Barriers to upgrading of cocoa production at the farm level in Southeast Sulawesi

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MASTER’S THESIS:

Barriers to Upgrading of Cocoa production at the farm level in Southeast Sulawesi

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ABSTRACT

The Indonesian cocoa sector has expanded vividly in recent years, but the recent boom in the incidence of cocoa pests and diseases on the island of Sulawesi has resulted in a crisis in the cocoa production at the farm level. The cocoa farmers are experiencing lower yields and deteriorating cocoa quality, which also increases the costs associated with processing and import of raw beans for the domestic cocoa grinding and chocolate industry.

This study involves an exploration of the factors that influence the cocoa farmers’ ability and willingness to adopt recommended farming and post-harvest practices in order to overcome the challenges at the farm level and upgrade their cocoa production in line with the market opportunities in the cocoa sector. This study identifies the barriers for upgrading the cocoa production at the farm level in Konawe district in Southeast Sulawesi through a combined qualitative study of the local market chain and the cocoa farmers’ farming and post-harvest strategies.

The analysis shows that the farmers are unable or unwilling to upgrade their cocoa production due to a wide spectrum of imperfections in the local market and supply chain, combined with the farmers’ limited personal capacity. The analysis emphasizes the importance of improving the transmission of market incentives and knowledge of less demanding farming techniques to the farmers.
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ABBREVIATIONS

ACRI: American Cocoa Research Institute
ASKINDO: Asosiasi Kakao Indonesia (Indonesian Cocoa Association)
CPB: Cocoa pod borer
FAQ: Fair Average Quality
FoB: Free on board
ICCRI: Indonesian Coffee and Cocoa Research Institute
PRIMA: Pest Reduction and Integrated Management
PsPSP: Panan Sering, Pemangkasan, Sanitasi, Pemupukan (Frequent harvest, pruning, sanitation, fertilizer)
VSD: Vascular Streak Dieback
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1. INTRODUCTION

Indonesia is currently the third largest producer of cocoa in the world next to Cote d’Ivoire and Ghana (Nielsen et. al 2013). Cocoa is predominantly produced on the island of Sulawesi, where more than 90% of the cocoa is produced by smallholder farmers (Lambert et al. 2004). In comparison to other cocoa producing countries, Indonesian cocoa farmers have been distinguished for their high yields, which have been pushed up by comparative and competitive advantages such as abundant rainfall, low input costs and a fairly efficient rural infrastructure (Ruf 2007; Badcock et. al 2007). However, in the late 1990s pests and diseases began to infest the cocoa fields in Sulawesi, which resulted in a crisis in the cocoa productivity and quality that is still evident today (McMahon et al. 2009; Ruf and Yoddang 2001).

Recent research has indicated that the cocoa productivity, quality and consistency has been deteriorating in Sulawesi due to a combination of factors, such as the infestation by pests and diseases, declining soil fertility, low quality planting material and insufficient post-harvest handling (Ruf 2007; Nielsen 2007). The most devastating pest, the cocoa pod borer (CPB), is responsible for losses in production of up to 40-80%, depending on what farmers do with the infested beans (Perdew 2009). Simultaneously, the CPB hampers the development of the cocoa pod, which results in underdeveloped, flat and clumped beans of a lower quality and consistency (Nielsen 2007; McMahon et al. 2009). These challenges are problematic for the Sulawesi cocoa sector. Cocoa from Sulawesi is sold for a discount price on the world market due its poor reputation that stems from the low quality and inconsistency of the beans (Nielsen 2007). Also, inconsistent and low quality beans are being traded along the Sulawesi cocoa market chain, even though they are claimed to be close to unusable by the domestic cocoa grinders (Intv. Engbers1; Nielsen 2007).

On the one hand, the cocoa industry and smallholder farmers face several challenges associated with the deteriorating cocoa quality, consistency and yields, which also affect the livelihood of the farmers negatively2. On the other hand, recent positive development on the world cocoa market and in the Sulawesi cocoa sector holds promises for a vivid future for cocoa production in Sulawesi.

In 2010, an export tax on unprocessed cocoa beans was imposed by the government of Indonesia to support and promote domestic processing of cocoa beans (Perez 2012). The

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1 An overview of the interviews is provided in the Interview references list
2 Martini et al. 2012 found that in Konawe district, the fieldwork area, 60% of the population can be categorized as poor
government’s effort to boost the Sulawesi cocoa sector is part of the national strategy to become an advanced economy by 2025, which will include a shift from export of raw materials to domestic manufacturing and processing (MP3EI 2012; Tijaja 2013). Meanwhile, the global demand for cocoa is driven upwards by a growing middle-class in countries such as India and China.

In response to the recent export tax and the global market trends, international and domestic cocoa processors and chocolate manufacturers are establishing cocoa grinding factories in Indonesia. Recent investors include an array of domestic, Asian and international manufacturers, including Mars Inc., Barry Callebaut and Cargill (Antara News 2013; AgroAsia 2011). The recent development of the cocoa sector has changed the market demands and opportunities on the island. First, cocoa traders and grinders strengthen their presence on the Sulawesi cocoa market to ensure a high supply of cocoa beans (Intv. Engbers). Second, the expansion of the domestic cocoa grinding industry has increased the demand for cocoa of a higher quality and consistency (Panlibutan and Meyer 2004; Ruf 2009). In recent years, the domestic grinders have put forward complaints about the poor quality and consistency of the beans from Sulawesi, which results in increased costs at the processing level associated with grading (Nielsen 2007; Intv. Engbers). Currently, the grinding industry is pushed to import beans of higher quality and consistency from Ghana, Cote d’Ivoire and Papua (Badcock 2007; Intv. Engbers). Third, compliance of ethical and environmental standards is being requested by chocolate consumers worldwide, which has inspired several of the major chocolate manufacturers to establish certification programs for cocoa farmers in targeted areas of Sulawesi, including Mars Inc. and Cadbury (Nielsen et al. 2013). The interest in certification by the private sector and governmental stakeholders is promising, but cocoa certified by Rainforest Alliance or Utz is a new phenomenon in Sulawesi and is only involving a minority of the farmers at the present stage.

The recent development in the Sulawesi cocoa sector provides a space for rural development and increased economic gains for both the cocoa industry and the cocoa smallholders. From the perspective of the cocoa industry, future sustainability will depend on the farmers’ ability and willingness to adopt improved farming and post-harvest practices in order to increase the productivity and ensure the compliance of quality, consistency and, in targeted areas, certification standards at the farm level. From the cocoa farmers’ perspective, the current development in the cocoa sector can be understood as renewed market opportunities. The poverty of the cocoa smallholders emphasizes the need to increase the farmers’ market performance and share in order to add value to their production, which can be achieved

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3 Called the Master Plan of Acceleration and Expansion of Indonesian Economic Development (MP3EI)
through appropriate upgrading of their production in line with the market opportunities at hand. Adoption of improved farming and post-harvest practices can lead to increased farm profits through higher yields or value added through price premiums (Laven and Boomsma 2012; Lundy et al. 2004; Panlibutan and Meyer 2004). In order to achieve this, it is paramount that farmers adopt improved practices to address the current challenges faced at the farm level.

In order to facilitate sustainable development in the cocoa sector and to promote poverty alleviation among cocoa farmers in Sulawesi, it is paramount to understand what factors that hamper or discourage farmers from improving their production and act on the current market opportunities. Also, in response to the challenges faced by the farmers in Sulawesi, research institutions and private stakeholders have developed a set of best-known cocoa practices to combat the specific causes to the recent bust in the cocoa production in Sulawesi. In this context, it is crucial to explore and understand the factors that influence farmers’ ability and willingness to adopt these recommended practices.

Research has shown that upgrading at the farm level relies on several enabling and encouraging conditions in the market and input chain (Lundy et al. 2004; Laven 2010). Several researchers have argued that farmers worldwide may face difficulties to adopt improved practices and increase their market capacity due to imperfections in the market and input chain, such as limited access to inputs, investment capital, production and market information, new technologies, standard specifications and, not least, market opportunities (Roshetko and Yuliyanti 2002; Bijman and Meijerink 2007; van der Meer 2006; Campbell 2008). This insight accentuates the importance of looking at how the smallholders’ ability and willingness to upgrade is affected by factors in the market environment in which they are embedded.

Existing research on the Indonesian cocoa sector is indicating that the low cocoa quality and consistency is partly caused by market imperfections (Nielson 2007; Panlibutan and Meyer 2004; Ruf and Yoddang 1998; Ruf 2007). However, little attention has been paid to how the market forces in Indonesia actually affect the cocoa farmers’ management at the farm level. Therefore, there is an urgent need to understand how eventual imperfections in the local market and input chain affect the farmers’ production strategies and add to the deteriorating quality, consistency and yields at the farm level.

A farmer’s willingness and ability to adopt an innovation is a balancing between what positive factors and incentives a farmer is facing and, on the other hand, what investments and opportunity costs it will involve adopting an innovation (Roshetko and Yiyanti 2002; Ostrom
Farmers’ ability and willingness to adopt improved practices can be positively influenced by economic incentives and support services, but may as well be jeopardized by external and internal disincentives that make it impossible, less profitable or demanding for farmers’ to adopt improved practices. This accentuates that, in order to understand what factors that directly affect the farmers’ willingness to adopt specific practices, we must understand the farmers’ strategies and, not least, the decisions they are based on. To explore strategies and contextual behavior calls for a qualitative study that can encompass the subjective reasoning and attitudes behind the farmers strategies and, simultaneously, explore how farmers are affected by the market context.

Through an identification of the factors that affect the farmers’ farming and post-harvest strategies this study arrives at an understanding of the disincentives and barriers for improving cocoa production at the farm level in Konawe district in the Southeastern corner of Sulawesi. In comparison to other areas in Sulawesi, the cocoa smallholders in Konawe district have been paid less attention by the private sector and researchers up to now.

There is a gap in our understanding of what factors that affect farmers’ choices in relation to adoption of improved farming practices (Adesina and Bidu-Forson 1995; Aragão Pereira 2011). Previous research on what factors that affect farmers’ adoption of agricultural practices has mainly been based on deductive research logic and based on numerical evidence. Further, many studies on the influence of market and supply chains on farmers’ management tend to take departure in the structure and components of the market rather than the farmers’ decisions, thereby assuming that certain market structures affect farmers’ management choices. These studies tell us much about what factors and external challenges we can expect is associated with farmers’ farm management, but they don’t provide us a qualitatively insight into what factors that affect farmers real life choices. Scant attention has been paid to the farmers’ own strategies and, not least, the influence of local market structures (Laven 2010; Roshetko et. al 2012). This study adds a qualitative component to the existing literature on what factors that affect farmers’ adoption of improved practices.

In this report upgrading of cocoa production refers to the adoption of improved farming and post-harvest practices in order to increase the cocoa yields and to comply with quality and consistency standards, which is expected to increase the farmers’ profit. These forms of upgrading consider the current market opportunities and demands in Konawe district, Southeastern Sulawesi, where this study was carried out. There are currently no certification schemes in Konawe district. This study does, on a limited scale, explore the challenges involved in introducing certification, since it is looking at the adoption of alternative farming
and pest/disease management practices, which are promoted in the certification programs. This report doesn't look at the environmental, ethical, health or social aspects of certification.
2. RESEARCH OBJECTIVE

The objective of this study is to uncover the factors that influence cocoa farmers’ ability and willingness to upgrade their cocoa production. This study seeks to identify the barriers and disincentives for upgrading cocoa production at the farm level in Konawe district, Southeast Sulawesi.

2.1 Research questions

1) What are the cocoa farmers’ farming and post-harvest strategies?
2) What factors affect the farmers’ ability and willingness to adopt the best-known cocoa farming and post-harvest practices?
3) How do local market and input chain conditions affect the cocoa farmers’ strategies?
4) How do personal factors affect farmers’ ability and willingness to act on existing market incentives for upgrading?
3. LITERATURE REVIEW

3.1 Defining the process of upgrading

Agriculture is increasingly viewed as an `engine for economic growth` in the developing world (World Bank 2007). In many developing countries the agricultural sector is dominated by small-scale producers and, therefore, the role of smallholders in economic development and poverty reduction is crucial (UNIDO 2009).

In order for small-scale agricultural producers to stabilize or improve their production they must sustain their competitiveness, which is closely related to the processes of upgrading and innovation (Lundy et al. 2004; Campbell 2008). Upgrading can be understood as a way for small-scale producers to increase their market performance and competitiveness and, not least, add value to their production. Kaplensky and Morris (2001) distinguish between the process of innovation and upgrading. Basically, innovation is to adopt improved practices, whereas for an innovation to be defined as upgrading it must result in added value.

Depending on the sector in which a small-scale producer operates, upgrading may involve more efficient and increased production, production of pioneer or specialty products, value addition through compliance of quality and consistency standards, empowerment through economies of scale, or improving the position in a value chain (Campbell 2008; Laven 2010; Lundy et al. 2004). To comply with quality and volume standards is paramount for smallholders to sustain their market performance and, thus, to increase their benefit and living standards (Lundy et al. 2004; Campbell 2008). In addition, in the cocoa sector upgrading increasingly involves improvements of not only the material product, but also the process of production, which is the case with certified, organic or fair trade products that must comply with specific ethical or environmental standards (Laven 2010; ICCO 2009).

As Kaplensky and Morris (2001) argue, upgrading doesn’t necessarily result in increased benefits, as the input and output prices fluctuate. This is the case with `immiserising growth`, where an increase in production can’t make up for a drop in prices, which may stem from supply-demand dynamics on the national or global market, or from currency devaluations. That said, through innovation agricultural producers raise their changes for obtaining a higher market share and an `entrepreneurial surplus` (Kaplensky and Morris 2001). In order to avoid unprofitable innovation, farmers must adjust their production to the dominant market trends and possibilities at hand (Lundy et al. 2004).
3.2 Factors that influence farmers’ choices

3.2.1 The individual choice

Ostrom (1990) has developed a model that explains the individual choice, or strategy. The model is illustrated in figure 1. This model can be useful to understand the process and the influential factors of individual choices or, in this context, the farmers’ willingness to adopt specific practices. Two arenas interact in the model: first, the internal world of the decision-maker and, second, an external world that affect the variables in the internal world. In this model four internal variables affect the individual choice, respectively the perceived expected benefits and expected costs of an action, and the decision-makers internal norms and discount rates. The argument is that individuals choose in accordance to their expectations concerning the costs and benefits involved in an action. In other words, peoples’ perceptions of the negative or positive attributes of particular innovations affect their willingness to adopt an innovation. This emphasizes the need to look at the farmers’ choices to understand why they adopt or refuse to adopt specific farming practices. This has also been emphasized by Aragão Pereira, who argues that “beliefs, attitudes and perceptions [...] inform farmers intention towards a particular behavior” (2011:61).

In Ostrom’s model the individual weighs up and understand the expected costs and benefits that will be involved in undertaking an action in accordance to his/her internal norms, which may be confined by external norms of social behavior. The distinction between the internal and external world emphasizes that the individual choice is subjective, albeit affected by factors in the external world. Internal norms are continuously mediated by social norms. The degree of social or intersubjective influence on the individual’s internal norms will depend on the character of the society and the action. Other researchers have stated that choices are context sensitive in that they are the outcomes of a particular individual or group that hold particular opinions in a particular context (Aragão Pereira 2011; Rogers 2003). Therefore, choices and behavior must be understood in a context (Chi and Yamada 2002; Taher 1996). Innovation evolves in a social context, where values, traditions, shared norms on behavior, knowledge, information, technologies and inputs are transmitted in-between farmers and, between the farmers and other actors (Ostrom 1990; Rogers 2003).

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Despite the rationality of the choice suggested in this model, choices are not always informed. Ostrom states that individuals may as well decide on a strategy that is based upon the individual’s limited knowledge of the expected costs and benefits involved in undertaking an action.
Further, in Ostrom’s model the individual operates with discount rates with which she/he assesses the action and the expected returns of the action. In short, the discount rate can be understood as the value an individual places on a possible action and its expected returns over time, which is heavily affected by external factors related to the particular situation and what alternative opportunities the individual is facing.

Figure 1. The internal world of the individual choice (Ostrom 1990:37).

Not least, according to Ostrom’s model, the expected costs and benefits involved in an action are affected by changing factors in the external world. Thus, factors in the external world will affect peoples’ willingness to make specific choices, for example to adopt an innovation. This is of particular relevance for this study. Several types of research have shown how different factors in the “external world” affect farmers’ adoption of agricultural innovations. These factors include:

- **Discount rate**: The inclusion of the concept discount rate adds a time horizon to the model. In short, the value of an innovation is (normally) decreasing over time; immediate value is prioritized higher than value added in some distant future. Hence, discount rates may, for example, be applied to future benefits.

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5 The inclusion of the concept discount rate adds a time horizon to the model. In short, the value of an innovation is (normally) decreasing over time; immediate value is prioritized higher than value added in some distant future. Hence, discount rates may, for example, be applied to future benefits.
factors may be associated with the character of the innovation itself, the personal capacity of the farmer or the characteristics of farmer’s farm, or may as well originate from the market and supply circumstances the farmer operates in\textsuperscript{6}. These are explained in detail below and have been summarized in appendix A. Several conflicting factors may affect farmers’ choices simultaneously, where some factors add to the perceived expected benefits and other factors add to the expected costs.

3.2.2 The characteristics of the innovation

In line with Ostrom’s model, Rogers (2003) argues that the adoption of an innovation is related to the perceived attributes and value of an innovation. In her review of studies on farmers’ adoption of improved farming practices, Rogers summarizes some general characteristics of an innovation that affect farmers’ perception of an innovation, which affect the farmers’ willingness to adopt or reject the innovation (2003;222). These general characteristics of an innovation are:

1. The \textit{relative advantage} of an innovation accounts for the perceived benefits of the innovation in comparison to the opportunity costs and relative riskiness of the innovation\textsuperscript{7}. Benefits and opportunity costs can be economic, social and the like.
2. The \textit{compatibility} of an innovation refers to the degree to which the innovation is consistent with the social and personal values, the experience, and the livelihood needs of the potential adopter.
3. \textit{Complexity} refers to the complexity of the innovation i.e. the complexity of the management techniques involved.
4. The \textit{trialability} of an innovation refers to the degree to which an innovation can be experimented with by the potential adopter.
5. The \textit{observability} refers to the degree the benefits and costs of an innovation are observable – visual - to the potential adopter and others.

Also, Taher (1996) and Chi and Yamada (2002) found that farmers’ trust in the efficiency of a technology was crucial for farmers’ decisions to adopt or reject new farming practices.

\textsuperscript{6} Kaplensky and Morris (2001) distinguish between ‘blockers and enablers’ of upgrading that are endogenous to the firm and those that are transmitted through other chain actors

\textsuperscript{7} Opportunity cost can be understood as the value lost or costs involved to adopt an innovation in comparison to the practice it supersedes
3.2.3 The farmer’s personal capacity and the farm characteristics

Several studies on the determinants of farmers’ adoption of cocoa innovations have shown that farmers’ adoption rates are linked to their personal capacity and the characteristics of their farms. Most of these studies have applied a deductive research approach and been based on numerical evidence primarily. These studies have examined if a selection of factors are associated with the farmers’ adoption of certain farming practices. Patricia and Ordóñez (2011) showed that availability of family labor and additional income influenced Ecuadorian farmers’ adoption of cocoa rehabilitation techniques. Baffoe-Asare et al. (2013) found that age, household size and social capital is associated with cocoa farmers’ adoption of pest and disease management practices in Ghana. Othman (1990) found that the availability of land, labor and investment capital had a significant impact on farmers cocoa production in Malaysia. Olujide and Adeogun (2006) and Boahene et al (1999) found a relationship between farmers’ educational status and their adoption rates of improved farming practices.

3.2.4 Market and input chain factors

Several factors in the market and input chain will affect the benefits and costs involved in adopting an innovation. Rogers (2003) emphasizes the importance of external incentives to encourage farmers to adopt improved practices. To adopt improved farming or post-harvest practices will involve an investment of money, time or labor, and farmers will request an incentive to undertake upgrading activities that require such investments (Roshetko et. al 2002). From a farmer’s perspective, the decision to adopt an innovation is a balancing between external incentives or markets stimulants that encourage adoption and the personal investment it will involve to act on the incentive. For example, a price premium for adequately dried cocoa beans is an incentive to dry the beans longer, but this will involve opportunity costs in the form of time and work.

Campbell (2008) argues that firms upgrade as a response to positive or negative incentives in the market chain that enable, encourage or push firms to upgrade. Incentives can be positive like price premiums, credit access, governmental services or input subsidies, but may also involve disadvantages for smallholders in the form of enforced standard regulation and price reductions (Lundy et al. 2012).

Research has shown that farmers act on price fluctuations by changing the intensity of their farm management (Laven 2012). In a study of cocoa farmers’ adoption behavior in Ghana, Opare (1980) found that correct knowledge of fermentation practices didn’t lead to adoption of the recommended practices, since the price offered by the buyers didn’t provide the
farmers with an incentive to invest the work required to improve the fermentation process. Ponte (2008) argues that in liberal markets the private sector can provide economic incentives for quality compliance in substitute of regulation by the government. Higher prices may be offered for differentiated cocoa beans of a higher quality or consistency, or farmers may receive a price premium if they comply with certification standards (Jano 2007; Laven 2010). This stress the importance of price signals to encourage farmers to adopt improved practices. That said, Kaplensky and Morris (2001) argue that market forces alone can be sub-optimal in enabling and encouraging small-scale producers to comply with market demands and standards – a process that can be referred to as ‘market failure’.

Some incentives are optional for farmers to act on, such as price premiums for specific types of cocoa, while other incentives are enforced through regulation of the trade in the market chain. Regulation and control procedures can be paramount to ensure compliance of quality and consistency standards among smallholders, especially in the absence of market incentives for differentiated trade (Ponte and Fold 2008). This may involve regulation of the percentage of waste material, the moisture level, the fermentation length, and the homogeneity of the cocoa beans (Ponte and Gibbon 2005; Ponte and Fold 2008; ICCO 2009). Standard compliance among smallholders may be enforced by government bodies and private sector stakeholders through regulation or promoted, not least, by control, grading and payment procedures at the farm-gate or warehouse level by local buyers and the warehouse staff. Buyers may reject to buy or offer price reductions to beans of lower quality or consistency, which either push or encourage farmers to comply with the specific standards. Several researchers have shown that a common pattern has emerged in cocoa sectors in Africa that have undergone liberalization. The removal or loosening of nationally enforced standard regulations and trade differentiation has resulted in deteriorating cocoa quality at the farm level in countries such as Nigeria, Cameroon and Cote d’Ivoire (Ponte and Fold 2008; Laven 2010; Haque 2004; Losch 2002). Ghana – defined as a partly liberalized cocoa sector - is an exception to this tendency, since a state-regulated standardization and grading system assures quality differentiated trade (Laven 2010; Anang 2011). Enforced regulation on quality may have the same effect on standard compliance as price premiums, but from a farmer’s perspective, regulation doesn’t necessarily result in increased profits. In the long run, enforced regulation can put a burden on farmers to comply with standard requirements and, hence, be a disincentive for farmers to keep cultivating cocoa.

In a study of quality incentives in the Ecuadorian cocoa sector, Jano (2007) outlines a combination of factors that impede the farmers in increasing the cocoa productivity and quality. He argues that limited dissemination of technologies and training to farmers, no access to loans, and the relatively high fertilizer prices promote poor farm management
among smallholders and results in a high incidence of diseases. These factors negatively constrain the local farmers in sustaining or improving the high quality of the cocoa beans for which Ecuador is renowned. In her extensive study of Ghana’s cocoa sector Laven (2010) outlines several incentives that promote sustainable cocoa production on a national scale. Improvements in the cocoa production has been promoted by government imposed subsidies on fertilizer and public input packages, which has resulted in increased availability of agricultural inputs and higher quality planting material for farmers. Nonetheless, Laven argues that the input costs are still relatively high, which in combination with inadequate credit facilities makes it difficult for cocoa farmers to invest and prosper.

