Promoting Sustainable Coffee Farming

Empowering Small-Scale Coffee Farmers in Northern Thailand

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An Interactive Qualifying Project
submitted to the faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
Degree of Bachelor of Science

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Submitted to:
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Abstract

Small-scale coffee farmers across Northern Thailand lack access to resources critical to coffee production and marketing. Absence of these resources results in less sustainable, lower quality lives for farmers and their communities. The goal of this project was to develop an approach to assist small-scale coffee farmers with overcoming barriers to a sustainable way of life by providing them with informational resources. In collaboration with the Raks Thai Foundation, the team designed and tested an approach to identify barriers to successful coffee production and developed methods for overcoming them in rural villages across Northern Thailand. We applied this approach in the village of Aayae. The results of the project included specific resources tailored to farmers in the village to obtain and organize coffee production information. Finally, the team provided recommendations to Raks Thai Foundation for the continued use of our approach.

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Executive Summary

"Agriculture no doubt, is an important sector that needs to be given attention in any developing economy" (Bamiduro & Rotimi Ayodele, 2011). In Thailand, currently 38% of the population works in the small farming and agriculture industry (Coates, 2010). As with most small-scale farming across the world, farmers in Thailand have limited incomes. Minimal access to technology and few social programs exist because of the far-off, hard to reach locations of these farming communities (Gollakota & Doshi, 2011).

In more recent years, coffee has been established as a solution to some of the economic concerns faced in Northern Thailand (Co & Boosarawongse, 2007). This crop has been selected as it requires small amounts of land and has the potential to produce sufficient income to farmers. The climate and geography of Northern Thailand combined with traditional farming practices in the region provides farmers with an ability to produce high quality Arabica coffee in an environmentally sustainable manner (Swallow, Garrity, & Van Noordwijk, 2002). The coffee growing process, however, is time sensitive and requires constant monitoring, skill, and experience in order to yield high quality beans (Mangal, 2007). As a result, many small, rural farming communities across Northern Thailand still struggle to produce quality Arabica coffee.

In order to realize a more sustainable way of life, coffee farmers in Northern Thailand should be able to successfully produce high quality coffee within their own communities. However, for the majority of small producers, a lack of business resources, such as quality control methods, data organization, pricing information and record keeping, hinders their ability to operate sustainably (Gresser & Tickell, 2002). With proper resources, farmers could improve upon their agricultural methods and business techniques and make their farms more profitable.

Methodology

The goal of our project was to provide coffee farmers in Northern Thailand with resources to improve coffee production, sales, and operations in an effort to promote a sustainable way of life in their communities. We developed a model approach for our sponsor to apply to rural coffee farming communities across Northern Thailand. Coffee farming communities each face their own unique set of barriers, hindering their ability to live sustainably. The step by step approach defined by our objectives may be used as a model for our sponsor to apply to other communities. In order to test the effectiveness of our model, we applied it in the Aayae village located in the Phrao province of Northern Thailand. This entailed working on four objectives as follows:

1. We assessed current coffee production practices in Aayae to identify barriers farmers face as they pursue a sustainable way of life in their community.

Specifically, agricultural and economic aspects of the coffee system were investigated. This assessment provided the team with an understanding of the community's present state. To identify specific barriers faced by farmers in the village of Aayae, interviews with the farmers and representatives from the Raks Thai Foundation were conducted. A SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis was conducted and a pairwise comparison chart was used to identify the prevalent barriers that exist in the community.

2. We determined strategies for overcoming barriers farmers face as they pursue a sustainable way of life in their community.

Once barriers were identified, various strategies to overcome the barriers farmers face were determined. We took into consideration the opinions of farmers and our sponsor on appropriate strategies fit for the Aayae community. Previously conducted research allowed us to determine

proper evaluation methods for the proposed alternative strategies. These strategies were then systematically evaluated using best of class charts to determine which approaches would be most effective.

3. We designed strategies to assist farmers with overcoming barriers faced as they pursue a sustainable way of life in their community.

Once a strategy for overcoming the barriers farmers face was determined, appropriate deliverables to support these strategies were created. Research was conducted on various means of producing deliverables. Methods that best met the needs of the team, Aayae farmers, and our sponsor were chosen to create final deliverables. These included an informational coffee booklet and database.

4. We applied and evaluated developed strategies in the community.

Our final deliverables were presented to farmers in Aayea. Meetings with both community farmers and our sponsor took place so that improvements to the deliverables could be made based on their feedback. Suggestions from farmers and our sponsor were noted and their recommendations were used when revising the final deliverables.

Findings and Outcomes

Through background research, interviews, and analyses of gathered data, our team obtained results concerning the barriers faced by farmers in the Aayae village and developed strategies to overcome them.

Findings related to the Aayae village

Farmers in Aayae face a range of significant barriers to their coffee production and are struggling to live sustainably. Environmental, social, and economic factors inhibit community members in the village from living sustainably. Farmers are experiencing difficulties conserving environmental resources, maintaining coffee production and processing methods, and operating so that income is adequate within the community.

Environmental Factors – **Coffee trees in the village of Aayae are currently affected by pests and diseases.** After speaking with farmers in the community it was clear that this was a major concern to the majority of farmers as diseases are drastically impacting coffee production yields.

Social Factors – **The primary language spoken in the Aayae village is Akha and most of the community does not know how to read, write, or speak Thai.** Language barriers hinder the farmers' ability to communicate effectively and conduct successful business operations outside the community.

The village is in a very remote location, contributing to the minimal technological development taking place in the community. Due to the remote location and limited access to technology, **most of the agricultural knowledge in the community has been passed down between generations by word of mouth or obtained from neighboring villages**. The village of Aayae would like to improve coffee production methods but are unable to gain further insight on many aspects of production they are currently struggling with.

Cultural preservation is also an ongoing concern to the community. There is no primary or secondary school in the village; children leave the community in order to receive an education. One farmer expressed his personal concerns, stating "children are separated from their parents at the age of four or five years old which is not suitable for them because they are not old enough to take care of themselves. This will impact how they grow up."

Economic Factors - Although the community has increased coffee production year after year, farmers are still not receiving as much income from this crop as they would like. **Currently, coffee produced in the Aayae village is not of consistent quality and as a result farmers are**

struggling to sell it. Villagers are unhappy with the prices they are getting for their lower quality coffee and would like to focus on improving the value of their beans.

The two most significant barriers the village of Aayae faces are lack of access to information and business skills. The six barriers most concerning to farmers in the Aayae village were identified, through interviews with farmers and Raks Thai, as formal education, transportation, business skills, intermediaries, access to information, and access to funding. It was determined that access to information and business skills were the most prevalent barriers the community currently faces. More specifically, a lack of coffee production knowledge and data organization is inhibiting farmers from realizing a more sustainable way of life. **Resources most critical to helping the Aayae village overcome the barriers they face are a database and informational booklet.** Potential resources were brainstormed and evaluated based on six different criteria: affordability, cultural acceptability, ease of use, ease of implementation, ease of replication, and effectiveness. The defined criteria, along with interviews of both farmers and Raks Thai Foundation representatives, helped determine that a booklet was an appropriate resource to help farmers overcome the barrier they face accessing information and a database would be most fitting to help farmers improve their business skills.

Findings related to The Model Approach

It is important to understand the background and current conditions of a community before attempting to introduce change. Taking the initial steps to understand the background and current conditions of a community is an important component to the success of a more general model to help rural communities overcome barriers they face. Understanding the community also means coming into the research free of preconceived ideas or developed solutions. This way, information learned from the community can be used to formulate ideas for solutions tailored towards the specific community. The Aayae community had significant barriers they hoped to overcome that were different from what the team had anticipated. Using this first visit as an opportunity to observe and acquire information from the community is beneficial when attempting to help develop solutions to the barriers they face.

It is not feasible to create one single solution that fits all villages. Individual small-scale coffee farming communities each face their own unique set of barriers and have distinct capacities to realize a sustainable way of life. Some coffee farming communities are looking to improve bean quality while others hope to increase the efficiency of their coffee production. The features contributing to an effective deliverable design such as cost, ease of use, and cultural acceptability are unique to specific villages.

Developing resources that are not matched with technical, social, and economic capacities of a village won't be useful. Because many members of the Aayae community were unable to fully understand some of the concepts presented, changes in the developed resources were made. Without appropriately adjusting these resources to match the capacities of the community, the created tools would not have been helpful.

A community's willingness to receive help and be involved in the process of identifying and overcoming barriers is critical to the model's success. By working with farmers in the community, it was clear that without their involvement our model would not be successful. The village of Aayae was just as involved in the process of overcoming barriers as we were. The community played a significant role in the outcome of our final deliverables. If we had not worked directly with farmers in the community, our deliverables would have focused on overcoming less significant barriers, as we would have not fully understood the barriers farmers in Aayae face.

The four-step model can be useful for capacity building in order to assist farmers with overcoming the barriers they face to a sustainable way of life. The Raks Thai Foundation aims to help communities 'develop the capacity' to learn on their own by working to provide them with a sense of power and confidence. We strived to incorporate this philosophy into our model approach.

Our approach, as applied to the village of Aayae, was effective in developing strategies for farmers to use as opposed to overcoming barriers for them. While working in Aayae, the barriers farmers face were not resolved for them. For example, we did not work in the coffee fields to help farmers treat diseases that were prevalent, but instead gave farmers resources to do this on their own. We aimed to help farmers gain the ability to learn on their own and provided them with resources to do so. By creating enthusiasm in the community about gaining more knowledge and providing farmers with appropriate resources to obtain it, we were able to conclude that our model is in fact useful for building capacities in order to overcome barriers communities face to a sustainable way of life.

Outcomes

The team created two main tools the village of Aayae could benefit from: a database to help improve farmers' management and business practices along with a booklet with suggestions for improved coffee production, processing, and marketing methods.

- *Creating the Database and User's Manual* – Considering various options, the team determined the most feasible data organization tool was Microsoft Excel. The database will allow farmers to keep records of their production numbers and have more control of the costs entailed. Hard-copy versions of the database were created for farmers without access to electronic devices to use. A user's manual was also created to assist farmers with using database.

- *Creating the Booklet* - The booklet contains information on practices for farmers to improve the quality of their coffee. Chapters of the booklet include: "What is this?", "Coffee in Thailand", "Coffee Production", "Coffee Processing", "Quality Maintenance", " Selling Strategies", "Maintenance of Old Trees", " Pesticide Control", "Resources", " References and Sources for Further Reading".

After drafting the database and booklet, we returned to the Aayae village to present our designs to the farmers and Raks Thai. Taking their opinions into consideration we reformulated our deliverables.

- *Adjusting the Database*- The database was split into two separate databases, to accommodate for the different roles of farmers in the community. One spreadsheet tracked expenses of farmers' revenues from buyers to avoid losses. The other database was simplified and adjusted to improve farmers' understanding.

- *Adjusting the Booklet*- We added more information and specific details to Recommended Methods and Coffee Production and chapters based on farmers' requests.

By providing coffee production information and a method for record keeping, we hope that future generations can continue to improve conditions in the community.

Recommendations and Conclusion

Through research and field visits we developed recommendations for the Raks Thai Foundation, farmers in Aayae, and future WPI-BSAC teams. We have formulated conclusions about our model based on testing completed in the village as well as recommendations concerning further refinement to the model approach.

Recommendations regarding the Aayae Village

We recommend that the farmers in Aayae apply the methods specified in the booklet as they see fit to improve the quality of their coffee. We also recommend that they use the marketing tips provided to better market their product. The tools developed for the village of Aayae had two central purposes. The coffee booklet aimed to provide farmers with more information on coffee production, processing methods, and marketing strategies.

We recommend that the farmers fill out fields of the database with data from previous years and continue to collect data to fill out all fields of the database in years to come. The purpose of the database was to provide farmers with an organized method of bookkeeping.

We recommend the Raks Thai Foundation further assist the Aayae village with the implementation of methods in the booklet and the record keeping in the database for at least one full year of the coffee cycle. The final versions of the booklet and database were given to the Raks Thai Foundation to give to the farmers of Aayae. As the methods in the booklet and database are new to farmers, it is critical for the Raks Thai Foundation continue to provide assistance with their use.

We recommend that the Raks Thai Foundation use our model to identify further barriers faced by the Aayae village and assist farmers to overcome them. The team chose to create two deliverables after assessing barriers in the Aayae village and evaluating the significance of each. However, we recognize farmers face many other barriers, not only those we addressed. As the village utilizes the tools developed to assist them, it is likely that other identified barriers will become more significant and new barriers will also emerge.

Recommendations regarding the model

We recommend that the Raks Thai Foundation follow the team's proposed methodological steps to assist other small, rural coffee farming communities overcome the barriers they face. The effectiveness of our developed objectives was assessed with the help of our sponsor in the village of Aayae. Our developed tools (the informational coffee booklet and the database) were both well received by the community; farmers wanted to learn more. A motivation to learn is critical to successfully build the capacity of a community. Based on these observations, we concluded that our approach used to develop resources for farmers is effective and can be used by the Raks Thai Foundation to help other coffee producing communities in Northern Thailand.

In order to improve the effectiveness of our model approach, we recommend spending more time with farmers in their communities when working to overcome barriers they face. By increasing the amount of time spent with farmers, a deeper connection can be made to the individual community; developing this connection will make it easier to understand the community's needs and help to develop better ways of approaching the problems they face. Spending more time in the community will help to gain new perspectives on the barriers farmers face.

We recommend that future WPI-BSAC teams in conjunction with the Raks Thai Foundation continue to evaluate and improve our model. Due to the timeframe of the project and difficultly traveling to the Aayae village, we were only able to visit the community for a short time. This made it difficult for the team to fully understand the culture of the community, which is critical when introducing new ideas. Due to these limitations, we recommend that more time

is spent in the village of Aayae evaluating our model and how successful it is. We also suggest the same evaluation be completed in other rural coffee farming villages the Raks Thai Foundation works with.

Understanding the relationship between participation, empowerment, and sustainability was extremely important in the development and application of our model. We worked directly with members of a rural, small-scale coffee farming community and allowed them to take control of their learning. As a result, farmers in the community were motivated to educate themselves and were provided with the means to do so. By using these concepts, as we did in our model, not only can the village of Aayae improve their quality of life, but so can rural coffee farming communities across Northern Thailand.

