders 05. Investors 06. Bank 07. Extension workers 08. The government (decision maker) 09. Research centre 10. Other (_________)
G1.	What is the most important factor influencing the supply of cacao beans in this region?				
G2.	What is the most important cause of price change in this region?				
G3.	What is the most important factor limiting the price received by farmers in this region?				

	01. Low quality of cacao beans 02. Long marketing channel 03. Low bargaining power of farmers 04. No price and quality standard 05. Other (______________)				
G4.	What are other main constraints to cacao agribusiness development?				

G5. Can cacao agribusiness develop significantly in West Sumatra in the next five years? 01. Yes 02. No, go to G7	G6. What conditions will support cacao agribusiness development in this region?	G7. Can the development of cacao agribusiness promote poverty alleviation in West Sumatra? 01. Yes 02. No	G8. In what conditions will the development contribute to poverty alleviation?

H. Decision Making Profile

H1. What kind of decisions can this institution make at the municipal level in terms of cacao agribusiness development?	H2. What is the proportion of municipal budget allocation to support cacao agribusiness development in this institution?

Appendix 3.6. Interview Guide: Department of Plantation

INTERVIEW GUIDE

Potential of Cacao Agribusiness for Poverty Alleviation in West Sumatra

Department of Plantation

H. Key Informant Profile

A1.	Name of respondent	
A2.	Job Position	
A3.	Municipality (*kabupaten)* 01. Solok 02. Pasaman 03. 50 Kota	
A4.	Land phone number (work)	
A5.	Mobile phone number	
A6.	Email address	
A7.	Date	......../......../2010

This questionnaire aims to identify factors affecting cacao agribusiness development in West Sumatra and the potential impact of the development on poverty alleviation. Those factors are assessed in terms of farming condition, marketing condition, supporting policy and poverty incidence.

I. Cacao Farming Profile

This section aims to find out cacao farming practices and availability of inputs for cacao farming in the period of June 2009 – May 2010 in each municipality.

The questions in this section will be asked to Extension Worker / Production Division Officer.

B1.	What geographic conditions encourage the development of cacao farming in this region?	Check list
	• Type of soil	
	• Altitude	
	• Rainfall	
B2.	What factors motivate farmers to plant cacao trees in this region?	
B3.	Are farmers good on cacao farming?	
B4.	What agronomic practices are farmers doing well? (Planting, fertilizing, pest and disease control, pruning, weeding, harvesting)	
B5.	What agronomic practices are farmers doing badly? (Planting, fertilizing, pest and disease control, pruning, weeding, harvesting) • Causes and the main cause • Solutions and the main solution	
B6.	What inputs were sufficient to support cacao farming in this region for the year? (Fertilizers, chemicals, labourers)	
B7.	What inputs were insufficient to support cacao farming in this region for the year? (Fertilizers, chemicals, labourers) • Causes and the main cause	

	• Solutions and the main solution	
B8.	Did famers use proper quantity of fertilizers for their cacao trees for the year? • If no, causes and the main cause • Solutions and the main solution	
B9.	Did famers use proper quantity of chemicals for their cacao trees for the year? • If no, causes and the main cause • Solutions and the main solution	
B10.	Did most cacao farmers ferment their cacao beans properly in this region? • If no, causes and the main cause • Solutions and the main solution	
B11.	Did most cacao farmers dry their cacao beans properly in this region? • If no, causes and the main cause • Solutions to improve their access to credit and the main solution	

J. Extension Services and Training

This section is about farmers' access to extension services and training on agronomic and post harvest practices.

The questions in this section will be asked to Program Division Officer.

Extension services and Training for Farmers

C1.	Were there extension workers allocated for cacao farming for the year in this region?	Checklist
	• If no, why were there no extension workers for cacao farming in this region?	

	• If yes, did farmers have enough extension services for the year? • How many times a month on average did the extension workers visit cacao farmers for the year? • What constraints did the extension workers have in providing services to farmers? • How to solve this constraints	
C2.	Did farmers get enough training in the past five years? • If no, causes and the main cause • Solutions and the main solution	
C3.	What kind of constraints did you find in conducting training for farmers?	
C4.	Was the objective of training for farmers achieved? • If no, the main cause	
C5.	Do most farmers apply the knowledge learned from training / extension services? • If no, what factors prevent farmers from applying the knowledge?	

Training for extension officers

C6.	Did extension officers get enough training in the past five years? • If no, causes and the main cause • Solutions and the main solution	
C7.	What kind of constraints did you find in conducting training for extension officers?	

K. Perceptions

Give perceptions on the following statements.
(Tick the box)

Code	Statement	01 Strongly disagree	02 Disagree	03 Agree	04 Strongly agree
D1.	Cacao yield in this region is low.				
D2.	The number of extension workers is sufficient in this region.				
D3.	Extension workers have enough knowledge and experience in cacao farming in this region.				
D4.	The willingness of farmers to grow cacao tree is very high in this region.				
D5.	The price of cacao beans received by farmers is low.				
D6.	Farmers are not able to bargain on cacao price.				
D7.	Village buyers mix different qualities of cacao beans.				
D8.	The price of cacao beans increases and decreases all the time.				
D9.	Farmers have enough information on the price of cacao beans.				
D10.	Farmers do not have enough knowledge on the quality of cacao beans.				
D11.	The supply of cacao beans decreased significantly due to the earthquake devastation in this region.				
D12.	The price of cacao beans increased after the earthquake devastation.				
D13.	The export tax does not generate a decrease in the cacao price at the farm gate.				
D14.	The new export tax is implemented well.				
D15.	The new export tax will not support processing industry development.				
D16.	The new export tax will encourage exporters to purchase more processed cacao products.				
D17.	It is easy to get farmers to participate in a program.				
D18.	Farmers are unable to apply the new knowledge from training.				
D19.	Farmers are able to apply the new knowledge from extension services.				
D20.	Most farmers are willing to apply the new knowledge immediately after training.				
D21.	My institution does not find any problem in coordinating with other institutions / organizations to implement the programs.				
D22.	My institution is able to evaluate and monitor the programs well.				
D23.	All programs implemented by my institution can achieve their objectives.				

L. Strategic Activities to Develop the Cacao Industry

What activities should be done to develop the cacao industry?

Code	Problem	Answer	What is the most important activity should be done to solve this problem?	What condition should be met to enable the activity succeed?	Who should be involved in that activity? 01. Cacao farmers 02. Dept. of Plantation 03. Dept. of Industry and Trade 04. Traders 05. Investors 06. Bank 07. Extension workers 08. The government (decision maker) 09. Research centre 10. Other (_________)
E1.	What the most important factor limit yields in this region? 01. Pest and disease 02. Low quality of cacao seedlings 03. Lack of fertilizer use 04. Other (____________)				
E2.	What is the most important cause of price change in this region?				
E3.	What is the most important factor limiting the price received by farmers in this region? 01. Low quality of cacao beans 02. Long marketing channel 03. Low bargaining power of farmers 04. No price and quality standard 05. Other (_____________)				
E4.	What are other main constraints to cacao agribusiness development?				

E5.	Can cacao agribusiness develop significantly in West Sumatra in the next five years?
E6.	What conditions will support cacao agribusiness development in this region? • Land availability and production • Marketing • Supporting policy
E7.	Can the development of cacao agribusiness promote poverty alleviation in West Sumatra?
E8.	In what conditions will the development contribute to poverty alleviation? • Income generation

M. Decision Making Profile

F1.	What kind of decisions can this institution make at the municipal level in terms of cacao agribusiness development?	
F2.	What proportion of the municipal budget for this institution is allocated to support cacao agribusiness development?	
F3.	Does the cacao tree crop take a higher priority in your institutional policy than other tree crops? Why?	

Appendix 3.7. The First Round Questionnaire of Delphi Surveys

Delphi Survey

Initial Questionnaire

(First Round)

Potential of Cacao Agribusiness for Poverty Alleviation in West Sumatra

Thank you for agreeing to participate in this survey on the priorities of strategies to develop the cacao industry in West Sumatra.

This questionnaire is the first of two rounds of the survey. Please try to answer all questions, even though we do not expect you to have in-depth knowledge of all of them. You will have the opportunity to revise your answers in the second round of the survey.

In these surveys, you will be asked to develop key strategies to support cacao industry development. Once we have received responses from all panellists, we will collate and summarize the findings and formulate the second questionnaire.

We assure you that your participation in the survey and your individual responses will be strictly confidential to the research team and will not be divulged to any outside party, including other panellists.

Name:	
Institution:	
Job position:	
Email address:	

Information about the research findings

There were some issues identified from workshops and surveys conducted in the three municipalities: Solok, 50 Kota and Pasaman. These issues are divided into two groups: production and marketing constraints. A list of the issues is presented below.