To carry out the activities involved in upgrading may require investment capital, new technologies, good planting material, or modern agricultural inputs among others. Therefore, the ability of a farmer to undertake the activities involved in upgrading depends on the farmer’s access to various inputs (Roshetko et. al 2002). Specific inputs required to adopt an innovation may be unavailable to farmers, unaffordable, or of low quality, which will hamper the farmer’s ability and willingness to adopt the innovation. Private suppliers, buyers or governmental agencies can enhance farmers’ access to primary inputs through trade and support services. Lundy et al. (2004) argue that there is a major gap in the provision of formal support services to farmers in most developing countries that directly hamper the farmers’ ability to improve and enhance the competitiveness of their enterprises. Also, facilities such as cocoa research stations, seedling nurseries, market information systems, a high number of experienced input suppliers and extension agents, or facilitating farmer groups and associations are likely to provide farmers with a better environment for upgrading. Farmer groups and associations may enhance farmers’ personal capacity and facilitate bulk purchasing of inputs, group saving and lending schemes, training, economies of scale, and collective production and marketing.

Several studies have shown that limited access to credit hamper farmers’ ability to invest in inputs such as fertilizer, pesticides, planting material, and farming and post-harvest equipment (Laven 2010; Jano 2007). Laven (2010) found that cocoa smallholders’ access to formal bank loans is constrained by the absence of savings, collateral, and trust between farmers and formal banks. Farmers have a limited insight into the formal loan procedures and banks show little insight into the precarious conditions and liquidity problems faced by cocoa smallholders. In general, banks require formal collateral in the form of land certificates, which in many developing countries can be expensive and difficult for farmers to obtain. That said, flexible and low-risk alternatives exist, such as group lending schemes and the warehouse receipt system, which is applied in a few cocoa producing countries. Farmers receive a receipt
when they trade and store their cocoa beans in some public or private warehouses, with which they have been able to uptake formal loans.

The existence of different incentives in the market and input chain is often the outcome of a strategic coordination of the market chain and sector. Market stimulants, standard regulation and support are often implemented intentionally by governments or, increasingly, by traders or processors that have an interest in supporting and encouraging farmers to increase their cocoa production and comply with specific quality, consistency and certification standards (Laven 2010; Campbell 2008). The transmission of incentives takes place through the interaction of actors in the input and market chain, who may have conflicting interests (Laven 2010). Regulation and vertical integration may promote consistent standard specifications and market incentives along the market chain, whereas long and unregulated market chains may be dominated by an array of intermediaries with conflicting interests (Laven 2010; Ponte and Fold 2008; Ruf 1998).8

Incentives in the cocoa sector must be understood in comparison with incentives to adopt other crops or livelihood strategies. Other crops may be more profitable or less demanding in terms of inputs and time, which will be an incentive for the farmers to turn their attention towards optimizing the management of the other crops and, thereby, reduce their maintenance of their cocoa fields, which Taher (1996) showed in his study of cocoa farmers’ adoption of farming practices in South Sulawesi. In addition, several studies have indicated that agricultural smallholders are risk averse and not necessarily profit-maximizing, since they have to consider the risks and uncertainties involved in adopting an innovation, such as input and output price fluctuations as well as seasonal cash and labor shortages (Taher 1996).

3.2.5 The prerequisites for adopting an innovation

Rogers (2003) argues that the adoption of an innovation is the outcome of a decision that evolves over several stages. First stage is gaining initial knowledge of the innovation. Awareness, knowledge and experience are prerequisites for successful adoption (David and Asamoah 2011; Rogers 2003). Several conditions in the input and market chain may either hamper or empower farmers’ ability to adopt specific farming and post-harvest practices.

A high degree of awareness of market possibilities, standards and improved farming practices improves the farmers’ capacity to upgrade. First, the farmer must be aware of the potential to

8 Vertical integration refers to a shortening of the steps in the market chain, which can be both upstream and downstream. Upstream vertical integration can be to establish local buying stations with direct contact to the farmers.
upgrade, which relies on that advanced market and production information reaches the farmer. Information on market opportunities, market standards and, not least, the correct procedures to comply with these standards may reach the farmer if informative market linkages are established or through the farmer’s participation in training programs. Laven (2010) states that the recent privatization of the input distribution system in Nigeria has made it possible for inexperienced suppliers to enter the input market and, thus, conflicting information on how to apply inputs is being transmitted to cocoa farmers. In a study of the factors that constrain cocoa smallholders in Ghana from improving the cocoa bean quality Quarmine et al. (2012) found, that the information on quality standards and the practices required to comply with the standards passed on from purchasing agents to farmers was asymmetric or absent, which made farmers evade from recommended practices.

Farmers may acquire knowledge and experience from observing demonstration fields, research stations and fellow farmers, or from participating in training programs. Extension service and training programs vary in quality, approach and content, which will affect the farmers’ experience with specific practices (Roshetko et al. 2012). Boahene et al. (1999) found that cocoa farmers in Ghana with increased access to extension service adopt hybrid cocoa earlier than their fellow farmers due to their insight into the appropriate practices involved in the adoption process.

3.3 The challenges for improving the cocoa production in Sulawesi

Several researchers have examined the challenges for improving the cocoa production in Sulawesi. Ruf and Yoddang (1998; 2001; 2007) have conducted several market-oriented studies of the local market chain and smallholder farmers’ management choices in primarily South Sulawesi. Nielson (2005; 2007; 2013) has in particular studied farmers’ management and adoption of good farming practices in relation to certification programs and private stakeholder projects in the Southern and Western areas of Sulawesi. Panlibutan and Meyer (2004) undertook an analysis of the drawbacks for upgrading in the cocoa value chain, primarily based on interviews with stakeholders in Central and South Sulawesi, and draw less on insight into farm level dynamics. Taher (1996) undertook an extensive quantitative study of the factors that affect cocoa farmers’ adoption of farming and post-harvest practices in South Sulawesi, including their adoption of spraying, fertilizer and fermentation. To sum up, these studies suggest that the productivity and quality of the cocoa production in Sulawesi is declining due to numerous factors, including the poor variety and age of the existing tree stock, the prevalence of pests and diseases, the inadequate adoption of good farming practices, partial fermentation caused by imperfections in the market chain, and poor soil
conditions. These studies will be referred to in the background section and will be discussed in detail in the discussion chapter.
4. BACKGROUND

This chapter will begin with a description of the Indonesian cocoa sector, where the current market demands and supplier failures will be summarized. This will lead to a description of the international and national quality standards for cocoa beans. Finally, this chapter will involve a description of the farming and post-harvest practices involved in upgrading cocoa production at the farm level. This chapter is based on secondary literature and interviews with stakeholders in the Sulawesi cocoa sector.

4.1 The challenges and opportunities in the Sulawesi cocoa sector

Cocoa production appeared throughout Sulawesi in the 1960s and was sparked by migration throughout the archipelago by the ethnic group Bugis (Ruf and Yoddang 2001). Cocoa production was introduced on a wide scale in the 1980s, but did not experience a breakthrough before the 1990s (Ruf and Yoddang 1998). The rapid increase in cocoa production in the 1990s was promoted by the abundant rainfall in the region, high farm-gate prices caused by the competitive and effective marketing system, access to subsidized inputs, a relatively well developed infrastructure and, not least, available forest land (Durand 1995; Akiyama and Nishio 1996; Ruf 1995). The cocoa boom later gained force from a drastic increase in the cocoa prices due to currency devaluations in the late 1990s (Ruf and Yoddang 1999; Nielsen 2007).

In the beginning of the 1990s, prior to the heavy infestation by pests and diseases later in the same decade, this resulted in `unbelievable` high yields compared to other cocoa producing countries worldwide (Ruf 1995). The boom was short-lived, however, and since the late 1990s the yields have decreased drastically. Ruf (2007) measured that yields had decreased from 1500-2000 kg/ha to 900-1200 kg/ha in the alluvial plains and from 1000-1300 kg/ha to less than 600 kg/ha in the hills. This has caused a productivity gap at the farm level, which stems from the prevalence of pests and diseases, declining soil fertility and ageing cocoa trees (Ruf 2007; ACDI/VOCA 2005). Also, the infestation of pests and diseases have resulted in a decrease in the quality of the cocoa beans and an increase in the percentage of waste material included in cocoa batches from Sulawesi.

Up to recently cocoa production in Indonesia was only targeted towards the international market for unfermented bulk cocoa, to which the Indonesian cocoa sector supplies large quantities of fat cocoa beans that are used to produce cocoa butter (Panlibutan and Meyer 2004). The Sulawesi cocoa sector holds a strong position on the bulk cocoa market, but it is not able to produce cocoa beans for the fine-flavor market due to the inferior cocoa varieties.
in Sulawesi (Nielson 2007). Lower quality cocoa beans can be used to produce cocoa butter, whereas higher quality beans is used to produce cocoa liquor, where flavor is significant (Jano 2007).

When the government imposed the export tax on unprocessed cocoa beans in 2010 the demand on the cocoa market changed significantly (Perez 2012; Intv. Turmudzi). Latest, the Kalla Group has announced a major investment in a chocolate factory in Konawe district in Southeast Sulawesi (JakartaGlobe 2013), while both ADM and Cargill are investing in grinding factories in Indonesia (Intv. Turmudzi). The domestic grinders need beans of higher quality and consistency for their chocolate production, which they are mainly importing from West Africa due to the low quality and consistency of the beans produced in Sulawesi (Intv. Engbers; Intv. Turmudzi; Badcock et al. 2007). Cocoa beans produced in Sulawesi have a high percentage of flat, mould, clumped, slaty, small, partially fermented beans and a high percentage of waste material (Nielson 2007; Ruf 2007; Intv. Engbers). Also, the national export standards (SNI) for cocoa are rarely met, but an international market still exist for the lower quality beans (Nielson 2007). The increase in domestic grinders has created a market for fully fermented beans that are needed to produce cocoa liquor, which didn’t exist a few years ago (Intv. Jaxx). In response, the government of Indonesia has recently facilitated meetings to discuss the options for enforcing national regulation of fermentation in the cocoa market chain to address the import of quality beans from West Africa (Intv. Turmudzi; Intv. Soetanto).

The usability and value of cocoa beans for chocolate manufacturers and raw bean grinders depend heavily on the quality and consistency of the raw beans, which is affected by the farming and post-harvest practices at the farm level and conditions along the market chain. Beans of a higher quality and consistency fetch a price premium at the world market, whereas the price is reduced for beans of a lower quality and consistency, which is the case with beans from Sulawesi (Jano 2007; Ponte and Fold 2008; Nielson 2007). This price reduction trickles down in the market chain and affects the farmers’ profit, which in combination with the decreasing yields is leading to a decline in the smallholder farmers’ interest in cocoa production (Nielson 2007; Intv. Engbers). On the other hand, competition between the local buyers in Sulawesi results in higher farm-gate prices in comparison to the prices in regulated and less efficient cocoa markets (Ruf 2007). The farm-gate price in Sulawesi is stated to be around 70-90% of the ‘free on board’ (FoB) export price (Panlibutan and Meyer 2004; Lambert et. al 2004).

Also, it has been estimated that up to 25% of the cocoa production in Sulawesi will need to be certified by 2020 to meet the growing market interest from large scale chocolate
manufacturers and buyers such as Mars Inc., Continaf BV and Nestlé (ACDI/VOCA 2005; Intv. Turmudzi). Certification schemes by Rainforest Alliance and Utz are supporting farmer groups in primarily the Southern, Central and Western areas of Sulawesi. In Southeastern Sulawesi, a certification program is running in Kolaka district, but no certification schemes are introduced in Konawe district.

### 4.1.1 International and national cocoa quality standards

The general criteria for high quality cocoa beans are fine flavor notes, large bean size, high fat content, proper fermentation and adequate drying. Consistent batches of cocoa beans must contain a low percentage of diseased, mould, germinated, adulterated, broken, flat, clumped and smoky beans with little waste material, such as placenta fragments and stones (ICCO 2009; CAOBISCO 2002). The standards applied at the fine-flavor market are much more stringent than the standards utilized at the market for bulk cocoa. In Sulawesi, these criteria are reduced to a set of criteria called the FAQ (Fair Average Quality) standards, which are the international standards for bulk unfermented cocoa beans (Panlibutan and Meyer 2004). These are in line with the national export standards, the SNI (Standard National Indonesia). To meet the FAQ standards beans must contain a maximum of 2,5% waste material, a humidity level of 7,5%, a maximum of 4% mould beans and a maximum bean count of 115 (Badcock et. al 2007; Intv. Turmudzi)\(^9\). Also, the beans must have a uniform appearance and have a low percentage of slaty, diseased and mould beans, which can be tested with the cut test. The price is reduced for cocoa beans that don’t comply with the FAQ standards (Panlibutan and Meyer 2004). These are the most important quality and consistency standards in the Sulawesi cocoa sector, since the beans are primarily used for production of cocoa butter (Intv. Engbers; Intv. Jaxx). Further, buyers and grinders in Sulawesi may offer higher prices if the farmers comply with additional standards, e.g. if farmers ferment the cocoa beans adequately or if the bean weight is higher. For example, PT Effem offers price premiums for fermented beans when minimum 95% of the beans are brown in the cut test (Intv. Engbers)\(^10\).

In order to upgrade their cocoa production the smallholder farmers must address the challenges that are currently causing decreasing yields and lower quality in their area. Also, cocoa farmers must comply with the market-specific quality, consistency and volume standards to increase their economic gains. These standards will be market-specific and

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\(^{9}\) The bean count indicates the size and weight of beans: a 100g sample must not consist of more than 115 beans.

\(^{10}\) The brown color of the interior of the bean indicates adequate fermentation
depend on what specific buyers and end market the farmers sell to. The local quality and consistency standards in Konawe district will be further explored in the results section.

4.2 Upgrading of cocoa production at the farm level

This section will provide an overview of the primary farming and post-harvest practices involved in upgrading cocoa production at the farm level. These practices have been chosen based on the description of the known market standards and major barriers for improving cocoa production in Sulawesi. The chosen best-known practices have been summarized in appendix B.

4.2.1 Best-known practices to improve cocoa quality and consistency

In order to comply with the market standards – and thereby increase the price they receive per kilo of cocoa beans - farmers must perform some farming and post-harvest practices adequately. Appropriate post-harvest handling is paramount to produce cocoa beans of high quality and consistency. This involves 3 primary phases: fermentation, drying and sorting. Quality corresponds for most cocoa varieties with fermentation length, where an optimal quality is achieved by 5 to 7 days of fermentation. Proper fermentation results in a better flavor, removes the bitterness in the beans and makes it easier for the grinders to remove the bean coat (Ruf and Yoddang 2009; Taher 1996). Optimal fermentation is carried out in aerated and covered boxes and the beans are turned according to the temperature level in the boxes, or at least on day 2 and 4. Inclusion of infested cocoa beans, placenta material or the pulp may result in musty and bitter flavor notes and, therefore, it’s important that farmers sort and wash the beans prior to the fermentation (ICCO 2009; Fold and Ponte 2008). Also, unripe and underdeveloped beans don’t ferment appropriately and will result in beans with a lower fat content (ICCO 2009; Intv. Engbers). This is related to what pods the farmers include in the harvest. The standards and requirements related to fermentation are far from the same for the fine-flavor and ‘bulk’ cocoa market. Farmers don’t necessarily have to ferment the cocoa beans to sell to the market for lower quality cocoa (Nielson 2007). On the other hand, if they want to fetch the premium associated with full fermentation they must ferment the beans until they show the signs of full fermentation. Fermentation is tested with a cut test, which reveals the color and consistency of the interior of the beans. In general, adequately fermented beans have brown fluids or cotyledons, which is the interior of the cocoa bean. Also, the cut test can reveal if the bean is slaty or adulterated, which indicates poor quality.

\[\text{11}\] For the Forastero type
The cocoa beans must be dried to a moisture level of around 7-8% to be exported (CAOBISCO 2002). Mould is a major concern during and after the drying, and it may occur at any stage of the drying process (Ruf 2007). Inappropriate or too little drying will increase the risks associated with mould, which is the case if the farmers don't turn the cocoa beans during the drying or dry the beans inadequately. This will also increase the problems with mould higher in the market chain and result in a major price reduction on the international market (Anang 2011). On the other hand, if the farmers want to avoid the risk of mould they can sell the beans wet, but this will result in a price reduction. Ruf and Yoddang (2009) estimate that the moisture level in fresh beans is 55%, 20-28% in beans dried for 2 days, 12-20% in beans dried for 3 days and 8-12% in beans dried for 4 days. The moisture level is tested with a moisture meter. A broken bean is an indicator of too long drying. Also, the surface of the bean under the shell tends to turn black when the beans are dried for too long. It is paramount that the beans are protected from rain and pollution during the drying to avoid mould and off-flavors. For example, beans may get smoky if they are exposed to smoke. After the drying the beans can be sorted to reduce the percentage of waste material and unmarketable beans. This can be executed at the farm level, by the buyers, warehouses or at the factory level.

As a rule of thumb, the potential flavor and fat content of the cocoa beans is determined by their genetic origin (Fold and Ponte 2008). The major cocoa varieties are respectively Forastero, which produces a lower quality ‘bulk’ cocoa; Criollo, known for its superior mild flavors, but also for its lower yields and susceptibility to diseases; and Trinitario, which is a large group of hybrids that combine the potential of the other two varieties. The Forastero constitutes 95% of the world market and is the dominating variety in Sulawesi (Fold and Ponte 2008; Panlibutan and Meyer 2004). ICCRI has been experimenting with fine-flavor varieties, but the results have been disappointing due to the susceptibility of the fine-flavor varieties to the specific pests and diseases found in Indonesia (Intv. Soetanto). The farmers can potentially boost their cocoa production by grafting superior planting material onto their existing or ageing cocoa trees or by replacing the trees with superior seedlings (Willson 1999). Several researchers have argued that the cocoa yields in Sulawesi are low due to the age and variety of the existing tree stock (ACDI/VOCA 2005; Panlibutan and Meyer 2004). Panlibutan and Meyer (2004) argue that the limited distribution of improved planting material in Sulawesi is a major constrain for the farmers to rejuvenate or replace their existing or old cocoa trees with superior planting material. The government of Indonesia launched the Gernas project in 2009 with the purpose of side-grafting the cocoa trees throughout Sulawesi with superior planting material.

Further, cocoa bean quality is affected by local soil conditions and the particular growing environment, including the climate (Jano 2007).
4.2.2 Best-known practices to increase cocoa yields

To comply with quality and consistency standards will increase the price the farmers receive per kilo of cocoa beans, but the farmers can also upgrade by increasing their production of cocoa beans. Numerous factors affect the productivity of the cocoa tree and this overview will only include factors that the farmers can manage. For example, pollination and rainfall are factors that the farmers can’t affect.

Good soil maintenance is the cornerstone of a productive cocoa farm, since cocoa needs a fertile soil rich in nutrients (Taher 1996). Without nutrients and healthy soil the growth and production of the trees will decline, which will result in decreasing yields and smaller beans. Cocoa trees have specific nutrient requirements in comparison to other crops. Nitrogen, potassium, phosphorus, calcium and magnesium are paramount to stimulate vigorous growth and pod production (Wood and Lass 2001). It is recognized that cocoa trees often experience a shortage of these nutrients. Not least, nutrients are removed when the cocoa pods are harvested. The cocoa pods are in particular rich in potassium, which must be replaced to avoid potassium deficiency\(^\text{12}\). This is in particular the case if the cocoa pods aren’t composted and spread in the fields.

Nutrients can be applied in the form of inorganic or organic fertilizer sources, or alternatively by applying manure or compost to the field. Decomposing mulch and crop residues will also add nutrients. Further, intercropping with leguminous tree species such as *Gliricidia sepium* or *maculata*, *Leucaena leucocephala*, *Flemingia sp.* or other leguminous species is beneficial for the cocoa trees, since these species uptake nitrogen from the air, which will become available to the cocoa trees when their leaves and roots decompose (Wood and Lass 2001). The recommendations for application of inorganic fertilizer in Sulawesi involve two times of application annually of 200-600g per mature cocoa tree, which must be mixed with the soil (Intv. ICCRI; Taher 1996). The stakeholders and manuals disagree on how much fertilizer it is optimal for the farmers to apply, which also depends on the existing soil conditions and what other soil enrichment practices the farmers carry out. Also, diseased pods can be composted with lime or a urea solution to kill the disease pathogens and later added to the field as compost, which is a good source of potassium.

\(^{12}\) On average, when 1000 kilo of cocoa beans and husks are removed during the harvest 70 kilo potassium, 34 kilo nitrogen and 5 kilo phosphorus is removed (Willson 1999)
To add nutrients alone is not sufficient to build a healthy soil. It is paramount to add organic matter to the soil to stimulate vigorous growth. Organic matter improves the ability of the soil to hold water and nutrients and, hence, make these available to the trees. Organic matter optimizes the growing conditions for the root system, thereby encouraging strong and healthy trees. Organic matter can be added in the form of compost, but will also be added when the mulch of leaves and crop residues decompose next to the cocoa trees.

The need of the cocoa tree for respectively shade and nutrients is closely related. As a rule of thumb, the less shade that is provided by shade trees the more nutrients the cocoa tree will need to produce optimally. In other words, in systems where little or no nutrient sources are applied the cocoa trees produce optimally and get less stressed under a higher percentage of shade. Studies have shown that the production of cocoa trees varies according to the degree of fertilizer and shade provided in the farming system (Wood and Lass 2001; David 2005). In farming systems where no nutrient sources are applied the production will be highest when cocoa trees are under 40-50% shade, whereas in systems where high amounts of fertilizer or other soil enrichment practices are applied production will be highest at much lower shade levels, down to 10% shade in systems where conventional fertilizer is applied (Wood and Lass 2001). The need for shade also depends on the age of the tree and the cocoa variety. Up to 60% shade must be established prior to transplanting of cocoa seedlings to ensure adequate shade, soil protection and avoid weed competition (Willson 1999). In general, trees are more vulnerable when not under shade, especially if the trees are in deficiency of nutrients or moisture, such as in periods with drought. Panlibutan and Meyer (2004) state that drought is a problem in some parts of Sulawesi. Some research suggests that the incidence of pests and diseases is lower in mixed farming systems as diseases move less easily from one tree to another. On the other hand, shade increases the level of humidity and, thus, increases the incidence of diseases.

To prune the canopy of the cocoa tree is important to increase the production. Pruning will increase the amount of sunlight that penetrates the canopy and will stimulate pod growth rather than leaf growth (Vos et. al 2003). Also, pruning will increase the air circulation in the canopy and reduce the humidity, which is directly related to the incidence of diseases such as black pod disease. This will also reduce the shade areas that the CPB-moth likes to inhabit (ACDI/VOCA 2005). Pruning of mature cocoa trees normally consists of two types of pruning, respectively a formation pruning once or twice annually and a regular maintenance pruning (Taher 1996).

**4.2.3 Reducing the loss to pests and diseases**
Several pests and diseases are causing severe losses in the production of cocoa beans in Sulawesi and, further, reduce the quality and consistency of the beans. The most serious of these are the cocoa pod borer and the black pod disease. Further, Vascular Streak Die-back (VSD) has expanded rapidly in recent years, which leads to dying trees and poor production (Intv. ICCRI).

The cocoa moth (*Conopomorpha cramerella*) lays its eggs on the surface of the pod and when the larvae, the cocoa pod borer, hatches it tunnels into the interior of the pod, where it damages the beans and inhibits their growth (Vos et. al 2003). The CPB affects the quality of the cocoa beans by competing with the developing beans for the nutritional resources in the pod, which results in smaller beans with a lower fat content and beans that fail to develop properly (ACDI/VOCA 2005). The result is low quality beans clumped together with the placenta. If the farmers decide to sell these beans it will result in an increase in waste material (Nielson 2007). A CPB infection can be recognized by the small channels in the pod surface and a yellowing of parts of the pod.

Black pod disease affects the interior of the pod and damages the beans partly. The symptoms of black pod disease, caused by *Phytophthora spp.*, are yellow lesions on the pod surface, which will develop into brown or black spots, on which white mycelia will start to grow (Willson 1999). Dispersal of the disease will be caused by raindrops splashing on the pod surface or by insects (Phillips-Mora 2009). If the farmers don’t harvest the pods they will mummify on the tree or on the ground. At this stage *Phytophthora Palmivora* spores will continue to infect developing pods on the tree and the inoculums of the disease can survive up to 3 years, even in the soil. The disease may eventually infect the young shoots, root system and tree trunk, and cause stem canker.