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1 Introduction

Major coffee corporations will sell you a cup of coffee for about $3.00. This cup contains approximately ¼ ounce of coffee. The person who grew the coffee beans for the beverage you are about to consume gets between 47¢ and 94¢ per pound for their product; that's about .008¢-.016¢ per cup of coffee. To put this into perspective, the person serving you takes about 1-2 minutes to pour your coffee, take your money, give back the change, etc. At minimum wage, that's between about 11¢ and 22¢ per cup (Ekosso, 2012).

"Agriculture no doubt, is an important sector that needs to be given attention in any developing economy" (Bamiduro & Rotimi Ayodele, 2011). There are about 450 million farmers worldwide farming on two hectares or less of land. 90% of these small-scale farmers live in Asia and Africa where they make up over 80% of all farms and produce more than 40% of the total agricultural output, contributing significantly to both the food supply and local economy (Hazell, Poulton, Wiggins, & Dorward, 2010). There are advantages to rural, small-scale farming both locally and nationally. Small-scale farming is more environmentally friendly and gives individuals an opportunity to provide for themselves; as a result there is greater potential for increased productivity. This practice promotes a better quality of life as it is often healthier than living in a city and also helps to support family unity and keep cultures intact. Though there are many benefits, rural, small-scale farming can also be a difficult way of life. Farming in underdeveloped areas runs hand-in-hand with poverty and low quality of life, as it does not consistently provide sufficient income for farmers and their families (Kristjanson, Place, Franzel, & Thornton, 2002). While small farms are a primary source of rural employment, they also account for the largest share of rural poor in most developing countries (Hazell et al., 2010). Health and education programs as well as technological advancements such as electricity and internet require access to resources such as funding, government assistance, additional training, and knowledge many communities do not have (Grocer, 2012). This makes it difficult for rural farming communities to advance. The ability to realize increased income and an improved quality of life poses a challenge to small rural farming communities across the globe.

In Thailand, currently 38% of the population works in the small farming and agriculture industry (Coates, 2010). As with most of the world's rural, small-scale farming, farmers in Thailand are not earning adequate income (Coates, 2010). Insufficient income as well as the remote locations of many rural farming villages makes assistance and support for these communities difficult. Very few social programs have been established because of the far-off and hard to reach locations of these villages as well as the limited access to technology these villages have (Gollakota & Doshi, 2011). There are multiple government programs in place which choose to support these communities through funding, in the form of loans. A majority of communities however choose not to accept these loans for fear of falling into debt. Rural farming communities are willing to receive help, as long as they do not have to borrow money (FAO, 2012). The number of people involved in small-scale farming throughout Thailand continues to decrease, as farmers are unable to support themselves on such little income. Many people are leaving their communities behind in hopes of receiving an education or finding a job that provides them with better income. As a result, the cultures of these rural villages are depleting (Tipraqsa & Schreinemachers, 2009). Fifty years ago 80% of Thailand's population was involved in small-scale farming. Today, this number has been reduced by more than half (Coates, 2010).

Due to the fact that such a significant portion of Thailand's population is involved in small-scale farming and agriculture, problems farmers face are a major concern to the country. Many programs have been designed and put in place with the hope of bringing increased income to rural farmers and their communities. For example, 'Economic Sufficiency' is an idea suggested by the government of Thailand in recent years. This concept aims to provide all regions of the country, particularly rural and remote areas with the ability to function sustainably and independently, without relying heavily on other areas for necessities the community requires in everyday life (Piboolsravut, 2004). Royal Projects have also been implemented to promote economic development across Thailand. One main objective of this program was to eradicate opium poppy cultivation. Specifically, a crop substitution program aimed at eliminating slash and burn farming methods associated with opium cultivation was implemented. These crop substitution programs provide assistance to small, rural farmers with planting fruits and flowers that have potential to yield high profits (Frost & Krueger, 2006). They help farmers realize improved quality of life without depending on opium poppy income (The Government Public

Relations Department, 2012). Despite efforts such as these, adequate income for farmers in Thailand is an ongoing concern.

In more recent years, coffee has been established as a solution to some of the agricultural concerns faced in Northern Thailand (Co & Boosarawongse, 2007). This crop has been selected as one of the alternatives to opium as it requires small amounts of land and has the potential to produce sufficient income for farmers. The climate and geography of Northern Thailand combined with traditional farming practices in the region provides farmers with an ability to produce high quality beans (Swallow et al., 2002). Not only do these practices produce better beans, these methods are also environmentally sustainable (Swallow et al., 2002). High quality coffee production, combined with efforts from buyers to support fair trade and sustainability, has the potential to help small coffee producers see an increase in their income.

Though coffee was introduced as an alternative to opium, this crop still poses challenges to many small, rural farming communities across Northern Thailand. In order to address issues around small-scale coffee farming, various aspects of the coffee industry have been considered. Firstly, coffee farmers have a very limited amount of education and knowledge of business and marketing skills. Secondly, coffee farming processes require skill and experience in order to produce high quality beans (Mangal, 2007). In order to realize a more sustainable way of life, farmers in Northern Thailand should be able to successfully produce and process coffee within their own communities. However, their ability to do so is hindered by farmers' limited access to resources necessary for effective business operations. For the majority of small producers, a lack of business resources such as quality control methods, data organization, pricing information, and record keeping negatively impacts their capacity to operate sustainably (Gresser & Tickell, 2002). With developments in technology, there is potential for underdeveloped farming regions to gain access to business resources not currently available (Gollakota & Doshi, 2011). With proper resources, farmers could improve upon their business techniques and make their farms more profitable.

Though there are common themes in the barriers small, rural coffee farming communities face throughout Northern Thailand, every community is different. Each village is unique in its history, culture, and perspective so the specific barriers each community faces in pursuit of a

successful and sustainable way of life also differ. Instead of having one solution to help every small, rural farming community in Northern Thailand, a program that can serve as a framework and be tailored to the specific needs of a community would have many more benefits. This approach would allow small, rural farming communities to effectively overcome specific barriers they face in their daily lives. As a result of successful programs, individual cultures and customs of rural, farming communities across Northern Thailand can be preserved (Fujioka, 2002).

The purpose of our project is to provide coffee farmers in Northern Thailand with resources to improve coffee production, sales, and operation in an effort to promote a sustainable way of life in their communities. This project goal stems from the idea that it is more effective to educate a population on how to perform a specific task than to do it for them (Swidler & Watkins, 2009). In order to accomplish our project goal, the team worked to develop an effective model that can be applied to coffee farming villages across Northern Thailand. We hope our four objectives can serve as standard steps to help communities overcome the specific barriers they face. In order to test the effectiveness of our objectives, we applied our standard model to the village of Aayae, a small settlement in the Phrao province in Northern Thailand. The team travelled to Aayae in order to carry out and evaluate our designed objectives and collaborate with farmers in the community to improve our design.

First, we assessed current coffee production practices in order to identify barriers farmers face as they pursue a sustainable way of life in their communities. Second, we determined strategies for overcoming barriers farmers face as they pursue a sustainable way of life in their communities. Third, we designed strategies to assist farmers with overcoming barriers faced as they pursue a sustainable way of life in their communities. Fourth, we applied and evaluated developed strategies in the community. Providing specific knowledge and resources to rural farmers tailored to their community will help them successfully produce and sell coffee independently. This aim coincides with the mission of the Raks Thai Foundation, our sponsor. A goal of this organization is to work with poor, underprivileged communities to help with challenges they face. This includes developing skills to help achieve a sustainable living and source of income. By providing business and management resources to farmers, we hope to help increase their potential to operate with minimal outside assistance. Ideally, with improved

knowledge and resources, farmers will be able to attain increased profits and improve their quality of life.

2 Background

In this chapter, we begin by highlighting the importance of small-scale farming worldwide and discuss the positives and negatives of this practice. We then move to small-scale farming specifically in Northern Thailand and how the cultivation of opium eventually led to coffee farming. Coffee production in general is then elaborated upon, and advantages and disadvantages of growing and selling this product are discussed. After this, recent efforts to help overcome the disadvantages of coffee production are introduced along with the areas in which these efforts are lacking. Various techniques used to progress these struggling areas are then discussed as well as how our sponsor, the Raks Thai Foundation, is trying to help coffee farmers by using these techniques.

2.1 Small-scale Farming Worldwide

Small-scale farming is extremely important throughout the world today. A small-scale farmer is described as one whose operation does not include the use of advanced technologies and in most cases provides food for family use before selling surplus (Kutya, 2012). Although small-scale farming is sometimes associated with low production at a high cost when compared to large production farming, it still contributes significantly to the world's food supply and local economies. Small-scale farming is especially important in developing countries, as many people farm for subsistence (to maintain and feed themselves), and then sell any surplus or grow small amounts of cash crops (crops intended for selling only) for profit (Kutya, 2012).

Unfortunately, small-scale farming is declining in many developing countries due to a "shift to more export-oriented production" that is being pushed by many governments (United Nations, 2007). In many cases, it is difficult for governments in developing countries to support small-scale farming as large-scale production can more easily provide food security (Chavez-Tafur, 2009). As large farming operations are favored, it becomes more and more difficult for small-scale farmers to earn an adequate amount of money from surplus items and small cash crops. Large-scale farms can sell crops at a much lower price, and without any government assistance, small-scale farmers struggle (Rabbinge & Kessler, 2009).

2.1.1 Positives of small-scale farming

Small-scale farming offers many positive economic, social and environmental benefits. One of the largest advantages to small-scale farming is the ability to farm for subsistence. Subsistence farming is described as farming in order to support oneself and selling the surplus or small amounts of cash crops for extra income (Encyclopedia, 2013). This type of farming can be very profitable as farmers require little outside assistance to operate and therefore do not have many expenses (Mincyte, 2011). When they sell their surplus or small amounts of cash crops, farmers have the opportunity to profit greatly.

Farmers that do not farm for subsistence also have opportunities to prosper economically. Farms that produce a variety of products are not reliant on one single crop for income; this provides farmers a form of insurance in an ever changing market (Andree, 2009). It has been shown that many small farmers often sell their products locally, within their own communities. An economic advantage to small-scale farming is the positive relationships with customers this practice supports. Relationships with customers are extremely important to the success of any business. By maintaining a close-knit customer base farmers are able to successfully sell their product (Andree, 2009).

In addition to the economic benefits that can be realized through small-scale farming, there are numerous environmental advantages to this practice as well. Small farms tend to use more environmentally sustainable techniques when compared to large-scale farms as they do not have the need to use heavy machinery or large amounts of fertilizers and pesticides for their crops (Andree, 2009). These practices help the land retain its nutrients, especially when used in conjunction with mixed crop and livestock systems common to most small-scale farms. Recently consumers have become more planet and body conscious when it comes to the products they buy. This has given small-scale farmers a large advantage over large-scale producers (Shankar, 2012).

One aspect of small-scale farming that is often overlooked is the social benefit of this practice. Small-scale farming allows families and communities to preserve their cultural heritage by avoiding non-traditional influences and trends of society (Rabbinge & Kessler, 2009). A strong cultural heritage usually coincides with stronger family ties and happier lives (Burton, 2008). When a farm is sustainable, the farmers' income can be as well and the cultural heritage of the farmers' families can remain strong. Unfortunately, often small farms receive little help when in need, and the allure of large technology for greater productivity is too great to pass down.

2.1.2 Negatives of small-scale farming

Small-scale farming also has many negatives which are why these farms account for the largest share of rural poor in most developing countries. Negatives the farmers face include minimal assistance and attention from their respective national governments, a push for implementation of expensive technology for constant production increase, and vulnerability to weather and other factors that can destroy crops.

Many countries have recently supported small-scale farming because of the positives it creates in communities as mentioned in the previous section (Chavez-Tafur, 2009a). However, in developing countries, it is difficult to support small farms as large-scale farms can easily provide the country with food security (Chavez-Tafur, 2009b). In many developing countries, a lack of farming standards has forced many small-scale farmers to either significantly increase their production or be overcome by large producers (Andree, 2009). Although some small farmers increase their production in order to avoid poverty, many do not have a means to do so as they lack the capital to purchase larger machinery or employ workers (Andree, 2009).

Inconsistent income is another problem constantly plaguing small-scale farmers worldwide. In developing countries, children in rural farming communities are often sent to schools in the city. Many of these children choose not to return home due to the low income that farming provides and the greater opportunities offered in an urban environment (Rabbinge & Kessler, 2009). This occurrence is frequent in countries all over the world. If it continues, the cultures of many small villages could be forever impaired and could be the end of the current life they live.

The negatives of small-scale coffee farming can be seen across the globe. In Thailand, small-scale agriculture accounts for the majority of all employment (Coates, 2010). Small, rural farming communities in Northern Thailand are hurting, as this way of life makes up such a significant portion of the population.

2.2 Small-scale Farming in Northern Thailand

In Northern Thailand, small-scale farming was the main way of life for the majority of the population until the mid-19th century (Coates, 2010). However, like many other developing nations, the national government made it extremely difficult for small-scale farmers to thrive. The government encouraged commercialized farms because they were able to produce more crops, export more, and in turn realize greater profits for the country (Marten, 1986). To promote this commercialization, all farms were taxed, even farms with the sole purpose of feeding a family. This led to a decrease in the overall number of small-scale farmers (Reunglertpanyakul, 2002). However, production increased for the remaining small farmers, as they farmed more in order to create a surplus to pay the taxes (Marten, 1986). Cash crops, or crops that are primarily grown to be sold, also became more prevalent in small-scale farms. However, this influx of production and the addition of cash crops such as sesame, corn and tobacco led to the exhaustion of a large amount of land. Traditional 'slash and burn' farming techniques (cutting down crops and burning them to partially replenish nutrients in the soil) were consistently used which eventually led to infertile lands (Hsin-Ching, 2012). In order to avoid poverty, these farmers turned to one crop that received large profits and that the soil could still produce: opium (Hsin-Ching, 2012).

2.2.1 Opium and its alternatives

Opium was a heavily traded product throughout Thailand for hundreds of years. In the 1940's opium agriculture boomed as high taxes and infertile soil throughout most of the Northern regions of the country made conditions for growing this crop favorable (McCoy, 1991).