Production Issues in Cacao Industry
Two major production issues in cacao industry development: 1. The yield of cacao trees 2. The quality of cacao beans Factors affecting the yield of cacao trees: • The quality of cacao seedlings • Fertilizing practices • The price of fertilisers • Pest and disease management • The price of chemicals for pest and disease management • Knowledge on pest and disease management • Capital availability • Access to information and availability of credit Factors affecting quality of cacao beans: • Drying practices • The maturity of pods harvested • Fermentation practices which are influenced by the price difference between proper fermented and improper fermented cacao beans • Communication with extension officers

Marketing Issues in Cacao Industry	
Factors affecting the price of cacao beans received by farmers:	Factors affecting buying price of marketing intermediaries paid to farmers:

1. Bargaining power of farmers. 2. The location of farmers from export point. 3. The source of price information. 4. The quality of cacao beans required by buyers. 5. The source of information on quality of cacao beans. 6. Then scale of business of main buyer. 7. Ability to sell cacao beans to buyers other than main buyer. 8. Indebtedness to the main buyer. 9. The number of buyers operates in farmers' location.	1. Bargaining power of marketing intermediaries on their selling price. 2. Marketing intermediaries' selling price. 3. The time to hold cacao beans. 4. Source of price information. 5. Indebtedness to the main buyer. 6. Storage facilities. 7. The status of marketing intermediaries in transaction (independent of buying agent).

Information on questionnaire

The following strategies were recommended with regard to production and marketing issues in the cacao industry. Please rate each of the strategies in terms of its value and also add some more key strategies. Then please identify what conditions are required before doing the strategy to make it viable.

Conditions to be in place

Conditions for each strategy refer to activities, resources and policies that are currently available and need to be in place to make the strategy work. The conditions can come from different categories. Examples of the conditions from some of the main categories are as follows.

	Economic conditions
E1.	Government funds are available.
E2.	Investment is required to improve road infrastructure in rural areas.
E3.	A soft loan is available to support the cooperative.

E4.	The budget for plantation sub-sector is increased.
E5.	The exchange rate is stable.
E6.	There is an increasing trend in the price of cacao beans sold in the international market.
E7.	Global consumption of chocolate increases.
E8.	Farmers' profit increases.
	Geographical condition
G1.	The location of cacao seedling nursery can be accessed easily by most farmers.
G2.	The location has suitable climatic conditions to grow cacao trees.
	Political condition
P1.	The relevant departments share a common interest in achieving the goals of this strategy.
P2.	The government has power to control the implementation of the program.
P3.	The government is committed to develop the cacao industry.
	Institutional condition
I1.	A certification system on cacao seedlings is available.
I2.	A control system is available to make sure that the distribution of fertilizers reaches the target farmers.
I3.	Farmer groups have been established.
I4.	Guidance and technical assistance are available to farmers.
I5.	The procedures to get credit for farmers are simple.
I6.	A group-based lending system is established as social collateral that imposes certain disciplinary actions on group members for better repayment.
I7.	The government facilitates a contract system between the processing industry and farmers.
I8.	Local academics are involved.
I9.	The number of extension workers is increased.
I10.	Facilities for extension workers are improved.
I11.	A policy is implemented to establish a grading standard and system of price differentials by grade.
I12.	Grading standards are disseminated to farmers.
I13.	Government mediation is required on price negotiation.
I14.	Processing industries are established.

	Training and capacity building
T1.	Training is provided for farmers on agronomic practices.
T2.	Expertise is available.
T3.	Farmer's knowledge on administration is improved.
T4.	Extension workers' knowledge is improved.
T5.	Knowledge on entrepreneurship is imparted to farmers.
T6.	Farmers have enough knowledge on harvesting and post harvesting.

Please tick the box provided to rate the strategies.

Rating value:

1 = not important   4 = highly important

2 = less important   5 = most important

3 = important

Q1. How important do you think the following strategies are to encourage farmers to grow good-quality cacao seedlings?

No	Key strategies	1	2	3	4	5	What should conditions be in place for doing the strategy? (Some conditions can be picked from the list provided above and add some more conditions)
1	The government should facilitate farmers to establish a cacao nursery in farmer groups by providing superior cacao seeds.						
2	The government should establish seedling nurseries in each municipality.						
3	Please add other key strategies.						

Q2. How important do you think the following strategies are to encourage farmers to use fertilizers?

No	Key strategies	1	2	3	4	5	What should conditions be in place for doing the strategy? (Some conditions can be picked from the list provided above and add some more conditions)
1	The government should simplify procedures for farmers to get subsidized fertilizers.						
2	The Department of Plantation should provide training for farmers on composting.						
3	Please add other key strategies.						

Q3. How important do you think the following strategies are to make capital available to small farmers for cacao industry development?

No	Key strategies	1	2	3	4	5	What should conditions be in place for doing the strategy? (Some conditions can be picked from the list provided above and add some more conditions)
1	The government should facilitate farmer groups to establish a village cooperative that can function to provide capital for farmers.						
2	As collateral is one of causes that restrains farmers to access credit, the government should provide a guarantee for farmers to enable them to get credit from a financial institution.						
3	Loans should be available for farmers at subsidized interest rates.						
4	Banks should distribute brochures to farmer groups to make information about credit more available for farmers.						
5	The processing industry should be involved to provide capital to enable farmers to buy inputs within a contract						

	system where farmers should provide cacao beans with required quality for the processing industry.						
6	Please add other key strategies.						

Q4. How important do you think the following strategies are to encourage farmers to manage pests and diseases?

No	Key strategies	1	2	3	4	5	What should conditions be in place for doing the strategy? (Some conditions can be picked from the list provided above and add some more conditions)
1	The Department of Plantation should provide training for farmers on biological control of pests and diseases.						
2	The government should provide subsidised chemicals.						
3	Reading material on pest and disease management should be made available to farmers.						
4	Extension visits should be more intensive.						
5	Please add other key strategies:						

Q5. How important do you think the following strategies are to increase prices received by farmers?

No	Key strategies	1	2	3	4	5	What should conditions be in place for doing the strategy? (Some conditions can be picked from the list provided above and add some more conditions)
1	Farmers should establish village cooperative that enable them to sell cacao beans in large amount to big buyers.						
2	Farmers should obtain the right information on cacao beans quality required by buyer.						
3	The government should provide price information to farmers through media such as local TV.						
4	A formal contract should be made between farmers and marketing intermediaries.						
5	Farmers should improve the quality of cacao beans through proper drying practices, harvesting ripe pods and proper fermentation.						
6	Alternative markets for fermented cacao beans should be made available.						
7	Please add other key strategies.						

Appendix 3.8. The Second Round Questionnaire of Delphi Surveys

Delphi Survey

The Second Round Questionnaire

Potential of Cacao Agribusiness for Poverty Alleviation in West Sumatra

Thank you for participating in this survey on the priorities of strategies to develop the cocoa industry in West Sumatra. We also thank you for the response in the first round survey.

The second questionnaire is the last questionnaire to be used in this survey. Please try to answer all questions, even though we do not expect you to have in-depth knowledge of all of them.

In this questionnaire, you are asked to provide an assessment of the key strategies and supporting conditions required to implement the strategy based on participant responses on the first round questionnaire.

We assure you that your participation in the survey and your individual responses will be strictly confidential to the research team and will not be divulged to any outside party, including other panellists.

Name:	
Institution:	
Job position:	
Email address:	

Please tick the box provided to rate the strategies.

Rating value:

1 = not important 4 = highly important

2 = less important 5 = most important

3 = important

Example how to fill table:

Question 1:

No	Key strategies	1	2	3	4	5
1	Strategy 1			√		
	How important do you think the following supporting conditions to implement this strategy properly.					
1.1.	Supporting condition 1			√		
1.2.	Supporting condition 2				√	

Questions

Q1. How important do you think the following strategies to encourage farmers to grow good quality seedlings?

No	Key strategies	1	2	3	4	5
Q1.1.	The government should facilitate farmers to establish a cacao nursery in farmer groups by providing superior cacao seeds.					
	How important do you think the following supporting conditions to implement strategy Q1.1 properly?					
1.1.	Training is provided for farmers on agronomic practices.					
1.2.	The government funds are available.					
1.3	Investment is required to improve road infrastructure in rural areas.					

1.4.	The program of cacao industry development should be included in the estate development planning at district, province and national level.					
1.5.	The location of cacao nursery can be accessed easily by farmers.					
1.6.	The location of cacao nursery should have suitable climate to grow cacao trees.					
1.7.	The budget for the plantation sector should be increased.					
1.8.	The government has the ability and a high capacity to control the implementation of the program.					
1.9.	The government commits to develop cocoa industry.					
1.10.	Improving farmer knowledge about entrepreneurship.					
1.11.	Farmer groups have been established					
1.12.	The certification system of the cocoa seedlings is available.					
1.13.	Experts are available.					
Q1.2.	The government establishes cacao nursery in each district / city.					
	How important do you think the following supporting conditions to implement strategy Q1.2 properly?					
2.1.	The government funds are available.					
2.2.	Investment is required to improve road infrastructure in rural areas.					
2.3.	Information about seed quality standards is disseminated to farmers.					
2.4.	The program of cacao industry development should be included in the estate development planning at district, province and national level.					
2.5.	The local government commits to develop cocoa industry from upstream to downstream.					
2.6.	The location of cacao nursery can be accessed easily by farmers.					
2.7.	The location of cacao nursery should have suitable climate to grow cacao trees.					