An infestation with Vascular Streak Dieback (VSD), caused by the fungus *Oncobasidium theobromae*, will make the production of pods decline and, if the infested branches are not pruned, kill the tree (Intv. ICCRI). Helopeltis, also known as the mosquito bug due to its appearance, causes damage to the young shoots and flowers of the cocoa tree. Helopeltis hardly affects the interior of the cocoa pods, but the damage on the flowers and the branches is uncertain.

Since the late 1990s several stakeholders have been involved in research on how to overcome these major threats to the cocoa production in Sulawesi. Research initiated by ACRI (American Cocoa Research Institute) and the Indonesian Cocoa Association (ASKINDO) found that a combination of phytosanitary and frequent harvesting, pod sanitation, pruning and fertilizer application reduced the loss in production caused by the CPB and black pod disease.
This bunch of practices is known by its Indonesian acronym, PsPSP. The PsPSP practices have been recommended as an alternative to the farmers’ extensive spraying of pesticides and are considered low input techniques to control several of the major pests and diseases in Sulawesi, in particular CPB and black pod disease (Perdew 2009). These practices have later been promoted by the PRIMA and Success Alliance projects, respectively supported by Mars Inc. and ACDI/VOCA. They are currently promoted in Sulawesi by the extension service.

The purpose of phytosanitary harvesting, frequent harvesting and pod sanitation is to reduce the population of the pests and diseases by breaking their lifecycle. By removing the infected pods dispersal of the diseases and pests will be prevented. Frequent harvest involves harvesting the ripe and almost ripe pods 3 times monthly, both to break the infestation cycle and to prevent the ripe pods from getting infested (Perdew 2009). Phytosanitary harvesting, or phytosanitary pruning, involves a frequent harvest or pruning of all the infested pods on the tree. Pod sanitation involves collecting the infested and mummified pods from the ground and burn, burry or composts them. Farmers are also supposed to remove the split pods after the harvest. Black pod disease is primarily managed by pruning, phytosanitary harvest, frequent harvest and pod sanitation, whereas VSD and stem canker is managed by pruning of the branches (Intv. ICCRI). Next to their positive effect on the incidence of pests and diseases, the practices improve the overall productivity and quality of the production through fertilizer application and pruning.

Pesticide spraying is still considered an integrated part of the management of CPB and Helopeltis (Taher 1996; Perdew 2009; Ruf and Yoddang 2004). It is recommended to spray directly on the infected areas of the pod, the tunnels, to combat the CPB and to avoid haphazard overuse of pesticides, which will increase the farmers input costs (Intv. ICCRI; Shapiro and Rosenquist 2004). Overuse will also kill potential beneficial insects, such as pollinators and beneficial ant species. That said, to combat Helopeltis farmers must spray on the young shoots on the tree (Intv. ICCRI). The recommendations on frequency of spraying are not consistent, but many stakeholders have argued that farmers should try to limit their spraying (Intv. ICCRI; Perdew 2009).

Several other integrated pest and disease management techniques have been applied on an experimental scale in Sulawesi, such as pod sleeves to prevent CPB infection, CPB pheromone traps and ant species that predate on eggs and larvae of pests. Not least, to replace or rejuvenate the existing cocoa trees with planting material that is resistant or tolerant to the major pests and diseases would be advantageous (McMahon et. al 2009). Such superior planting material can be identified by the farmers on their farms, in case they are familiar
with vegetative propagation techniques, or it can be distributed to the farmers by governmental or private stakeholders. Finally, weeding will increase the air circulation and remove eventual host species.
5. METHODOLOGY

5.1 Research approach and choice of methods

In order to understand the farmers’ choices and strategies, and the factors that directly affect them, we must find out what the farmers base their decisions on. This study takes departure in the farmers’ reasoning behind their actions and decisions.

To explore decisions calls for a qualitative research approach and methodology (Ashley and Boyd 2006). Qualitative methods can be applied to explore how people derive meaning from the context they are embedded in and how this influences their behavior (Denzin and Lincoln 2008). Through a description of the farmers reasoning this study aims at providing an understanding of the farmers’ choices and what factors that affect their willingness to perform specific farming and post-harvest practices. This has been achieved through qualitative interviews and first hand observations.

This involves some basic assumptions. It is assumed that, at least to some extent, the rationale behind the farmers’ decisions will be revealed in their explanations. Also, it is assumed that the farmers base their decisions on rational decisions that an outsider is able to understand.

In order to explore a farmer's reasoning it is paramount that the researcher doesn’t affect the farmer's explanation, either by asking guiding questions or narrowing the farmer’s narrative and options. The researcher must provide the farmer the opportunity to present his/her own explanation. The quality, and validity, of such a qualitative exploration will depend on the researcher's ability to ask appropriate open-ended questions and listen to what is at stake for the farmer. This is a common interview technique applied in qualitative ethnographic methods, such as the semi-structured interview.

There are shortcomings to all research methods. To look at the farmers' reasoning will only reveal some of the factors that affect their farming and post-harvest strategies. First, their reasoning will not reveal the factors that the farmers don’t include in their explanations, whether they do so intentionally or not. Second, the farmers’ reasoning will not reveal factors that the farmers aren’t aware of, for example market conditions that they don’t know about. Third, to look at the farmers reasoning will only reveal the factors that affect the farmers’ choices directly. Many factors may affect the farmers’ choices indirectly, such as the farmers’ position in the village, their level of training and their income. Only through a combination of research methods, also known as method triangulation, will a researcher be able to reveal
some of the multiple factors that directly and indirectly affect the farmers’ choices. The purpose with this study is to collect qualitative data, which will only reveal some of the factors that affect the farmers’ choices. This study has involved triangulation of both methods and respondents: different methods were used to explore the same topics and different stakeholders were asked the same questions.

3 main methods were applied in this study. During the fieldwork in the villages in Konawe district, the qualitative interviews with the farmers were paired with observations of the farmers’ farming and post-harvest practices. Further, a minor market chain study was conducted, which consisted of interviews with several stakeholders in the local and national cocoa market chain. The findings obtained from applying multiple methods complement each other to develop a more comprehensive and valid interpretation (Nuijten 2011).

The intention of this study is to produce new insight into farmers’ management strategies by taking departure in the farmers’ everyday narratives and practices. To take departure in empirical evidence, rather than in theoretical assumptions, draws on inductive research logic. No hypothesis is tested in inductive research and the qualitative inquiry is guided by the research questions and a literature review (Patton 2002; Aragão Pereira 2011). Deductive logic has been applied in the market study and in a few questions in the primary interviews with the farmers, but only related to the farmers’ know-how and access to inputs. This is in line with Tolich and Davidson’s (2003) argument that no study is solely inductive or deductive.

There is an element of pre-structuring and assumptions involved in all research. Research is a subjective interpretation in that it reflects the researcher’s theoretical standpoint and perception of the world, which is emphasized in the postmodern paradigm (Maxwell 2006; Ashley and Boyd 2006).

5.2 Village fieldwork

5.2.1 Choice and description of villages

The fieldwork was conducted in 3 villages in Konawe district in Southeastern Sulawesi, respectively Wonua Hoa, Lawonua and Asinua Jaya. The cocoa farmers in Southeast Sulawesi have received little attention from researchers compared to other areas of Sulawesi, which was the reason to conduct the fieldwork in this region. 3 villages were chosen in order to study the challenges for upgrading the cocoa production in the region on a wider scale.
ICRAF (World Agroforestry Centre) has recently initiated the AgFor project in these and many other villages in South and Southeast Sulawesi. The Agfor project has recently established farmer groups in the villages and train the farmers in nursery management and vegetative propagation techniques. I was affiliated with ICRAF as a research fellow during my time in Indonesia, which improved my access to the villages considerable. In this study I have chosen only to focus on farming practices that aren’t related to the current work by ICRAF in the villages, which would have questioned the reliability of the farmers’ responses due to my position. For this reason, vegetative propagation, nursery management and rehabilitation is not included in this study.

The primary reason for undertaking fieldwork in these particular villages was that cocoa production is an important livelihood strategy in all the villages. These villages were also chosen due to their obvious differences. All the villages are remote in that they are located down unpaved roads. Lawonua is located close to Unahaa, a larger town, and within an hour of driving from the main city in the region, Kendari. A map is provided in appendix C. The short distance to Kendari improves the villagers’ access to agricultural inputs and a wide range of market actors. Also, an agricultural extension service office is located next to Lawonua that facilitates training sessions in the village, including training in fertilizer application (Intv. extension officer). In addition, a private oil palm plantation was established in Lawonua in 2010, which now employs around 100 farmers according to the headman in the village. Wonua Hoa is located far from Kendari near Unahaa, but access to the village is poor due to the unpaved road that leads to the village. Asinua Jaya is located in the northern part of Konawe district, four hours of driving from Kendari on a partly paved and unpaved road.

Both ACDI/VOCA and Swisscontact has conducted training programs in Asinua Jaya and Lawonua, but only a small group of farmers have been involved. These projects have primarily trained the farmers in the PsPSP practices. From 2009 to 2011 the government-supported Gernas project rehabilitated ageing cocoa fields in Lawonua and Asinua Jaya with improved planting material. The Gernas project also involved a one-time hand out of input packages to the farmers, including fertilizer and pesticides. In comparison, there has not been any training in Wonua Hoa prior to the AgFor project. The farmer groups involved in the AgFor project have recently paid a visit to the Cocoa Research sub-station in Konda, which works as a resource and demonstration centre in the area. The station has a demonstration farm with superior cocoa clones, a large-scale cocoa nursery and fermentation boxes. The centre distributes superior planting material to the extension service offices in the area.

13 Many of these farmers are not from Lawonua village
The farmers in the villages are primarily of Tolaki and Bugis origin. The majority of the farmers in Lawonua and Asinua Jaya are Tolaki, whereas the farmers in Wonua Hoa are almost entirely Bugis. Most of the farmers of Bugis origin moved to the area in the late 1990s or in the start of the millennium from South Sulawesi to invest in cocoa production. They bought land from the local Tolaki, who then moved to the outskirts of the villages and cleared new forest land (Intv. headman). The cocoa production boomed in the villages after the arrival of the Bugis, where cocoa replaced coffee and cashew nut as the dominating cash crop. Currently, most of the cocoa trees are between 8-12 years old, whereas some farmers in Asinua Jaya have cocoa trees that are up to 24 years old.

5.2.2 Choice of respondents

The population in each village varies, which affected the number of respondents in each village. The number of households within the small village of Wonua Hoa is below 10, whereas the population in the other villages is much larger. All farmers in Wonua Hoa grow cocoa, whereas many farmers in Lawonua and some farmers in Asinua Jaya don’t grow cocoa at all.

Table 1. Number of interviews in the villages

<table>
<thead>
<tr>
<th>Village</th>
<th>Farming and pest/disease management strategies</th>
<th>Post-harvest strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

The interviews are divided in interviews that were conducted in the cocoa fields (farming and pest/disease management) and interviews conducted at the post-harvest facilities.

An overview of the number of interviews conducted in each village is provided in table 1. This overview distinguishes between interviews about the farmers work in the field, respectively the farming practices and pest and disease management, and interviews about the farmers’ post-harvest practices. The reason is that the interviews were paired with observations of the farmers practices, so interviews about the farmers’ work in the field was carried out in the fields, whereas the interviews about the farmers’ post-harvest practices were carried out at

14 The exact number of households in the villages is unknown
the fermentation and drying facilities next to the house. Both the farming and post-harvest practices were covered in one interview whenever the cocoa fields were located next to the post-harvest facilities, which was the case in 21 interviews. This means that 64 primary interviews were conducted in total.

All households present at the time of the fieldwork within the village of Wonua Hoa were interviewed. The choice of informants in Lawonua and Asinua Jaya was based on some simple criteria. First, only farmers growing cocoa as one of their main crops were interviewed. Thus, this study only provides an insight into the strategies of primary cocoa farmers. A few other farmers, who have replaced cocoa with other crops, were also interviewed, but these interviews are not included in the results section. Second, the respondents were chosen from all areas of the villages, including farmers from the hilly areas on the outskirts of the village and farmers living in the centre of the village. Third, in order to capture the heterogeneity of the farmers, respondents with different background were purposefully picked out. Based on the researcher’s personal judgment respondents were chosen due to their ethnicity and position in the village. This is much similar to what Maxwell calls purposeful sampling (2006), which is a sampling technique that can be used to capture the heterogeneity, or homogeneity, of a population. Purposeful sampling it applied to obtain in-depth information rather than to be able to generalize from a sample to a population (Aragão Pereira 2011). All respondents had mature cocoa trees, older than 6 years, since little cocoa has been planted recently in these villages.

The total number of respondents in each village is low, which is mainly due to the low number of available primary cocoa farmers within the boundaries of each village. Further, some interviews have not been included in the sample. On some occasions it was obvious that the farmer was unwilling to explain his/her reason to undertake or not undertake certain practices. For example, some women seemed to be too shy to explain their strategies in-depth.

5.2.3 Primary interviews

The qualitative interviews were designed for the particular purpose of this study: to explore the factors that directly affect the farmers farming and post-harvest strategies.

15 5 failed interviews
The purpose was to explore the farmers’ choices related to specific farming and post-harvest strategies, which have been explained in the background section\textsuperscript{16}. For this reason, the interviews were divided into several small sub-interviews, one sub-interview for each best-known practice.

Each interview started with some general questions, mainly open-ended, about the farmers livelihood and farm, such as questions related to the farmers farming system, what challenges he/she were facing on the cocoa farm, what training he/she has participated in, what ethnic group he/she belongs to, land size, household size, when he/she planted the cocoa trees, when he/she moved to the village, the importance of cocoa compared to other crops and so forth. This information was primarily used to build a frame of reference for the rest of the interview, but it has also been used to a limited extent in the analysis to draw comparison between the farmers’ profiles and their strategies.

There was almost a survey-like uniformity to all the interviews in that each interview consisted of some specific sub-interviews, one for each practice, which consisted of some specific questions that all the farmers were asked about. The survey-like structure was applied in order to be able to collect both quantitative and qualitative data in the interviews. Nuijten (2011) argues that it is possible to collect quantitative and qualitative data in the same interview by making use of different types of questions. In each sub-interview all farmers were asked a set of questions that were similar for all the farmers, which made it possible to compare the farmers’ strategies in the data analysis quantitatively. For each of these questions followed an explorative unstructured conversation based on open-ended questions, thereby allowing the farmers to express their strategies and the factors that affect them in their own words. For example, all farmers were asked the same questions about what pods they harvest and what pods they don’t harvest, but the conversation about why they harvest the pods they do and what factors that affect their harvest strategies was unstructured, explorative and based on open-ended questions. During the unstructured conversations the researcher aimed at avoiding to mislead the respondents’ responses by not asking questions based on his own assumptions. The almost survey-like questions in each sub-interview were used to cover \textit{what and how} questions\textsuperscript{17}, whereas the unstructured conversation was used to cover \textit{why} questions\textsuperscript{18}. All the questions were open-ended and formulated according to inductive research logic. The data obtained with the survey-like

\textsuperscript{16} The interviews were based on the chosen farming, pest/disease and post-harvest practices in appendix B

\textsuperscript{17} What are the farmers’ strategies; How do the farmers perform specific practices; What do the farmers know; What key inputs and knowledge-sources do the farmers have access to

\textsuperscript{18} Why do the farmers do as they do; what is the rationale behind their decisions; why are the farmers willing or reluctant to perform specific practices
questions has allowed for quantitative analysis, whereas the data obtained from the conversations has allowed for a qualitative analysis.

Also, in each sub-interview were included some specific questions to explore if the farmers were able to perform each practice adequately, which involved questions related to the farmers know-how, experience and access to inputs. These questions were based on a simple a priori assumption drawn from the literature review: farmers need know-how and access to some key inputs to be able to adopt specific practices in the first place.

When one sub-interview was covered another sub-interview would begin. Finally, many interviews ended with some explorative questions, for example about credit access or particular market conditions. There was no specific order to the questions, but the researcher kept track of what questions that had been asked by using an interview guide. The interview guide can be viewed in appendix D.

The interviews had to involve different informants, since it is custom that the man is responsible for the work in the field, whereas the post-harvest practices are included in the woman’s household duties. Therefore, the men were interviewed in the fields about the farming practices, whereas the women were interviewed at the drying and fermentation facilities next to the house. Thus, interviews were often divided in two: one interview consisting of sub-interviews on farming practices and another interview with sub-interviews on post-harvest practices. For some households only the farming or post-harvest practices were covered, since it was impossible to interview both household members. This has not been a major concern for the results, since each practice was explored in a separate sub-interview and, not least, since the farmers strategies for each practice will be analyzed separately. Some interviews were conducted with both household members present, in particular interviews about the post-harvest practices.

The quality of the obtained data relied on the interpreters’ ability to ask appropriate questions and communicate the responses to the researcher. Fortunately, the two interpreters hired during the fieldwork period spoke the local ethnic languages and they have grown up in the area. It seemed to be a great advantage that many farmers knew the interpreters from earlier, or at least their families, whereby trust was established immediately. Also, the interpreters had a profound insight into the local customs and norms. Both interpreters had completed a university degree in English, which made it possible to cover complex and detailed matters in the interviews without any form of misunderstandings. Prior to the fieldwork I had long conversations with each interpreter about how to ask the
different questions and we continuously talked about interview techniques as the fieldwork evolved.

5.2.4. Observations

The interviews were paired with observations of the farmers farming and post-harvest practices. Interviews about the farming practices were therefore carried out in the fields, whereas interviews about the post-harvest practices were executed next to the houses, where the cocoa beans are fermented and dried. If a farmer was harvesting at the time of the interview, the interview would often begin by asking into the farmer’s harvest strategy. The decision to combine the interviews with observations of the farmers’ field and post-harvest practices emerged from an experience during the first day of the fieldwork. After the second interview, we - the interpreter and I - accompanied the farmer to the field and spend an hour observing what he did. What the farmer did in the field added new details and an extent of uncertainty to what he had told us during the interview in his house. New questions emerged from these observations and it turned out that what he actually did was much more complex than what he had explained earlier. In the field the farmer’s explanations were detail-rich, specific and more influencing factors were revealed. Not least, the farmer could make use of tangible examples to explain what he did. For example, the farmer pointed out the pods he would harvest and sell, and the pods he would leave on the tree, which was paramount to understand the farmer’s disease management and harvest practices and, finally, how these practices were related to the market chain.

The fieldwork also included participatory observation. During the fieldwork we stayed over in the villages, where we observed and took part in the farmers’ everyday lives: the daily rhythm, the work duties, the culture and the farmers’ livelihood priorities, which broadened my view and enabled me to improve my interview questions.

5.2.5. Data management and analysis

The analysis of the farmers’ strategies took part during and after the interviews. Qualitative data analysis is a continuous reflexive process and mainly takes part in the context the data is unfolded (Maxwell 2006).

The management and final analysis of the fieldwork data evolved over multiple stages. A sketch of the data sheets that were used for the data management and analysis is provided in appendix E.
First, after the fieldwork the interviews were written down in horizontal and vertical columns with the purpose of avoiding fracturing of the farmers’ profiles and explanations, which is illustrated in data sheet A. To read vertically provides an understanding of the profile of each farmer, showing the characteristics, strategies and influential factors of each farmer. To read horizontally provides an understanding of each practice, for example fertilizer application, and what factors that affect the farmers’ strategies in relation to this practice. Unsatisfying interviews – or sub-interviews – were not included. The data was then analyzed qualitatively to get an overview of the different strategies of the farmers for each practice and to find out how it would make sense to further analyze, categorize and present the data. An overview was made of the primary strategies of the farmers for each practice and the farmers’ strategies were then categorized in 3 primary strategies. Also, all the influencing factors expressed by the farmers for each strategy, for example all the factors that were found to influence all the farmers’ fertilizer application, were then provided a code. In the second stage of the data analysis the farmers were categorized according to their strategy and what village they live in, which is illustrated in data sheet B. Each farmer was given a coded profile of the factors that they had explained influence their strategy. This provided a quantitative overview of the farmers’ strategies in each village and a coded overview of what factors that affected each farmer. The uniformity of the questions in the sub-interviews made it possible to look quantitatively at the frequency of the farmers’ strategies and the factors that affect them. In the final analysis of the data it was possible to combine the quantitative overview in data sheet B with the detailed information from the farmers’ profiles in data sheet A with the researcher’s personal qualitative field notes.

The findings presented in the results section are almost entirely based on the farmers’ explanations of their own strategies and the influential factors. These are sometimes combined with the researcher’s observations during the interview. Also, very few descriptions are based on a comparison between the personal characteristics of respectively the adopters and non-adopters. These descriptions are based on a numerical comparison between the profiles of the different farmers and their strategies. These numerical comparisons were carried out to find if the farmers’ strategies are numerically related to their participation in training programs or other characteristics in their profiles. These observations and numerical indications are included at the end of each practice in the results section.

Appropriate knowledge has been considered a prerequisite for being able to adopt some of the practices appropriately, which has affected the presentation of the data in the results section. Therefore, the farmers are divided in two groups in the results section when it was found to be relevant for their strategies, respectively farmers that have heard about a practice
and how to perform it adequately, referred to as knowledgeable farmers, and farmers that haven’t heard about a practice.

5.2.6 Secondary interviews

3 topic-interviews with key farmers were executed during the fieldwork to explore specific topics in-depth, such as credit access and market and input chain conditions. These topics were also explored during the other interviews. 2 of these interviews were group interviews. 3 key informant interviews, one in each village, were carried out with the village heads or a key farmer. These interviews included a basic timeline-exercise to get an overview of the historical land use in the villages. Timeline-exercises are normally associated with PRA-methods. Finally, 3 interviews were executed with farmers in Lawonua who had replaced their cocoa trees with other crops lately, in particular pepper.

5.3 Market chain study

The market chain study was undertaken to obtain an understanding of the market context the farmers operate in and what external factors that affect the farmers’ ability to adopt the recommended farming and post-harvest practices. Some of these factors may be ‘hidden’ to the farmers or don’t appear in the farmers explanations. Farmers may be unaware of market conditions that hamper their ability to upgrade their cocoa production.

Several stakeholders in the local and national cocoa market chain were interviewed. Five local buyers and two warehouses were interviewed in the study of the local cocoa market chain. An overview of these and their characteristics are provided in appendix J. Further, key stakeholders from multinational cocoa buyers such as Mars Inc. and Continaf BV, and representatives from ACDI/VOCA, VECO and CSP were interviewed to get an overview of the national cocoa sector. Also, I stayed for two days at the Indonesian Coffee and Cocoa Research Institute (ICCRI) in Jember, Java, to interview the experts on recommended practices and the governments’ involvement in the market and supply chain. The interview guides for these semi-structured interviews were prepared from the literature review of market factors that influence farmers’ practices, which is summarized in appendix A, and

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19 The interview guide for credit access is provided in appendix F. The interviews about the market and input chain conditions were based on appendix A
20 The interview questions for the local buyers are provided in appendix G
21 See the Interview references list
from background literature on the cocoa production in Sulawesi. The interview questions were chosen based on the specific role and expertise of each informant.

The study of the market chain draws inspiration from value chain research, but the methodological approach is modified in comparison to a typical value chain analysis. This study overlaps with typical value chain research in that it provides an insight into the practices, interests, roles and relationships of the actors in the market chain (Kaplensky and Morris 2001; Lundy et. al 2004). That said, the purpose of this study is not to provide an overview of the overall economic flow, organization or power relations in the Sulawesi cocoa value chain, but to provide a qualitative insight into how the cocoa farmers’ strategies may be hampered or empowered by factors in the market chain, with a particular focus on the upstream market chain that the farmers are embedded in\textsuperscript{22}. A short description of the value chain approach is provided in appendix H. This study has in particular been inspired by Lundy et al. (2004), who call for a research approach that looks beyond the historically narrow focus on the sole agricultural practices of the farmers to include an analysis of the market chain in order to comprehend how markets affect the performance and competitiveness of small-scale farmers. In order to overcome market failures Lundy et al. (2004) emphasize the need to identify limiting factors in the market chain.

\textsuperscript{22} Upstream refers to the part of the market chain that is located “upstream” or closest to the farmers.
6. RESULTS

6.1 The local market chain

The purpose of this market chain description is to provide an overview and understanding of the local market chain for two reasons. First, this overview will provide an overview of the local market opportunities and, thus, make it clear in what way it makes sense for the farmers to upgrade their production. Second, some factors in the market chain may affect farmers’ ability to upgrade indirectly and may not appear in the farmers own explanations. This description is based primarily on interviews with the local market actors, but price examples by the farmers have also been included.