Once Thailand became a large supplier of opium, debates started regarding whether or not the cultivation of this product should be permitted as opium is a strong narcotic that was illegal to sell in many countries (Chamnivikaipong, 2006). In 1948, the Thai government introduced an anti-opium campaign aimed at outlawing opium use in the country by 1953. However, in 1949, after seeing how much money opium brought into the country, the government repealed the campaign (McCoy, 1991). Passive attempts to 'outlaw' opium in the 1950's were followed by more serious action when the effects of opium on citizens became more apparent. Opium farmers remained in poverty despite the high profit margin of this product.

The Thai government decided to encourage the production of other crops in order to bring money into the country without promoting the production and sale of opium. Prince Bhi-sa-tej Ra-jani led the government movement known as the Royal Hill Tribe Assistance Project (also known as the Royal Project or the Crop Replacement Program) (Hsin-Ching, 2012). The project introduced various fruit trees, tea, cabbage, lettuce and many other crops to Northern Thailand farmers who grew opium, and offered assistance on how to grow each of the crops (Renard, 2012). The program took a number of years to introduce but eventually a change was seen. In 1968, Thailand produced around 150 metric tons of opium. By 1985, Thailand only produced 50 metric tons (Chamnivikaipong, 2006). One replacement crop introduced to many Northern Thailand farmers that had a significant impact was Arabica coffee. Arabica coffee was and still is a very important crop due to its potential for a large profit with little negative effects to the soil.

2.2.2 Coffee Farming Communities in Thailand

There are two main types of coffee that are grown throughout the world: Arabica and Robusta. Arabica is known as being of much higher quality, as long as it is cultivated in the correct manner (Keable & Canadian, 1910). Until the Crop Replacement Program was introduced, Thailand grew Robusta coffee in the southern regions of the country. The low altitude and high temperatures required for Robusta coffee production made the southern regions of Thailand practical for the cultivation of this crop. The Crop Replacement Program's aim however was to target rural communities, specifically in the northern part of the country as this was where opium was primarily grown. Due to the cooler, mountainous climate of Northern

Thailand, the Crop Replacement Program introduced Arabica coffee to many Northern communities (Angkasith, 2001).

There have been many success stories in various small rural farming communities who began growing Arabica coffee after the government initiative. Perhaps the most recognized of the Northern Thailand communities is a small community located in Doi Chaang, which began growing coffee in the early 1970's. In the early 1990's, multiple villages in the area joined together and formed the Doi Chaang Coffee Company and began selling in various places around Thailand (Doi Chaang Coffee, 2012). Their success in Thailand drew the attention of a venture capitalist and the Doi Chaang Coffee Company now sells coffee internationally (Doi Chaang Coffee, 2012). The success of growing coffee in small, rural farming communities like Doi Chaang has motivated many other communities to do the same. One example of this is in the village of Aayae.

2.2.2.1 Aayae Village

Aayae is a small, remote village of approximately 266 people located in the Phrao province of Chiang Mai as shown in Figure 1. Aayae is a relatively new Akha village, as they split off from a larger village in Chiang Rai only 32 years ago. More information on the Akha culture can be found in Appendix A: Information On Akha Hill Tribes. Unfortunately, the villagers in Aayae have struggled to make sufficient income since its establishment. This lack of income has left community members with limited access to healthcare and other social programs, as they are too expensive (Songwut, 2013). Little income also contributes to the farmers' inability to advance their farming operations.

In Aayae, farming currently serves as the primary source of income. Originally, the village grew plums as a cash crop. However, over the years, more and more villages began to also grow plums as they were a crop promoted by the Royal Projects. This led to an overproduction and a reduction in selling price for the village.

In recent years, the Aayae village has seen the success of some of the coffee farms around Northern Thailand, such as in Doi Chaang. Seven years ago, the village decided to grow coffee in order to increase their income. They decided to grow Arabica coffee due to the ideal climate conditions of the community, as well as the coffee's potential for high profit as it is a high quality product. However this coffee is only of high quality when grown in the correct manner.

Figure 1: Location of Aayae village in map of Thailand (Google Maps) (left)

Figure 2: The Aayae Village (right)

2.3 Coffee Production

Getting coffee from the producers' trees to the consumers' coffee cups involves a series of steps. This process involves planting trees, harvesting, wet or dry processing, sorting and grading, roasting, grinding, packaging, shipping, and finally brewing. In most cases, the exportation occurs before the roasting in order to maintain the coffee's flavor and aroma (Angkasith, 2001). A detailed diagram of this entire process is shown in Figure 3.

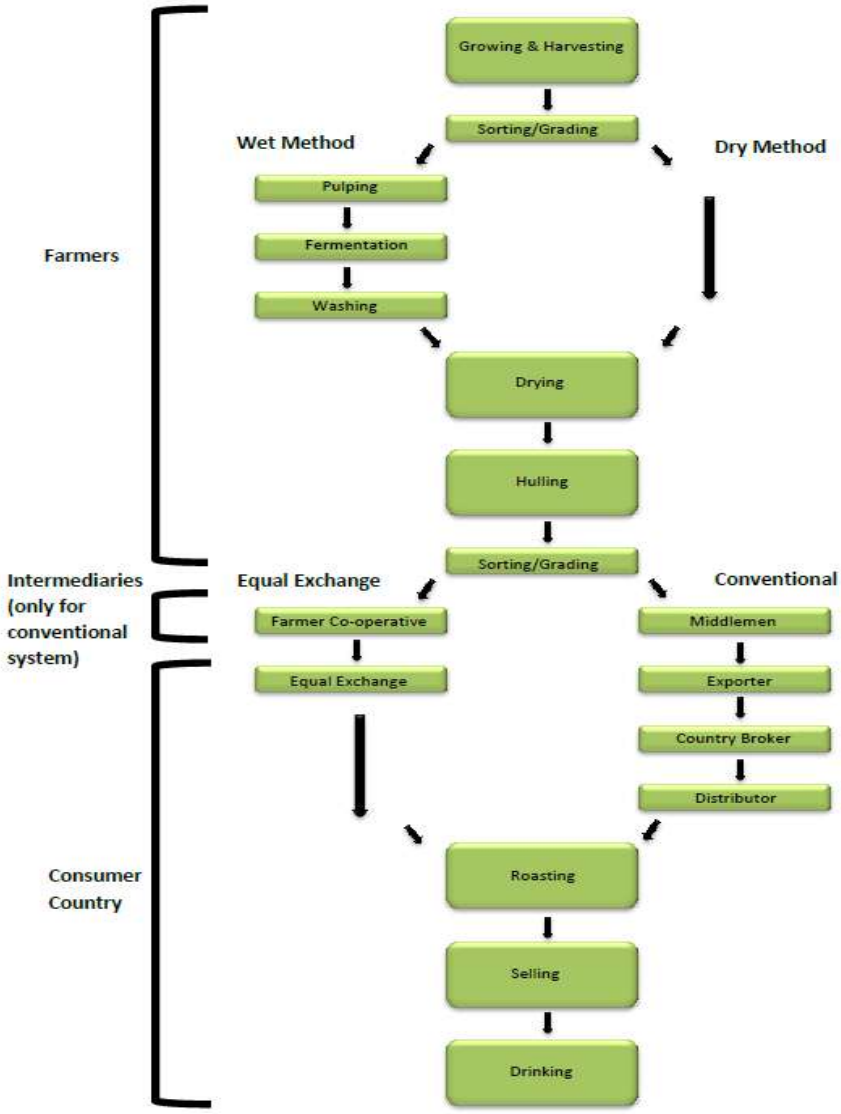


Figure 3: Detailed diagram of coffee production process

(Adapted from (Nickilisacole, 2012) and (Brown et al., 2012))

2.3.1 Growing, Harvesting and Processing Coffee

Coffee production is a complex system that requires careful quality control at every step, from growing through the final sorting and grading processes before export (Subedi, 2010). In this section we will discuss the methods of coffee production and the features that promote high quality and valuable coffee beans.

Preparation and Growing

Land preparation is an important step which needs to be completed one year before the planting of small coffee trees (FAO, 2012). Non-shade trees must be removed and the land should be weeded before the small trees are planted. Coffee trees should be planted by hand during the rainy season. Weeding for the first year after planting is crucial as weeds can take nutrients away from the young tree (defoundation.org, 2005). Coffee trees will not flower and produce fruits until three to four years after they have been planted. For these three to four years, weeding should still be carried out regularly. The coffee trees should also be pruned during this time. Pruning is extremely important to the success of the tree and consists of removing unnecessary branches from the plants.

Harvesting

Shortly after the trees begin to flower, they will begin to produce fruit. When the coffee cherries turn bright red, they are ready to be picked. A diagram of this is shown in
Figure 4. There are two types of picking: strip picking, and selective picking (Hicks, 2001). Strip picking involves using machines to pick all of the cherries at once, and selective picking, which requires manual labor to pick only the ripe cherries. Although selective picking produces higher quality beans, it is much more labor intensive (Rau, 2008).

Figure 4: Various Stages of Coffee Fruits: Flowering (left), Unripe Cherry (center), Ripe Cherry (right)

Processing

There are two widely used coffee processing methods; dry and wet. The dry method requires less technology and contains fewer steps. However, the wet method is known for

producing higher quality beans, especially in the case of Arabica coffee beans (Hicks, 2001). Due to higher quality, farmers receive a greater income when making use of the wet method (Subedi, 2010). The sorting process for both methods is the same; floating tanks are used to separate the ripe cherries from the unripe. The ripe cherries are then usually hand-graded, meaning they are sorted manually by size and ripeness (Subedi, 2010). Cherries that are ready for the next steps of processing sink and those that should be discarded float in the water (Rau, 2008). After this step, the wet and dry methods differ.

Using the dry method, ready cherries are then laid out in the sun on the floor or ideally, on a raised bed, and turned periodically. This process can take up to four weeks (Hicks, 2001). After the coffee beans have been dried, they go through hulling, where the shells are removed. In the last step of the dry method before export, another round of sorting and grading occurs (Subedi, 2010). Beans are then packaged and stored. Ideal storage of the beans is in a ventilated and dry room where bags containing coffee beans can be laid out without being piled one over another or touching the ground (defoundation.org, 2005).

In the wet method, after harvesting and sorting, cherries go through four additional steps: pulping, fermentation, washing, and hulling (Hicks, 2001). Pulping is the stage where outer shells are removed. This is done shortly after harvesting and requires machinery which can vary in complexity, from manual processing to automatic (intracen.org). Pulping is followed by the fermentation process. Fermentation consists of immersing coffee beans in a tank that contains natural enzymes in order to remove mucilage that is in contact with the beans (defoundation.org, 2005). The coffee beans are then washed by hand or machine in fresh, cold water (intracen.org). After washing, these beans are then laid in the sun, either on the floor or on raised beds, for drying (Rau, 2008). Drying in the wet method only takes eight to ten days, however the beans should be stirred at least once per hour to guarantee even drying (Hicks, 2001). These dried beans then go through hulling and polishing processes, which consist of removing the dried parchment layers from the beans and smoothing its surface (machines used are shown in Figure 5). A final round of sorting and grading is performed before beans are ready for packaging (Subedi, 2010). The beans can then be stored in the same way as the dry method. Growing, harvesting, and processing coffee are all important steps to coffee production process; marketing coffee however, is just as critical.

Figure 5: Various Machines Used for Pulping, Hulling and Polishing

2.3.2 Marketing Coffee

When pricing coffee, general physical features of the coffee beans are taken into account. These considerations include color, texture, weight and size, and coating of the coffee. The first and most important consideration when evaluating coffee beans is color. Deep blues, light greens, and pale yellows are preferred over gray or brown beans (Keable & Canadian, 1910). Additionally, the texture should be hard and waxy. Ideal size is based on preference, but generally larger, heavier beans are better. Proper weather conditions throughout the beans' growth are also considered since the color of the beans relies heavily on moisture content, which in turn depends on the weather (Keable & Canadian, 1910).

Other than these generic physical features, there are no simple standards for evaluating coffee in the raw state. Different buyers have varying experience in the business and look for different characteristics. No explicit standards for coffee value have been defined. Ultimately a buyer bases his or her valuation of coffee upon an expected sale price. This means that depending on where the buyer is marketing his or her product, price can vary greatly (Quinn, 1960). The reason for lack of definite standards is because the aromatic quality of coffee only appears once it has been exposed to high temperatures during roasting, which is when quality is certain. Aroma and taste rapidly fade however, and can be lost quickly after the roasting process occurs. This feature of coffee means that roasted beans must be quickly packaged in order to maintain aroma and taste (Ethiopian Embassy).

As a result, most of the value in coffee comes from the roasting, grinding, packaging, shipping, and selling processes as opposed to the actual cultivation of coffee. Other characteristics taken into consideration by buyers are the country of origin, altitude of the growing site, color, processing method, and number of defects in a lot (Grocer, 2012). Coffee growing in areas such as Northern Thailand can be very advantageous as it has the potential to be of high-quality and sell for a high price; however the difficulty of putting a price on this coffee presents complications for farmers (Samranpong, Ekasingh, & Ekasingh, 2009).

2.3.3 Advantages of growing and selling coffee

There are many advantages as well as barriers to growing and selling coffee for small, rural farming communities in Northern Thailand as outlined in Table 1.

Advantages		Barriers	
Climate	Cooler weather, higher altitude leads to higher quality Arabica Coffee	**Limited Knowledge**	Farmers lack knowledge to improve farming and processing techniques and business skills for selling
Traditional Farming Practices	These techniques are more environmentally friendly which helps prolong land use	**Minimal Transportation**	Lack of paved roads and means of transportation deter buyers from traveling to the villages to buy coffee
Potential for Profit	*High quality* Arabica coffee can generate large sums of money in the market	**Intermediaries**	They usually offer extremely low 'take it or leave it' prices for coffee
		Low Access to Bank Loans	Small, rural farmers lack skills to develop a solid business plan leading to denied loans from banks

Table 1: Advantages and disadvantages of small-scale coffee farming

Advantages for growing coffee in Northern Thailand include climate, traditional farming practices and potential for profit. As previously mentioned, the climate of Northern Thailand is ideal for growing Arabica coffee. This leads to many advantages including the ability of small coffee farms to use very environmentally friendly methods as they need little fertilizer to help coffee trees grow. Many small, rural farming communities in Northern Thailand also use traditional farming practices without the use of machines for harvesting or processing (Chinnasri & Chinnasri, 2011). These environmentally friendly and traditional farming methods can be very appealing to the buyer of the coffee. Some of these farms have the potential to meet certain organic and sustainable certifications that are sought out in the global market (Hernani, 2006). Reducing or eliminating the cost of chemicals by using organic farming methods saves farmers money and also prolongs the use of land because resources are not depleted rapidly (Northwest Shade Coffee Campaign, 2012). More information on organic and sustainable certifications can be found in Appendix B: Coffee Certifications.