2.8.	The budget for the plantation sector should be increased.					
2.9.	The government has the ability and a high capacity to control the implementation of the program.					
2.10.	There is a control over supply of seedlings in the community / market.					
2.11.	The certification system of the cocoa seedlings is available.					
2.12.	Experts are available.					
Q1.3.	Subsidized quality seedlings and credit for operating costs are available to farmers during the planting and maintenance stage.					
	How important do you think the following supporting conditions to implement strategy Q1.3 properly?					
3.1.	The government funds are available.					
3.2.	The government has the ability and a high capacity to control the implementation of the program.					
3.3.	The government commits to develop cocoa industry.					
Q1.4.	The government provides training and extension services to improve farmers' knowledge about seedling quality.					
	How important do you think the following supporting conditions to implement strategy Q1.4 properly?					
4.1.	Technical training on side grafting is available.					
4.2.	The government funds are available.					
4.3.	The government provides the cocoa planting demonstration plots to train farmers to grow good quality seeds.					
4.4.	Improving extension officers' knowledge.					

Q2. How important do you think the following strategies to encourage farmers to use fertilizer?

No	Key Strategies	1	2	3	4	5
Q2.1.	The government creates a simple procedure for farmers to obtain subsidized fertilizer.					
	How important do you think the following supporting conditions to implement strategy Q2.1 properly?					
1.1.	The control system is available in the distribution of fertilizer to farmers.					
1.2.	The government funds are available.					
1.3	All stakeholders commit to implement the policy.					
1.4.	Guidance on designing plan of required fertilizer is available for farmers to claim subsidized fertilizer.					
Q2.2.	The Department of Plantation provides training for farmers on composting.					
	How important do you think the following supporting conditions to implement strategy Q2.2 properly?					
2.1.	The government funds are available.					
2.2.	The budget for the plantation sector should be increased.					
2.3.	The government commits to develop cocoa industry.					
2.4.	Improving extension officers' knowledge.					
2.5.	Farmer groups have been established.					
2.6.	Guidance and technical assistance are available to farmers.					
2.7.	Facilities and infrastructure are available to do composting.					
Q2.3.	Farmers are encouraged to develop integrated cattle-cocoa farming, where cow manure is source of organic fertilizer; and cacao husks are source of fodder.					
	How important do you think the following supporting conditions to implement strategy Q2.3 properly?					

3.1.	The government funds are available.					
3.2.	The budget for the plantation sector should be increased.					
3.3.	Farmers' profit increases.					
3.4.	The government provides cattle and facilities and infrastructure to produce organic fertilizer.					
3.5.	The government has the ability and a high capacity to control the implementation of the program.					
3.6.	Improving farmers' knowledge on entrepreneurship.					
3.7.	Improving extension officers' knowledge.					
3.8.	Guidance and technical assistance are available to farmers.					
3.9.	Experts are available.					

Q3. How important do you think the following strategies to make capital available to farmers in order to develop cacao industry?

No	Key Strategies	1	2	3	4	5
Q3.1.	The government facilitates farmers' groups to form cooperatives and empower the existing cooperatives.					
	How important do you think the following supporting conditions to implement strategy Q3.1 properly?					
1.1.	The existence of a simple procedure of credit for farmers.					
1.2.	The government funds are available.					
1.3	The government has the ability and a high capacity to control the implementation of the program.					
1.4.	The government commits to develop cocoa industry.					
1.5.	Improving farmers' knowledge on administration					
1.6.	Improving farmers' knowledge on entrepreneurship.					
1.7.	Farmer groups have been established.					
1.8.	Formation group lending system as social security rules that impose a particular discipline for group members to ensure loan					

	repayment.					
1.9.	Soft loans are available to support the cooperative.					
1.10.	Guidance and technical assistance are available to farmers.					
Q3.2.	Lack of collateral caused farmers to have less access to credit; therefore, the government should provide guarantees for farmers to obtain loans from financial institutions.					
	How important do you think the following supporting conditions to implement strategy Q3.2 properly?					
2.1.	The existence of a simple procedure of credit for farmers.					
2.2.	The government funds are available.					
2.3.	Credit system is run with pure Islamic system.					
2.4.	The budget for the plantation sector should be increased.					
2.5.	The government has the ability and a high capacity to control the implementation of the program.					
2.6.	The government commits to develop cocoa industry.					
2.7.	Improving farmers' knowledge on administration.					
2.8.	Improving farmers' knowledge on entrepreneurship.					
2.9.	Formation group lending system as social security rules that impose a particular discipline for group members to ensure loan repayment.					
Q3.3	Credit with subsidized interest is available for farmers and existing revitalization credit is optimized.					
	How important do you think the following supporting conditions to implement strategy Q3.3 properly?					
3.1.	The government funds are available.					
3.2.	Credit is reserved for farmers with small land or poor farmers.					
3.3.	The government has the ability and a high capacity to control the implementation of the program.					
3.4.	The government commits to develop cocoa industry.					

3.5.	Improving farmers' knowledge on administration.					
3.6.	Improving farmers' knowledge on entrepreneurship.					
3.7.	Savings of farmers in cooperatives should be able to serve as collateral for the government (or banks) to provide credit to farmers.					
Q3.4	Bank distributes brochures on credit to farmers' groups so that the credit information is available to farmers.					
	How important do you think the following supporting conditions to implement strategy Q3.4 properly?					
4.1.	Empowering farmer Institutions to allow farmers to access existing credit facilities.					
4.2.	Improving farmers' knowledge on entrepreneurship.					
4.3.	Farmers have collateral.					
Q3.5	Processing industries are involved in the provision of capital for farmers to purchase input through a contract system where farmers supply cocoa beans quality desired by the processing industry.					
	How important do you think the following supporting conditions to implement strategy Q3.5 properly?					
5.1.	Legal certainty is entailed for both parties to keep their promises.					
5.2.	The policy of standard quality (grading) and the system of the difference in price based on quality are imposed.					
5.3.	Establishing processing industry for cocoa beans.					
5.4.	Improving extension officers' facilities.					
5.5.	Information on quality standards is disseminated well to farmers.					
5.6.	The number of extension workers is increased.					
5.7.	The government mediation is needed in price negotiations between farmers and the processing industry.					
5.8.	The government facilitates partnerships between processing industry and farmer institutions.					
5.9.	Farmer groups have been established.					

5.10.	Training is provided for farmers to produce cacao beans that meet quality standard.					

Q4. How important do you think the following strategies to encourage farmers to control pest and disease?

No	Key Strategies	1	2	3	4	5
Q4.1.	The Department of Plantation provides training for farmers on pest and disease management using natural enemies.					
	How important do you think the following supporting conditions to implement strategy Q4.1 properly?					
1.1.	The program should be acompanied by building a system providing natural pesticides and herbicides in the region.					
1.2.	Involving academics (higher education institutions) locally.					
1.3	The budget for the plantation sector should be increased.					
1.4.	The government commits to develop cocoa industry.					
1.5.	Plantation extension services are necessary in every plantation area.					
1.6.	Improving extension officers' knowledge.					
1.7.	Farmer groups have been established.					
1.8.	Experts are available.					
Q4.2.	The government provides subsidized chemicals.					
	How important do you think the following supporting conditions to implement strategy Q4.2 properly?					
2.1.	The government funds are available.					
2.2.	The budget for the plantation sector should be increased.					
2.3.	The government has the ability and a high capacity to control the implementation of the program.					
Q4.3.	Reading materials on pest and disease management are available for farmers.					

	How important do you think the following supporting conditions to implement strategy Q4.3 properly?					
3.1.	Extension services are available.					
3.2.	The government funds are available.					
3.3.	Farmers actively seek information.					
Q4.4.	More intensive visits of extension workers.					
	How important do you think the following supporting conditions to implement strategy Q4.4 properly?					
4.1.	Extension services on plantation are available.					
4.2.	Improving extension officers' facilities.					
4.3.	The number of extension workers is increased.					
4.4.	Improving extension officers' knowledge.					
4.5.	Farmer groups have been established.					
4.6.	Guidance and technical assistance are available to farmers.					

Q5. How important do you think the following strategies to increase price received by farmers?