The local market chain consists of multiple different actors who make use of different standard specifications, prices and practices, including government supported warehouses, private warehouses, and a wide range of different types of village buyers. The heterogeneity in the local cocoa market chain is illustrated in appendix J, which provides an overview of the standard specifications and prices of the local market actors that were interviewed for this study. The local buyers and warehouses are responsible for ensuring standard compliance and transmitting market information to the farmers due to the absence of farmer associations, certification schemes and upstream vertical integration by end buyers in the area.

Several private and a single government-supported (LEMS) warehouse are located in the proximity of Unahaa, the closest major town to the 3 villages. Larger warehouses are located in the major cities in Southeast Sulawesi, Kendari and Kolaka. The warehouses have different market interests and standards, since they sell to different end buyers throughout Indonesia, which include domestic grinders and raw bean exporters. This provides the farmers with a wide range of potential market options.

The private warehouse interviewed for this study use the SNI/FAQ standards to value the beans. The warehouse accepts all beans except for batches with a high percentage of mould beans. Price reductions are added to beans that don’t comply with the national standards. The price reductions are based on official standard tests, respectively the moisture meter and samples to test consistency and bean size. The highest price they offer is 18,500 Rp/kg$^{23}$ for beans with 8% moisture level that comply with the SNI. The private warehouse staff stated that no farmers sell fully fermented beans to the warehouse, but the warehouse shows an

\[1 \text{ USD is equal to 12,119 Rp (January 29, 2014).} 18,500 \text{ Rp is equal to 1,52 USD}\]
interest in sourcing fermented beans, since it would add value to their production. The warehouse staff expressed that they never ask the farmers for fully fermented beans, since it is uncommon to ferment fully. The beans are dried and sorted mechanically at the warehouse. The warehouse offers loans and higher prices for large batches of beans to reliable local buyers, but doesn’t offer these services to farmers.

A LEMS warehouse is located in Andomosingo near Unahaa (Intv. LEMS). This is a private warehouse, but it is supported by the Department of Horticulture to promote trade of fully fermented cocoa beans in the region. This warehouse only buys fully fermented beans, which they control with an aroma and cut test. They advice farmers to ferment in boxes for at least 4-5 days, since beans fermented in sacks seldom comply with the high quality standards. The warehouse also buys wet beans from farmers and then ferments the beans themselves. The additional standards that the farmers have to comply with are a bit more stringent than the SNI: maximum 2% waste material, 7.5% moisture level and a bean count of 110. The price is reduced if the farmers don’t comply with these standards and the warehouse doesn’t accept beans with more than 4% waste material or mould beans. They offer 20,000 Rp/kg for wet beans and 22,000 Rp/kg for fully fermented and well-dried beans. The warehouse mainly buys directly from farmers at the farm-gate and they only buy from farmers that they know are able to comply with their standards. This was visible on the road to the warehouse, where the farmers had professional drying equipment and fermentation boxes.

Due to the high standard requirements at the warehouse level farmers must dry and sort the beans adequately to make it profitable to sell to the warehouses. The warehouses also accept inadequately dried beans, but they seem to offer higher discounts for inadequately dried beans compared to the local buyers, as some farmers argued. Also, in most cases farmers have to transport the beans to the warehouses themselves.

Different types of buyers operate at the village level, from large buyers with a courtyard full of drying beans to small-scale cocoa buyers, who are also farmers themselves. The village buyers are also referred to as tengulak by the farmers. They either live in the villages or drive from village to village on motorbikes. Some buyers have a relationship with specific farmers, who get in contact with them whenever they are interested in selling their beans. There is a tendency among the farmers to shop for the highest price and, thus, most buyers drive around in the villages and stop whenever they notice that a farmer is drying his/her beans.

The buyers that were interviewed for this study argued that the competition between the local buyers is high, since there are several buyers in each village. This has an influence on the farm-gate prices and standards and, further, increases the farmers’ bargaining power. The
local buyers accept all types of beans, but reduce the price according to the dryness and visual appearance of the beans. The buyers estimate the dryness and consistency of the beans from the feeling and visual appearance of the beans, by using their hands and eyes only, and no buyers use official test equipment. Some buyers split a couple of beans to test the dryness and consistency of the interior. The local buyers also buy wet beans with a high percentage of waste material, including germinated, flat, clumped and broken beans. Several of the local buyers argued that they offer higher prices to farmers, even for inconsistent beans, in order to establish trusted trade relationships, which will ensure the buyers a higher supply of cocoa beans. The low price reductions at the farm-gate seem to make it profitable for the farmers to sell inconsistent and less dried cocoa beans to the local buyers. The local buyers make it easy for the farmers to sell their cocoa beans and the competition between the buyers ensures high farm-gate prices, in particular for inconsistent and wet beans. This distorts the existing market signal to produce consistent and higher quality cocoa, but it also decreases the work burden for the farmers associated with drying and sorting. The buyers, or their wives, dry and sort the beans themselves before they sell them to the warehouses.

The local buyers stated that they pay between 15.000-18.000 Rp/kg for well-dried and well-sorted partially fermented beans. According to the farmers’ statements, the farm-gate prices for partially fermented beans are almost the same in the different villages. Appendix I provides an overview of the farm-gate prices provided by the farmers. The average price for unsorted beans that have dried for 2 days is 12.000 Rp/kg; 13.000 Rp/kg for beans dried for 3 days; and 14.000-15.000 Rp/kg for beans dried for 4 or 5 days. These prices are an average of the prices stated by the farmers and they are only an estimate, since they neither include prices for beans of different consistency nor take into consideration that different farmers seem to receive different prices depending on their relationships with buyers. The price reduction for unsorted beans with a high percentage of waste material beans is up to 2.000-2.500 Rp/kg according to a couple of the local buyers (buyer III and IV).

It’s uncommon among the local buyers to buy fully fermented beans. Only one of the interviewed buyers, a larger buyer in Lawonua, said that he prefers to buy fully fermented beans, since the warehouses in Kendari and Kolaka offer higher prices for these. He offers up to 20.000 Rp/kg for fully fermented, well-dried and sorted beans to the farmers. He stated that he is seldom able to buy fully fermented beans, since most farmers don’t know how to ferment adequately. There are several reasons to why the other local buyers don’t ask the farmers for fully fermented beans. First, not all of the local buyers prefer to sell to warehouses that offer price premiums for fully fermented beans (buyer I and IV). Second, the interviewed

24 Refers to the buyer’s number in appendix J
buyers argued that they prefer not to offer a price premium for fully fermented beans, since the fully fermented beans are only sold in small batches. Many buyers prefer to mix all the beans and are therefore not interested in separating the small batches of fully fermented beans from the partially fermented beans. Also, the high farm-gate prices for partially fermented beans will decrease the price difference between partially and fully fermented beans. This means that the local buyers only get a low share of the price premium for fully fermented beans. Finally, not all buyers know how to test if beans have been adequately fermented. The local buyers don’t need a license to operate and, thus, some buyers seem to be less experienced and unaware of the exact standards for full fermentation. For these reasons, three of the interviewed buyers (I, III and V) stated that they offer the same price for fully and partially fermented beans, while one buyer (IV) argued that he is pushed to offer price premiums for fully fermented beans if a farmer requests it, but that he mixes them with the partially fermented beans afterwards.

According to the farmers, the prices for fully fermented beans at the warehouse level are between 20.000-24.000 Rp/kg depending on the moisture level, quality and consistency of the beans. 24.000 Rp/kg is for fully fermented, well-dried and well-sorted beans. The prices offered for fully fermented beans by local buyers are between 15.000-20.000 Rp/kg. In comparison, the price for partially fermented beans is up to 20.000 Rp/kg at the warehouse level for well-dried and sorted beans, and between 15.000-18.000 Rp/kg at the village level. In short, the price premium for fully fermented beans ranges from 500 to 4.000 Rp/kg depending on the buyer and the quality of the beans. In general, the standard requirements for fully fermented beans are strict in comparison to partially fermented beans; they must be larger in size, have a better visual appearance, contain less waste material and preferably with a lower moisture level.

The local buyers have another important function, since they offer loans to the farmers, either in the form of money, fertilizer or rice. The farmers repay the loans with cocoa beans in the peak harvest season, which ensures the local buyers a supply of cocoa beans. The loans are flexible and normally consist of small amounts. The farmers can still sell their cocoa beans to other buyers. The buyers argued that they only offer loans to farmers that they are convinced are able to repay, which excludes the poorest farmers. A couple of the buyers don’t offer loans to farmers, since they have experienced that the farmers choose to repay with the lowest quality cocoa beans, while they sell the better beans to other buyers.
6.2 The farmers’ strategies and influencing factors

The farmers’ farming and post-harvest strategies and the influencing factors are presented in this chapter. An overview of the best-known farming and post-harvest practices that have been used for the analysis of the farmers’ strategies is provided in appendix B.

6.2.1 Primary challenges from the farmers’ perspective

When the farmers were asked about what major challenges they are facing on their cocoa farm, all farmers explained that the incidence of several pests and diseases is severe. Almost all farmers viewed the high incidence of CPB and black pod disease as a major problem, since they are causing reduced yields and profits. Only a couple of farmers did not complain about these intruders. The farmers complained that the recent boost in disease and pest infection has caused a depressing production cycle: the cocoa yields are decreasing, while cocoa production has become work and input demanding. This is a serious concern to all cocoa farmers. Some farmers, only of Tolaki origin, have begun to replace the worst infected cocoa fields with more profitable crops, whereas the farmers of Bugis origin are more loyal to cocoa production. On the positive side, farmers seem to keep and maintain the most productive parts of their cocoa fields. Further, the shrinking income and uncertain profit from cocoa production seem to make many farmers unwilling to invest in their fields.

6.2.2 The farmers’ farming strategies

6.2.2.1 Pruning

The farmers’ pruning was not explored in detail. 79%25 of the respondents prune frequently, either daily, weekly or at least several times every month, depending on the size of their fields. 12% prune infrequently, normally a couple of times annually, whereas only 9% don’t prune their trees. The farmers’ main reason to prune frequently is to increase the sunlight and aeration in the canopy, which most farmers know will stimulate the pod growth and reduce the humidity and, thus, potentially reduce the incidence of diseases. Farmers with old trees complained that it’s hard to prune tall trees, which makes it impossible for them to prune adequately. This was confirmed during field observations in old cocoa groves. The farmers showed no experience in reducing the height of tall trees by pruning and they often lack basic

25 27 out of 34 respondents
pruning equipment, such as a saw and pruning shears. In addition, the farmers are reluctant to prune branches that still produce pods.

6.2.2.2 Integration of shade trees

Cocoa is mainly grown in monocultural systems with zero shade or little shade in patches. This farming system is dominating in the large cocoa fields surrounding the villages, whereas the minor homegardens next to the houses are diverse agroforestry systems with a few cocoa trees. Many farmers have kept a few rambutan, langsat and scattered forest trees in the large cocoa fields. Rambutan is a host species for CPB, but the fruits are highly valued by the farmers. Some farmers in Wonua Hoa grow coffee for local consumption between the cocoa trees and a few farmers in Lawonua include coconut trees. These exemptions don’t distort the overall impression that cocoa is grown in full sun.

In the seldom case where farmers have begun to include other tree species in the cocoa fields it is caused by the decreasing production of their cocoa trees. The recent inclusion of other crops is stimulated by the high incidence of disease infested, old and less productive cocoa trees that some farmers are keen to replace with more profitable crops such as pepper, oil palm or clove. This is mainly a tendency among the Tolaki, who seem to be fonder of crop diversification than the farmers of Bugis origin. This tendency has a limited impact on the farmers’ cocoa farming systems, since the farmers still favor monocultural farming systems.

85% of the farmers know that cocoa seedlings require shade to grow healthy and vigorously during the first years. This has also become visual with the recent construction of small nurseries in the villages by the AgFor project. That said, most of these farmers also argued that mature cocoa trees are growing well in the absence of shade. The common argument among the farmers is that mature cocoa grows well without shade, which is based on the farmers own experiences with growing cocoa in full sun and how cocoa has been grown traditionally in the region.

Only 28% of the respondents showed awareness of the advantages of using leguminous species - often recognized by their feather-shaped leaves – as shade trees. Among these were 4 farmers in Asinua Jaya who have been taught about the beneficial effects of leguminous species in a training program facilitated by Care in 1995. The other farmers that are aware of the beneficial attributes of leguminous species have heard about it from fellow farmers.

26 28 out of 33 respondents
27 10 out of 36 respondents
Though, hardly any of these farmers seem to use leguminous species as permanent shade trees in their cocoa fields. It is tradition to grow *Gliricidia* – locally known as gamal - as fences along the edges of the fields, but they are seldom integrated in the cocoa fields as shade trees and the leaves are not applied as mulch, which would add nutrients as they decompose, while acting as a buffer for the dispersal of diseases. Despite the ease of planting most leguminous species, no cocoa fields were observed with gamal or *leucaena leucocephala* – locally known as lamtoro – as permanent shade trees.

6.2.2.3 *Soil enrichment practices: manure and compost*

The majority of the farmers are not familiar with basic soil enrichment and protection practices. Even on steep slopes the farmers don’t plant cocoa in contour lines or between contour hedgerows, which would be beneficial to avoid erosion of the topsoil and prevent run-off of water and nutrients. No green manure or cover crops are grown, and no mulch is added to the fields. The only ground cover in the cocoa fields is the residues of the cocoa trees, since weed is normally killed with herbicides, which exposes the topsoil to sun and rain.

56%\(^{28}\) of the farmers have heard about the positive effects of applying manure, including farmers from all the villages. Of the farmers that are aware of the benefits of applying manure 44% applies it, but they argued that they only apply manure on a very limited and experimental scale to the highest-yielding trees. All of these farmers consider it unfeasible to collect and apply manure to their cocoa fields on a wide scale due to the work it would involve. The farmers that apply manure can be divided in 3 main groups according to their explanations. Some are entrepreneurial farmers that want to experiment with the potential positive effects of manure, some are farmers who can’t afford conventional fertilizer brands and a couple of farmers argued that they prefer manure to conventional fertilizer. The other half of the knowledgeable farmers doesn’t apply manure for different reasons. Almost all argued that they don’t consider it imperative to apply manure as long as they apply conventional fertilizer sources. In addition, many argued that manure is not “available”. This argument is also put forward in villages where livestock is present, which is the case in Asinua Jaya. When the farmers state that manure is not available they refer to that manure is not available for free or easy to collect. It seems that the availability of manure depends on if farmers know somebody with livestock. If the farmers don’t have relatives or friends in the proximity with livestock they must pay for the manure, which no farmers seem to be willing to. According to a few farmers manure has been handed out earlier by the extension service in

\(^{28}\) 18 out of 32 respondents
Lawonua and in a Swisscontact project in 2003 in Asinua Jaya. Only one of these farmers applies manure currently.

None of the respondents apply compost to their cocoa fields and no compost piles were observed during the fieldwork. No farmers seem to be experienced with how to build a proper compost pile. 29% of the respondents have heard about composting, but most of them expressed uncertainty about the actual effect of applying compost. These farmers are reluctant to invest the work hours needed to apply compost, since they are not convinced of its actual effect. All of the knowledgeable farmers indicated that composting is not feasible on a large scale due to the work it would involve and, in general, most farmers argued that it is sufficient to apply fertilizer. 4 farmers in Asinua Jaya have been trained in building compost piles by either Care or Swisscontact, but the support and training only resulted in temporary application. 3 of these farmers argued that they are no longer able to do composting, since compost starter bottles aren’t available locally. They emphasized that they need a compost starter mix to do composting. Sadly, these farmers don’t know how to replace the conventional compost starter mix with alternatives such as topsoil, molasses and yeast mixes, cocoa fruit pulp or similar ingredients. What to them is a matter of limited access is rather a lack of knowledge of alternatives that can replace it.

In general, many farmers expressed that as long as they apply conventional fertilizer sources there is no need to enrich the soil in other ways. The attitude of many farmers is that conventional fertilizer is sufficient and, in addition, only a minority of the farmers demonstrates awareness of the need to apply organic matter to improve the structure, nutrient uptake and the water holding capacity of the soil. A group of farmers in Wonua Hoa is an exception, since they were emphasizing the negative effects they have experienced by only applying inorganic fertilizer sources to the soil. They argued that inorganic fertilizer makes the soil hard and they are concerned that yields might decline due to the poor soil structure. Based on this experience they are currently experimenting with a mix of inorganic and organic fertilizer brands, Pupuk Organik, but they have not considered making use of other soil enrichment practices. They have decided to test organic fertilizer sources since the price of organic fertilizer is 1/3 of the price of the inorganic fertilizer brands. Also, a few farmers in the other villages complain about negative side-effects of applying inorganic fertilizer sources, but none of these were able to mention alternative nutrient sources.

29 9 out of 31 respondents
30 It costs 25,000 Rp for a 40kg bag of organic fertilizer, whereas inorganic fertilizer sources cost between 75,000 and 105,000 Rp for a 50kg bag, depending on the type of fertilizer and the village
After the harvest the cocoa pods – rich in potassium - are split in piles, where they decompose, but no farmers seem to scatter the decomposed pods in the fields strategically. No farmers know how to decompose the disease-infested pods by killing the disease pathogens with lime or a urea solution.

6.2.2.4 Inorganic fertilizer application

Several conventional inorganic fertilizer brands are easily available from private suppliers in the area, who are supported by the government through subsidies that reduce the fertilizer price. The suppliers of fertilizer run small shops in the larger villages or sell the products at the market without providing the farmers any kind of professional advice on application, which was confirmed in interviews with the farmers.

To provide an estimate of the farmers use of fertilizer turned out to be complicated. Most of the farmers don’t keep a record of the amount of fertilizer they buy and apply. In addition, farmers apply different amounts of fertilizer to different trees and they don’t know the exact number of trees they grow per hectare. To talk with the farmers about how much fertilizer it is advisable to apply per tree annually was difficult. It was a hypothetical question to the farmers, since it depends on the local farm conditions among other factors. Thus, this was not assessed thoroughly in the end and not included in these results.

Farmers usually apply a combination of NPK, Urea, KCL, TSP-36 and ZA at rates according to what is optimal in their experience and from advice from mainly fellow farmers. Most farmers who apply conventional fertilizer mix one part Urea with two parts KCL and two parts TSP-36 or ZA. They also apply NPK fertilizer on the side. The brand NPK Phoska is highly favored by many farmers, since it contains many of the most important macro – and micronutrients, so farmers don’t have to apply supplemental fertilizer sources. This brand was promoted by the Gernas program in 2009, and it was given to farmers for free for a short period. Some farmers, in particular in Wonua Hoa, complained that this brand is no longer available.

31 Of the farmers that were able to provide price-examples of their annual fertilizer costs most estimated costs to be between 400,000 to 900,000 Rp per hectare, but some of the farmers stated that they would apply fertilizer for up to 1,400.00 Rp per hectare. This is almost double the amount estimated by this simple calculation: with a spacing of 3m x 3m one hectare can accommodate 800-1,000 cocoa trees according to Perdew (2009). 900 trees applied 0.5kg fertilizer each per year will be 450 kg of fertilizer ha/annually. The average price for a 50 kg bag of any of the fertilizer brands is 75,000-100,000 Rp. This means that the expected fertilizer costs for one hectare of cocoa accommodating 900 trees is around 780,000 Rp annually if farmers apply the recommended amounts.

32 Urea is a nitrogen source; KCL is rich in potassium; TSP-36 contains high levels of phosphate; ZA contains high levels of nitrogen and sulfur; NPK fertilizer also contains many micronutrients in small quantities next to the macronutrients
Wonua Hoa also complained that KCL fertilizer is no longer available from their common supplier. There is not a specific fertilizer for cocoa on the market.

The farmers’ attitude to, and experience with, fertilizer application is positive. Many farmers explained that they have been experimenting with applying different amounts of fertilizer throughout the years, both to cocoa and other crops and they now have their favorite brands and mixes. Based on their prior experiences the farmers argued that it is paramount to apply fertilizer to boost the yields. Many farmers have tried not to apply fertilizer, but they argued that production declines.

A large share of the respondents, approximately 90%, are well-informed of the benefits of fertilizer application and the basic recommendations for how and how frequent to apply fertilizer, which include 2 times of application annually 50-70 cm from the tree trunk. Most of these farmers are also aware of that the need for nutrients increase as the cocoa tree matures. The last 10% of the farmers that aren’t familiar with the recommendations for fertilizer application are from Asinua Jaya. Half of these farmers apply fertilizer once annually, while the other half doesn’t apply fertilizer.

Table 2. Application of inorganic fertilizer among knowledgeable farmers

<table>
<thead>
<tr>
<th></th>
<th>Apply fertilizer 2 times annually</th>
<th>Apply fertilizer 1 time annually</th>
<th>Don’t apply Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>7% (1)</td>
<td>21% (3)</td>
<td>64% (9)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>11% (2)</td>
<td>78% (15)</td>
<td>11% (2)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>83% (5)</td>
<td>17% (1)</td>
<td>0% (0)</td>
</tr>
</tbody>
</table>

The farmers’ strategies in the three villages differ radically. Respectively 7, 11 and 83% of the knowledgeable farmers in Lawonua, Asinua Jaya and Wonua Hoa apply two times annually. The farmers in Lawonua and Asinua Jaya seem to be less consistent in their application of fertilizer, since they stated that they mainly apply to their favorite trees or patches of the field. Most farmers argued that they prioritize to apply fertilizer to trees with a high production potential and they are reluctant to apply fertilizer to trees that produce few pods or are heavily infested. In comparison, the farmers in Wonua Hoa stated that they apply fertilizer to the whole field, also in order to make weaker trees stronger.
All of the farmers that apply twice annually argued that they apply fertilizer to optimize their production. Some of the farmers that apply twice annually argued that they have access to supplemental income that they invest in fertilizer, which include a farmer who works for the oil palm company in Lawonua and two elder farmers in Asinua Jaya who get pension support. This suggests that supplemental income can be an important source of investment capital. The farmers in Wonua Hoa apply fertilizer more frequently, but they mix inorganic and organic fertilizer brands, which reduces the fertilizer costs drastically. This enables them to apply more fertilizer.

Respectively 21, 78 and 17% of the knowledgeable farmers in Lawonua, Asinua Jaya and Wonua Hoa only apply fertilizer one time annually and 64% of the farmers in Lawonua don’t apply fertilizer at all. Most of the farmers in Lawonua have received advice on fertilizer application from the extension service, while some farmers in Asinua Jaya have participated in training sessions.

The farmers that don’t apply fertilizer optimally put forward two major reasons to why they only apply fertilizer in either small quantity, one time annually or don’t apply fertilizer at all. First, all of the farmers consider fertilizer expensive. 96% of all the knowledgeable farmers stated this as the main – if not the only - reason why they don’t apply as much fertilizer as they would prefer. Some farmers stated that they can’t afford to buy fertilizer, at least not as much as they would prefer, and other farmers just state that they prioritize to invest differently, such as in their pepper production. In particular farmers in Asinua Jaya and Lawonua argued that they are not able to buy fertilizer. Only 1 farmer in Asinua Jaya and 2 farmers in Lawonua have borrowed money from the local buyers to buy fertilizer for their cocoa fields, while many other farmers seem to be reluctant to do this. All of the farmers in Wonua Hoa stated that they have never asked for a loan and that they don’t need it.

Second, all of the farmers who also plant pepper stated that they prefer to apply the fertilizer they buy in their pepper fields. Most of these farmers claimed that they don’t apply fertilizer in the cocoa fields as they can’t afford to apply fertilizer in all of their fields. This is primarily the case in Lawonua, and to some extent in Asinua Jaya, where diversification with pepper, oil palm and clove is becoming popular.

Many farmers explained that they are applying less fertilizer than earlier due to the increase in the incidence of pests and diseases, which has increased the overall input and management costs, in particular for pesticides, and reduced the returns from their cocoa production.
Also, a couple of farmers in Lawonua used to apply fertilizer when it was provided for free as part of the Gernas program in 2009. They indicated that they are waiting for fertilizer to become available for free again. The couple of farmers in Asinua Jaya that don’t apply fertilizer don’t consider it necessary, since their soil is rich due to annual periods with flooding. Curiously, 3 farmers in Asinua Jaya and 2 in Lawonua have reduced their application of inorganic fertilizer and instead started applying more manure.