Coffee is one of the most traded agricultural commodities in the world (FAO, 2012). Since it is very highly traded it can generate large sums of money for small farms. However, there is often too much coffee on the market and a lot goes unsold (FAO, 2012). The majority of this is Robusta and low to medium quality Arabica coffee. High quality Arabica coffee sells at a very high price as it makes up only a small portion of the market (FAO, 2012). When farms are able to produce high quality Arabica coffee, they rarely have difficulty selling it for a high price. The potential for profit of growing Arabica coffee is clearly evident and many farmers have been drawn to it because of this. However, the difficulty of growing such high quality Arabica coffee can lead farmers to an even worse quality of life (Angkasith, 2001).

2.3.4 Barriers to growing and selling coffee

As mentioned, it can be difficult for farmers to grow Arabica coffee and increase their quality of life. There are many barriers to growing and selling coffee for rural, small-scale coffee farming communities which include limited knowledge, minimal transportation, the presence of intermediaries and low access to bank loans. Many rural farmers in Northern Thailand have

either little or no formal education and literacy skills, and therefore they have no way of learning new coffee growing, processing and selling principles and techniques without the help of others. An average Thai coffee farmer receives only six years of schooling, none of which include business or management education (Nonthakot & Villano, 2008). In the village of Aayae specifically, 111 people are literate, and 159 are not (Songwut, 2013). Similar numbers can be seen throughout a majority of small villages in Northern Thailand (Thailand Ministry of Education, 2009). With such limited education and knowledge, it is extremely difficult for farmers to learn new farming and processing skills needed to increase coffee quality and production. Outside of learning through word-of-mouth, these farmers do not receive information on how to improve their quality and production.

Many small, rural farming communities in Northern Thailand lack a suitable means of transportation (Walker, 2003). Villages often have no paved roads, are far away from any cities or towns, and have few vehicles capable of transporting substantial amounts of coffee to 'local' buyers (Rigg & Ritchie, 2002). For example, the closest paved road to Aayae is over one and a half hours away and requires a four-wheel drive vehicle. This creates a problem because many buyers are also unwilling to come to the villages to buy the coffee due to the difficult access of the community. Reluctance and difficulty to transport the coffee from both the buyer and seller understandably makes it difficult for the coffee to be sold. This also leads to another challenge to many coffee farmers: intermediaries.

Intermediaries, or middlemen, have their own advantages and disadvantages. Many help farmers sell their coffee by paying them directly for it, and some of them give the farmers a fair price. However, many are smart businessmen who usually buy products from producers at prices well below their market value in order to maximize their own profit (Ssempijja, 2012). In many of the villages in Northern Thailand, these intermediaries are the only buyers who will transport coffee from the village. "These middlemen will approach farmers directly and offer them a price for their coffee. This price is usually much lower than the global commodity price but farmers usually don't have access to any other selling options" (Skillicorn, 2012). With middlemen present, coffee farmers do not have to reach out to global markets, transport the beans, or advertise their product to potential buyers. These intermediates often contribute to the farmers' sales by providing transportation and connections with potential clients. These

attributes are difficult for smallholder coffee farmers to obtain on their own because they do not hold the capital or the business skills necessary to ensure that their product will generate profit (Mérel, Sexton, & Suzuki, 2009).

Small, rural coffee farming communities in Northern Thailand also have extremely limited access to bank loans (The Hindu, 2009). In order to improve production, output and quality, the farmers need to invest in labor and or production tools (such as machinery to de-shell, etc.). Receiving this capital to use, however, is extremely difficult for these small farmers, as many hardly have enough money to sustain themselves (Rigg & Ritchie, 2002). In order for a small rural farmer to receive a bank loan, they must have a solid business plan to present to the bank. Without any business skills or education, loans that farmers request are typically denied (Mérel et al., 2009). Despite not being able to secure loans through banks, recently small, rural farming communities have been offered loans through the Thai government in an effort to increase the quality of life throughout the country. This is just one of the many efforts currently being used to help rural farming communities in Northern Thailand (Songwut, 2013).

2.4 Strategies to Overcome Barriers

Efforts to help coffee farmers overcome barriers and improve their quality of life have recently been put into place. In Thailand, programs including multiple Royal Projects, Sufficiency Economy and government loan programs have been established over the last several years in an effort to improve the quality of life of many small, rural coffee farming communities in Northern Thailand (Asia News Monitor, 2012). There have also been efforts from large companies to help small coffee farms around the globe. Those however, are very scarce in Thailand. More information on efforts from large companies can be found in

Appendix C: Large Companies In Support Of Small-Scale Coffee Farming. There have been many Royal Projects, as discussed in Background Section 2.2.1, which have helped rural farmers and promoted coffee growth. The Royal Projects aimed at coffee farming educate farmers on the general areas of coffee growth and production (TD Trading, 2013). The Royal Projects have introduced coffee into many small communities throughout Northern Thailand.

Initiatives such as these projects however, have their flaws. The Royal Project initiative solely aims to *introduce* coffee into the community (thaimain.com, 2013). The projects are not designed to further assist farmers with any problems they have. The projects are also not catered to each specific village, which means they cannot address specific disadvantages each village faces (Songwut, 2013). For example, in Doi Chaang, the farmers struggled for over 20 years to properly sell their coffee after it was introduced to the community. The Royal Project initiative did not address marketing strategies which were critical for the success of the Doi Chaang coffee farmers. Fortunately, 20 years later they were able to create a cooperative between various farms in the area and begin selling their coffee throughout Thailand.

Another Thai government effort to improve the quality of life for small, rural farming communities is known as the idea of 'Sufficiency Economy'. The concept of 'Sufficiency Economy' for rural farmers is that they should be able to survive on their own with little outside assistance (Krongkaew, 2003). Once farms accomplish this, they can sell small amounts of cash crops, such as coffee, or surplus from the crops they eat themselves as additional income. Once a majority of the country has enough to live on, then and only then can Thailand have "advanced levels of economic development" (Sathirathai & Piboolsravut, 2004). The Thai government set forth a set of specific guidelines to help farmers achieve this 'sufficiency' lifestyle. These guidelines were extremely detailed; they give information on how each farm should split up its crops, how to rotate crops and how to produce these plants in an environmentally friendly manner (Piboolsravut, 2004). This initiative, however, was catered even less to each community than the Royal Projects. Sufficiency Economy gives guidelines, but does not give support to help the farmers through problems they encounter.

One smaller, but more direct form of help the Thai government offers is loans to small, rural farming communities. These loans vary in amount, depending on the size of the village

(Songwut, 2013). They can be used for labor and or production tools in order to help increase production. Although these loans are available, many communities do not take them as they fear being in debt to the government. For coffee farmers specifically, it is difficult to accept these loans because the market is so unstable. Also, farmers only sell coffee once a year; therefore they are only paid once a year for the coffee. At the time of harvest, many farmers have very little money (Boyle, 2012). Farmers fear that if they accept these loans, they may not be able to pay them back.

Although these efforts to help small, rural coffee farming communities in Northern Thailand were relatively successful, they all have evident problems. There are still a large number of communities that do not have sufficient income to build schools and adequate health centers. This is because none of these programs take into account the specific needs and problems of each community. These programs are also lacking the means to educate farming communities on ways to further advance themselves. The needs of the community must be addressed, and farmers must develop the capacity to progress themselves in order to increase their quality of life.

2.5 Meeting the Needs of Farmers through Education

One effective method to increase the quality of life of small, rural coffee farming communities in Northern Thailand is education. This is because it is much more effective to educate a population on how to perform a specific task than to simply do it for them (Swidler & Watkins, 2009). Education on specific topics in rural areas is a highly discussed topic among researchers as it is extremely difficult to bring effective education to such remote locations with unique cultures.

Based on a study that brought HIV education to rural areas in Thailand, three methods help rural communities to effectively learn and continually use this knowledge (Rao & Svenkerud, 1998). The three methods are: offer depth in the subject instead of just a brief overview of many topics, use leaders in the community to teach the other members, and, finally, be culturally sensitive. In the study, offering depth in the subject helped the community develop a

sense of how severe and widespread the problem was. It also gave them specific prevention techniques that would not have been mentioned if there was no depth in the subject. Using community leaders to effectively train the community helped in the study to "bridge the gap that often exists between outreach workers and members of an isolated population" (Rao & Svenkerud, 1998). The HIV study also stressed the importance of being culturally sensitive, as community members could feel ostracized if the researcher was judgmental towards their culture and personal opinions.

In order to successfully educate the community, it is also extremely important to work with the village members directly and be immersed in the problem (Vichit-Vadakan, 2013). The concept of working directly with a community to effectively educate them is the basis of Participatory Action Research (PAR). Using this approach can help communities develop the ability to further educate themselves and overcome difficulties that come about in their lives while gaining a sense of confidence. This approach is frequently used by the Raks Thai Foundation, which is an organization trying to help rural coffee farming communities around Northern Thailand improve their quality of life.

2.5.1 Participatory Action Research

A common method of educating rural communities is Participatory Action Research. The basis of this approach is to make the "researched become the researchers" (Baum, MacDougall, & Smith, 2006). In other words, the community and people at hand are taught to take control of their own research; eventually they are the ones who collect their own data and analyze it. A brief outline of this process is shown in Figure 6.

Figure 6: Outline of Participatory Action Research

In order to achieve this goal, the main problems are first identified by the researchers with input from the community members (researched) at hand. A joint plan of action is then prepared. This plan of action is developed hand in hand with the community members, with the researchers having a slightly less important voice in the plan. Finally, the plan is implemented and evaluated by the community members themselves (Baum et al., 2006). In this step, the researchers act more as facilitators and not as educators.

Educating rural communities with Participatory Action Research has the ability to not only increase the knowledge of the community but also lead them to an increased quality of life. PAR is one way to help rural community members develop an ability to continually learn and progress on their own. This concept is often referred to as Capacity Building. By developing a community's ability to take control of their own learning, community members successively take more control of their own lives and develop a sense of 'power' and confidence; they are empowered. Capacity Building through PAR strives to empower the participants involved by establishing the participants as "more powerful agents" (Baum et al., 2006). This process is briefly explained in Figure 7.

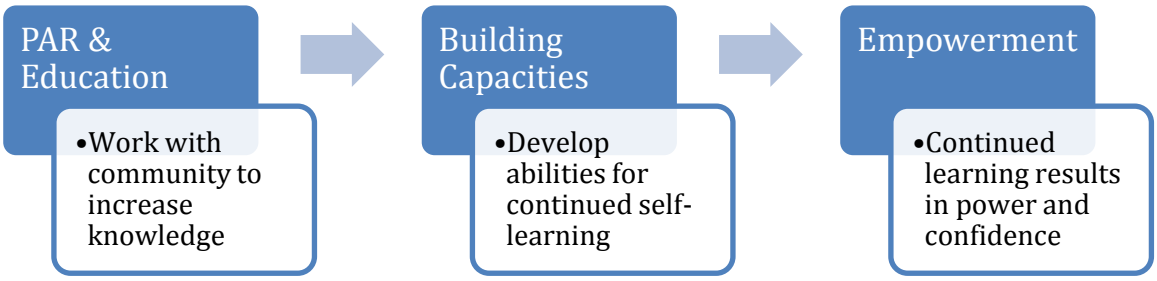


Figure 7: Capacity Building and Empowerment through the use of PAR

2.5.1.1 Capacity Building as a Means of Empowerment

Capacity Building, a conceptual approach to development, is considered essential in order to promote sustainable growth and progress for people and their communities (Hounslow, 2002). Through capacity building individuals and communities are able attain the appropriate skills and necessary resources to help themselves progress. Capacity building helps provide people with specific resources they need to progress and also plays a huge role in empowerment, another critical piece of development (Lusthaus, Adrien, & Perstinger, 1999). Capacity building involves identifying constraints and finding ways to strengthen peoples' abilities to overcome obstacles. This has proven to be an effective approach in both the development and empowerment of people and communities (Hounslow, 2002). Another important aspect of capacity building is finding and building upon abilities the community members already have (Hounslow, 2002). Using Participatory Action Research is crucial in building upon these preexisting abilities. By using PAR, researchers work with the community and jointly develop resources that build upon their skills, as it is better to build upon these strengths than try to improve weaknesses (Hounslow, 2002)

In the context of this project, capacity building can be applied to the development of farmers' coffee processing, production, and marketing skills. The team will utilize this concept in order to help provide effective developmental resources to rural coffee farmers in Northern

Thailand. Our intent is to provide effective developmental resources that not only help the community members with their coffee production and marketing skills but also to help them develop the ability to learn on their own. The emphasis of Capacity Building is the fact that *community members themselves* are the ones who will eventually develop, implement and sustain actions to lead themselves to a better life (Smith, Littlejohns, & Thompson, 2001). As community members continually learn, plan and implement their own actions, they will feel a sense of empowerment; power and confidence in their abilities. The Raks Thai Foundation is one of the only organizations in Thailand that is currently promoting the use of Participatory Action Research and Capacity Building as a means to empower coffee farmers and improve their overall quality of life.

2.5.1.2 How the Raks Thai Foundation is helping

Founded in 1997, the Raks Thai Foundation is Thailand's local sector of the CARE Foundation (CARE International, 2008). The mission of this organization is to promote the development of underprivileged communities by overcoming the various challenges faced in their daily lives. These challenges include healthcare, balancing land preservation and land-clearing farming practices in struggling villages, and developing skills to achieve sustainable living (PreventionWeb, 2011). The Raks Thai Foundation's central aim is to empower poor communities through cooperation in their development work. By analyzing the difficulties communities face, defining and implementing alternatives, this organization aims to develop appropriate solutions tailored to community needs (PreventionWeb, 2011).