No	**Key Strategies**	**1**	**2**	**3**	**4**	**5**
Q5.1.	Farmers form cooperatives so that they can sell their cocoa beans in large quantities to wholesalers, exporters or processors.					
	How important do you think the following supporting conditions to implement strategy Q5.1 properly?					
1.1.	The government facilitates formation of contracts system between wholesalers, exporters and processing industries with farmers.					
1.2.	The government commits to develop cocoa industry.					
1.3	Improving farmers' knowledge on administration.					

1.4.	Improving farmers' knowledge on entrepreneurship.					
1.5.	Farmer groups have been established.					
1.6.	Soft loans are available to support the cooperative.					
Q5.2.	Farmers receive sufficient information about the quality of cocoa beans desired by buyers.					
	How important do you think the following supporting conditions to implement strategy Q5.2 properly?					
2.1.	The policy of standard quality (grading) and the system of the difference in price based on quality are imposed.					
2.2.	Improving extension officers' facilities.					
2.3.	Information on quality standard is disseminated to farmers through extension and brochures.					
2.4.	Improving extension officers' knowledge.					
Q5.3.	The government provides price information to farmers through online sms system.					
	How important do you think the following supporting conditions to implement strategy Q5.3 properly?					
3.1.	The policy of standard quality (grading) and the system of the difference in price based on quality are imposed.					
3.2.	Information on quality standard is disseminated well to farmers through extension and brochures.					
3.3.	The government commits to develop cocoa industry.					
3.4.	Improving farmers' knowledge on entrepreneurship.					
Q5.4.	The existence of a formal contract between the farmer and the exporter or processing industry.					
	How important do you think the following supporting conditions to implement strategy Q5.4 properly?					
4.1.	Legal certainty is entailed for both parties to keep their promises.					
4.2.	The policy of standard quality (grading) and the system of the					

	difference in price based on quality are imposed.					
4.3.	Information on quality standard is disseminated well to farmers through extension and brochures.					
4.4.	The government mediation is needed in price negotiations between farmers and the processing industry.					
4.5.	Improving farmers' knowledge on administration.					
4.6.	Improving farmers' knowledge on entrepreneurship.					
4.7.	Farmer groups have been established.					
Q5.5.	Farmers improve the quality of cocoa beans through harvesting ripe fruit, appropriate drying fermentation.					
	How important do you think the following supporting conditions to implement strategy Q5.5 properly?					
5.1.	The policy of standard quality (grading) and the system of the difference in price based on quality are imposed.					
5.2.	The existence of a significant price difference between fermented cocoa and non fermented cacao so that farmers can be motivated to produce good quality cocoa.					
5.3.	Improving quality of cacao beans should be performed together by farmer groups, not by individual farmers.					
5.4.	Need to empower farmer Institutions.					
5.5.	The government provides farmer groups with drying and fermentation facilities.					
5.6.	Information on quality standard is disseminated well to farmers through extension and brochures.					
5.7.	Involving academics (higher education institutions) locally.					
5.8.	Improving extension officers' knowledge.					
5.9.	Farmers have adequate knowledge on harvesting and post-harvest.					
5.10.	Guidance and technical assistance are available to farmers.					
5.11.	Experts are available.					

Q5.6.	Availability of alternative market for fermented cocoa beans.					
	How important do you think the following supporting conditions to implement strategy Q5.6 properly?					
6.1.	The policy of standard quality (grading) and the system of the difference in price based on quality are imposed.					
6.2.	The cocoa price increases in the international market.					
6.3.	Establishing processing industry for cocoa beans.					
6.4.	Farmers' profit increases.					
6.5.	World chocolate consumption increases.					
6.6.	Stable exchange rate.					
6.7.	The government also buys fermented cacao beans through state companies.					
6.8.	The government commits to develop cocoa industry.					

Appendix 4.1. Video of the Process of PIPA Workshop

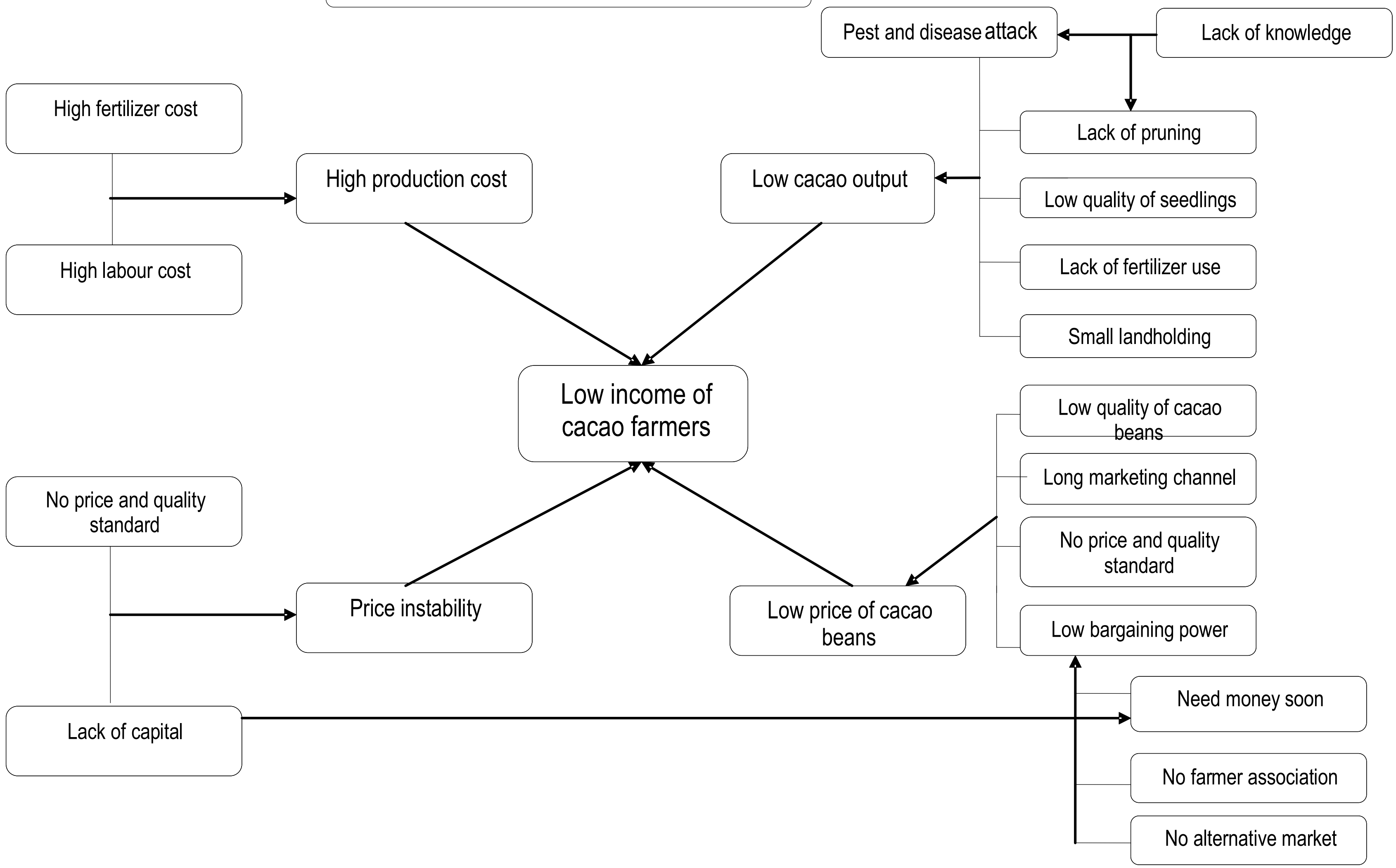
Appendix 4.2. Frequency of Votes for Identified Problems in the Cacao Industry in West Sumatra

Problem	Frequency			
	Solok	50 Kota	Pasaman	West Sumatra
	n = 18	n = 21	n = 29	n = 68
Lack of extension services	13		25	38
Lack of knowledge on agronomic practices	7	15	8	30
Low quality of seedling	12	11	5	28
Pest and disease attack	13	4	12	29
Price instability	9	13	4	26
Lack of capital	10	5	12	27
Lack of pruning		15	11	26
Low production	5	15	2	22
Low price of cacao beans	3	12		15
Low quality of cacao beans	6	7	2	15
Small landholding		15		15
There is no farmer association	11			11
Unavailability of soft loans	11			11
Less attention to annual crops compare to food crops		12		12
Lack of regional supporting policy		12		12
Lack of processing equipment		12		12
There is no supplier for good quality seedlings	10			10
Difficult procedures to get credit	10			10
No collateral	10			10
Research findings are not disseminated well		11		11
Marketing system: long marketing channel	9			9
No price and quality standards for cacao beans		6	6	12
Lack of stakeholder synergies		10		10
Lack of cooperation between farmers and bank or village cooperative			12	12
Lack of fertilizer availability			12	12
No local financial institution		8		8
Low quality of extension officers		7		7
Low quantity of extension officers		7		7
Lack of facilities for extension services		7		7
Lack of fertilizer use			9	9
High production cost particularly fertilizer			9	9
No price differentiation between fermented and non-fermented cacao beans		6		6
Low bargaining power		6		6
Cannot afford to buy good seedlings		5		5
Low budget for development of plantation from the government			6	6
High labour cost			4	4