Most of the knowledgeable farmers know that it is best to mix the fertilizer with the soil, while other farmers don’t consider it necessary. Some argued that they try to mix it with the soil, but many also admitted that they don’t always do so as they consider it demanding. Most farmers apply the fertilizer in a circle around the tree on the soil surface and only few farmers mix the fertilizer with the soil to avoid evaporation and run-off. In general, the work load involved in fertilizer application is not considered a major obstacle among the farmers due to the infrequent application.

The higher frequency of application in Wonua Hoa might stem from the general entrepreneurial attitude among the farmers in Wonua Hoa, who seem to be willing to invest in their cocoa fields. The farmers in Wonua Hoa often expressed a pride in growing cocoa, which they themselves associated with being Bugis. This attitude was much different from many Tolaki, who didn’t favor cocoa in comparison to other crops with economic potential. Also, the farmers in Wonua Hoa own larger plots of land, at least 2 ha., which may increase their ability to invest in fertilizer due to their higher outputs.

### 6.2.3 The farmers’ pest and disease management strategies

The farmers argued that the infestation of CPB has increased drastically since 2005, while the infestation of black pod disease has been a major concern since 2009. The field observations revealed that almost all fields are infected with CPB and black pod disease. Many farmers stated that they are uncertain about how to manage these – including farmers who have participated in training in pest and disease management - but almost all of the farmers consider pesticide application and pruning the best techniques.

A few farmers explained that a low number of cocoa trees have died in the last couple of years33. These farmers are not able to distinguish between an infection of VSD and Phytophthora palmivora in the branches and trunk, so it is uncertain what causes the dying trees.

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33 The farmers that complained about dying trees stated that a maximum of 3 trees/ha were dead
trees. The farmers’ limited insight into the lifecycle of *Phytophthora palmivora* and VSD makes it hard for them to carry out preventive practices, even though some farmers attempt to prune the infected parts, albeit they seem to be reluctant to prune enough. Stem borer and *Helopeltis* are also considered minor problems by many farmers.

Also, some farmers face minor problems with animals, such as flower-eating ants, squirrels, wild boars, birds, livestock and monkeys passing through the fields. Finally, some farmers complained about cherelle wilt, which is a natural phenomenon, since the cocoa tree produces flowers and miniature pods beyond its capacity.

### 6.2.3.1 Spraying

The study of the farmers’ use of pesticides mainly involved management of the CPB, since this is the major threat in the area and has to be controlled with direct spraying on the tunnels on the pod. The interviews involved questions to the farmers’ methods and frequency of application. Also, it is advised to spray less frequently.

It became clear from the farmers’ statements that spraying is a primary and highly prioritized practice. Spraying is considered the main practice to combat the CPB and black pod disease by almost all farmers. The favored brand among the farmers is Alika, which is an insecticide that was promoted by Gernas to control the CPB and it is easily available in local stores. If farmers apply more than one brand they mix the insecticides and fungicides to reduce the work involved in spraying.

<table>
<thead>
<tr>
<th>Table 3. Farmers’ spraying frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequent spraying</strong></td>
</tr>
<tr>
<td>Lawonua</td>
</tr>
<tr>
<td>Asinua Jaya</td>
</tr>
<tr>
<td>Wonua Hoa</td>
</tr>
</tbody>
</table>

The number of respondents in Wonua Hoa is low and will not be included in this analysis. In Lawonua and Asinua Jaya, 80% of the respondents spray frequently, 2-3 times monthly.

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34 Many farmers complained that they can’t buy Ridomil and Matador in their area, which they have heard are an efficient insecticide and fungicide. Some farmers also apply Decin, Akodan and Canon. The costs associated with pesticide application were not collected for many farmers.
whereas respectively 13 and 16% spray infrequently, approximately 1 time monthly. Only 2 farmers don’t apply pesticides in Lawonua and Asinua Jaya. These farmers are alone in their household and argued that they don’t have time to spray their cocoa fields. Also, many farmers argued that they prioritize to spray in the most productive fields and that they give up maintaining the worst infested parts of their fields in long periods, when they are in shortage of money.

Almost all farmers do broad and preventive spraying rather than strategic and pest-specific spraying. None of these farmers are aware of the need to apply pesticides directly on the CPB tunnels and they don’t know when it is appropriate to spray respectively the pod, for CPB infection, and the tree, if Helopeltis is present. To spray frequently and broad is costly and work demanding. Only 3 farmers, 2 in Lawonua and 1 in Asinua Jaya, argued that they are not spraying broadly. They attempt to spray directly on the infected areas of the pod to combat the CPB. These farmers have been taking part in training in pesticide application by ACDI/VOCA, but they all spray frequently.

When the farmers were asked about their strategies to control the pests and diseases, almost all farmers stated that they consider spraying the primary technique, together with pruning, to reduce the incidence of these intruders. Knowledge and trust seem to be the two major factors affecting the farmers’ spraying strategies, respectively related to the efficiency of pesticides/fungicides and related to the alternative pest and disease management practices. First, some farmers are not familiar with the alternative pest and disease management practices that have been promoted as alternatives to frequent spraying by ACDI/VOCA, Swisscontact and the extension service officers in Asinua Jaya and Lawonua. Only up to 40% of the farmers, depending on the village, have participated in training sessions or received random advice of alternatives to spraying.

Second, hardly any farmers seem to trust the efficiency of these alternatives to spraying or consider them viable alternatives. On the one hand, the majority of the farmers, 61%, stated that they trust the efficiency of pesticides/fungicides from their own experience, which – as they argued - is their main reason to apply it. All of these farmers spray frequently. On the other hand, a minority of the farmers, 39%, consider spraying ineffective or even problematic. Most of the latter farmers argued that spraying isn’t efficient and a couple of them argued that spraying may affect the environment negatively. They keep on spraying despite their distrust in the practice, but some of the farmers spray less frequently. They argued that they consider it a risk not to spray, since there are no efficient alternatives to spraying from their viewpoint, whether this means that they don’t trust the efficiency of the alternatives or they don’t consider it feasible to adopt the alternatives.
The training has had a limited impact on the farmers’ willingness to spray less frequently. Farmers that have participated in training spray more or less as frequently as other farmers. Training may have increased the farmers’ awareness of the negative impacts associated with spraying, but it hasn’t convinced the farmers of the effectiveness of the alternative practices.

6.2.3.2 **Phytosanitary harvesting**

Phytosanitary harvesting is to either harvest or cut all of the infested pods on the tree, which farmers are advised to do frequently. The word for this practice is a bit misleading, since what farmers do is to cut the infested pods off the trunk and branches with their machete or pruning poles.

A high percentage of the farmers, between 86 and 100% depending on the village, have heard about phytosanitary harvesting, whereas only 53-71% were able to explain how the practice prevents pests and diseases from increasing in number. Though, even knowledgeable farmers expressed that they are uncertain about the effect of performing the practice. Here we have to distinguish between having heard of a practice and to be convinced of its positive effect.

**Table 4. Knowledge of phytosanitary harvest among farmers**

<table>
<thead>
<tr>
<th></th>
<th>Familiar with the practice and its importance</th>
<th>Familiar with the practice</th>
<th>No awareness of the practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lawonua</strong></td>
<td>53% (8)</td>
<td>33% (5)</td>
<td>14% (2)</td>
</tr>
<tr>
<td><strong>Asinua Jaya</strong></td>
<td>67% (10)</td>
<td>27% (4)</td>
<td>6% (1)</td>
</tr>
<tr>
<td><strong>Wonua Hoa</strong></td>
<td>71% (5)</td>
<td>29% (2)</td>
<td>0% (0)</td>
</tr>
</tbody>
</table>

*Familiar with the practice and its significance*: have heard about phytosanitary harvesting and understand how it prevents disease dispersal

*Familiar with the practice*: have heard about phytosanitary harvesting, but have a limited understanding of its potential effect

Training was not a prerequisite for understanding the importance of phytosanitary harvesting, since it is visual to farmers how infected pods infest other pods, which was insinuated by farmers that have not participated in training. On the other hand, training in the PsPSP practices may have resulted in an increased awareness of disease dispersal and the importance of phytosanitary harvesting among farmers in Lawonua and Asinua Jaya. Many of
the farmers that have received training belong to informal community-based farmer groups. No farmers have received training in Wonua Hoa, but many of the farmers have years of experience with cocoa production in South Sulawesi. Due to the small size of the village knowledge-sharing among the farmers is common.

Table 5. Farmers’ participation in training in PsPSP

<table>
<thead>
<tr>
<th>Village</th>
<th>Joined coordinated training</th>
<th>Received random advice</th>
<th>No training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>33% (5)</td>
<td>33% (5)</td>
<td>33% (5)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>40% (6)</td>
<td>20% (3)</td>
<td>40% (6)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>100% (7)</td>
</tr>
</tbody>
</table>

*Coordinated training:* longer training sessions in PsPSP by ACDI/VOCA, Swisscontact or Gernas

*Random advice:* personal advice from extension service

Between 13-28% of the respondents, depending on the village, attempt to adopt phytosanitary harvesting fully by removing all the infested pods on the trees. This is what distinguishes them from the partial adopters, who only remove the pods of no economic value. The farmers that attempt to adopt phytosanitary harvesting fully understand how diseases and pests disperse throughout the tree and infest other pods and, they argued that they do phytosanitary harvest to break the infestation cycle in an attempt to reduce the number of infested pods. Many of them, except for the adopters in Wonua Hoa, belong to the informal village-based farmer groups that have received the main share of the training in the villages.

Table 6. Farmers’ adoption of phytosanitary harvesting

<table>
<thead>
<tr>
<th>Village</th>
<th>Full adoption</th>
<th>Partial adoption</th>
<th>No phytosanitary harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>20% (3)</td>
<td>67% (10)</td>
<td>13% (2)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>13% (2)</td>
<td>67% (10)</td>
<td>20% (3)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>28% (2)</td>
<td>72% (5)</td>
<td>0% (0)</td>
</tr>
</tbody>
</table>

*Full adoption:* remove all infested pods from the tree, including big infested pods

*Partial adoption:* only cut the pods of no economic value and leave the big pods on the tree to mature
No adoption: leave all infested pods on the tree

Between 67-72%, depending on the village, of the farmers do phytosanitary harvesting partially while they prune, but they only remove the worst infected and small pods of no economic value. They still leave the larger infested pods on the tree to mature, which they include in the harvest later on to add kilos. According to the farmers, infested pods can be divided in two groups: first, some pods are too underdeveloped or infested to be of any economic value. Second, the beans from big infested pods can be sold despite the infestation. In consequence, only few farmers harvest all the infested pods separately as recommended in phytosanitary harvest, since they prefer to harvest the big infested pods during the regular harvest. This is an explicit disincentive for many farmers to remove all the infested pods, despite the risk that other pods will get infested. This disincentive stems from the market conditions, where inconsistent beans of lower quality are accepted, at least among local buyers operating in the villages, who all farmers sell to.

Many of the farmers who have adopted phytosanitary harvesting partially expressed that they are not convinced of the effect of carrying out phytosanitary harvesting, not least the cost-benefit of the extensive work it involves. This is another disincentive for farmers to adopt it fully or on a larger scale. No farmers have observed the actual effect of adopting phytosanitary harvesting over an extended period. There are no demonstration fields or experimentation with proper harvesting and field sanitation in the area except for the fields at Konda Research Station that only few farmers have visited. It makes little sense to these farmers to adopt phytosanitary harvest fully as long as they are able to sell some of the infested beans and as long as they are not convinced that phytosanitary harvesting will increase their yield.

Some farmers in Lawonua, of which all have received training in phytosanitary harvesting, explained that they have attempted to adopt phytosanitary harvest fully, but they had all experienced disappointing results, since their fields kept becoming infested due to the permanent presence of diseases and pests in the area. They expressed uncertainty with the effect of phytosanitary harvest. These negative experiences make them unwilling to invest more time on it and they are now performing phytosanitary harvesting partially. That said, most of the partial adopters are still convinced that phytosanitary harvest has a positive effect, albeit they are uncertain of the scope of the effect.

Phytosanitary harvesting is considered a secondary practice by all farmers – a practice to which farmers only devote their attention if they have time after applying pesticides, pruning and harvesting. Most of the farmers trust in pesticide application as the primary, if not the
only, way to combat pests and diseases, which limits their incentive to carry out phytosanitary harvesting and sanitation.

Not least, the farmers argued that the work load involved is the greatest disincentive to adopt phytosanitary harvest, if only partially. Phytosanitary harvesting is a work intensive task. It has already been explained that the high incidence of the pests and diseases is a rather new phenomenon in this region. The farmers argued that cocoa used to be a less demanding crop prior to the heavy pest and disease infestation. The farmers have been unprepared for the work burden of pest and disease management in cocoa, which became clear from the farmers statements. Some farmers seem to be reluctant to invest further work hours in their cocoa fields, since they are now facing decreasing yields and lower returns to their cocoa production.

Some farmers argued that it is impossible to adopt phytosanitary harvest fully due to their personal situation. These include single farmers with no assistance in the field or household, farmers with more than 1,5 ha. of land, farmers who have off-farm work and, not least, farmers who own hilly or swampy land. These farmers argued that their lack of work assistance and time, or their large farm size and inaccessible land are clear disincentives to adopt phytosanitary harvesting fully. The farmers in Wonua Hoa are an exemption. They own much land, but carry out phytosanitary harvesting partially in the whole field, which is possible since they have flat land and easily accessible fields of trees that are easy to manage. Farmers argued that it is hard to do phytosanitary harvest in tall cocoa trees, which are dominating on some farms in Lawonua and Asinua Jaya. This will hamper farmers with old fields from carrying out phytosanitary harvest fully.

Both the farmers that have adopted the practice fully and partially argued that they only harvest the infested pods infrequently. In addition, many of the farmers not only do phytosanitary harvest infrequently, but they also seem to prioritize productive and less infested parts of their fields. Heavily infested trees are left unmanaged and farmers tend to give up maintaining the worst infected fields. Some of the farmers with large plots of land claimed that it would not be possible for them to adopt phytosanitary harvest fully in all their fields due to the work load involved. Further, farmers don’t carry out phytosanitary harvest preventively, but mainly remove pods when they are severely infested and of no value, which give the pests and diseases an opportunity to disperse.

Only up to 20% of the farmers, depending on the village, don’t do any form of phytosanitary harvesting at all. They only harvest the salable pods, while the rest of the infested pods are left on the tree. These farmers can be divided in three groups that share some common
characteristics. First, some of them have never heard about phytosanitary harvesting, neither from training sessions nor from fellow farmers. In general, these farmers have a limited understanding of how diseases and pests disperse. Second, some farmers consider it impossible to do phytosanitary harvest due to the work burden it will involve. This includes single farmers with no assistance in the household and farmers with less accessible land, such as farmers that own cocoa fields in hilly or swamp areas. Third, due to declining yields and the increasing work load involved in cocoa production, some farmers, in particular of Tolaki origin, have turned their attention towards more profitable and easier manageable crops, mainly pepper. This is the case among farmers in both Asinua Jaya and Lawonua. These farmers argued that they prioritize to work in the pepper fields and, hence, they have decided to maintain their cocoa fields on a limited scale. Farmers refrain from performing other practices than the harvest in some cocoa fields, and many of the worst infested cocoa fields have been abandoned in this process.

6.2.3.3 Field sanitation

Field sanitation is suppose to follow phytosanitary harvesting: after the farmers cut the infested pods off the tree they are suppose to collect them and either compost, burry, burn or in other ways discard them to avoid diseases and pests to disperse. As explained in the phytosanitary harvesting section, the unmarketable worst infested pods are often left on the tree, where they will produce mycelia and later mummify as part of the disease cycle. Farmers often cut off the mummified pods later on and leave them on the ground. The field observations revealed that many mummified pods are left on the ground.

Only 6-29% of the respondents, depending on the village, attempts to adopt sanitation fully. None of the farmers compost the infested pods, but they either burn, burry or discard the pods in the river. Approximately 56% of the farmers don’t do sanitation at all and 33-71%, depending on the village, does it partially on a limited scale.

In Asinua Jaya, the farmers that attempt to adopt sanitation fully or partially are mainly members of the village-based farmer group, who have received the main share of the training in PsPSP from private stakeholders such as ACDI/VOCA and Swisscontact. The farmers that adopt sanitation in Lawonua have often taken part in training sessions in PsPSP facilitated by Gernas or the local extension service. This became clear by looking at the profiles of the farmers who have adopted sanitation fully. That said, it is hard to say to what degree training encourages farmers to adopt certain practices or whether the farmers who are part of the

35 See table for training in PsPSP below phytosanitary harvesting
farmer groups are more willing to adopt certain practices due to their personality and status in the village, which made them join the farmer groups in the first place. The members of the farmer groups often seem to have a more experimental attitude to farming, be wealthier and have a better position in the community, which enabled them to join the farmer groups in the first place.

All farmers in Wonua Hoa have heard about the practice, despite the lack of training in the village, but knowledge-sharing among the small population of farmers is common.

Table 7. Field sanitation among farmers

<table>
<thead>
<tr>
<th></th>
<th>Attempted full adoption</th>
<th>Limited adoption</th>
<th>No field sanitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>13% (2)</td>
<td>33% (5)</td>
<td>53% (8)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>6% (1)</td>
<td>39% (7)</td>
<td>56% (10)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>29% (2)</td>
<td>71% (5)</td>
<td>0% (0)</td>
</tr>
</tbody>
</table>

*Full adoption: Attempt to discard all infested pods (burn, bury, cover or dump in the river)*

*Limited adoption: Infrequent field sanitation on a limited scale*

The farmers’ adoption of field sanitation seems to be related to their awareness of the need to do sanitation. Up to 38% of the farmers have never heard of the practice and therefore don’t perform it. Between 38-66%, depending on the village, of the farmers has heard about the practice, but they are unable to explain why it is important to prevent diseases and pests to disperse.

Table 8. Farmers’ understanding of the importance of field sanitation

<table>
<thead>
<tr>
<th></th>
<th>Familiar with the practice and its significance</th>
<th>Familiar with the practice</th>
<th>Not heard of the practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>33% (5)</td>
<td>40% (6)</td>
<td>27% (4)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>25% (4)</td>
<td>38% (6)</td>
<td>38% (6)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>33% (1)</td>
<td>66% (3)</td>
<td>0% (0)</td>
</tr>
</tbody>
</table>

*Familiar with the practice and its significance: have heard about sanitation and understand how it prevents disease dispersal*

*Familiar with the practice: have heard about sanitation, but have a limited understanding of its potential effect*
Disease dispersal is a complex phenomenon. Most of the farmers seem to understand how pests move on and how diseased pods on the stem infest neighbor pods on the tree, but only few farmers understand how diseases move from the soil or pods on the ground to the pods on the tree or into the tree trunk. The complexity of disease dispersal seems to affect the farmers understanding of the need to remove the infested pods on the ground, in particular black pods, in order to prevent infestation from the soil to the tree and the newly developed pods. Of the farmers who have heard of sanitation, only 25-33%, depending on the village, seems to understand the rationale for carrying out sanitation. This became clear during the structured conversations with the farmers about disease dispersal and sanitation. Therefore, some of the farmers who have heard about field sanitation don’t perform it or, in most cases, only adopt it partially and on a limited scale. Some farmers also stated that there is no need for sanitation, since they already apply pesticides.

Lack of knowledge or understanding is far from the only reason not to carry out sanitation. The farmers put forward several other reasons not to adopt the practice fully, if at all. First of all, much in line with phytosanitary harvesting, sanitation is perceived as a secondary practice that farmers only perform if they have time after pruning and spraying pesticides.

Many farmers expressed that they are unable to do sanitation due to the work load involved. Sanitation is not a practice that can be paired with other practices, since it requires that farmers walk an extra round with the wheelbarrow to collect the infested pods on the ground. This is almost impossible on less accessible land, as the farmers argued, in particular in swampy or hilly areas. For this reason farmers with less accessible land don’t perform it. Farmers that grow pepper or oil palm argued that they don’t do sanitation in their cocoa fields, since they prioritize to work with the more profitable crops. This was the case with farmers in Lawonua and Asinua Jaya.

Not least, farmers with larger plots of cocoa – more than 1,5 ha. - argued that it was impossible to adopt the practice fully. For this reason, some farmers have given up doing it or only do sanitation in the most productive and accessible parts of their fields. This was the reason provided by many farmers in Wonua Hoa, who have only adopted sanitation partially. A single women in Wonua Hoa attempt to do sanitation, but she receives help from fellow farmers.

Further, the farmers who had heard about sanitation expressed uncertainty with the cost-benefit of removing the infested pods from the ground, which is a clear disincentive to perform it when time is limited and, not least, when this argument is paired with the farmers’
superficial understanding of how diseases disperse. The benefit of sanitation is not easily observable and has never been observed by the farmers.

During harvest, farmers collect the pods in a wheelbarrow or by hand and then split the pods. The majority of the farmers leave the pods in a pile, either in the field or next to their houses, and only very few discard the old pods to avoid sporulation and pests to move on. None of the farmers compost the pods as recommended.

6.2.3.4 Frequent harvesting and harvest

Farmers are recommended to harvest frequently, 2-3 times monthly, to break the infestation cycle of pests and diseases and to avoid that the ripe pods get infested on the tree. Farmers are also supposed to only harvest the ripe and semi-ripe pods.

To harvest frequently is a prioritized practice among the farmers and between 89-100%, depending on the village, of the respondents harvest frequently, at least two times a month. Most farmers expressed that they have noticed that ripe and semi-ripe pods get easily infested compared to unripe pods and, thus, they see a clear economic incentive in frequent harvest to keep the loss of production from disease and pest infection low. Also, many farmers argued that they harvest frequently to keep a constant flow of income. Further, to harvest frequently means that farmers only have to ferment and dry small batches of beans, which is important with their limited drying capacity and equipment. A couple of farmers were found not to harvest frequently, since they prioritize to work off-farm and therefore don’t have time to harvest frequently.

Table 9. Adoption of frequent harvesting among farmers

<table>
<thead>
<tr>
<th>Village</th>
<th>Harvest frequently</th>
<th>Harvest infrequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>89% (8)</td>
<td>11% (1)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>92% (11)</td>
<td>8% (1)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>100% (6)</td>
<td>0% (0)</td>
</tr>
</tbody>
</table>

*Frequent harvest:* at least two times a month during the peak harvest season

*Infrequent harvest:* one time or less monthly

The market for cocoa beans of inconsistent quality is a clear economic incentive for farmers not to perform phytosanitary harvest or harvest as recommended. Most farmers sell beans
from infested pods to the local buyers and, therefore, harvest marketable infested pods as part of the normal harvest instead of separately in the phytosanitary harvest.

Despite the tendency to harvest frequently no farmers harvest according to the recommendations, since farmers include infested pods and pods at different levels of ripeness in the harvest. Some farmers harvest ripe pods, yellowing pods (often CPB infested pods), big unripe green pods and big infested pods together, which result in reduced yield-loss and more kilo, but beans of lower quality and consistency. Beans from unripe or infested pods are underdeveloped and of lower quality. 33-67% of the farmers, depending on the village, include infested pods in the harvest and 33-56% includes both unripe and infested pods. That said, some of the farmers stated that they include these pods in the harvest and fermentation, but sort the beans before they sell them to the local buyers to avoid the small price reduction added for bean batches with waste material. According to many farmers, to harvest the big green unripe pods will limit the total number of pods getting infested, which reduces the loss from pest and disease infection that increases as the pods ripen. Farmers don’t harvest small pods as the beans are too small.