All projects carried out by the Raks Thai Foundation have basic fundamental goals for the community: improving quality of life, promoting equality, helping communities to determine their own futures, and promoting sustainable development (PreventionWeb, 2011). Specific projects the Raks Thai Foundation has completed include the establishment of HIV prevention programs and programs to fight against the discrimination of reproductive health rights. More recently the Foundation has helped communities in Northern Thailand conserve watershed forests and create sustainable agriculture in the surrounding areas (CARE International, 2008).

Small-scale, rural coffee farming communities in Northern Thailand have lately caught the attention of the Raks Thai Foundation (CARE International, 2008). Many of these communities have the potential to produce high quality coffee beans; however they are currently lacking the necessary skills and resources to do so (Gresser & Tickell, 2002). The mission of the Raks Thai Foundation directly coincides with the desires of many small-scale coffee farming communities across Northern Thailand. These communities want to take an active role in overcoming barriers they face to a sustainable lifestyle, while preserving their culture and ideals.

2.6 Conclusion

Small-scale farming is a difficult way of life for rural communities around the world. In Thailand, small-scale agriculture is the largest area of employment. In the past, many communities in Northern Thailand grew opium as a cash crop to increase their income. Thai Government initiatives to eliminate opium production led to the promotion of the growth of Arabica coffee. However, growing and selling Arabica coffee is difficult. These Government initiatives merely *introduced* coffee to communities in Northern Thailand but failed to address problems that materialized in the coffee production processes. The programs also did not take into account the specific needs of each village and did not provide a means to educate the farmers to overcome challenges on their own. As a result, many small, rural coffee farmers are struggling to earn adequate income. The Raks Thai Foundation is an organization trying to address these issues by working directly with struggling coffee growing communities to identify and overcome these problems. By building the capacities of these communities, they hope to help farmers by giving them the necessary resources to educate themselves and overcome the problems they face.

3 Methodology

The purpose of our project is to provide coffee farmers in Northern Thailand with resources to improve coffee production, sales, and operation in an effort to promote a sustainable way of life in their communities. By providing farmers in Northern Thailand with strategies to improve coffee production and processing, this project will help sustain coffee farmers and their way of life. A sustainable way of life for farmers includes an ability to conserve environmental resources, maintain coffee production and processing methods within the community using minimal outside assistance, and operate so income is adequate within the community. We aimed to create tools that will enhance farmers' skills directly by allowing them to operate independently. Additionally, we hope to empower the community by giving farmers greater control over their farming processes, leading to increased local income and improved overall quality of life.

There are two central purposes of our methodological steps:

- The first is to develop a model for our sponsor to apply to other rural coffee farming communities in Northern Thailand. The team hopes to provide a framework for the Raks Thai Foundation to use as they assist small-scale coffee farmers with overcoming barriers in their communities. Each village in Northern Thailand faces their own specific barriers. The steps defined by our objectives may be used as a model for our sponsor and be applied to each individual village. This will allow the Raks Thai Foundation to develop specific solutions that will fit the needs of the farmers in each village.
- The second is to test our model by applying it to the coffee farming village of Aayae. By implementing our model, we hope to provide the small, rural farming community of Aayae with resources to help overcome the barriers faced as they pursue a sustainable way of life. The location of the village of Aayae can be seen in Figure 1.

All objectives were carried out using participatory action research (PAR) and capacity building techniques. As described in section 2.5.1 of the Background chapter, PAR is a process that keeps community members involved throughout the entire development and evaluation of solutions. Farmers in the community were continuously involved in the process of overcoming barriers faced in the village, from start to finish. This project used the fundamental PAR steps to assist the village of Aayae as they strive to overcome barriers to a more sustainable way of life in their community. As explained in section 2.5.1.1 of the Background chapter, capacity building is a concept that stems from an idea that providing communities with tools and resources to overcome obstacles they face is the most beneficial way to promote progress. An important aim for our project was to provide the community of Aayae with tools they can use and maintain themselves to overcome the barriers they face as they pursue a sustainable way of life. By providing farmers with an ability to use these tools independently, we hope to empower the community and help support future development. Figure 8 is a diagram relating the creation of our objectives to concepts of PAR.

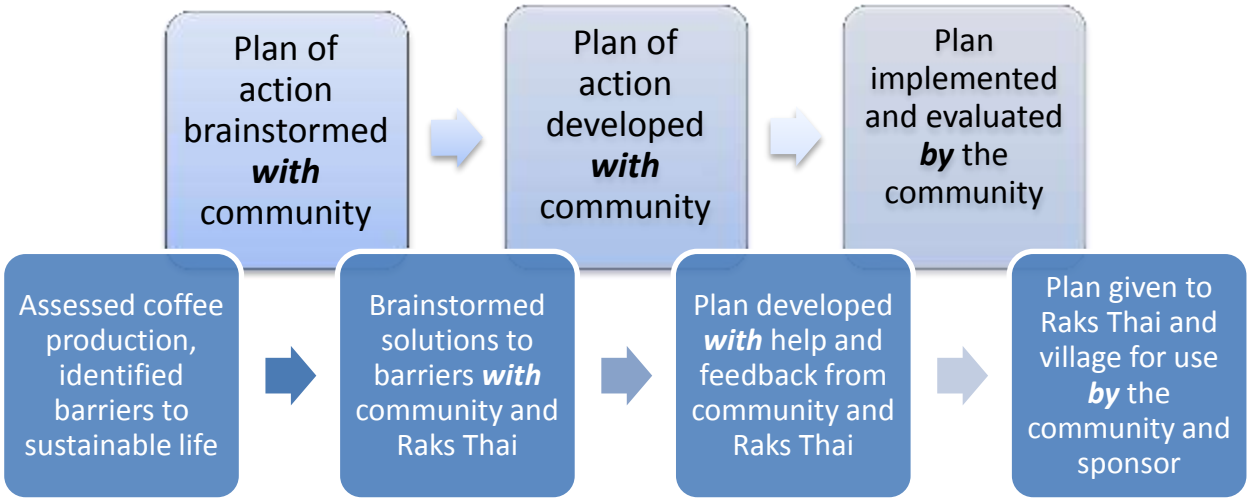


Figure 8: Diagram Relating PAR and our Objectives

In order to develop appropriate tools for farmers to use as they strive to reach a sustainable way of life, we accomplished the following objectives in the Aayae village:

1. Assessed current coffee production practices in order to identify barriers farmers face as they pursue a sustainable way of life in their community.

The current farming conditions and practices in the village of Aayae were assessed. Specifically, agricultural and economic aspects of the coffee system were investigated. This assessment provided the team with a more thorough understanding of the community's present state. Before arriving at the village, relevant background research was gathered in order identify common barriers faced in rural coffee farming communities. To identify specific barriers faced by farmers in the village of Aayae, interviews with the farmers and representatives from the Raks Thai Foundation were conducted.

2. Determined strategies for overcoming barriers farmers face as they pursue a sustainable way of life in their community.

Once barriers farmers face were identified, various strategies to overcome these barriers were determined. The team took into consideration previously conducted research such as case studies, as well as the opinions of farmers and our sponsor on appropriate strategies. Potential strategies were then systematically evaluated in order to determine which approaches would be most effective.

3. Designed strategies to assist farmers with overcoming barriers faced as they pursue a sustainable way of life in their community.

Once a strategy for overcoming barriers farmers face was determined, appropriate deliverables to support these strategies were created. Research was conducted on various means of producing deliverables. Methods that best met the needs of the team, Aayae farmers, and our sponsor were chosen to create the final deliverables.

4. Applied and evaluated developed strategies in the community.

Our final deliverables were presented to farmers in the village of Aayae. Meetings with both farmers and our sponsor were held in order to receive feedback so that improvements to the deliverables could be made. Suggestions provided by farmers and our sponsor were noted and their ideas and recommendations were used when making revisions to our final deliverables.

This chapter contains details of each of the four objectives that are incorporated in our model, which was applied to the village of Aayae.

3.1 Assessed Current Coffee Farming Practices in Order to Identify Barriers Farmers Face as they Pursue a Sustainable way of Life in their Community.

In order to gain a further understanding of coffee production in the village of Aayae, current farming conditions were assessed, focusing on both agricultural and economical aspects of the coffee system. Before the team traveled to the village of Aayae, background research was conducted to determine common barriers of farming communities in developing countries, barriers of small-scale coffee farming, and general barriers farmers face in Thailand. Such barriers are described in section 2.1 of the Background chapter. During our visit to the Aayae village we conducted interviews and shadowed coffee farmers in order to collect data as further explained in this section. We then analyzed the collected data as described below.

Collecting Data

Prior to visiting the village, the team developed interview questions based on information we hoped to obtain from farmers and our sponsor. Questions were aimed at disadvantages and difficulties of growing and selling coffee, as well as coffee production and processing techniques as briefly discussed in sections 2.3.4 and 2.3.1 of the Background chapter, respectively. We were also aiming to assess the willingness of the community to accept help and the types of changes this community would be willing to make. It was crucial to know what the community is willing to change in order for us to apply concepts of PAR, in which the researched take the lead of their own development and growth as explained in more detail in section 2.5.1 of the Background chapter. Through interviews the team hoped to gain insight on this specific community in order to ensure the strategies we developed would be both effective and appropriate for Aayae. The team also hoped to see first-hand the severity of various problems the village faced. A detailed list of interview questions prepared for farmers, community members, and Raks Thai representatives can be found in Appendix D: Farmers' Questionnaire for First Trip to Village. These questions were translated into Thai prior to our visit to the village. We conducted individual interviews and group discussions with both farmers and Raks Thai

Foundation representatives using our interview questions as a guide. Thai to English translations took place throughout the interviews and every group member took individual notes.

Before meetings with farmers and our sponsor we asked if they would agree to be interviewed, and informed them of the purposes and goals of our research. They were then told that any information obtained that could be used as identifying information would remain confidential. During the interviews and discussions with the local farmers, we were able to obtain specific information about their farms, details on how they go about selling their product, the marketing techniques they currently use, their feelings on income, prices they sell their coffee for, and overall morale. While talking with the farmers, a detailed history of the village was provided which helped the team gain a better understanding of the problems at hand. The farmers were also asked what resources they thought would benefit them the most. Notes taken from these interviews can be found in Appendix E: Interview Notes from Trips to Aayae Village and are discussed in detail in the Findings chapter.

In order to further assess the current coffee farming practices in Aayae, we studied the present coffee production process in the community by shadowing coffee farmers for one day. Our goal through shadowing was to understand the farmers' specific growing, harvesting, and post-harvesting processes. We were able to obtain information on the size and type of coffee fields in the area, as well as the day-to-day activities of the farmers. Through touring one of the interviewed farmer's coffee fields, the team was able to see problems first hand and have a better understanding of the needs of the farmers in the Aayae village.

Together these two steps, interviewing and shadowing, helped the team gain a further understanding of the farming practices used and identify problems in the process. Meetings were held with Raks Thai Foundation representatives before and during the visit to Aayae. During these discussions, representatives were asked about problems they believed were most important to overcome, and what the overall goal of the project should be. From these responses, we were able to focus the topic of our project: helping the farmers of Aayae overcome barriers as they pursue a sustainable way of life.

Analyzing Data

The team used three methods to interpret and analyze information gathered from the day spent in Aayae. In order to analyze the interviews conducted with the farmers and Raks Thai representatives, the team carried out the following practices:

- First, we read our individual field notes multiple times to revisit our experiences from the day. We then discussed thoughts we had on the day as a group. Notes were taken on this discussion as we discovered common themes and ideas we shared. Then, collected notes were categorized using preset and emergent category techniques to define barriers the village faced. These techniques involve defining a set of categories at the beginning of the categorization step but being open to the emergence of new categories as the step is carried out. We then sorted these identified barriers based on significance and relevance to our project and its goal. Further details on our analysis technique can be found in Appendix F: Analyzing Interviews.

- Second, the team completed a SWOT analysis of the Aayae village using data from the first method. SWOT analysis is a central component of strategic planning (Gilley, Gilley, Quatro, & Dixon, 2009). This method is used to assess the strengths, weaknesses, opportunities, and threats involved in a project. The SWOT analysis method is versatile and can be applied to products, people, and places (Gilley et al., 2009). The SWOT analysis process involves identifying factors that are both advantageous and disadvantageous to project objectives (Jensen, 2010). By identifying strengths and weaknesses within the village the team was able to gauge the present state of the community and get a better idea of what was impacting them both positively and negatively (Gilley et al., 2009). To begin thinking about the future of this community, the team focused on opportunities and threats to get a perspective on new directions to move and challenges the village may face along the way (Gilley et al., 2009). SWOT analysis helps to realize the goals of a project and set specific objectives for its completion (Jensen, 2010).

- The third method of analysis was a pairwise comparison chart. This chart was completed in order to further define significant barriers the village faces in pursuit of a sustainable way of life. Pairwise comparison charts are used to compare ideas on a pair-by-pair basis to produce a rank order of most significant to least significant (Dym & Little, 2009). Once significant barriers were identified using the first and second methods, the team used information gathered from farmers and Raks Thai Foundation representatives to complete the chart. Our pairwise comparison chart produced a rank order of barriers based on their importance to the community and our sponsor. An example of a pairwise comparison chart can be seen in

	Barrier 1	Barrier 2	Barrier 3	Barrier 4	Total
Barrier 1	X	1	0	1	**2**
Barrier 2	0	X	0	0	**0**
Barrier 3	1	1	X	1	**3**
Barrier 4	0	1	0	X	**1**

- Table 2. Using the chart, all barriers were compared against one another; the barrier listed in each row was compared with the barriers listed in the columns. If the barrier listed in the row was more important than the barrier listed in the column, a score of 1 was given. If the barrier listed in the row was less important than the barrier listed in the column, a score of 0 was assigned. For example, in Table 2, when comparing Barriers 1 and 2, it was determined that Barrier 1 is more significant. Therefore, a score of one 1 was assigned to the field where the row of Barrier 1 overlaps with the column of Barrier 2. After all barriers were compared with one another, scores were totaled by horizontal row. The barrier that received the highest score was the one farmers and our sponsor believed to be most significant, the second highest score received was the second most important barrier, and so on. In our example, Barrier 3 received the highest

score of 3 and is the most significant barrier. The team assumed that one or two barriers would always be more prevalent than the rest during this analysis. In the rare case of a tie between all barriers, farmers would have been asked for further input of their opinions and a decision would have been made based on earlier observations and research. From the rank order obtained from the chart, the team was able to determine the most significant barriers farmers are facing as they pursue a sustainable way of life in their communities. By focusing on these barriers, the team hoped to complete a project with the greatest positive impact on the farmers.