Appendix 4.3. Percentage of Votes for Identified Problems in the Cacao Industry in West Sumatra

Problem	Percentage (%)			
	Solok	50 Kota	Pasaman	West Sumatra
	n = 18	n = 21	n = 29	n = 68
Lack of extension services	72		86	56
Lack of knowledge on agronomic practices	39	71	28	44
Low quality of seedling	67	52	17	41
Pest and disease attack	72	19	41	43
Price instability	50	62	14	38
Lack of capital	56	24	41	40
Lack of pruning		71	38	38
Low production	28	71	7	32
Low price of cacao beans	17	57		22
Low quality of cacao beans	33	33	7	22
Small landholding		71		22
There is no farmer association	61			16
Unavailability of soft loans	61			16
Less attention to annual crops compare to food crops		57		18
Lack of regional supporting policy		57		18
Lack of processing equipment		57		18
There is no supplier for good quality seedlings	56			15
Difficult procedures to get credit	56			15
No collateral	56			15
Research findings are not disseminated well		52		16
Marketing system: long marketing channel	50			13
No price and quality standards for cacao beans		29	21	18
Lack of stakeholder synergies		48		15
Lack of cooperation between farmers and bank or village cooperative			41	18
Lack of fertilizer availability			41	18
No local financial institution		38		12
Low quality of extension officers		33		10
Low quantity of extension officers		33		10
Lack of facilities for extension services		33	0	10
Lack of fertilizer use		0	31	13
High production cost particularly fertilizer		0	31	13
No price differentiation between fermented and non-fermented cacao beans		29		9
Low bargaining power		29		9
Cannot afford to buy good seedlings		24		7
Low budget for development of plantation from the government			21	9
High labour cost			14	6

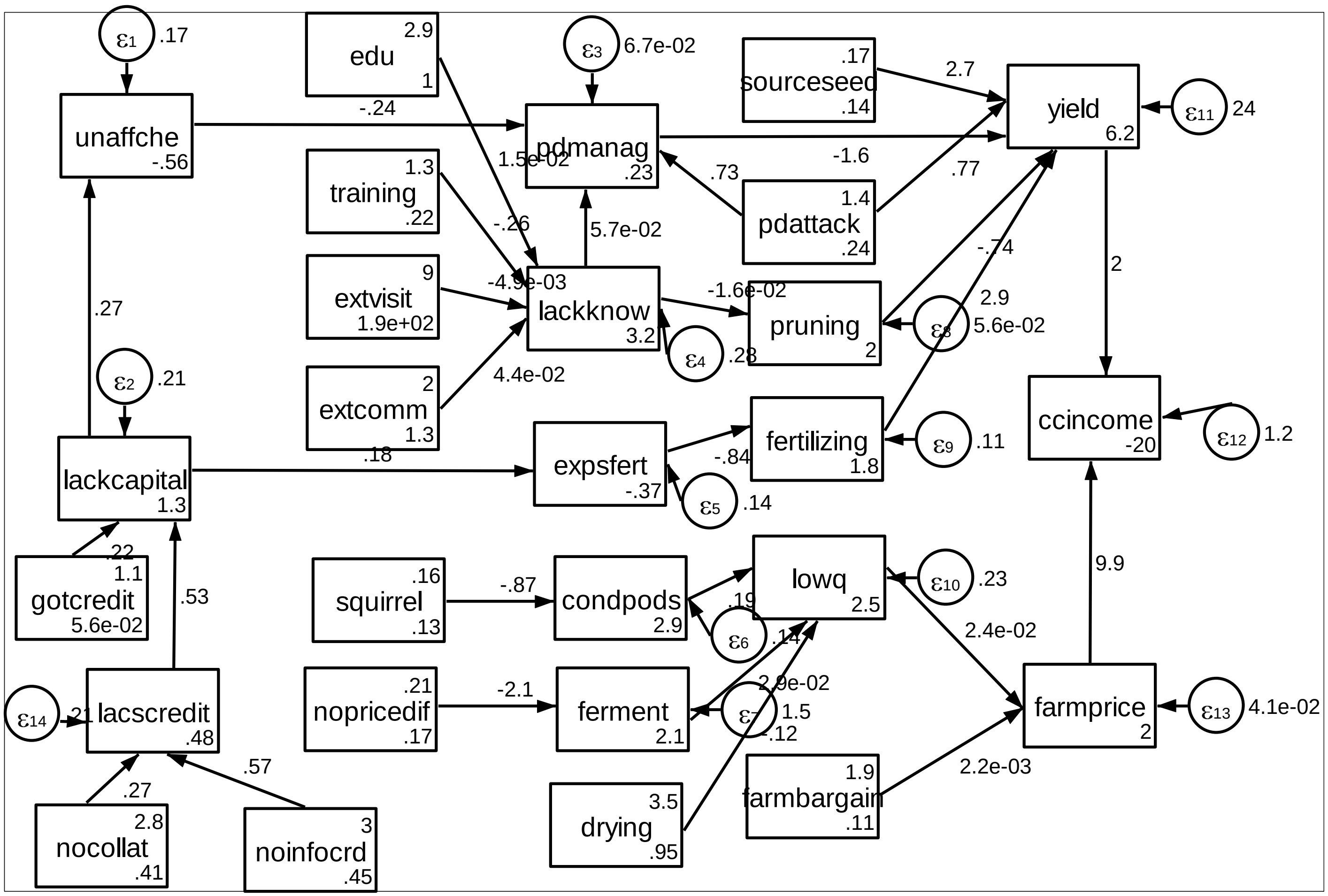
Appendix 4.4. Problem Tree ofthe Cacao Industry



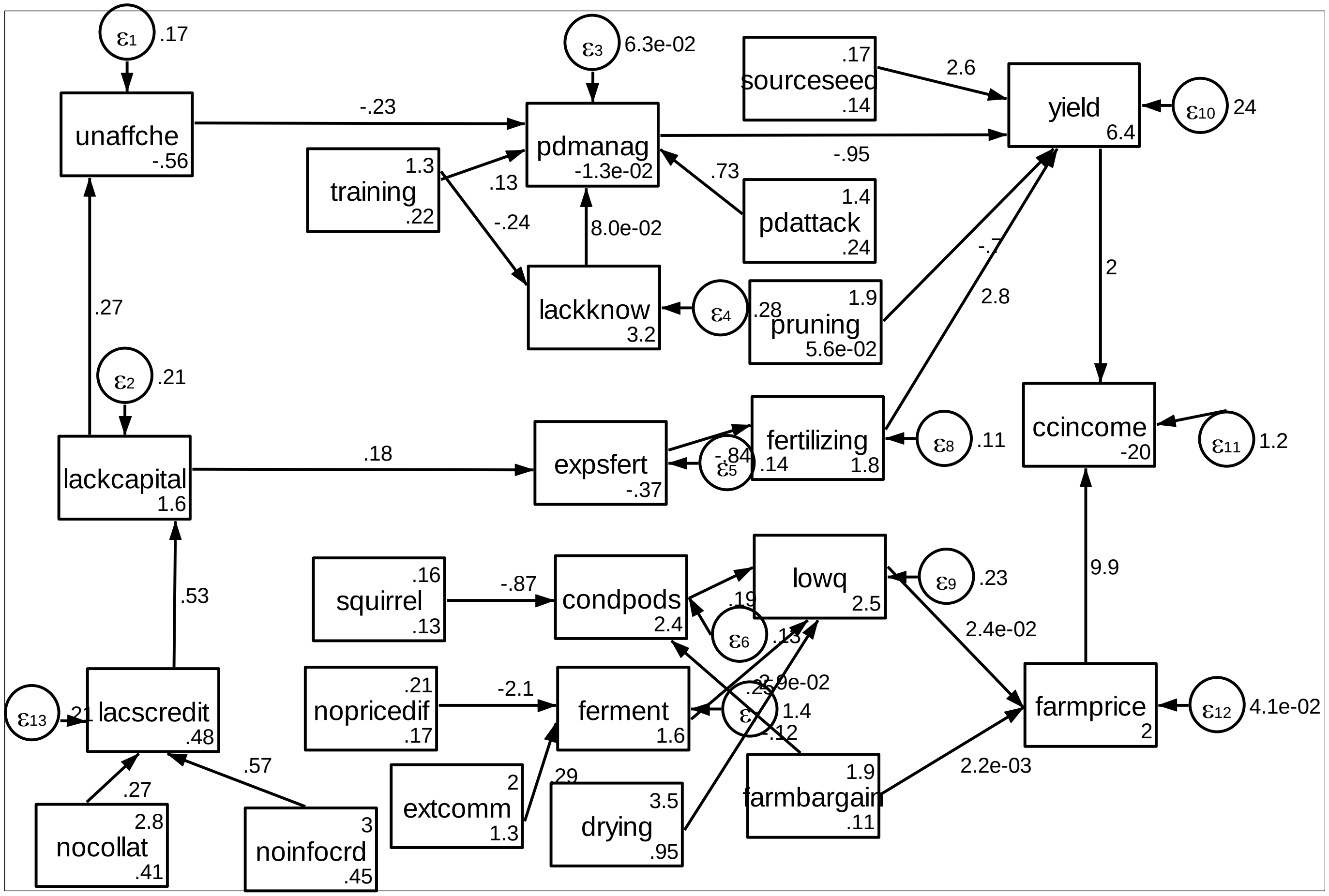
Appendix 6.1. Test for Multicollinearity of Base Model for Cacao Production