**Table 10. Farmers’ harvest practices: types of pods included in the harvest**

<table>
<thead>
<tr>
<th>Village</th>
<th>Include ripe/semi-ripe and infested pods</th>
<th>Include ripe/semi-ripe and unripe pods</th>
<th>Include ripe/semi-ripe, infested and unripe pods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>33% (3)</td>
<td>0% (0)</td>
<td>67% (6)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>42% (5)</td>
<td>0% (0)</td>
<td>58% (7)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>67% (4)</td>
<td>0% (0)</td>
<td>33% (2)</td>
</tr>
</tbody>
</table>

The farmers seem to be aware of that unripe, infested, small and flat beans are of lower quality, but the local buyers don’t seem to question the consistency and quality of the beans to an extent where it becomes unprofitable for the farmers to include infested and unripe pods. It makes little sense for the farmers not to include unripe and infested pods in the light of the commonness and economic logic of including these pods in the harvest. The farmers’ rationale is based on what is common, accepted, and economically strategic with the current market conditions. That said, some local buyers do reduce the price for inconsistent beans, but the farmers argued that the reduction, between 500-2000 Rp/kilo, is not worth considering since it also involves extra sorting. If the farmers want to avoid this discount they can sort the beans later on, after the fermentation and drying phase, and only discard the beans that are visually of a lower quality.
6.2.4 The farmers’ post-harvest strategies

6.2.4.1 Fermentation

The study of the local market chain revealed that there is a market for fully fermented beans. The LEMS warehouse in Andomosingo and regional warehouses in Kendari and Kolaka source fully fermented beans – some only source beans fermented in boxes, while most private warehouses accept beans fully fermented in sacks or rattan baskets. In order to comply with the standards for fully fermented beans farmers have to ferment for 4-7 days to produce beans with a brown interior, preferably in wooden boxes to assure that the beans also comply with the higher consistency standards for fully fermented beans.

However, only 4 of the respondents, 1 farmer in Lawonua and 3 farmers in Asinua Jaya, ferment fully to fetch the price premium offered for fully fermented beans. None of the farmers ferment in wooden boxes as recommended. Only a single box was observed during the fieldwork, but it was not in use. 53% of the farmers have heard of box fermentation, but they seem to agree that it is much easier to ferment in sacks or rattan baskets, which they can carry from the house to the drying mattresses. Further, only a couple of farmers have actually tried to ferment in boxes and only few seem to understand the effect of box fermentation on bean quality, which became clear during conversations with the farmers about the effect of box fermentation.

Table 11. Farmers’ fermentation strategies (all in sacks or rattan baskets)

<table>
<thead>
<tr>
<th></th>
<th>Full fermentation 4-7 days</th>
<th>Partial fermentation 1-3 days</th>
<th>Don’t ferment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>6% (1)</td>
<td>89% (16)</td>
<td>5% (1)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>17% (3)</td>
<td>83% (12)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>0% (0)</td>
<td>72% (5)</td>
<td>28% (2)</td>
</tr>
</tbody>
</table>

All the farmers that ferment fully emphasized that they have to ask – if not push - the local buyers for price premiums, since it is uncommon that the local buyers ask the farmers for fully fermented beans. They are all familiar with the practices involved in full fermentation.

36 21 out of 40 respondents
and, albeit superficially, understand the effect of fermentation on bean quality and how to test if beans have been adequately fermented. Two of them sell the beans to a local buyer and two transport the beans to a nearby warehouse in Unahaa. The farmers that sell to the warehouse argued that it is most profitable for them to sell fully fermented beans directly to the warehouse. This is only possible during the great harvest season, where the volume of beans is high, and when they decide to collectively transport the beans to a warehouse.

A few farmers don’t ferment the beans at all, respectively 1 farmer in Lawonua and 2 farmers in Wonua Hoa. None of these farmers understood the necessity to ferment the beans fully, nor are they offered price premiums for fully fermented beans by local buyers. The farmer in Lawonua is an elderly single woman, who prefers to work less and sell the beans immediately.

Between 72-89% of the farmers, depending on the village, ferment partially, either in sacks or a rattan basket. Most of the farmers ferment for 3 days, followed by 2 days. To ferment the beans partially is common in these villages, as many farmers argued. This tradition of partial fermentation is further reinforced by the local market dynamics, which affect the farmers’ decision to only adopt partial fermentation of the cocoa beans.

First, the price premiums for fully fermented beans are low at the village level, which has been explained in the market chain description. To transport the beans to the warehouse can be difficult and costly and, therefore, all farmers sell to local buyers, while only 8% sell directly to warehouses when possible. Farmers don’t store the beans due to the risk of mould, which makes it difficult to coordinate transportation to the warehouse with the intervals of fermentation and drying. In general, only a couple of the farmers are in contact with a warehouse and updated on their prices. This makes most farmers unable to fetch the higher premiums for fully fermented beans offered at the warehouses.

Second, the main problem is not that the price premiums for fully fermented beans are low at the village level, but rather that the local buyers don’t offer price premiums for fully fermented beans to the farmers. The possible reasons to this have been outlined in the market chain description. Only 12% of the farmers that ferment partially stated that they are offered price premiums for fully fermented beans by the local buyers. They stated that the premiums they are offered by the local buyers are ranging from 500-1200 Rp/kilo. The farmers’ choice of local buyer affects their incentive to undertake full fermentation. 60% of

37 3 out of 40
38 4 out of 33 respondents that ferment partially
39 20 out of 33 respondents
the farmers that ferment partially have heard of the existence of price premiums from fellow farmers – mainly from neighbor villages where price premiums are available - but they have never been asked for fully fermented beans themselves. Consequently, many farmers are uninformed of the exact price premiums, standards requirements, tests and practices involved in full fermentation. The local buyers are well aware of that fully fermented beans are in shortage and, for this reason, when buyers want to purchase fully fermented beans they only ask farmers they know are able to comply with the stringent standard requirements for fully fermented beans (Intv. buyer I, II and III).

For example, a small group of knowledgeable farmers in Lawonua are awaiting price premiums. They have gained their knowledge of full fermentation from past experiences in South Sulawesi. They are now waiting for an economic incentive to ferment fully and they have tried to push the local buyers for price premiums. Though, the local buyers they know are reluctant to offer price premiums. They have considered going to the warehouse, but they have not established a link to any warehouse. The lack of a linkage to a warehouse is the major disincentive for them to undertake full fermentation and invest in boxes, they argued. These farmers blamed the local buyers for distorting the farm-gate prices.

The farmers that are well-aware of the existence of the market for fully fermented beans face several disincentives to act on existing or potential price premiums. The standard requirements for partially fermented and fully fermented beans are not the same. In order to fetch a significant price premium for fully fermented beans it is not sufficient for the farmers to merely leave the beans a couple of days longer in the sacks or rattan baskets. If the farmers want to fetch a higher price premium they must sort and dry the beans adequately, which will result in a loss of kilo and extra work. As long as the farmers only sell to the local buyers the price premiums will remain low and therefore not justify the loss in kilo. The farmers that are offered price premiums by the local buyers, but still have decided to ferment partially, all argued that the price premium for fully fermented beans is too low to act on. All of them include infested beans in the fermentation and refuse to sort adequately afterwards, which explains the low price premiums.

The market for inconsistent beans provides the farmers with an incentive to include infested and unripe beans in the fermentation to add kilos. Pods infested with CPB are referred to as hard (*kiras*) by the farmers, since the beans and placenta are pasted in a hard pod-shape. It is common among farmers to include these infested pods in the fermentation, since it enables them to separate the infested beans from the placenta. Farmers will not be able to sell most of these beans as fully fermented beans due to their bad appearance. Further, if the farmers choose to fully ferment infested and unripe beans they will fetch a low price premium that has
to make up for the work involved in improved fermentation, drying and sorting. Most of the knowledgeable farmers that ferment partially argued that the loss of kilo associated with sorting infested and unripe beans from the good beans in order to fetch a price premium is a disincentive to undertake full fermentation. Though, farmers can sell the bad and good beans separately, as a few farmers argued, but it will increase the work burden and the price reduction will be higher for the bad beans than for beans of mixed quality. This explains why some farmers don’t act on the existing and potential price premiums, and why many farmers don’t consider fully fermented beans at the village level a profitable business.

The farmers that ferment fully often sort the beans in two heaps before they ferment them: the good beans are fully fermented, while the bad beans are partially fermented, since the bad beans can’t be sold as fully fermented beans anyway. They sell the fully fermented good-looking beans to the warehouse or a trusted local buyer, and then sell the bad beans to another local buyer. Further, two of these farmers stated that they only include the ripe pods in the share they sell as fully fermented beans; the unripe and infested pods are sold as bad or mixed beans.

Some farmers mentioned that to extend the number of days of fermentation in sacks results in more black beans, which again result in a price reduction. A handful of the farmers have noticed that fermentation itself results in a weight loss, why they are reluctant to ferment the beans longer. In addition, a couple of farmers argued that they prefer to ferment the beans faster to obtain a faster flow of cash.

All of the farmers who undertake partial or full fermentation argued that they consider fermentation important as it removes the pulp from the beans, which makes drying faster and improves the appearance of the beans. Non-fermented beans will take 5 days to dry adequately, one farmer explained, while it only takes 3 days to dry fermented beans, which reduces the number of days occupied by drying. This is the major reason why farmers keep fermenting partially. This is also what matters when they sell the beans to the local buyers, who reduce the price according to the visual appearance and the dryness of the beans. 2-3 days of fermentation is optimal to remove the pulp from the beans, many farmers argued.

The procedures and concepts involved in fermentation, in particular how it affects the quality of the cocoa bean, are complex. When the farmers were asked if fermentation affects the bean quality it became clear that the farmers’ perception of bean quality is associated with the dryness of the beans, and less with the fermentation process itself. Fermentation is seldom acknowledged to enhance the bean quality in other ways than improving the drying process. In addition, most farmers are unaware of how to test if the beans have been adequately
fermented. Most farmers consider the ‘chocolate color’ – the brown color revealed in the cut test - an indicator of optimal drying, not of adequate fermentation. Despite their participation in a training session in box fermentation at the Cocoa Research sub-station in Konda, most farmers in Wonua Hoa expressed uncertainty with the effect of fermentation on bean quality and, not least, how to ferment in boxes. Two of the women expressed that fermentation has nothing to do with bean quality and firmly told that “beans always have a good flavor when they come straight from the tree”. In Lawonua, a group of farmers build a pilot box for fermentation on request from the extension service a couple of years ago, but they have never used it.

6.2.4.2 Drying

The farmers are supposed to protect the beans from rain and pollution during the drying process, preferably by using solar dryers. Higher prices are offered for adequately dried beans, where the highest price is offered for beans with a 7-8% moisture level, equivalent to 4-5 days of drying.

All the farmers dry the cocoa beans on bamboo mattresses, either on raised platforms or on the ground. Farmers cover the beans with plastic or put them in sacks when it rains. No farmers have a permanent plastic cover – or a greenhouse dryer - which could easily optimize the drying process. Several greenhouse driers were observed on farms closer to the warehouses, but not in the villages included in this study. No farmers have received training in improved drying techniques.

The farmers can decide for how long they prefer to dry the beans, since the local buyers are available daily in the great harvest season. This also means that the farmers can choose what buyer they sell to and thereby shop for the highest price. To sell the beans to warehouses is more problematic, since the farmers are unable to store the beans due to the risk of mould, which means that transportation has to be available frequently. It has already been explained in the description of the market chain that the moisture level – or rather the estimated dryness – of the beans determines the price at the farm-gate level. There is a clear price signal associated with the dryness of the beans, since no other factor affects the price as much as the dryness of the beans. All farmers seem to be aware of that beans dried for 4-5 days are fetching a higher price than beans dried for fewer days.

The majority of the farmers know about the SNI standard for drying, the 7-8% moisture level, but since neither the farmers nor the local buyers possess a moisture meter the actual moisture level is not tested when the beans are traded at the farm-gate. Therefore, farmers
don’t dry in order to reach a specific moisture level, but according to how many days they find it profitable to dry, whether they try to dry for 4-5 days to reach the highest price or intentionally dry the beans less. At the warehouse level the price is determined according to the moisture level, which is tested with a moisture meter. Two factors affect the drying strategy of all the farmers, respectively the prices offered by the local buyers and the weather. The farmers act according to the price reductions added for inadequate drying, and how many days it normally takes to fulfill what they found favorable. During rainy periods farmers have to dry the beans longer to reach the same price and level of dryness.

We must distinguish between 3 groups of farmers that act according to the price in different ways. 20-30%, depending on the village, of the farmers argued that they attempt to reach the full price for adequately dried beans offered by the local buyers and to avoid any price reduction for inadequate drying. They dry the beans for 4-5 days depending on the weather. 50-80% of the farmers, depending on the village, dry the beans inadequately for 2-3 days, whereas up to 20% of the farmers operate with multiple strategies depending on the opportunities they have at hand.

Table 12. Farmers’ drying strategies

<table>
<thead>
<tr>
<th></th>
<th>4-5 days of drying</th>
<th>Multiple strategies</th>
<th>2-3 days of drying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawonua</td>
<td>30% (6)</td>
<td>20% (4)</td>
<td>50% (10)</td>
</tr>
<tr>
<td>Asinua Jaya</td>
<td>30% (3)</td>
<td>20% (2)</td>
<td>50% (5)</td>
</tr>
<tr>
<td>Wonua Hoa</td>
<td>20% (1)</td>
<td>0% (0)</td>
<td>80% (4)</td>
</tr>
</tbody>
</table>

Half of the farmers that apply multiple drying strategies dry according to what prices the local buyers offer. If a buyer offers a satisfying price for beans dried for 2 days the farmers normally sell the beans; if they don’t find the price satisfying they dry longer to fetch a higher price or wait for other buyers to come by. We have to understand this everyday bargaining, where the farmers adjust their strategy according to the market opportunities at hand, which can be quite unforeseeable. A couple of these farmers also stated that they dry fewer days when they harvest larger batches of beans, since they don’t have the equipment to dry large batches of beans at the same time. Thus, they can only dry for more than 3 days outside the peak harvest season.

The other half of the farmers with multiple strategies sell infrequently to a warehouse, which include one farmer in Lawonua and two in Asinua Jaya. When they sell to the warehouse they
dry the beans for 4-5 days in order to reach the higher price offered at the warehouse. Also, they argued that the price reduction for inadequately dried beans is higher at the warehouse level, so it is mainly an advantage to go to the warehouse with well-dried and rather consistent cocoa beans. The farmer in Lawonua stated that she dries the well-fermented beans longer than other beans to optimize the price. On the other hand, when these farmers sell to local buyers they only dry the beans for 2-3 days. The farmers' choice of buyer and the prices offered by different buyers are affecting their drying strategy.

The farmers that attempt to dry optimally, for 4-5 days, argued that they found it more profitable to fetch the highest price possible. Some of these farmers argued that the weight of the beans is reduced when they dry longer, but according to their calculations it is still more profitable to dry longer to avoid the price reduction for inadequately dried beans.

84% of the farmers that dry for 2-3 days base their strategy on a calculation. These farmers argued that to dry the cocoa beans longer will reduce the weight of the beans and, hence, they have calculated that the difference in profit from selling inadequately dried beans compared to adequately dried beans is insignificant, when they compare the loss of kilo associated with longer drying with the price reduction for inadequately dried beans. They then prefer to dry the beans less to avoid the work involved in drying longer. Also, to dry for a shorter period has other advantages as the farmers explained. First, it means that the farmers get a faster flow of income, which many farmers consider an advantage. Second, to dry longer also involves a higher risk for mould beans, which may reduce the farm-gate price further, depending on the farmers' choice of buyer. Third, some of these farmers consider it problematic to dry large batches of beans due to their limited drying equipment.

It is not possible for single farmers to dry the beans adequately as long as they dry the beans on bamboo mattresses exposed to the rain, since they can’t work in the fields on days where they dry. This was the reason why two of the farmers only dry for 2 days. This is not a problem in households with more than one member, since it is custom among all farmers that women dry the cocoa beans as part of their household duties, while the men are working in the fields.

\[40\] 16 out of 19 of the farmers that dry for 2-3 days
7. DISCUSSION

This chapter will involve a discussion of the factors that affect the farmers’ ability and willingness to adopt the recommended farming and post-harvest practices. The discussion will primarily draw on previous research on the cocoa sector and farmers’ practices in Sulawesi in order to keep the discussion relevant in a national context. Each section will begin with a brief analysis of how the farmers’ current farming and post-harvest strategies are expected to affect the productivity, quality and consistency of their cocoa production.

7.1 Farming practices

7.1.1 The farmers’ strategies and expected consequences

The partial or absent application of conventional fertilizer may result in declining pod production, if only in abandoned and less prioritized cocoa fields. Fertilizer is often mis-applied on the soil surface, whereby nutrients are lost due to evaporation or run-off. In the absence of shade trees the cocoa trees will depend more on fertilizer and other soil improvement practices to keep the pod production high. Thus, the limited use of alternative soil enrichment techniques in the villages is problematic. The general lack of nutrient application and soil enrichment will weaken the cocoa trees and thereby make them more susceptible to pest and disease infection. On the positive side, farmers are pruning frequently, thereby reducing the humidity and increasing the sunlight in the canopy, which will stimulate pod growth.

7.1.2 Factors influencing the farmers’ fertilizer application

In their extensive study of the Indonesian cocoa value chain, Panlibutan and Meyer (2004) draw attention to some factors that affect cocoa farmers’ farm management. They put forward two factors that limit the farmers’ ability and willingness to purchase inputs. First, they argue that cocoa farmers lack an understanding of the cost-benefit of applying fertilizer, which makes them unwilling to invest in fertilizer. In comparison, this report suggests that most of the farmers in the 3 villages in Southeastern Sulawesi are well aware of the benefits of applying fertilizer due to their prior positive experiences. The reasons to why the farmers in these villages are less willing or able to apply adequate fertilizer are more complex. The farmers’ explanations indicate that the farmers’ ability and willingness to invest in fertilizer is constrained by the economic uncertainty and hardship that stems from the recent challenges
with cocoa production in the region. Cocoa has turned into a demanding and less profitable crop with the severe increase in the incidence of pests and diseases in recent years. Many farmers are no longer convinced of the economic advantages of investing in the worst infected parts of their cocoa fields, at least beyond the current level, as long as their production drops, while the need for investments and inputs increase. This is an incentive to invest less in, or abandon, the least productive parts of their cocoa fields. The farmers consider it expensive to apply fertilizer due to the drop in production, despite the fertilizer subsidies, or advantageous to apply the fertilizer to crops with a higher return. Some farmers argued that they are no longer able to afford the costs associated with adequate fertilizer application. Most of the farmers are still reluctant to replace their vigorous and productive cocoa trees with other crops, but some farmers have turned their attention, and thereby investments, towards pepper, clove or oil palm cultivation instead. Training in fertilizer application will not be sufficient to circumvent these barriers to adequate fertilizer application.

Panlibutan and Meyer (2004) also state that cocoa farmers in Sulawesi lack access to collateral to financial institutions. The only collateral accepted is a land certificate, which can be costly and difficult to obtain. They suggest that improved access to credit from formal financial institutions or alternative lending schemes may encourage farmers to invest in fertilizer. In comparison, this study did not explore the farmers land ownership in detail, but during the interviews some farmers argued that they own a land certificate, despite the costs involved in obtaining one. Other farmers explained that it is difficult to obtain a land certificate for land located next to the forest, which formally belonged to the government. Jaxx confirmed that a land certificate is needed if the farmers want to borrow money in a bank (Intv. Jaxx). He explained that the banks favor larger loans and are less willing to offer the small loans requested by the farmers (Intv. Jaxx). A significant finding for this discussion is that the farmers are not willing to accept the risks involved in a formal bank loan, not least when their profit from cocoa production is decreasing and uncertain. The farmers explained that they will not risk losing their land if they are not able to repay a bank loan. As described in the results section, only few farmers borrow money from the local moneylenders, whereas many farmers seem to be reluctant to borrow money from the local moneylenders to invest in fertilizer. The loans offered by the tengulak are flexible and often consist of smaller amounts that the farmers can repay with cocoa beans whenever they are able to do so during the great harvest season. It is much easier for the farmers to borrow money from the tengulak, who are always available and flexible. In conclusion, a flexible low-risk lending scheme will be needed to encourage the farmers to borrow money to invest in fertilizer, which Panlibutan and Meyer also suggest.
In his quantitative study on cocoa farmers’ adoption of farming practices in South Sulawesi, Taher (1996) presents some findings of relevance for this discussion. He found that 26% of the farmers had adopted fertilizer application fully, 59% had adopted it partially, and 15% did not apply fertilizer. Taher argues that knowledge was not a limiting factor, since 94% of the farmers knew about the positive effect of fertilizer, which was their main reason to apply fertilizer, if only inadequately. These findings are much in line with the results presented in this report. He further argued that the farmers’ fertilizer application had decreased in periods with high fertilizer prices, which suggests that the input costs may have affected the farmers’ ability to purchase fertilizer. In addition, he shows that cocoa farmers mis-apply fertilizer, since they are spreading the fertilizer on the soil surface instead of mixing it with the soil as recommended.

Several market chain studies suggest that subsidies and governmental services may stimulate application of inputs (Lundy et. al 2012; Laven 2010). This report may help us understand why the government’s attempt to encourage the farmers to apply more fertilizer through training and subsidies partly fails. As described in the results section, the farmers in Lawonua have received the main share of training in fertilizer application, but their fertilizer application is low. The subsidies may reduce the farmers costs associated with fertilizer application, but the price reduction doesn’t seem to be sufficient to encourage the farmers to apply enough fertilizer. Many farmers still need supplemental investment capital to buy fertilizer. It seems that the limited effect of these government-imposed incentives is partly caused by another supply chain imperfection: the farmers’ limited access to credit, which hampers their ability to purchase fertilizer. Several market chain studies have emphasized that limited access to investment capital can be a major obstacle for farmers to invest in inputs (Jano 2007; Lundy et. al 2004; Laven 2010). In her study of Ghana’s cocoa sector Laven (2010) argues that the government-imposed subsidies on fertilizer have not encouraged farmers to invest sufficiently in fertilizer, which is partly caused by the farmers’ limited access to credit facilities. This is in line with the situation in Southeast Sulawesi.

Concurrently, this also illustrates why the farmers aren’t able to be profit-maximizing. The farmers know that fertilizer will increase their production, but they will not accept the risks involved in a loan and, thus, aren’t able to optimize their production by investing in fertilizer. This is an example of how smallholder farmers’ behavior can be risk averse, which other researchers have emphasized (Taher 1996; Roshetko and Yuliyanti 2002).

Taher argues that if other tree crops are traded for higher prices and involve less opportunity costs the farmers will have an incentive to abandon or reduce the maintenance of the cocoa fields and direct their attention towards more profitable crops (Taher 1996). This is the case
with pepper and oil palm in Southeast Sulawesi, which affect the farmers' willingness to adopt several of the recommended practices, including fertilizer application, soil enrichment practices, sanitation and phytosanitary harvest.

### 7.1.3 Factors influencing the farmers' adoption of soil enrichment practices

This study shows that the farmers consider most of the alternative soil enrichment practices work demanding and that the potential of these practices is unknown to most of the farmers. They are not considered alternatives to conventional fertilizer sources by the large majority of the farmers, which hamper their ability to improve their cocoa farming under the current circumstances. For example, the farmers' limited knowledge of the positive attributes of applying manure and compost makes them unwilling to invest time and money on these practices. These findings are in line with a previous study by Nielson et. al (2005), who undertook a combined quantitative-qualitative study in relation to the PRIMA project in South Sulawesi on the cocoa farmers' adoption of good farming practices. He emphasizes that the farmers lack knowledge of alternatives to inorganic fertilizer, not least the financial benefits involved in adopting them. In addition, he argues that the farmers’ use of, and experience with, inorganic fertilizer sources makes them unwilling to invest in alternative practices. Curiously, he also argues that the farmers’ practices are affected by the local land history. He found that the farmers are reluctant to make long-term investments in their land due to the uncertain land ownership in the region, which has been caused by the arrival of migrants, much similar to what has happened in Southeast Sulawesi. The farmers land ownership was not explored in detail in this report. On the other hand, no farmers complained that their land status was uncertain and several farmers of Bugis origin stated that they did not consider it necessary to obtain a land certificate.