	Barrier 1	Barrier 2	Barrier 3	Barrier 4	Total
Barrier 1	X	1	0	1	**2**
Barrier 2	0	X	0	0	**0**
Barrier 3	1	1	X	1	**3**
Barrier 4	0	1	0	X	**1**

Table 2: Example of Pairwise Comparison Chart

These methods were chosen to evaluate data collected in the village because they are adaptable, straightforward, and recognized approaches. Our chosen methods allowed the team to work directly with the farming community and our sponsor to get personal opinions and ideas that can be incorporated into later objectives.

3.2 Determined Strategies for Overcoming Barriers Farmers Face as they Pursue a Sustainable Way of Life in their Community.

To determine the best strategies for overcoming barriers rural coffee farmers face, two main steps were accomplished. The goal of these steps was to identify characteristics of an effective resource for the community and develop detailed strategies that can be created and applied to the community.

First, all information gathered from background research, observations from the village, and interviews with farmers and our sponsor was summarized and analyzed. The team used analysis techniques described in Objective 1, but focused this analysis on information about overcoming barriers to a sustainable way of life in their communities. This included discussion on cultural barriers, the team's time and budget constraints for the project, as well as overall feasibility of our potential solutions. As identified in Objective 1, the most significant barriers faced by the village of Aayae were the barriers the team hoped to focus on.

The team developed several strategies to overcome each barrier. To do this, a brainstorming session among team members took place. We used field notes from the day as well as background research throughout this session. The team made significant efforts to keep in mind the concept of capacity building. As further explained in section 2.5.1.1, capacity building involves identifying constraints and finding ways to strengthen peoples' abilities to overcome obstacles. The brainstormed list was then narrowed down by the group as a whole, keeping in mind both the farmers' and sponsor's needs. We were looking for effective strategies that would not only help the community members directly but would also help them develop the ability to learn on their own.

Second, the team along with the Raks Thai Foundation and a few of the villagers created best-of-class charts for each of the barriers we chose to focus on for the village of Aayae. We used our field notes and information obtained from interviews with farmers, community members, and our sponsor to evaluate each alternative solution. Completing this chart with our sponsor and a few of the villagers provided an opportunity for both parties to provide input about additional alternative solutions and suggestions. Using this method, all groups involved in the project could contribute their ideas and thoughts on possible solutions, one of the fundamental ideas of PAR.

Best-of-class charts allowed us to evaluate alternative strategies based on defined criteria. Each potential strategy was evaluated based on specific aspects that needed to be considered in the strategies' design; this included affordability, cultural acceptability, ease of use, repeatability, ease of implementation, and effectiveness. These criteria were determined based on input from our sponsor given their experience working with other villages and on observations made during our visit to the village. An example of a best-of-class chart can be seen in Table 3. To complete the chart, potential strategies were listed horizontally across the top of the chart and aspects that needed to be considered in the strategies' design (affordability, cultural acceptability, ease of use, etc.) were listed in a vertical column on the left-hand side. Each potential strategy was compared with the other potential strategies based on the aspects that needed to be considered in the strategy's design. Every potential strategy was assigned a score ranging from one to the number of alternatives being evaluated; this score indicated how well the strategy met the specific aspect that needed to be considered in the strategy's design. A score of one corresponded to the alternative that met the aspect best, two second best, and so on. In Table 3, for example, Strategy 3 was ranked first, Strategy 1 was second, and Strategy 2 was third for Aspect 1. In case of a tie between two strategies for a specific aspect, the scores would be averaged. For example, in Table 3 Strategies 1 and 2 are tied between second and third for Aspect 2. Therefore, a score of 2.5 was assigned to both of them. All scores were summed for each potential strategy and the strategy that received the lowest score was considered the best alternative (Dym & Little, 2009). In our example, the best strategy is Strategy 3 with a total score of 4.

	Strategy 1	Strategy 2	Strategy 3
Aspect 1	2	3	1
Aspect 2	2.5	2.5	1
Aspect 3	3	1	2
Total	**7.5**	**6.5**	**4**

Table 3: Example of Best-of-Class Chart

By first assembling data gathered from the village, then brainstorming and narrowing down potential strategies, the team was able to develop a list of well defined, feasible strategies keeping in mind both the sponsor's and farmers' needs. The team discussed these ideas with our sponsor and villagers of Aayae in order to keep them involved and allow them to own the strategies chosen, using again concepts of PAR. The best of class chart provided a systematic way to evaluate each of our potential strategies together in order to select an effective strategy for the community we worked in.

3.3 Designed strategies to assist farmers with overcoming barriers faced as they pursue a sustainable way of life in their community.

This objective required the team to design strategies for coffee farmers in the village of Aayae to overcome barriers faced as they pursue a sustainable way of life. The team designed specific tools to assist the village with improving current coffee production practices. With guidance from the Raks Thai Foundation's staff and farmers in the village the team decided to create two tools designed specifically for the village of Aayae.

To accomplish this objective the team first conducted background research on the deliverables we hoped to produce. This research included methods for creating effective tools and specific means, such as computer software that can be used to create these tools. The team also consulted with experts in the coffee field and conducted more specific background research on coffee production methods. This research was mainly focused on four different manuals. Each of these manuals contained very specific insight and recommendations ranging from fertilizers and pesticide control to more sustainable practices for small-scale coffee farmers. More information on each of these manuals can be found in Appendix G: Referenced Coffee Farming Manuals. Since the manuals used were not from Thailand, we contacted Khun Nut, a professor of Agriculture in the Chiang Rai University, for more information regarding coffee production in Northern Thailand. He provided us with advise on more feasible practices to control pests and diseases, proper methods for the use of fertilizers, such as quantity and

concentration, to be used by farmers over the years. This information was extremely helpful, since he was more aware of alternatives that were more accessible for farmers in the village of Aayae.

The team determined the most feasible ways to create the tools to be designed for the village, keeping in mind the farmers' and sponsor's needs. Prototypes were created and the team discussed details about the design of the tools with Raks Thai and the farmers to confirm their applicability to the community. It was crucial to get the opinions of the farmers prior to the creation of the tools because, with the use of PAR, if the farmers did not accept ownership of the tools that would be handed to them, they would not be as willing to learn and use them. Once the farmers and our sponsor accepted the designs, drafts of the tools were created.

Developing potential solutions to overcome barriers farmers face in pursuit of a sustainable way of life is critical, but not the only aspect kept in mind when trying to assist farmers. In order to provide rural coffee farming communities like Aayae with the ability to overcome barriers they face, developing appropriate strategies for the community is a first step, but this in itself is not sufficient. Teaching farmers how to successfully and independently use and maintain these tools in their communities is a key factor in truly making a significant impact. Information and instruction tailored to their needs is critical. The team was conscious of proven rural education methods and also open to new methods others suggested. As we were working with the community, we gathered their input on how to best tailor our designs to their needs. This was the most important factor since we were following the methods of PAR and the community must own the changes suggested. Previous research has shown that in rural communities there are three key components to effective teaching. Our team designed an approach that: offered depth in the subject instead of a general overview, had community leaders teach other community members instead of teaching them ourselves especially when generalizing your results to other villages, and remained culturally sensitive (Rao & Svenkerud, 1998). These methods are explained in greater detail in Section 2.5 of the Background chapter. The three components to effective teaching as well as PAR were considered throughout the development process of our tools.

3.4 Applied and Evaluated Developed Strategies in the Community.

Once preliminary drafts of the tools were created, the team traveled to the village of Aayae to introduce these deliverables to the farmers and Raks Thai. First, we interviewed the farmers and Raks Thai in order to get feedback on the presented tools. Then, we analyzed the feedback and made modifications according to the feedback received.

Collecting feedback

Collecting feedback is an important step of our model. As in PAR, farmers should be involved in every step of the process. After deliverables were produced, farmers had a significant say on what should be changed in order to better fit their needs. Farmers and representatives from Raks Thai were interviewed in order to obtain feedback. The team asked for suggestions on how to improve our developed tools. Specifically, questions were asked regarding how easy the tools were to use and understand, if any part of the developed tools were unnecessary, if pieces of the tools were missing, farmers' personal likes and dislikes, and any additional suggestions they had. The chart with guide questions for the interviews can be found in Appendix H: Farmers' Feedback Questionnaire.

Analyzing feedback and modifying deliverables

Feedback from farmers and Raks Thai Foundation provided the team with further suggestions and ideas regarding the modification of our deliverables. Notes taken from conducted interviews with the farmers were examined in order to identify common requests of changes to be made to the created tools. We also gathered and sorted through additional details regarding the coffee production methods of the farmers. This information was brought to our attention as the farmers more thoroughly analyzed the developed tools. We were then able to make adjustments and improvements to our deliverables based on the suggestions and supplementary information that we gathered. Using this method to modify our tools for the village confirmed our deliverables better met the needs of both farmers and our sponsor.

3.5 Conclusion

Through the use of PAR and Capacity Building techniques, our team was able to complete the four objectives that compose our model at the village of Aayae. We applied our model to the village and were able to identify the specific needs of the coffee farmers of the Aayae village and determine and design strategies that fit their needs. We hope that the farmers will be able to own the tools created for them and use them for years to come.

4 Findings and Discussion

As part of our research we developed a model approach to overcoming barriers in small-scale coffee farming communities across Northern Thailand. A series of steps were developed and then applied to the village of Aayae in order to test and evaluate the usefulness of our developed approach. Specific findings gathered from the village of Aayae, pertinent to the barriers they face as well as results from analyzing the effectiveness of our model will be discussed in the this chapter.

4.1 Findings related to coffee farming in The Aayae Village

In order to organize all of the collected information from our initial village visit, the team completed a SWOT analysis of the Aayae village to identify the strengths, weaknesses, opportunities, and threats the community currently faces. The SWOT analysis was an effective tool to gather and organize information obtained from our village visit. This analysis was also beneficial because it was not biased towards our personal ideas or anticipated solutions. The results of the SWOT analysis for the Aayae village can be found in Figure 9.

Strength:	Weakness:
• Arabica Coffee • Tight Knit Community • Willingness to adapt/progress • Climate • Small-Scale	• Isolation • Transportation • Business Skills ○ Minimal Data Organization • Limited Coffee Production Education • Language Barriers (Ahka language spoken by most members of the community, little Thai)
Opportunity:	**Threat:**

• Land Access
• Farming Techniques
  ○ Shade-Grown
  ○ Hand-Processed
	• Worm
	• Black Leaf
	• Decreasing Population
	• Access to Education

Figure 9: SWOT Analysis for Aayae village

Finding 1: Farmers in the Aayae village face a range of significant barriers in their coffee production and are struggling to live sustainably.

Numerous environmental, social, and economic factors inhibit community members in the village of Aayae from living sustainably. Farmers are currently experiencing difficulties conserving environmental resources, maintaining coffee production and processing methods, and operating so that income is adequate within the community. Interviews were conducted with seven Aayae farmers and two Raks Thai Foundation representatives at the village in order to gain the community's perspective on the barriers they currently face.

Environmental Factors

Coffee trees in the village of Aayae are currently affected by a variety of diseases. After speaking with farmers in the community it was clear that this was a major concern to the majority of farmers as diseases are drastically impacting coffee production yields. *Two of the most prevalent diseases in Aayae coffee trees were described by farmers as the "worm" and "black leaf" problems.* Farmers are unsure of how to stop these diseases. The "worm" and

"black leaf" problems were classified as threats in the SWOT analysis and the team was able to see first-hand affected trees through observations in the coffee fields. Photographs of the "worm" and "black leaf" problems are shown in Figure 10. Villagers are seeking to improve the health of the trees in order to increase coffee output and improve quality.

Figure 10: Diseases affecting Aayae Coffee Trees

The low output and quality of coffee in the Aayae village has influenced the farmers' decision to use fertilizer to grow coffee plants, as they hoped this choice would increase coffee outputs. According to our interviews, *farmers would like to stop this practice and move towards more environmentally friendly farming techniques in the near future.* Shade-grown coffee is a future opportunity for the Aayae village as it is a more environmentally friendly farming technique. Shade-grown coffee farming techniques is listed as an opportunity in the SWOT analysis. One farmer explained that the community "began using chemical fertilizer in order help the trees produce more, but in the future we must look towards organic farming for the coffee to be chemical-free." Farmers interviewed in the Aayae village explained that a majority of the farmers in the community strive to use more organic farming methods because they want to conserve resources in their community. During an interview with one of the community's farmers he commented, "we want to have less impact on the environment" and another explained that he wanted to learn how to improve coffee production and processing methods while being environmentally friendly. Farmers in the community also believe that by using organic methods, their coffee will be more appealing to consumers.

Social Factors

During a site visit to the village of Aayae the team was able to see first-hand current social circumstances within the community. First, **the primary language spoken in the Aayae village is Akha**. **Most of the community does not know how to read, write, or speak Thai.** This hinders the farmers' ability to communicate effectively and conduct successful business affairs outside of the community. Four of the farmers in the community that have been formally educated are able to communicate in Thai; these farmers play a key role in the village as they complete most of the community's relations outside of Aayae. This language barrier was identified as a weakness in the SWOT analysis.

The village is in an extremely remote location, one hour and thirty minutes away from the nearest town; four wheel drive vehicles are required to reach the village. The remote location of the village, as shown in Figure 11, has contributed to the minimal technological development taking place in the community; *there is currently little electricity accessible.* However, there is one member of the village who works closely with Raks Thai and owns a laptop. Due to the community's remote location and limited access to technology, *most of the agricultural knowledge in the community has been passed down between generations by word of mouth or obtained from neighboring villages.* This method for obtaining agricultural knowledge has been identified as a weakness in the SWOT analysis. The village of Aayae would like to improve coffee production methods but are unable to gain further insight on many aspects of production they are currently struggling with.