Endogenous variable	Exogenous variable	VIF
unaffche	*lackcapital*	1.00
pdmanage	*unaffche*	1.12
	lackknow	1.00
	pdattack	1.12
lackcapital	*lacscredit*	1.01
	gotcredit	1.01
expsfert	*lackcapital*	1.00
farmprice	*lowq*	1.01
	farmbargain	1.01
lackknow	*edu*	1.09
	training	1.17
	extvisit	1.22
	extcomm	1.31
condpods	*squirrel*	1.00
ferment	*nopricedif*	1.00
pruning	*lackknow*	1.00
yield	*pdmanag*	3.14
	pdattack	3.00
	fertilizing	1.12
	sourceseed	1.03
	pruning	1.08
fertilizing	*expsfert*	1.00
lowq	*condpods*	1.05
	ferment	1.02
	drying	1.04
ccincome	*farmprice*	1.11
	yield	1.11
lacscredit	*nocollat*	1.73
	noinfocrd	1.73

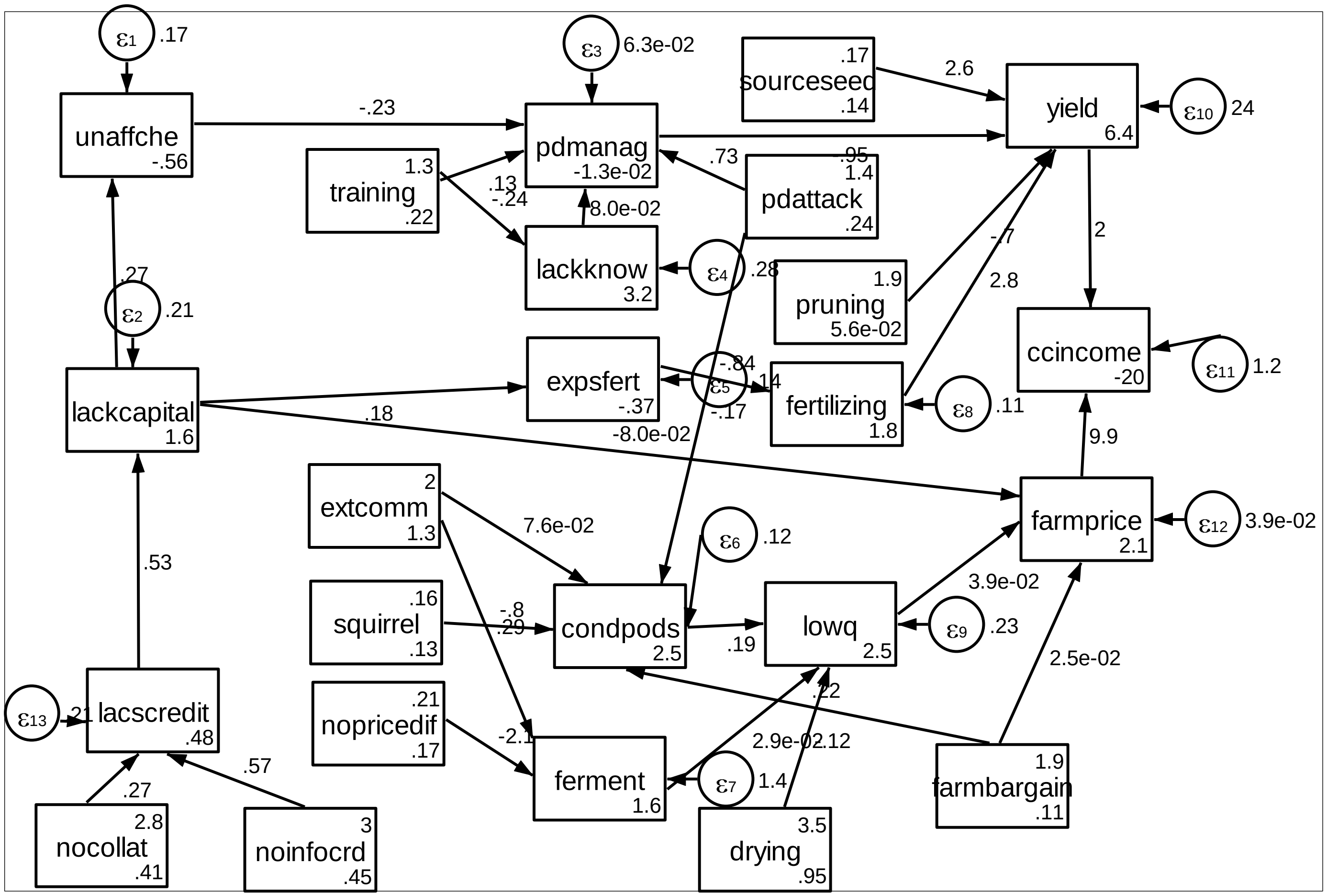
Appendix 6.2.The Base Model for Cacao Production



Appendix 6.3. Model 1 for Cacao Production



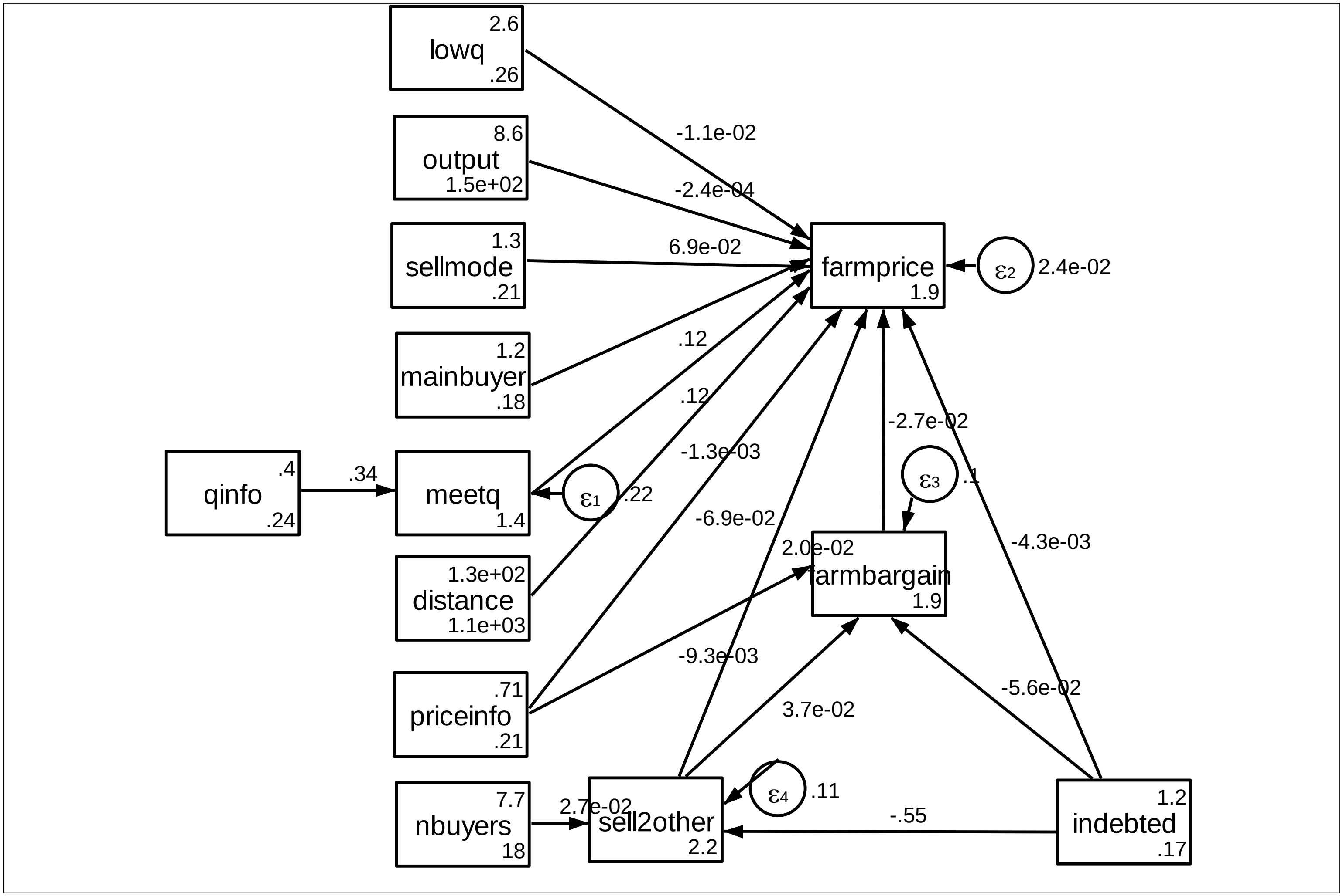
Appendix 6.4. Model 2 for Cacao Production