With the current drop in fertilizer use it would be beneficial to integrate beneficial shade trees in the cocoa fields to add shade and mulch. Leguminous species are available and easy to plant, but the farmers are not familiar with the multiple opportunities involved in cacao-agroforestry. To grow cocoa under full sun is common. Curiously, Taher (1996) showed that mixed cocoa farming systems are common in parts of South Sulawesi. His study showed that only 40% of the area with mature cocoa was without shade trees, whereas 60% of the cocoa area was in intercropping with shade trees, respectively 40% with *Gliricidia maculate* and *Sesbania sp.*, and 20% with coconut and fruit trees. Taher doesn't provide an explanation of why the farmers in South Sulawesi grow shade trees.
7.2 Pest and disease management practices

7.2.1 The farmers’ strategies and expected consequences

Frequent and broad spraying is common in the villages, which increases the costs involved in spraying. The farmers’ spraying is inefficient for two reasons. First, the farmers’ spraying does not target the specific pests, in particular CPB. Second, spraying is seldom combined with additional pest and disease management techniques. There is a constant presence of infested pods in the fields, either in the trees or on the ground, due to the farmers’ limited adoption of phytosanitary harvest, sanitation and alternative techniques. Many farmers are no longer able to manage parts of their fields, in which the pests and diseases will continue to disperse unhindered. Mummified pods in the tree or on the ground will infect developing pods or might even infect the whole tree. This will influence the farmers’ future cocoa yields, which will eventually affect their ability and willingness to invest in their fields negatively, in particular if the pests and diseases are allowed to increase to an unmanageable level. The practice of including the infested and unripe pods in the harvest and fermentation results in beans of lower quality and consistency, which is problematic for the local grinders and add to the low reputation of cocoa from Sulawesi.

7.2.2 Factors influencing the farmers’ spraying

All studies on the use of pesticides by cocoa farmers in Sulawesi indicate that the large majority of the cocoa farmers spray. Nielson et. al (2005) and Panlibutan and Meyer (2004) found that the farmers spray broadly due to their limited knowledge of how to spray appropriately. This confirms the findings in this report: the farmers’ spraying is not pest and disease specific, which seems to be partly caused by their inadequate knowledge of appropriate application methods, combined with the less work involved in mixing pesticides and fungicides. Nielson also stated that farmers mix pesticides with other agrochemicals, including liquid fertilizer.

Nielson et. al (2012) and Perdew (2009) have argued that the current level of spraying by the cocoa farmers in Sulawesi can be defined as haphazard over-use, which must be viewed in the light of the current effort of multiple stakeholders to implement cocoa certification programs throughout Sulawesi, in which alternative pest and disease management practices are promoted. In a recent quantitative study of the impact of a certification scheme in West Sulawesi, Nielson et. al (2012) found that certification has an impact on the farmers use of pesticides. Their study included a target and control group, where only the target group takes part in a certification program. The farmers that take part in the certification program have
reduced their application of pesticides within the last five years, whereas the farmers that don’t take part in the certification program have increased their spraying. This suggests that certification programs may either inspire or push farmers to reduce their spraying. On the other hand, this report shows that it will be a challenge to implement certification in the villages in Southeastern Sulawesi due to the farmers’ trust in spraying, but a certification scheme could provide an incentive to reduce the spraying. Nielson et. al (2012) argue that spraying has been promoted by Gernas in that they have been distributed pesticides for free, which is a direct incentive to spray more. Gernas has also distributed Alika to farmers in Southeast Sulawesi in 2009. Overall, the farmers extensive and frequent spraying is promoted by the availability of these agrochemical inputs, which is ensured by the presence of the local suppliers and the efficient market for agrochemicals.

This report also shows that the farmers’ limited knowledge of alternative pest and disease management techniques seems to affect the scope of their spraying. From the farmers’ viewpoint, there are no efficient alternatives to spraying. As described in the results section, the farmers are either not familiar with the alternative pest and disease management techniques or don’t trust the effect of these practices. This makes the farmers unwilling to reduce their application of pesticides and adopt alternatives. Nielson et. al (2005) argues that it will require an extensive investment in farmer extension to change the farmers’ attitudes to the alternative pest and disease management techniques and, thereby, to spraying. In comparison, this report indicates that the farmers need real life experiences to trust in the efficiency of new practices and that training isn’t necessarily sufficient. The PsPSP practices have been promoted in the area within the last eight years by several stakeholders, but they have not been adopted adequately on a wide scale by the farmers, which make it impossible for the farmers to observe the potential effect of these practices.

7.2.3 Factors influencing the farmers’ adoption of phytosanitary harvest, sanitation and frequent harvesting

As discussed above, the farmers’ limited trust in the efficiency of the alternative pest and disease management practices is an important factor that makes farmers unwilling to carry out phytosanitary harvest and sanitation. This has earlier been shown by Chi and Yamada (2002), who in their study of farmers’ adoption of improved farming practices in the Mekong Delta found that farmers’ trust in the positive attributes and efficiency of a technology was crucial for the farmers’ decisions to adopt or not adopt new farming practices.

The farmers distrust in the effect of phytosanitary harvest and sanitation is obviously related to their limited knowledge and understanding of the benefits involved in adopting these
practices. This study shows that the farmers’ limited knowledge hampers their willingness to adopt the alternative pest and disease management practices adequately. As described in the results section, the farmers don’t understand how diseases disperse from the soil or ground to the tree and newly developed pods and, therefore, they don’t understand the major reason to carry out sanitation. This is related to what Rogers (2003) refers to as the complexity of an innovation, which she argues affect farmers’ adoption of innovations. In this case, the infestation cycle of in particular *Phytophthora palmivora* is complex, which hampers the farmers’ ability to understand the reason to perform sanitation. Ultimately, this makes the farmers uncertain about the potential of adopting these practices. The complexity of the reasons to carry out these practices is also associated with what Rogers (203) calls the observability of an innovation, which refers to the degree the benefits of an innovation can be observed by a potential adopter. Rogers argues that the observability of an innovation affect farmers’ adoption rates. Disease dispersal from the ground/soil to the tree is not easily observable and obvious to the farmers. For this reason, farmers don’t understand it and don’t see the benefit in removing infested pods from the ground. On the other hand, many farmers have observed how diseases move from one infested pod to another pod in the tree, why many farmers see the point in undertaking phytosanitary harvesting. This partly explains the differences in the farmers’ adoption of respectively phytosanitary harvesting and sanitation.

Nielson (2007) argues that the phytosanitary harvesting and sanitation practices have not been widely adopted among cocoa farmers in Sulawesi due to the availability and aggressive marketing of pesticides, next to the work load involved in adopting these practices. Lambert et. al (2004) also found that cocoa farmers in Sulawesi are in shortage of labor, which will affect their ability to adopt work-intensive practices. This is much in line with the findings in this report, where the work involved in adopting phytosanitary harvesting and sanitation is a major limiting factor. The results show that many farmers have an almost undifferentiated trust in the effect of pesticides, which in combination with their uncertainty about the effect of phytosanitary harvesting and sanitation, makes many farmers unwilling to carry out the work involved in experimenting with the alternative pest and disease management practices. On the other hand, the current work involved in spraying pesticides is also demanding due the farmers’ frequency of spraying, which could be reduced if the farmers combined spraying with phytosanitary harvesting and sanitation.

Taher (1996) argues that cocoa, due to the multitude of farming and post-harvest practices involved, is demanding compared to other crops, which increases the management and exploitation costs involved in cocoa production. This puts a limit to how many cocoa farming practices the farmers are able and willing carry out and to what extent the farmers are able to adopt recommended practices. This is closely related to the findings in this study and gives
emphasis to the farmers’ major concern about the profitability contra the investments involved in cocoa production, which directly affects their ability and willingness to undertake many of the “secondary” practices. This study also shows that some farmers refrain from adopting these practices due to the opportunity costs involved. For example, some farmers prioritize to work in their pepper fields and other farmers prefer to work off-farm.

Also, other farmers are simply unable to adopt these practices fully due to their limited personal capacity or the characteristics of their farm. This was the case with single farmers and farmers with land in hilly or swamp areas. Taher (1996) argues that the adoption of an innovation can be related to the degree an innovation is perceived to be suitable for the physical conditions in the designated area. To follow up on Taher’s argument, this study concludes that phytosanitary harvesting, and in particular sanitation, is difficult on hilly land or in swamp areas, which makes it impossible for some farmers to adopt these practices.

Finally, the farmers face a clear economic incentive to include infested and unripe pods in the harvest, which is also a disincentive to do phytosanitary harvesting. As long as the farmers sell to the local buyers it is likely to be profitable for them to add infested and unripe pods in the harvest, which will add kilo. This is what Laven (2010) refers to as a perverse market incentive, which stems from the lack of differentiation and grading among the local buyers, since they hardly distinguish between beans of high and low consistency in the prices they offer. This clearly shows the influence of market dynamics on farmers’ behavior. In general, to control what farmers harvest, ferment and sell is hard in the absence of adequate control of the quality and consistency of the cocoa beans. Flavor-control of the beans is only performed by the end buyers in Makassar and not integrated in the long market chain. This will influence the farmers’ willingness to comply with the national consistency and quality standards. In line with the results above, Nielson et. al (2005) found that farmers in South Sulawesi were harvesting immature pods and that 90% of the farmers harvest frequently.

Laven (2012) argues that cocoa farmers in Ghana respond to fluctuating prices and the profitability of cocoa by changing the intensity of their field maintenance. This is related to the results in this report, since the farmers in Southeast Sulawesi intentionally refrain from performing certain practices, in particular fertilizer application and phytosanitary harvesting, in the fields they no longer find profitable to maintain, which seems to be caused by the increase in the incidence of pests and diseases. In this case the farmers don’t respond directly to the price, but rather to the perceived cost-benefit of performing different practices. In general, this study suggests that the farmers in Southeast Sulawesi don’t act directly according to the cocoa prices, but to the cost-benefit of acting on the prices, which becomes obvious when looking at their drying strategies.
7.3 Post-harvest practices

7.3.1 The farmers’ strategies and expected consequences

The farmers’ partial and inadequate fermentation results in cocoa beans that lack aroma and are harder to grind. Sacks don’t provide the optimal conditions for fermentation and result in a higher percentage of black beans due to the lack of aeration in the sacks (Intv. Janetski). The partial fermentation is a minor problem for the farmers, since they sell to the market for bulk cocoa, not least due to the inferior cocoa varieties grown in Sulawesi. The tradition to include infested and unripe beans in the fermentation results in beans with a lower fat percentage and off-flavors, underdeveloped beans and a high percentage of waste material, which increases the end buyers’ costs associated with sorting and control. From a farmer’s perspective, the inclusion of unripe and infested pods increases their profit by adding kilo.

The inadequate drying by the farmers is less problematic for the cocoa industry. The local buyers and warehouses in Southeast Sulawesi dry the beans to a 7-8% moisture level, which probably limit the problems associated mould beans higher in the Indonesian cocoa market chain. On the other hand, both the local buyers and most of the warehouses apply inappropriate and unprofessional drying techniques. Further, the farmers miss out on the higher price premiums for adequately fermented and dried beans by selling to local buyers instead of the warehouses. If the farmers fermented fully, dried optimally, sorted and transported the beans to the warehouse they would be able to increase the price with 5,000-12,000 Rp per kilo of beans depending on the current prices they receive and what warehouse they would be able to sell to. Finally, the inadequate drying technique applied by the farmers extent the length of drying, increases the risk of mould and exposes the beans to external pollution.

7.3.2 Factor influencing the farmers’ adoption of fermentation practices

Several studies have examined why cocoa farmers don’t comply with quality and consistency standards through proper fermentation, drying and sorting. It is not a surprise that cocoa farmers in Sulawesi ferment inadequately, since this has been emphasized in earlier studies by Ruf and Yoddang (2009), Taher (1996), Panlibutan and Meyer (2004) and Nielson et. al (2005).

Taher (1996) and Ruf and Yoddang (2009) argue that the work load involved in adequate fermentation and drying limits the farmers’ ability to perform them appropriately. Ruf and
Yoddang argue that the farmers’ field and post-harvest practices must be understood as one work cycle. Ruf and Yoddang argue that if a farmer ferments and dries the beans adequately it will take 10 days, which means that there will be less available days to undertake other practices in the field, such as to harvest frequently. They further argue that, due to the frequent rainfall in Sulawesi, the farmers can’t work in the fields while they are drying beans on platforms exposed to rain next to their houses.

In comparison, the work involved in partial or full fermentation was not a major concern for the farmers in Southeast Sulawesi; only a few farmers complained about the work burden involved in fermentation and drying. The reason is that the everyday work is divided in the household, where men are responsible for the work in the fields and women are responsible for the household tasks. The post-harvest handling, respectively fermenting and drying the cocoa beans, are considered household duties. Therefore, the work involved in fermentation doesn’t overlap with the work in the field. The field and post-harvest duties overlap for households with only a single member, which affect their intervals of work in the field, fermentation and drying. In general, the women argued that, if a fair price premium was offered, they would face no problems in fermenting optimally as long as they were provided with adequate instructions and equipment.

Taher (1996) argues that farmers’ decision to ferment is determined by the price offered by the buyers; he argues that farmers tend to ferment adequately if the price premium is high enough. He adds that farmers in South Sulawesi are unwilling to undertake adequate fermentation since the price premium for well-fermented beans doesn’t take into account the work involved in proper fermentation. Ruf and Yoddang (1998) argue that the price premium for fully fermented cocoa beans is low in Sulawesi, which makes farmers unwilling to adopt proper fermentation. They argue that low premiums are caused by the high competition between the local buyers, which increases the price for partially fermented beans. Nielson et al. (2005) found that farmers in Noling, South Sulawesi, have fermented adequately earlier, but that they no longer ferment adequately due to the insignificant price difference between the fully and partially fermented beans.

This study shows that there is a market for fully fermented cocoa beans in Southeast Sulawesi. At the village level, price premiums for fully fermented beans are non-existing or range between 500 to 4000 Rp/kg depending on the buyer, the dryness and the consistency of the beans. On the other hand, if farmers choose to sell the beans to the warehouse, the price may increase as much as 9.000 Rp per kilo if they also optimize their drying and sorting. These findings emphasize the importance of what prices the farmers have access to, both at the village and warehouse level. While Panlibutan and Meyer (2004) argue that price information
is widely available to farmers, Nielson et. al (2005) shows that the market actors in West Sulawesi don’t provide clear price signals to the farmers. In comparison, this study shows that the local market in Southeast Sulawesi is two-pronged: some warehouses offer price premiums for fully fermented beans and some warehouses don’t. For this reason, many farmers probably sell to local buyers that don’t operate in the market chain for fully fermented beans. This confirms a finding by Panlibutan and Meyer (2004), who state that the market for fully fermented beans isn’t large enough to justify the production of fully fermented beans on a wide scale. That said, we must keep in mind that the market for fully fermented beans has developed drastically in recent years due to the recent demand for fully fermented beans from the domestic grinders.

This study shows that there is a gap between the price premiums offered at the warehouse level and the presence of price premiums at the village level, since the price premiums are not transmitted to the village level by the local buyers. As described in the results section, the farmers argued that they have to push the local buyers for price premiums, which means that the farmers themselves must be aware of the premiums at the warehouse level. Further, several buyers argued that they are not interested in buying small batches of fully fermented beans. First, it involves more work to keep them separated from the partially fermented beans and, second, the beans seldom comply with the higher requirements for fully fermented beans. The information gap between the warehouses and the farmers is manifold. The farmers are not informed of the prices, the standard specifications and the appropriate practices involved in adequate fermentation, neither by the local buyers, warehouse personnel or the extension service. This makes the large majority of the farmers unable to take advantage of the existing market for fully fermented beans, which becomes a problem for the whole cocoa sector. This is an example of what Kaplensky and Morris (2001) refer to as a ‘market failure’.

Other studies have shown that local intermediaries may disturb market incentives from being transmitted to farmers (Roshetko et. al 2012; Laven 2010). Several researchers have argued that trading and business interests, standard specifications, control procedures and price signals are not necessarily enforced, consistent or transparent along a market chain (Ruf 1998; Laven 2010). This has in particular been observed in long and poorly coordinated market chains with little vertical integration or government-imposed regulation, such as the cocoa value chain in Indonesia (Ruf 1998). Ponte and Fold (2008) argue that the flow of information on quality standards is more difficult in long and fragmented market chains. Laven (2010) argues that both vertical integration by private buyers and regulation imposed by the government may improve the enforcement of standard specifications and trade differentiation along the market chain, which can be enforced by buying-stations. This has been emphasized in several studies of the partly regulated market chain in Ghana, where
stringent control and grading at the buying stations has maintained the quality of the cocoa produced in Ghana (Anang 2011; Laven 2010; Ponte and Fold 2008). In liberalized cocoa sectors, on the contrary, the quality control systems are privatized, which is resulting in a lack of quality control due to the competition between multiple buyers, the lack of trade differentiation and the existence of inexperienced buyers on the market (Laven 2010).

This an example of why it can be important for governmental or private stakeholders to coordinate the market chain in order to encourage the farmers to comply with quality and consistency standards. Further, it shows why access to warehouses or buying stations with clear standard specifications and price signals can be paramount to ensure quality compliance among farmers. This study shows that the absence of a linkage to a warehouse limit the farmers’ access to the higher prices and clear quality incentives offered at the warehouse level. On the other hand, the stringent quality and consistency requirements at the warehouse level will involve extended drying, sorting and potentially fermentation for the farmers.

Taher (1996) argues that the beans lose weight when they are fermented fully, 10% on average, which is a disincentive for the farmers to ferment adequately. This study shows that some farmers are reluctant to ferment longer due to the weight loss associated with longer fermentation.

7.3.3 Factors influencing the farmers’ drying practices

Fold and Ponte (2008) argue that cocoa farmers in Cote d’Ivoire dry inadequately due to what they refer to as the ‘logic of the farm-gate buyer’, who prefers to buy large batches of beans rather than waiting for the beans to be adequately dried. The same phenomenon is reported by Laven (2010) in Ghana, where buying companies ask the farmers for inadequately dried beans. This pushes farmers to sell inadequately dried beans, which causes mould problems higher in the market chain. This perverse market incentive – a term applied by Laven - has also been reported by Ruf and Yoddang (1998) in Sulawesi. They argue that the high competition between the local buyers pushes the cocoa farmers to shorten the fermentation and drying time, which has caused problems with inconsistent beans and removal of the bean coat at the grinding factories.

In comparison, this study shows that the cocoa farmers in Southeast Sulawesi act on – but not according to – the trading interests and price signals transmitted by the local buyers. The farmers include the clear price signals associated with beans at different levels of dryness in their own calculations. The clear market signal for adequately and inadequately dried beans at the farm-gate in Southeast Sulawesi enable the farmers to be economically strategic and
enable them to decide on a strategy that they believe will maximize their own profit. The reason why many farmers dry inadequately is not that they are pushed to sell faster, but rather that they don’t find it economically rational to dry adequately for personal and micro-economic reasons, primarily due to the loss in bean weight associated with extended drying. Rather, this study suggests that the competitive market conditions enable farmers to shop between the local buyers and, thus, enable the farmers to decide on whatever strategy they find economically favorable. Some farmers added that the local buyers want to buy wet beans and in large batches, but only ill-informed farmers can be expected to put aside their own economic interests when facing a buyer’s request. We must not underestimate the capacity of well-informed farmers to decide on their own personal strategy, even when they are facing the incentives and interests of stakeholders higher in the market chain. This study suggests that the farmers’ drying strategies are personal and flexible according to the opportunities at hand; this also means that if a buyer offers a fair price for inadequately dried beans some farmers may choose to sell, while others may not. On the other hand, this study has mainly explored the farmers’ reasoning and less what actually happens when the buyers buy the beans from the farmers. This was only observed on 3 occasions and the researcher’s presence probably affected the bargaining.

Ruf and Yoddang (2009) explain that the fermentation and drying process is closely related. They explain that full fermentation is mainly advisable when farmers also dry appropriately, since to ferment the beans for 5 days will involve a risk if the farmers don’t dry the beans optimally. Beans always ferment a little more while they dry, in particular if they are piled together or put into sacks during rainy periods. So as long as the farmers don’t have proper drying equipment with rain cover, there will be a risk associated with fermenting for 5 days, since the beans might over-ferment during the drying. This will reduce the market acceptability of the beans. This must be taken into consideration when solutions to the inadequate fermentation at the farm level are suggested. In addition, this report indicates that the farmers in Southeast Sulawesi ferment longer, at least 2-3 days, because the fermentation will remove the pulp and, thus, improve the drying of the beans. As the farmers argued, fermented beans dry faster and the appearance of the beans is better, which will result in a higher price.

Ruf and Yoddang (2009) also argue that cocoa farmers seldom dry the beans more than two days due to the risk of mould associated with longer drying. The farmers in Southeast Sulawesi were less concerned about the risk of mould and only a handful of the farmers mentioned this. This was a concern for the local buyers (Intv. buyer I, II, IV), since they dry the beans adequately before they sell them to the warehouses, where mould beans aren’t accepted.
In Southeast Sulawesi, a few farmers also stated that they dry fewer days when they harvest large batches of beans in the great harvest season, since they don't have the equipment to dry large batches of beans at the same time. This was emphasized by Panlibutan and Meyer (2004) as one of the major reasons why farmers dry the cocoa beans inadequately.
8. RESEARCH LIMITATIONS

This study can only provide an insight into the strategies and the challenges faced by primary cocoa farmers in 3 particular villages in Southeast Sulawesi. Many other farmers are growing cocoa on the side, but only primary cocoa farmers were interviewed for this study. Other farmers may face other challenges related to their specific situation. This study involved a limited number of respondents and did not cover a representative sample of the farmers in the villages or the region.

No study can encompass all the factors that affect the cocoa farmers’ practices directly or indirectly. First, to take departure in the farmers’ choices will only reveal some of the factors that affect their strategies. This has been discussed in the methodology chapter. Second, a conversation is momentary, whereas decisions evolve over a long period. An informant might provide one explanation in one moment and change explanation in other situations, depending on what he/she considers important during the interview. It can be difficult to fully comprehend strategies and choices in a single interview. Limited time was used with each informant and all informants were only interviewed once, which affect the depth of the farmers’ explanations. Also, it is out of the scope of this study to examine how the farmers’ ability and willingness to upgrade has been changing under different circumstances. Third, a researcher will always affect the data by his/her own qualitative interpretation, which happens during and after the interview. There is a limit to what and how much an outsider is able to understand. A researcher will, intentionally or not, look for logic factors that can easily be explained. When a researcher communicates through a translator there is also a risk that some data will be lost in the translation.

The purpose of this report was to provide an overview of the factors that affect the farmers’ strategies directly, which was revealed in their explanations. This was combined with a minor study of the local market chain to reveal factors that were ‘hidden’ to the farmers and, therefore, may affect their ability to upgrade indirectly. Many other factors may be related to the farmers’ choices indirectly, such as the farmers’ educational status, age, land ownership and income level. It is hard for a qualitative study like this to encompass such factors. A quantitative study can reveal such ‘indirect’ factors, which is illustrated in most of the studies about farmers’ adoption of crops and practices.

Some aspects of the farmers cocoa production have not been covered. Most importantly, this study lacks an analysis of the existing cocoa varieties, the farmers’ use of vegetative propagation techniques and insight into rehabilitation techniques, farm planning and nursery management. These aspects were not included due to the researcher’s affiliation with ICRAF.
Also, the farmers’ adoption of other pest and disease management techniques has not been examined, including pod sleeves, beneficial ants, pheromone traps, drainage and weeding. Also, this study has mainly been concerned with management of respectively CPB and black pod disease, and thereby partly ignored the threat of VSD, stem borer and Helopeltis. Finally, the farmers’ pruning practices were not examined in detail, even though pruning is one of the most important practices to boost production and prevent disease infection.
9. CONCLUDING REMARKS AND IMPLICATIONS

This report shows that the farmers in Southeast Sulawesi are experienced in conventional cocoa farming. Many farmers have been trained in the conventional farming practices and conventional inputs are easily available. On the other hand, the farmers’ application of fertilizer and pesticides is often inappropriate, which increases the costs involved in applying fertilizer and pesticides. This is the case when farmers spray pesticides broadly or apply fertilizer on the soil surface. The farmers’ inappropriate application increases the input costs associated with cocoa production in a difficult time, where the production seems to decline due to the high incidence of pests and diseases. Many farmers are at crossroads due to the lower returns to their cocoa production and many farmers no longer maintain the worst infected parts of their cocoa fields, while some farmers have turned their attention completely towards pepper cultivation instead. It is paramount to address these challenges and increase the returns to cocoa production at the farm level by encouraging the farmers to invest in their cocoa fields, for example through low-risk lending schemes, improved farmer extension and promotion of low-cost farming techniques that optimize the farmers profit without being too demanding.

The conventional farming practices are no longer sufficient to circumvent the major challenges related to the high incidence of pests and diseases. Pesticides are sprayed in fields where the pests and diseases are thriving due to the limited phytosanitary harvesting and sanitation. Also, the farmers can’t afford to apply sufficient fertilizer, whereby it becomes problematic to grow cocoa under full sun. These are major problems that the farmers aren’t equipped to manage. The farmers don’t have the experience needed to adopt the alternatives to the conventional cocoa farming practices, neither are they convinced of the opportunities and benefits involved in suitable and low-cost alternative farming practices that may involve organic fertilizer, manure application and leguminous shade trees.