Figure 11: The Remote Location of the Village of Aayae

Cultural preservation is also an ongoing concern to the community. **There is no primary or secondary school in the village so children leave the community in order to receive an education.** One farmer expressed his personal worries, stating "children are separated from

their parents at the age of four or five years old which is not suitable for them because they are not old enough to take care of themselves. This will impact how they grow up." Another farmer explained that children leave the village without having adequate knowledge about their community, fluency in their native language, or experience with the village customs and rules.

Economic Factors

Although the community has increased coffee production year after year, farmers are still not receiving as much income from this crop as they anticipate. **Currently, coffee produced in the Aayae village is not of consistent quality and as a result farmers are struggling to sell it.** *In order to sell the community's coffee, a village representative purchases all of the coffee from the village at once.* He then takes the coffee to potential buyers in the Chiang Mai area. One company has been purchasing coffee from the village for a few years but only purchases the "top" quality coffee Aayae produces; this is only about 20% of their harvest. The village representative then struggles to sell the remaining lower quality coffee for an adequate price. *Villagers are unhappy with the prices they are getting for their lower quality coffee and would like to focus on improving this.* "I believe we really should start with improving the coffee production process as the first step," said one member of the community. One farmer explained that as consumers are choosing and demanding better quality coffee the Aayae village must "step it up with the quality of our own coffee in order to meet the growing the demand of the consumers. If we do not attempt to satisfy these demands, there may be the possibility of our coffee prices falling further."

Farmers in the community were unable to provide detailed information regarding past coffee sales. Any information received from farmers about expenses, production, and profits was vague. The team learned that farmers did not have a system for budgeting or record keeping. Farmers also expressed interest in learning more about standards and specifics to measure coffee quality. They believe that by having access to information about coffee quality and the value of their product, it will be possible to improve coffee production and sales.

Finding 2: The two most significant barriers the village of Aayae faces are coffee production knowledge and data organization

Pairwise comparison charts were used to determine the most significant barriers the Aayae village currently faces. Through interviews with farmers and the Raks Thai Foundation, *six barriers most concerning to farmers in the Aayae village were identified as formal education, transportation, business skills, intermediaries, access to information, and access to funding.* These barriers were then evaluated as described in section 3.1 of the Methodology chapter. From this numerical evaluation it was determined that access to information and business skills were the most prevalent barriers the village of Aayae currently faces (Table 4).

	Formal Education	Transp.	Business Skills	Intermed.	Access to Info.	Access to Funds	Total
Formal Education		1	0	1	0	1	**3**
Transportation	0		0	1	0	1	**2**
Business Skills	1	1		1	0	1	**4**
Intermediaries	0	0	0		0	1	**1**
Access to Information	1	1	1	1		1	**5**
Access to Funds (loans, credit, etc.)	0	0	0	0	0		**0**

Table 4: Pairwise Comparison Chart for Aayae

Finding 3: Resources most critical to helping the Aayae village overcome the barriers they face are a database and informational booklet.

Using a best of class chart, the team was able to evaluate resources in order to determine which alternatives were most appropriate for the Aayae community. *Each potential resource was evaluated based on six different criteria as determined by farmers and Raks Thai. These criteria were affordable, culturally acceptable, easy to use, easy to implement, easy to replicate, and effective.* Each alternative was evaluated in the best of class charts as described in section

3.2 of the Methodology chapter. From these charts, it was determined that *a booklet was an appropriate resource to help farmers overcome the barrier they face accessing information and a database would be most fitting to help farmers improve their business skills.* Completed best of class charts can be found in Table 5 and Table 6.

Once a booklet and database were deemed appropriate resources for the Aayae village, the team gained further insight on specific information regarding these deliverables from background design research and discussions with farmers and our sponsor. From these meetings the team determined that *it would be important to include specific directions on how to use these resources*. Incorporating as many pictures as possible into the deliverables design would also improve how well it is received by the community.

	Booklet	Website	Classes	Video	Community Associate
Affordable	1	2.5	4	2.5	5
Culturally Acceptable	1	3	4.5	2	4.5
Easy to Use	2	5	4	3	1
Easy to Implement	2	1	4	3	5
Easy to Replicate	1	4	2	5	3
Effective	3	5	1.5	4	1.5
Totals	**10**	**20.5**	**20**	**19.5**	**20**

Table 5: Best of Class Chart for Access to Information Barrier in Aayae

	Bookkeeping Training	Database (with Training)	Hired Accountant
Affordable	2	1	3
Culturally Acceptable	2	1	3
Easy to Use	2.5	2.5	1
Easy to Implement	3	2	1
Easy to Replicate	3	1	2
Effective	3	2	1
Totals	**15.5**	**9.5**	**11**

Table 6: Best of Class Chart for Data Organization Barrier in Aayae

4.2 Findings related to The Model Approach

Finding 4: It is important to understand the background and current conditions of a community before attempting to introduce change.

The first step of the team's research approach required assessing the current condition of the community; this included information about the community's current coffee farming and processing methods. However, the principal intent of this first step was to gain a better understanding of the community as a whole. Taking this initial step is an important component to the success of a more general model to help rural communities overcome barriers they face. Before any change was introduced to the community, a personal connection was established. The team was able to learn from farmers about the community's history and farming practices. Developing a personal relationship with the community had many advantages. Because this initial connection was made, farmers were more willing to share detailed information with the team and answer any questions we had.

Farmers spoke to us well over the scheduled interview times and even continued conversations when we returned to our housing for the evening. From these conversations, we

received more information about the community's feelings on preserving their culture, and how important this was to them. Instead of just providing us with information about the coffee fields and processing techniques used, farmers in the community wanted to take us to the fields, so we could see first-hand the problems they face. They showed us step by step how the coffee grows, and how the beans are collected and processed. Seeing all of the coffee production issues first hand, helped the team to get a better grasp on the community's current condition. At one point during the interview, a discussion about fertilizer was taking place. One woman left the interview and returned later with several empty bags of fertilizers farmers have used for the past several years; this additional information was extremely helpful to the team, as shown in Figure 12.

Figure 12: A Look at one of the Coffee Processes and one of the Fertilizers used

Understanding the background and current conditions of a community also means coming into the community free of preconceived ideas or developed solutions. This way, information learned from the community and formulated ideas for solutions will be directed and tailored towards the specific community. Coming into our initial visit to the Aayae village, the team had some ideas about barriers faced and solutions for farmers to overcome these barriers. The team thought that a serious barrier the community faced was their ability to successfully market coffee. Potential solutions developed by the team included product design (logos and slogans) and advertisement ideas. Through completing this step however, we realized that our initial thoughts on barriers farmers faced were not a major concern. The community had other, more pressing barriers they hoped to overcome at this time such as the quality of their coffee. Using the first visit to a community as an opportunity to observe and acquire information is beneficial when attempting to help the community with developing solutions to the barriers they face.

As we worked to develop a personal connection with the community, and fully understand the situations and backgrounds of farmers in Aayae, we experienced some communication barriers. *We found it was difficult to conduct interviews with a large number of farmers, resulting in a limited sample size.* WPI students spoke English and our Thai counterparts spoke both English and Thai. Most Raks Thai Foundation representatives spoke Thai, with little English. Members of the Aayae village spoke Akha, and a few farmers in the community were able to speak both Akha and Thai. To overcome this limitation, WPI students relied heavily on Thai counterparts for translations and interview notes, as shown in Figure 13. Proposed interview questions were translated into Thai prior to meetings, so that the team was better prepared. Farmers that were able to speak Thai translated the answers of Akha speaking farmers into Thai.

Figure 13: Translations during Interviews of the Farmers

Finding 5: It is not feasible to create one single solution that fits all villages.

Individual small-scale coffee farming communities each face their own unique set of barriers to a sustainable way of life. After speaking with representatives from Raks Thai, it was clear that even within the nine small-scale coffee farming communities this organization works closely with, the barriers faced by the communities range in both severity and type. For example, some coffee farming communities are content with the quality of their coffee, but are looking for help increasing the efficiency of their coffee production through the use of machines or hired labor.

All of the features that contribute to an effective deliverable design such as cost, ease of use, and cultural acceptability are unique to specific villages. Different features may be more important to individual communities or there may be constraints facing a community which would make other criteria for the designed deliverable more significant. This information would impact which resources are most appropriate for the community.

Finding 6: Multiple solutions may be necessary to effectively overcome barriers in a particular village.

Sometimes multiple resources may be necessary to assist communities in overcoming the barriers they face. One specific resource may not be adequate, depending on which barriers are present in the community. For example, in the village of Aayae interviews with farmers included discussions about a wide range of barriers that were not easily connected to one another. When asked what the single most critical barrier facing the community was, one farmer responded "there is not one major problem but many problems." Farmers explained troubles they were having with diseases in their coffee plants and also issues they faced maintaining accurate records. Developing a resource to improve farmers business skills was nearly as important as helping farmers gain knowledge about various coffee farming techniques. There was not one single deliverable that could adequately help farmers overcome both tasks thus, the team decided to create two separate deliverables addressing each barrier individually. Developing multiple solutions may be a more effective approach to helping farmers overcome the barriers they face in their communities.

Finding 7: Developing resources that are not matched with technical, social, and economic capacities of a village won't be useful.

When the team presented the preliminary informational resources to the village, it was apparent that some parts of these resources were too complicated for the villagers. Our resources required technical capacities greater than what most villagers possessed. Some of the fields that required calculations such as "average revenue" and "percentage of coffee roasted" were not clear to farmers. They had trouble understanding the significance of these values and how to calculate them. Because many members of the community were unable to fully understand some the concepts presented, changes in the developed resources were made. Without appropriately adjusting these resources to match the capacity of the community, they would not have been helpful.

Finding 8: Individual members of a community may have different needs

The database developed for farmers was created in Microsoft Excel and then printed out so that it could be used in the community. Despite a user's manual that explained how to fill in all of the calculation fields of the database, many farmers still did not fully understand how to properly complete it. In order to make a useful and effective resource that farmers would fully understand and easily use, the team had to simplify the database and improve the explanations of the calculations. Information on selling and buyers had to be removed, as most farmers do not deal with that aspect of their coffee production.

Although most farmers needed a simpler database, the villager who purchases coffee from all farmers (Khun Wut) needed a more advanced database. He consistently took written records of the sale of the village's coffee and therefore would not have benefited from the printed spreadsheets. The original printed spreadsheet was modified for use by Khun Wut and Raks Thai; it was revised as a Microsoft Excel file because both Khun Wut and Raks Thai have computer access. This spreadsheet was revised to include buying and selling information including how much coffee was purchased from each farmer and how much coffee was sold to each buyer. These necessary modifications made it clear that resources are ineffective if community members do not have the technical capacity to use them, and also that resources will not be effective if they not match the specific capacity of the community members.

Finding 9: A community's willingness to receive help and be involved in the process of identifying and overcoming barriers is critical to the model's success.

By working in conjunction with Raks Thai representatives and farmers from the community, it was determined that without community involvement our model would not be successful. By keeping the village of Aayae just as involved in the process of overcoming barriers as we were (by assisting with identifying barriers, brainstorming solutions, and evaluating potential deliverables) the community played a significant role in the outcome of our developed final deliverables.

During our first visit to Aayae, we found that many farmers were well aware of the specific barriers they were facing in the community and which barriers they wanted to focus on

overcoming. This highlights the importance of the villagers input; if we did not work directly with farmers in the community, the team may have focused on overcoming different, less significant barriers. Before working alongside the sponsor and farmers in the Aayae village, the team set out to focus on marketing coffee and improving product design for the community. We did not fully understand the barriers farmers in Aayae faced and hoped to overcome. After working with the community we were able to understand how important it was for farmers to overcome barriers to producing high quality coffee. Farmers were willing to give their thoughts and opinions on ideas we suggested and also recommended resources they thought would work well for the barriers they hoped to address.

At our second visit to the village of Aayae, we presented preliminary drafts of our informational booklet and database to community members. Farmers were very excited to see the work we completed, as it was directed at many of the ideas they suggested. They expressed their appreciation for keeping the community involved and working with them throughout the deliverable development process. One farmer stated “you are the first group to take these steps towards helping our community. This is setting a foundation, a good base for our community to progress.” The optimism community members had towards our project was extremely apparent through this visit. When we asked the villagers if we could film a short video of them talking about the project, they were more than happy to help and be a part of the process.

Finding 10: The designed four step model can be useful for capacity building in order to assist farmers with overcoming the barriers they face to a sustainable way of life.

Our sponsor, the Raks Thai Foundation aims to help communities ‘develop the capacity’ to learn on their own by working with them and eventually giving the community a sense of power and confidence. We strived to incorporate this philosophy into our model approach. Through Participatory Action Research, we were able to see that this was extremely successful. One Raks Thai representative explained, “the way Raks Thai works is through the emphasis of researching both with and of the villagers themselves. Their participation is important as it will help us understand and receive more effective feedback. Because in the end, when we are not there, they should be able to independently sustain their own living.”

Through our work with the Aayae village, we found that our designed four step model can be useful to build the capacities of small, rural farming communities. Because our approach is to develop strategies for farmers to use as opposed to overcoming barriers for them, our model encourages building the capacities of farmers so they have the means to overcome barriers on their own. When presenting the first draft of deliverables to farmers in the community, a question raised by one of the farmers interviewed was where he could obtain additional information about coffee farming practices he wanted to know more about. Farmers were already taking steps to overcome barriers their community faces on their own.

As explained in section 2.5 of the Background chapter, the use of participatory action research can lead to the building of capacities for communities. We used the principles of PAR in our application of the model to the Aayae village by involving the farmers in every step of the process. Through Participatory Action Research, we were not only able to develop resources catered specifically to the village but also help the village develop their ability to continually educate themselves.

Due to the difficulties associated with traveling to rural coffee farming communities, we were unable to fully test the application of the model in multiple villages, thus limiting our understanding of its generalizability. The remote locations of coffee farming communities and farmers' busy schedules only allowed for short stays at one village (Aayae) to take place. The team had the opportunity to spend time with farmers, learning about their culture and current needs, however this time was limited. In order to overcome this limitation the team visited the village twice. Once to gather initial data and information and a second time to get feedback from farmers on the tools we developed for the community. The team spent significant time preparing for these visits in order to make the most of our time. By developing a schedule, the team was able to get significant information and insight from members of the community given our limited time. The team also kept open lines of communication throughout the project with our sponsor. The Raks Thai Foundation has been working with the village of Aayae and nine other small, rural coffee farming communities for many years so they had plenty of insight and suggestions for the team.