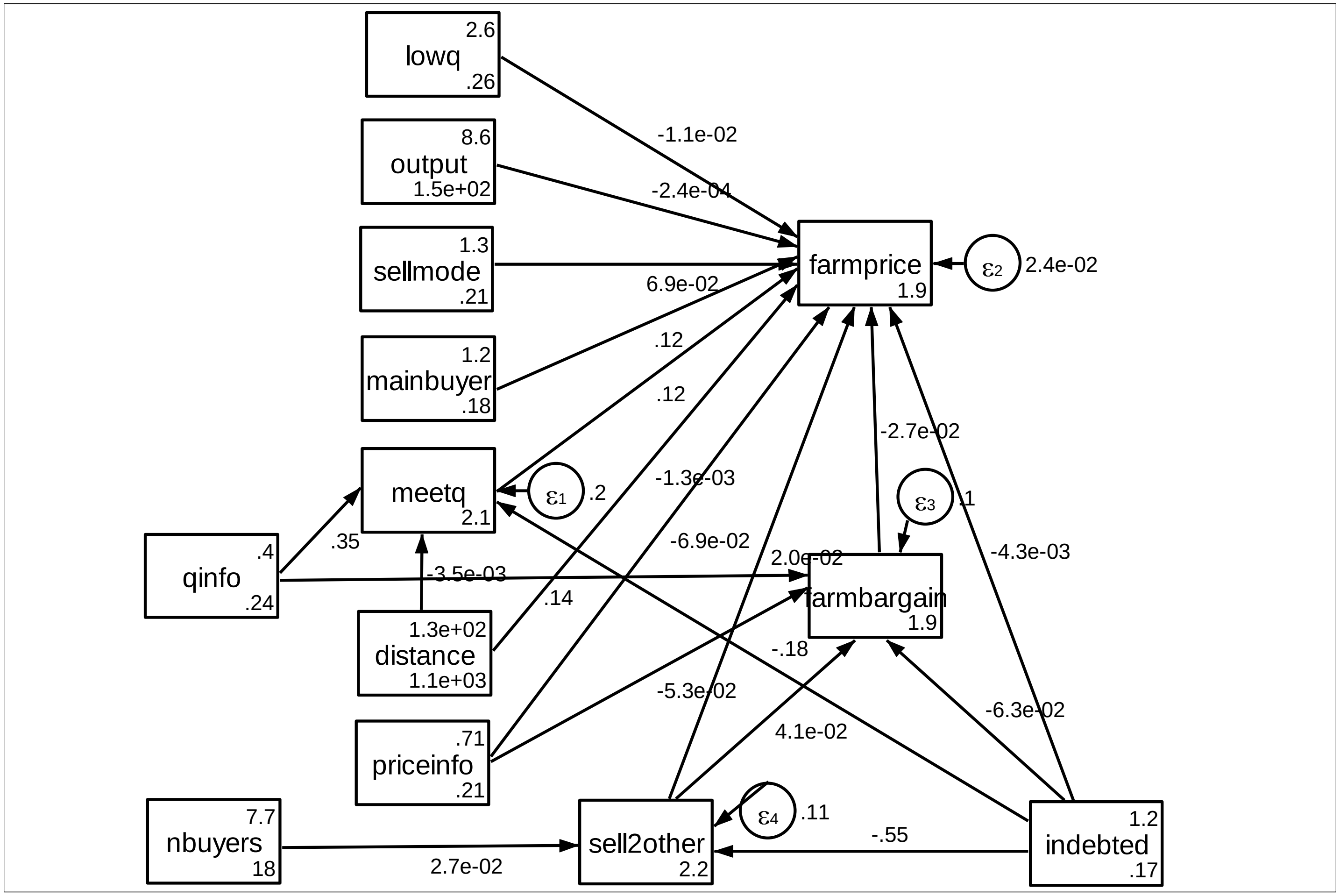
Appendix 7.1. Test for Multicollinearity of Base Model for Cacao Marketing from the Farmers' Perspective

Endogenous variable	Exogenous variable	VIF
farmprice	*meetq*	1.31
	farmbargain	1.03
	sell2other	1.65
	mainbuyer	2.37
	output	1.18
	lowq	1.12
	priceinfo	1.25
	distance	1.25
	sellmode	1.99
	indebted	1.61
meetq	*qinfo*	1.00
farmbargain	*sell2other*	1.48
	priceinfo	1.04
	indebted	1.50
sell2other	*nbuyers*	1.01
	indebted	1.01

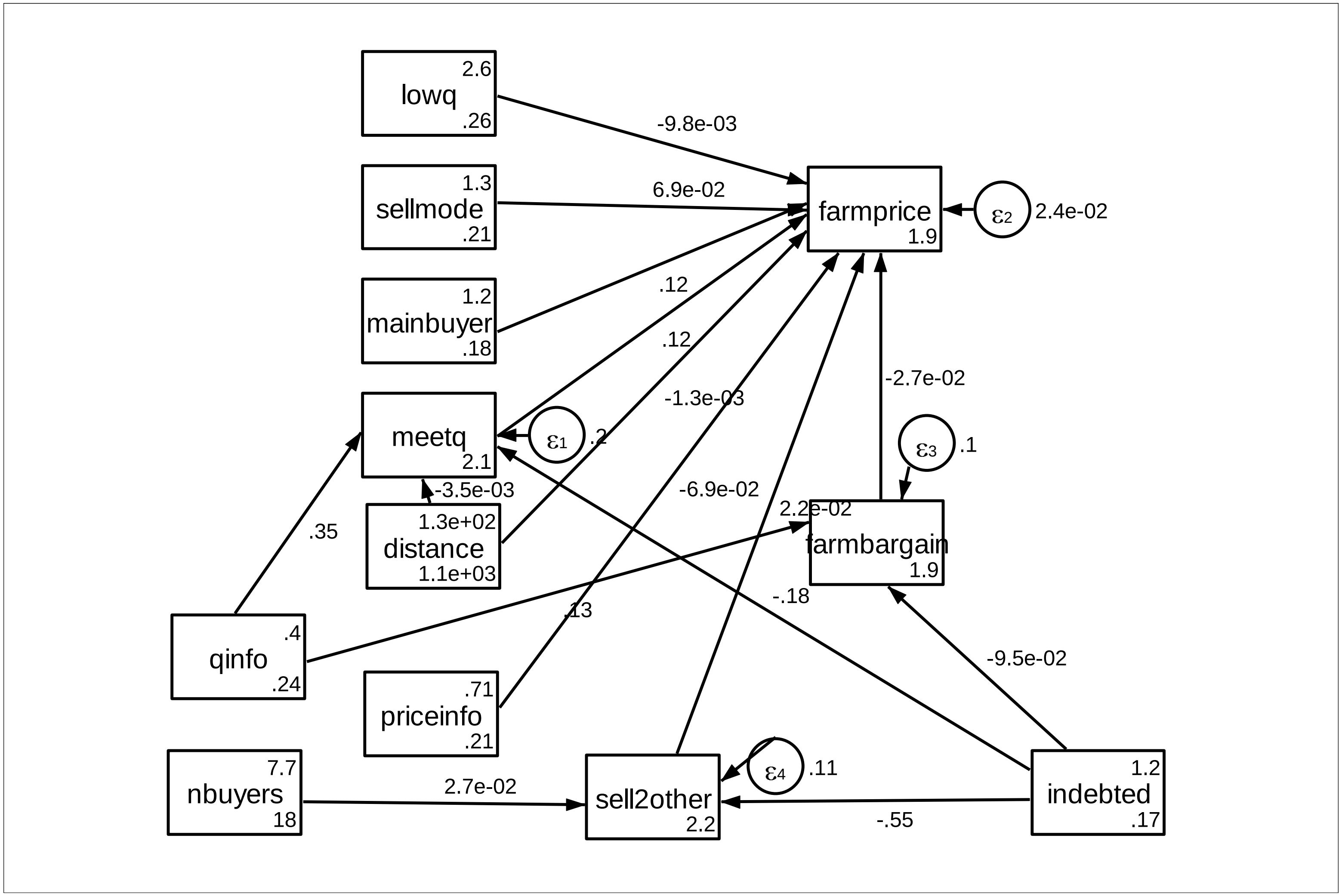
Appendix 7.2.The Base Model for Cacao Marketing from the Farmers' Perspective