This study shows that training doesn’t necessarily result in adoption of new practices. Training might increase the farmers’ awareness, but the farmers trust in their own experiences first of all. If they are not convinced of the profitability of a practice they will be unwilling to adopt it. Some of the improved practices are adopted less by the farmers, because the benefit of adopting them is unclear to the farmers. It is paramount to convince the farmers of the benefits involved in adopting the alternative pest and disease management practices, which will require first hand observations and positive experiences.

The farmers profit is low due to their scarce contact with the regional warehouses, where price premiums are offered for adequately fermented, dried and sorted beans. Further, the
farmers aren’t able to ferment and dry adequately due to their lack of knowledge and equipment. There are feasible ways to improve the farmers’ post-harvest handling, but they must not increase the farmers work load. For example, farmers can optimize the drying process in basic “greenhouse” dryers and warehouses can collect the beans at the farm-gate, which they do elsewhere in Southeast Sulawesi. This would also improve the control of the quality and consistency of the beans at the farm-gate and provide the farmers with a direct economic incentive to improve their post-harvest practices. Currently, the low consistency and quality of the cocoa beans produced in Southeast Sulawesi is mainly a concern for the end buyers, but this will become a major concern for the farmers if they want to optimize their profit by selling to the warehouses in the future.

The government of Indonesia has recently taken the first step towards enforcing fermentation standards in the Sulawesi cocoa sector, which will force the farmers to comply with the standard requirements for full fermentation. This study outlines some serious obstacles for the farmers to comply with the standards for full fermentation, since the market signal for full fermentation has been distorted or absent up to now due to the interests of the local buyers. It would be hard for the farmers to adopt full fermentation unless they are trained, provided fermentation equipment and a clear market incentive. To centralize the fermentation of the cocoa beans through the establishment of village-based fermentation facilities or at the warehouses could be a way to optimize the fermentation process easily, but this would involve other challenges. Cocoa is already demanding compared to other crops, so it is paramount that the farmers are not pushed to adopt more demanding practices through regulation unless their profit increases. Enforced standard regulation could be an incentive for more farmers to turn their attention towards less demanding crops. On the other hand, this study shows that the current competitive market forces alone don’t encourage and enable the farmers to ferment fully. Improved access to warehouses would increase the transmission of market incentives, standard requirements and knowledge to the farmers.

This report shows that the smallholder farmers in Southeast Sulawesi are unable or unwilling to upgrade their cocoa production due to a wide spectrum of factors that stem from the market or input chain as well as from the farmers limited personal capacity and farm characteristics. The farmers are, when they are well-informed, economically strategic. Many farmers are unable to be profit-maximizing and act on positive incentives due to their limited knowledge, access to inputs and markets, or due to the risks involved in investments. Such prerequisites of upgrading are highly affected by the dynamics in the market and input chain, which could be improved by the government, private stakeholders or through collective action. The farmers are hampered by imperfections in the market and input chain, such as the limited transmission of knowledge, opaque market standards, impediments in the
transmission of market incentives, and limited market access. On the other hand, the competition in the local market chain reduces the price reduction for inconsistent beans and provides the farmers easy access to different buyers. Also, this study shows that micro-economic factors or personal priorities may make farmers unwilling to act on the existing and clear market incentives, which is exemplified in many farmers' drying strategies.

On the positive side, some farmers have a positive attitude to cocoa production and seem to maintain their cocoa fields well through frequent and adequate pruning, application of inorganic and organic fertilizer sources, infrequent phytosanitary harvesting and frequent harvesting. These farmers tend to belong to the clusters of experienced farmers that exist in all the villages, of which many belong to the village-based farmer groups. Common to all of them is their willingness to invest and experiment in their fields to overcome the pest and disease challenges and optimize their profit. Their positive attitude might be a personal capacity or it might be an outcome of their favorable situation.

This study adds a qualitative component to our understanding of what factors that affect farmer's adoption of improved farming practices and, thereby, supplement the existing - and primarily quantitative – research. Also, this study shows how market and supply chain dynamics may influence choices at the farm level. This has been possible by using the farmers’ choices and reasoning as a gateway to find out why farmers choose to adopt, or refuse to adopt, recommended farming and post-harvest practices.
REFERENCES


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CAOBISCO (2002). Cocoa Quality Standards. CAOBISCO, Brussel


Ruf, François (2007) The cocoa sector. Expansion, or green and double green revolutions?


INTERVIEW REFERENCES

This is a list of the interview informants referred to in this report.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Name/function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engbers</td>
<td>Ruud Engbers, President Director, Mars Symbioscience Indonesia, Makassar</td>
</tr>
<tr>
<td>Extension officer</td>
<td>Employee at the extension office near Lawonua</td>
</tr>
<tr>
<td>Headman</td>
<td>Headman in the village of Lawonua</td>
</tr>
<tr>
<td>ICCRI</td>
<td>Coffee and Cocoa Research Institute of Indonesia located in Jember. Interview with multiple researchers at ICCRI.</td>
</tr>
<tr>
<td>Indrayanti</td>
<td>Rini Indrayanti, General Secretary, Cocoa Sustainability Partnership</td>
</tr>
<tr>
<td>Janetski</td>
<td>Noel Janetski</td>
</tr>
<tr>
<td>Jaxx</td>
<td>Ross Jaxx, Chief of party, AMARTA II, ACDI/VOCA, Jakarta</td>
</tr>
<tr>
<td>Konda Cocoa station</td>
<td>The Cocoa Research Sub-station in Konda in the district of Konawe</td>
</tr>
<tr>
<td>LEMS</td>
<td>Government-supported warehouse in Andomosingo near Unahaa, Konawe district</td>
</tr>
<tr>
<td>Peni</td>
<td>Peni Agustiyanto, Veco</td>
</tr>
<tr>
<td>Soetanto</td>
<td>Dr. Soetanto, Head of Research Division, ICCRI, Jember</td>
</tr>
<tr>
<td>Turmudzi</td>
<td>Ahmad Turmudzim, Sustainable Cocoa Program Coordinator at Continaf BV in Indonesia. Continaf is a cocoa procurement company.</td>
</tr>
<tr>
<td>Warehouse</td>
<td>Private cocoa warehouse in the town of Unahaa, Konawe district</td>
</tr>
</tbody>
</table>
APPENDIX A: Influencing factors drawn from the literature review

Input chain factors

Support services:

- Frequency, type and source of training
- The existence of input subsidies or input package schemes
- The scale and development of the local input chain

Input supply and status:

- Source and type of input suppliers
- Smallholders’ access to agricultural inputs, credit, land certificates and market information
- The quality, affordability and availability of inputs for smallholders

Market chain factors

Actors, infrastructure, linkages and dynamics:

- Type, number, location and role of actors and buyers
- Relationships, trade linkages, vertical integration, competition and collective action in the chain

Procedures, standard setting, control and prices:

- Trade procedures
- Standard requirements
- Regulation, control and grading
- Prices negotiated by actors and smallholders

Chain preferences, experience and awareness:

- Buying and sale interests of actors and smallholders
- Smallholders’ and actors’ experience and awareness of market opportunities, procedures, standards and prices

Livelihood factors

Farmers’ perceptions and attitudes to cocoa production:

- The importance of cocoa in the farmers’ lives and the farmers’ reasoning for cultivating cocoa
- Farmers’ view on the opportunity costs, complexity and profitability of cocoa production in comparison to other land use options
- Farmers’ view on the labor and investments involved in cocoa production compared to other crops

Livelihood strategies:

- Farmers’ attitudes to possible livelihood strategies and off-farm work
Immediate food security concerns, risks and traditional behavior

Personal and farm factors

The farmer

- Ethnic belonging
- Position in the village
- Household situation
- Labor capacity
- Wealth
- Attitude

The farmer's farm

- Land size and topography
- Pest and disease incidence
- Age of trees

Characteristics of the innovation

- Complexity
- Observable and possible to experiment
- Trust in efficiency
APPENDIX B: farming, pest/disease management and post-harvest practices

By drawing on literature about the specific challenges involved in cocoa production in Sulawesi and on general literature about cocoa production I have chosen the following cocoa management practices for how farmers can address the constraints they are facing in Sulawesi and in general upgrade their cocoa production. Each practice consists of many possible sub-practices, but I have chosen what I believe are the primary practices involved in each practice.

**Farming practices**

<table>
<thead>
<tr>
<th>PRIMARY PRACTICE</th>
<th>CHOSEN SUB-PRACTICES</th>
</tr>
</thead>
</table>
| Inorganic fertilizer          | • Optimally apply two times annually of up to 500g to each mature cocoa tree  
• Mix the fertilizer with the soil 50-70 cm from the tree trunk |
| Alternative soil enrichment   | • Application of organic fertilizer sources  
• Compost application  
• Manure application  
• Leguminous species as shade trees  
• Spread decomposed pods in the field  
• Application of dolomite , lime stone or alternatives |
| Beneficial shade trees        | • Inclusion of shade trees adjusted to the soil conditions and application of nutrients  
• Shade for cocoa seedlings |
| Pruning                       | • Frequent pruning  
• Prune tall and diseased trees |

**Pest and disease management practices**

<table>
<thead>
<tr>
<th>PRIMARY PRACTICE</th>
<th>CHOSEN SUB-PRACTICES</th>
</tr>
</thead>
</table>
| Spraying                          | • Pest and disease specific spraying rather than broad application, including direct application for CPB  
• Semi-frequent spraying, around 10 times annually |
| Frequent harvesting and harvest   | • Frequent harvesting, optimally 3 times monthly  
• Only include ripe and almost ripe pods in the harvest |
### Phytosanitary harvesting
- Harvest infested pods frequently
- Harvest pods all year round

### Field sanitation
- Remove, burn or bury infested pods on the ground
- Discard the pods that are split after the harvest
- Compost infested pods with lime or urea solution

### Post-harvest practices

<table>
<thead>
<tr>
<th>PRIMARY PRACTICE</th>
<th>CHOSEN SUB-PRACTICES</th>
</tr>
</thead>
</table>
| Fermentation     | - Ferment for 4-7 days optimally  
|                  | - Fermentation technique: optimally in boxes  
|                  | - Limit inclusion of inappropriate material such as unripe pods, infested pods, placenta material and pulp |
| Drying           | - Dry optimally to 7-8% moisture level equivalent to 4-5 days of drying  
|                  | - Protect beans from rain and pollution during drying, optimally in solar/greenhouse dryer  
|                  | - Turn the beans to avoid mould |
APPENDIX C: map of villages

Map of Southeast Sulawesi showing Konawe and Kolaka district. This map shows the locations of Lawonua (closest to Kendari near the coast), Wonua Hoa (near the line between Kolaka and Konawe district) and Asinua Jaya (in the northern part of Konawe district).

Lawonua: yellow
Wonua Hoa: orange
Asinua Jaya: green

Source: Martini et. al 2013 and http://dasamining.wordpress.com/tambang-sulawesi-tenggara/
APPENDIX D: Interview guide for primary farmer interviews

Personal information:
- Farming systems and significance of cocoa
- Household size; land size; when moved to the village; age of cocoa trees; ethnicity

Questions about the farmer’s general strategies:
- What general challenges does the farmer face in his/her cocoa production? What hamper the farmer in improving his/her cocoa production?
- How does the farmer address these challenges?
- What cocoa management practices does the farmer carry out and why? What are the farmer’s primary practices?
- Received training in what practices?

QUESTIONS IN EACH SUB-INTERVIEW:

Questions related to each primary practice (for example soil enrichment):
- What does the farmer do
- Why does he/she do it this way
- What does the farmer consider appropriate/best to do; does the farmer do this and why/why not

Questions related to the sub-practices (for example two annual applications of fertilizer):
- What does the farmer do in relation to the recommended practice
- The farmers knowledge of the practice
- The farmers awareness of the advantages of the practice
- The farmers’ attitude to the practice; farmer’s opinion on the effect and importance of the practice
- Talk about possible constraints to carry out the practice: what affect the farmer’s ability and willingness to carry out the practice?
- Does the farmer have access to equipment and inputs
- Training and advice; what source
- Influence of market conditions

Farming practices

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<thead>
<tr>
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<tbody>
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- Manure application
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- Spread decomposed pods in the field
- Application of dolomite, limestone or alternatives

### Beneficial shade trees
- Inclusion of shade trees adjusted to the soil conditions and application of nutrients
- Shade for cocoa seedlings

### Pruning
- Frequent pruning
- Prune tall and diseased trees

#### Pest and disease management practices

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- Turn the beans to avoid mould |
**APPENDIX E: Templates for data management and analysis**

**Data sheet A:**

Data sheet with profile of each farmer. This sheet can be read vertically (the profile of a farmer) and horizontally (what are the strategies of all farmers for each practice and what factors affect their strategies for each practice)

<table>
<thead>
<tr>
<th></th>
<th>FARMER 1</th>
<th>FARMER 2</th>
<th>FARMER 3</th>
<th>FARMER 4</th>
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<tbody>
<tr>
<td><strong>Area in the village</strong></td>
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<tr>
<td><strong>Characteristics of farmer</strong></td>
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<tr>
<td><strong>Field observations</strong></td>
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<tr>
<td><strong>Training and demonstration</strong></td>
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<tr>
<td><strong>Challenges and primary practices expressed by farmer</strong></td>
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<tr>
<td><strong>Pruning</strong></td>
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<td></td>
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<td></td>
<td>The explanation of FARMER 2 for his/her pruning strategy and influencing factors</td>
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<tr>
<td><strong>Spraying</strong></td>
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<tr>
<td><strong>Harvest</strong></td>
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<tr>
<td><strong>Frequent harvesting</strong></td>
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<td><strong>Phytosanitary harvesting</strong></td>
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<td><strong>Sanitation</strong></td>
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<td><strong>Fertilizer</strong></td>
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<tr>
<td><strong>Soil enrichment practices</strong></td>
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<td><strong>Shade trees</strong></td>
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<tr>
<td><strong>Fermentation</strong></td>
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<td><strong>Drying</strong></td>
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<tr>
<td><strong>Selling, sorting, and control</strong></td>
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</table>
Data sheet B

The farmers are divided according to their strategy and village. Each farmer is provided a coded profile of the factors that influence his/her strategy.

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<thead>
<tr>
<th></th>
<th>STRATEGY 1</th>
<th>STRATEGY 2</th>
<th>STRATEGY 3</th>
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<tbody>
<tr>
<td>Lawonua</td>
<td>FARMER 1 (profile of coded influencing factors)</td>
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<tr>
<td></td>
<td>FARMER 9 (coded factors)</td>
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<tr>
<td>Asinua Jaya</td>
<td></td>
<td>FARMER 41 (coded factors)</td>
<td></td>
</tr>
<tr>
<td>Wonua Hoa</td>
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</tbody>
</table>
APPENDIX F: Credit access and land ownership interview guide

- Does the farmer consider money and access to money as a major constrain for him/her to improve his/her cocoa production? In comparison to other constraints?

- From what source(s) does the farmer borrow money?
  - Bank and what bank? Any banks at all? Any obstacles? Need land?
    - Does he/she have a land certificate (which would work as collateral in the bank)?
    - Why does he/she not go to the bank? Too expensive or far away?
    - Has he/she tried?
    - Can women take a loan?
  - Relatives or family? Remittances?
  - Friend or neighbor?
  - Cocoa buyer?
  - Tengulak (local moneylender)?
  - Community bank? Savings and lending group in community?
  - Warehouse (receipt)?
  - Government?
  - Mobile phone/computer?

- How do they pay back the money?

- Tengulak:
  - Who is the tengulak?
  - Pay back through lower cocoa prices or interest rates?
  - A creditor (tengulak) can claim land and trees if somebody fails to repay the debt?
  - Any tengulak in this community?
  - Does the farmer always know how much the cocoa price will be or does the tengulak decide the price according to the loan?
  - If the farmer borrows money, is he/she then able to sell the cocoa to other buyers than the tengulak that provides you the loan?
  - Do tengulak pay them in advance of harvest?

- Land ownership: What is the legal status of the land?
  - Possess land certificate or customary law land (Adat) ~ which also work as communal crop land?
  - Did the farmers used to own (more) land? How did he/she lose it? To moneylender or did he/she sell it?
APPENDIX G: Interview questions to local buyers

1) Role and function in relation to farmers? Agreement with farmers?

2) How many buyers operate in this area? What type of buyers? Do you feel competition from other buyers? Differences between buyers? How does this affect prices and standards?

3) Price signals/premiums/discounts:
   - What type of cocoa do you purchase from the farmers?
   - What does the price you offer farmers depend on:
     - A price per kilo cocoa; kilos of cocoa x a standard price per kilo
     - Price according to how many kilos (volume)
     - The material quality or consistency: pay lower when low quality or much waste material?
     - How long it is dried? Moisture level, color, moldiness?
     - How long it is fermented?
     - Fair trade or specialty premiums?
     - Price differentiation for specific cocoa varieties (high/low quality varieties)?
   - Is it paid as a premium or discount?
   - Have you heard of price premiums for the ones above (market possibility awareness)?
   - Premium/discount in comparison to FAQ price?
   - Do other buyers you know pay differently or premium/discounts for specific types of cocoa?
   - How is the price determined
   - Prompt payments or payment in advance of harvest (credit/loan procedure)
   - Loan or deducted from cocoa price?
   - Do you think the specific price procedure affects farmers willingness to fully ferment, sort/grade, and fulfill specific standards and requirements

4) Control and tests:
   - Have you experienced any problems with the cocoa from this area (like low quality? Low volume? Low consistency?)? What are the main concerns in your opinion?
   - Do you test the quality of the cocoa when you buy? Why not?
   - What types of tests?
   - Do you know about the national quality standards? Have you received training in cocoa quality and how to test it?
   - Do farmers know about these tests and cocoa quality, in your opinion?
   - Have you heard of the SNI tests? Do you know other farmers/buyers that carry them out?
   - Do you have any quality requirements when purchasing? Grades? Do you follow national SNI standards for quality?
   - Do you advice farmers on quality, e.g. sorting, storing, drying or fermentation?
   - Do you sort low quality from high quality? Or cocoa from different varieties?
• Do farmers/buyers sort or control cocoa quality? Why/why not?

5) Experience and awareness

• Do you have experience with cocoa farming yourself?
• Do you need a license to operate?
• Do farmers/buyers know what characterizes quality cocoa and how to test it?

6) Buyers interests:

• What type of cocoa do you prefer to buy?
• Do you buy with waste material or partly fermented/dried? Do you mind doing this?
• Do you have any interest in buying high quality cocoa or all cocoa the same?
• Do you buy as much cocoa as possible, even though it is bad quality?
• Do buyers mind drying beans after purchasing?
• In your opinion, do other buyers do the same as you?

7) Relationships:

• How would you define your relationship with the farmers? Do you know them well, are you relatives/family?
• How long have you been a buyer in this area? Do you have long term agreements with farmers or do you buy randomly? Why do farmers sell specifically to you and not other buyers (due to other services)?
• In your opinion, are farmers bound to buyers due to indebtedness or can they choose freely? Loans to farmers?
• How do different buyers pay? And how much?
• In your opinion, what type of buyer do the farmers prefer?
• Do any farmers sell directly to buying stations, warehouses or more direct processing companies?

8) Next stages in supply chain:

• Where do buyers sell their cocoa? Other buyers, warehouse, upstream buying station (which?) or processor/exporter (what company)?
• Are there control tests or requirements when you sell your cocoa? Grading? Consistency? Quality? What tests?
• Do you get a higher price for better cocoa; or price per kilo; or price according to volume?
• Does the next step ask for better fermented or appropriately dried beans?
• How do warehouses work? Control/grading/credit/storing/transparency/traceability/volume
• Private fermentation/drying companies in villages/district
APPENDIX H: The value chain approach

A dominating paradigm in the research of the market chain’s influence on smallholders’ competitiveness is the framework and approach applied in value chain research and development. The general value chain analysis involves an investigation of each step of the value chain and provides an overview of the overall flow of goods and money in the whole chain from input suppliers, producers, processors, traders and consumers (Campbell 2008; UNIDO 2009; Lundy et al. 2004). Value chain studies are in general carried out to detect limitations or identify opportunities for improvements of the overall performance within a value chain. Lundy et al. (2004) emphasize that there are no definite procedures for value chain research. In general, value chain studies aim at examining and mapping several of the following objectives:

- The actors and their relationships and functions in the chain
- The flow of goods, information and services throughout the chain
- The governance and power relations in the chain
- The performance and need for upgrading within the chain
- The economic distribution, value added and costs throughout the chain
APPENDIX I: Farm-gate prices according to drying time

These prices were provided by farmers in the villages. These prices are for partially fermented beans only. These prices are an average of the prices stated by farmers and only an estimate, since they neither include prices for beans of different consistency and quality nor take into consideration that different farmers seem to receive different prices depending on their relationships with buyers. The prices also tend to vary for different buyers and throughout the season. It was not possible to obtain reliable prices for all levels of drying in all the villages.

Lawonua

*Farm-gate:*
- 1-2 days of drying: 10.000 Rp/kg
- 2 days: 12.000 Rp/kg
- 2-3 days: 12.000-13.000 Rp/kg
- 4-5 days: 14.000-15.000 Rp/kg
- 4-5 days and good relationship with buyer: 15.000 Rp/kg

Asinua Jaya

*Farm-gate:*
- 2 days: 12.000 Rp/kg
- 2-3 days: 13.000-14.000 Rp/kg

*Warehouse:*
- 4 days: 20.000 Rp/kg (not fermented)

Wonua Hoa

*Farm-gate:*
- 4 days: 15.000 Rp/kg

*Warehouse:*
- 4 days: 17.000 Rp/kg
## APPENDIX J: Local market chain actors

Overview of interviewed market actors, standard specifications and prices in Konawe district, Southeast Sulawesi

<table>
<thead>
<tr>
<th>Location</th>
<th>LEMS warehouse</th>
<th>Warehouse</th>
<th>Village-buyer I</th>
<th>Village-buyer II</th>
<th>Village-buyer III</th>
<th>Village-buyer IV</th>
<th>Village-buyer V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andomosingo near</td>
<td>Unahaa town</td>
<td>Wonua Hoa</td>
<td>Lawonua</td>
<td>Lawonua</td>
<td>Lawonua</td>
<td>Lawonua</td>
<td>Lawonua</td>
</tr>
<tr>
<td>Unahaa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of buyer</td>
<td>Government-supported warehouse</td>
<td>Private warehouse</td>
<td>Local buyer</td>
<td>Large scale local buyer</td>
<td>Small local buyer</td>
<td>Local buyer</td>
<td>Small-scale buyer and farmer</td>
</tr>
<tr>
<td>End buyer</td>
<td>Mars Inc./ PT Effem in Makassar</td>
<td>Different warehouses</td>
<td>Different warehouses, including in Kendari and Kolaka</td>
<td>Different warehouses or larger village buyers</td>
<td>Different warehouses</td>
<td>Different warehouses or larger village buyers</td>
<td></td>
</tr>
<tr>
<td>Buyer functions</td>
<td>Ferment, dry, sort, store</td>
<td>Dry, sort, store</td>
<td>Dry to 7% moisture level and sort</td>
<td>Dry and sort</td>
<td>Dry and sort</td>
<td>Dry and sort</td>
<td>Dry and sort</td>
</tr>
<tr>
<td>Official standard requirements</td>
<td>&gt; SNI and beans fermented in boxes &gt;4 days</td>
<td>SNI</td>
<td>Personal</td>
<td>Personal</td>
<td>Personal</td>
<td>Personal</td>
<td>Personal</td>
</tr>
<tr>
<td>Fully fermented beans traded</td>
<td>Yes</td>
<td>No, since it’s uncommon</td>
<td>Uncommon and only in small batches. Doesn’t want to buy fully fermented beans due to the extra work load</td>
<td>Prefers to buy fully fermented beans, but uncommon</td>
<td>Very seldom</td>
<td>Very seldom, since he is not interested in separating partially and fully fermented beans</td>
<td>Very seldom, but he just mixes all the beans, so no particular interest in buying fully fermented beans</td>
</tr>
</tbody>
</table>