Appendix 7.3. Model 1 for Cacao Marketing from the Farmers' Perspective



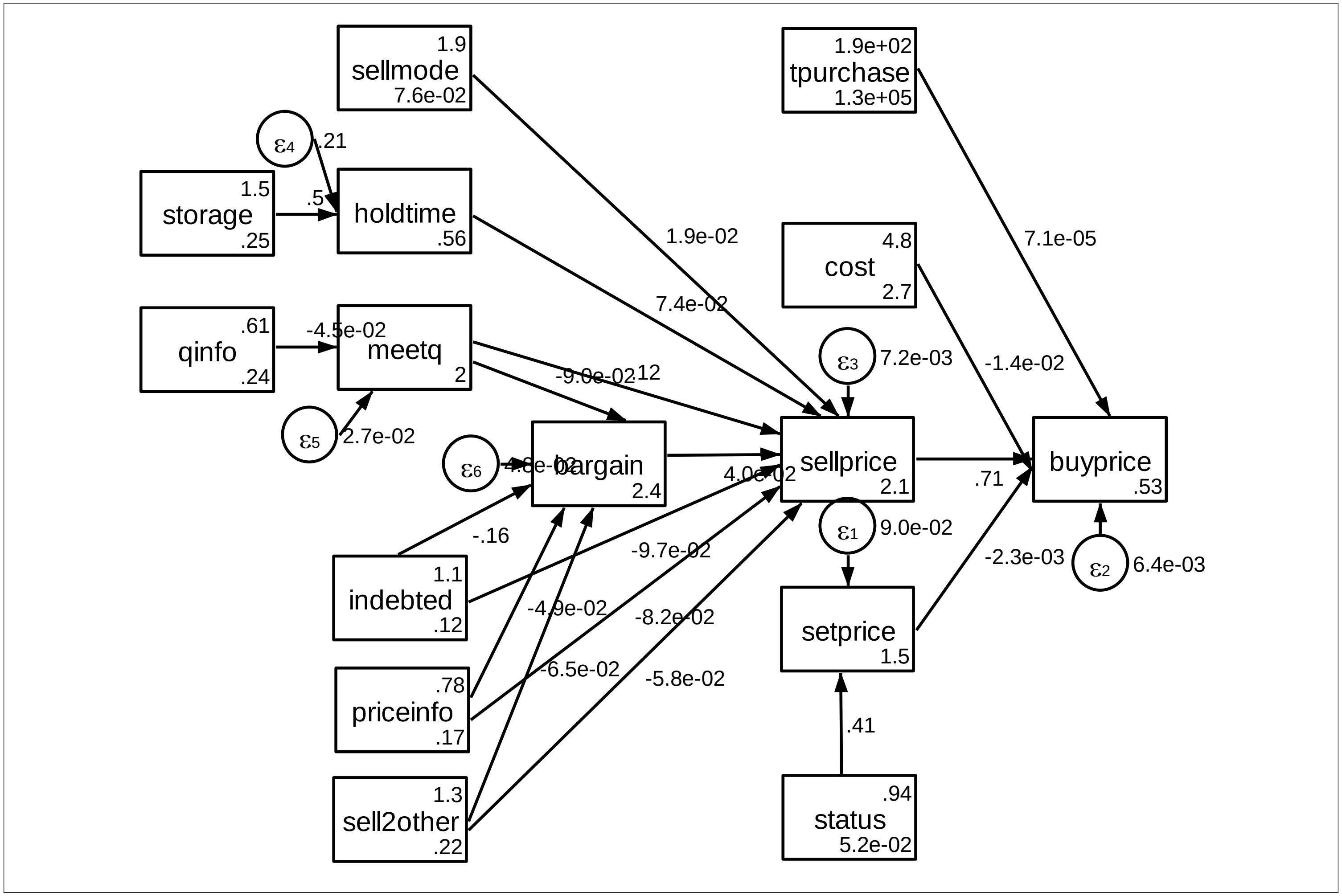
Appendix 7.4. Model 2 for Cacao Marketing from the Farmers' Perspective



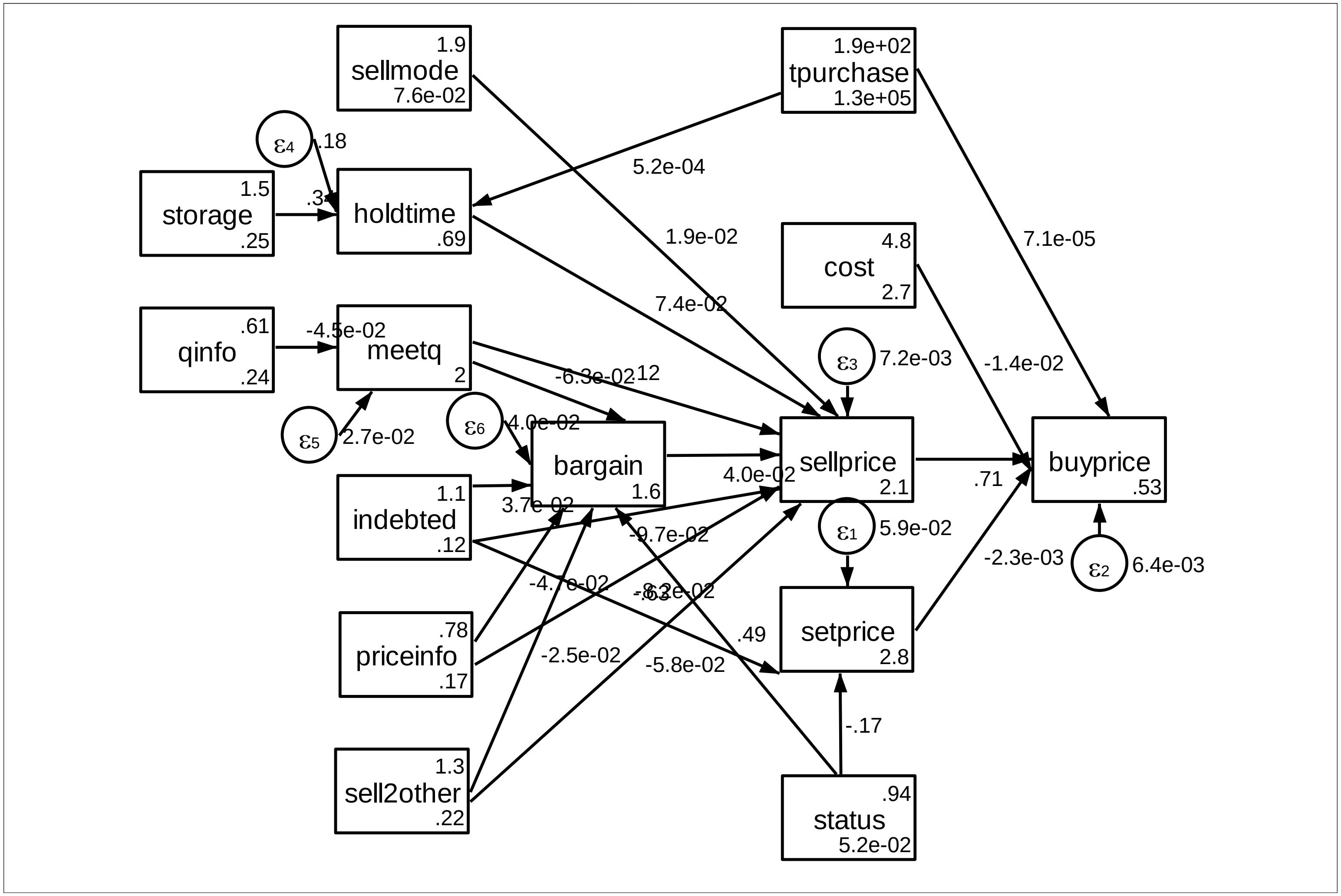
Appendix 7.5. Test for Multicollinearity of Base Model for Cacao Marketing from the Buyers' Perspective

Endogenous variable	Exogenous variable	VIF
buyprice	*setprice*	1.17
	sellprice	1.58
	tpurchase	1.57
	cost	1.16
setprice	*status*	1.00
sellprice	*holdtime*	1.14
	bargain	1.32
	meetq	1.09
	sellmode	1.29
	priceinfo	1.09
	indebted	1.19
	sell2other	1.21
holdtime	*storage*	1.00

Appendix 7.6. The Base Model for Cacao Marketing from the Buyers' Perspective



Appendix 7.7. Model 1 for Cacao Marketing from the Buyers' Perspective



Appendix 7.8. Model 2 for Cacao Marketing from the Buyers' Perspective