While working in Aayae, community members were involved in every step of the problem solving process, but were not given specific answers to the problems they face. For example, we

did not work in the coffee fields to help farmers treat the diseases that were prevalent, but instead gave the community resources to help them do this on their own. We gave the farmers information on the treatment of the disease but more importantly we gave them contacts and resources to consult when they run into more problems. We aimed to help the farmers gain the ability to learn on their own by creating a desire for more knowledge and giving them resources to obtain this information. This is the basis of capacity building. If the farmers develop a want for more information and have the resources to obtain it, they would have the capacity to learn on their own.

During our second visit to the village of Aayae, we were able to see the community's desire to learn first-hand. In the preliminary draft of the booklet, there was a short section on the use of fertilizers and pesticides used in coffee farming. When this information was presented, the farmers were interested in learning more and asked the team to provide more facts and tips on their use. Farmers also asked for more contacts in case they needed more information. In the database, there were various fields, such as the number of trees affected by the worm and black leaf disease, which the farmers were not able to complete. However, farmers began to realize that these fields were important as they saw connections between these fields and others. For example, farmers were able to see a link between the affected trees and total production. They were also able to see to what extent paid workers affected total profit, as they did not keep accurate records of labor costs. Although farmers were not able to completely fill out these fields, they wanted to keep these fields in the database to further track data on their own.

By creating enthusiasm in the community about gaining more knowledge and providing them with appropriate resources to obtain it, as shown in Figure 14, we were able to conclude that our model is in fact useful for capacity building in order to overcome the barriers farmers face to a sustainable way of life.

Figure 14: Farmers were Interested in the Deliverables Presented

4.3 Outcomes

With assistance from Raks Thai Foundation staff and farmers in the village of Aayae, the team decided to create two main tools for the village to use: a database, to help improve farmers' organizational techniques and business practices along with a booklet, including suggestions for improved production, processing, and marketing methods.

First, the database was created to help farmers organize all of their coffee data. We hope this will help farmers to personally manage the growth and production of their farms, as well as provide buyers with information on coffee production, past and present. Secondly, an educational booklet was created as a tool for farmers. The booklet contains information on areas of production, processing, and marketing. We hope farmers will be able to use this booklet to improve their coffee production practices, recognize standards, and validate the quality of their beans.

Creating a Database and User's Manual

Coffee farmers in Northern Thailand would benefit from developing their organizational skills. The ability to demonstrate present yields is advantageous, because farmers can use this information to negotiate with buyers. This information can be obtained using software that organizes data in an easy to understand, user friendly way. Taking into consideration technological options based on cost, effectiveness, ease of use, and cultural acceptability the

team conducted research on various software options. For villages in Northern Thailand, the team determined the most feasible data organization tool is Microsoft Excel. This spreadsheet program will allow farmers to keep record of their production numbers and have more control over budget information.

In the database file each farmer would have a tab to input his or her data as shown in Figure 15. Each row in the spreadsheet represents one “round” of the year because farmers perform two “rounds” per year of production as shown in Figure 16. Columns in the database include information on costs (labor and fertilizer), revenue (harvesting and selling), and totals (costs, revenue, and profit). The database is pictured in Appendix I: Preview of Original Version Of The Database.

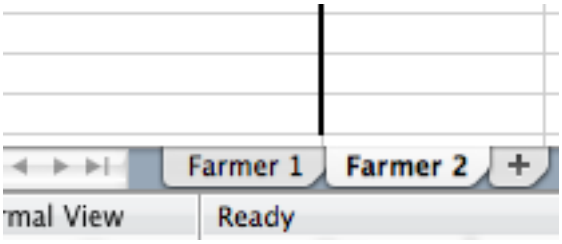


Figure 15: Tabs in the database

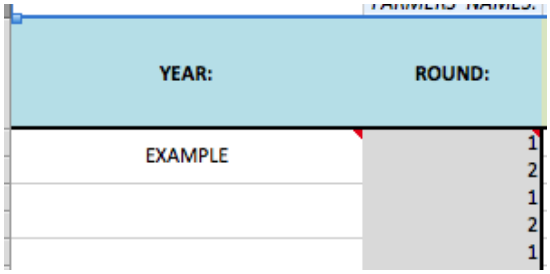


Figure 16: Rows representing one "round"

We created a printed version of the spreadsheet for farmers lacking access to electronic devices as shown in Figure 17. In these spreadsheets, cells were left open so that formulas could be completed by hand with the assistance of team members and Raks Thai representatives. With this information a resident of the village that has access to a computer will be able to complete a spreadsheet in Microsoft Excel.

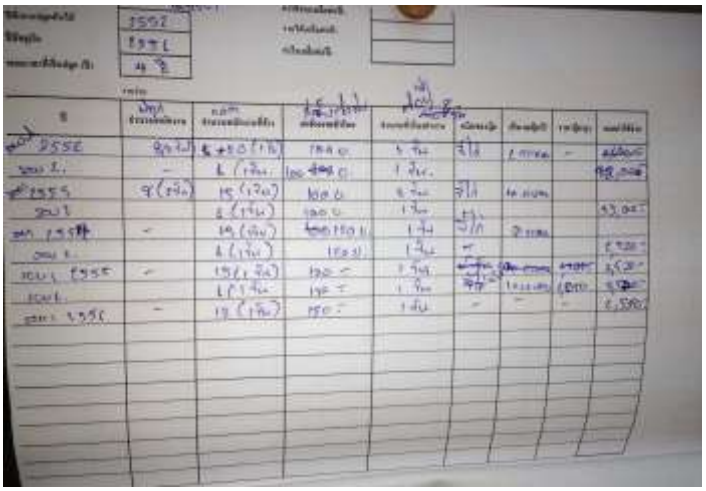


Figure 17: Hardcopy version of database

In order to assist farmers with the use of the database, both printed and electronic versions, we created a user's manual. This manual contains basic information such as how to rename and print electronic files as well as more advanced chapters containing the description of each input and output field and the formulas used in output fields. A copy of this manual can be found in Appendix L: User's Manual for Farmers' Database. We also created a separate sheet with formulas that can be attached to hard copy versions of the spreadsheet, in order to make the spreadsheet easier to use. A copy of this formula sheet can be found in Appendix N: Formula Sheet for Databases Output Fields. We hope this manual will facilitate the introduction of the database and will serve as a tool for later generations to use as well.

Creating a Coffee Production and Processing Booklet

In order to effectively communicate agricultural and marketing strategies a summary of important facts and information was provided to the farmers in the village of Aayae in the form of a booklet. This booklet is intended to be used as a resource for farmers to reference to in order to improve coffee production skills.

A booklet was created and divided into multiple chapters based on the needs of farmers. These needs were identified through discussion and interviews in the village of Aayae. Farmers explained the issues they currently face, and information in the booklet was tailored to their needs. The outline of the booklet is detailed below:

Chapter I: What is this? – *A short description of the booklet and its purpose.*

Chapter II: Coffee in Thailand – *Information about coffee as a commodity and how was it introduced to the Northern parts of Thailand.*

Chapter III: Coffee Production – *Ideal methods and practices for coffee production (from planting to harvesting); several images will be provided for a better understanding.*

Chapter IV: Coffee Processing – *Ideal methods and practices for processing coffee (from harvesting to roasting); several images will be provided for a better understanding.*

Chapter V: Quality Maintenance – *Information on different ways to assess the quality of coffee during production and processing.*

Chapter VI: Selling Strategies – *A guide to help farmers market and sell their coffee, along with a set of strategies, best times to sell, etc.*

Chapter VII: Maintenance of Old Trees – *Key information on rejuvenation of old coffee trees.*

Chapter VIII: Pesticide Control – *List of procedures and recommendations to deal with different pests coffee farmers in Northern Thailand face, as well as common pest to Arabica coffee.*

Chapter IX: Resources – *List of contacts that buyers can refer when doubts about coffee production and processing arise.*

Chapter X: Sources of Information and Further Reading – *List of manuals and research papers used for the creation of the booklet, which can be used as further reference.*

Glossary – *An assortment of less common words for farmers with their definitions.*

The developed booklet contains important information on appropriate practices for farmers to improve quality and further understand the value of their coffee. Ideally this knowledge will grant farmers more leverage for successful negotiations and business transactions. The booklet itself will also serve as a reference tool to help farmers become more economically and agriculturally sustainable in the years to come.

With a first draft of the database and booklet prepared, we returned to the Aayae village to present our designs to farmers and the Raks Thai Foundation. Our trip's goal was to collect data from farmers with assistance from Raks Thai and fill out a sample of the database as well as

present the booklet to farmers. We hoped to receive feedback about the database as well as the booklet form this visit. Interviews were conducted with the coffee farmers in the village of Aayae that were available to meet with us. From these interviews and taking into consideration Raks Thai's opinions of our developed deliverables, further revisions took place.

Adjusting the Database and User's Manual

Our initial plan for presenting the database and user's manual to farmers was to provide them with a packet, which included the hard-copy version of the spreadsheet and formula sheet. We then planned on personally assisting farmers with filling out required fields. However, we learned from Raks Thai that most farmers present for the interviews did not know how to read or write the Thai language. While there are residents of the Aayae village that can read and write Thai, many were not present at the time of data collection. In the future however, these farmers will be able to assist farmers who cannot read and write in Thai with completing fields of the spreadsheet. As a result of this change, team members who were able to speak Thai conducted interviews with four farmers to gather the data necessary for each field. We were able to get further insight from this process because it was easy to pinpoint aspects of our spreadsheet that were difficult for farmers to understand. At meetings with a Raks Thai representative and through interviews with farmers a particularly important piece of new information was found, resulting in a major adjustment to our final deliverables. Farmers in the village of Aayae do not sell their coffee directly to outside buyers. Instead, Khun Wut, a resident of the village who works with the Raks Thai Foundation, buys the parchment coffee from all farmers for a set price that differs each year according to the market. He then takes the responsibility of either selling the coffee in parchment form or taking it to a roasting facility in an attempt to get higher prices for the roasted product.

Realizing that there are two steps to the village's coffee selling system performed by different people (coffee production by farmers and coffee sales by Khun Wut) required a more drastic change to the database. We decided to split the original database up into two separate databases, one for the farmers and one for Khun Wut as shown in Figure 18. The new farmer's database is much simpler. It contains more fields for input of fertilizer information (Figure 19) but instead of multiple fields to input buyers' data, it only includes a small section for the

amount of parchment coffee sold to Khun Wut and the price he paid the farmers on that round of the year (Figure 20). Khun Wut's database includes fields to enter farmers' names and the amount purchased from each farmer (Figure 21). We also added the fields from the farmer's original database about buyers into Khun Wut's database so that he could keep track of the top buyers and what the best form (parchment or roasted) is to sell the coffee (Figure 22). This database will also help Khun Wut to more easily recognize if he has earned or lost any money after his coffee purchase. This last feature will hopefully be helpful to Khun Wut because he has been taking the risk of assisting other farmers; each time Khun Wut purchases coffee from the village, he does not know if he will receive any dividends from it. An updated version of the farmers' database is shown in Appendix J: Preview Of Final Version Of Farmers' Database and of Khun Wut's database is in Appendix K: Preview Of Khun Wut's Database. Both databases are attached as supplemental materials.

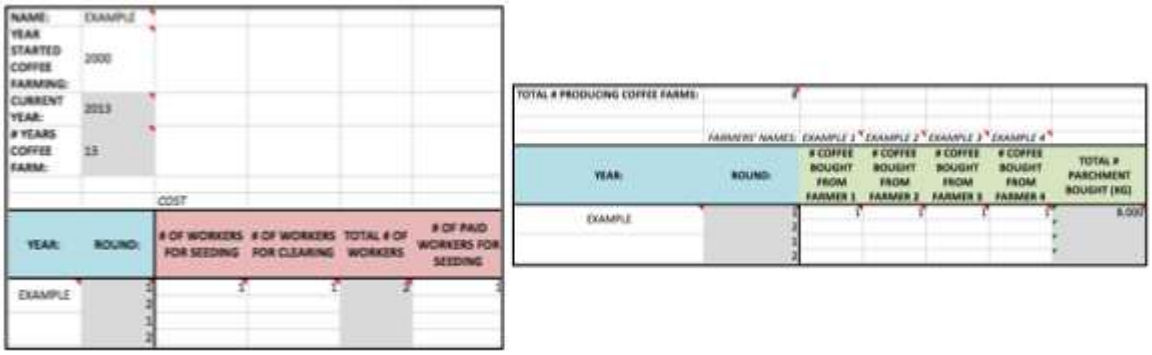


Figure 18: Comparison of Farmers' and Khun Wut's Database

FERTILIZER TYPE - NURSERY	# FERTILIZER (BAGS) - NURSERY	FERTILIZER PRICE/BAG - NURSERY	FERTILIZER TYPE - ADULT	# FERTILIZER (BAGS) - ADULT	FERTILIZER PRICE/BAG - ADULT	FERTILIZER TYPE - +10 YRS	# FERTILIZER (BAGS) - + 10 YRS	FERTILIZER PRICE/BAG - + 10 YRS	TOTAL COST FOR FERTILIZER
EXAMPLE	THB 1.00	THB 1.00	EXAMPLE	1	THB 1.00	EXAMPLE	1	THB 1.00	THB 3.00

Figure 19: Farmers' Database with more Fields about Fertilizers

# PARCHMENT TO KHUN WUT (KG)	PRICE PAID BY KHUN WUT (BAHT/KG)

Figure 20: Farmers' Database with Modified Fields about Sold Coffee

FARMERS' NAMES:	EXAMPLE 1	EXAMPLE 2	EXAMPLE 3	EXAMPLE 4
ROUND:	# COFFEE BOUGHT FROM FARMER 1	# COFFEE BOUGHT FROM FARMER 2	# COFFEE BOUGHT FROM FARMER 3	# COFFEE BOUGHT FROM FARMER 4
1				

Figure 21: Khun Wut's Database with Fields about Farmers

BUYER 1	# SOLD BUYER 1 (KG)	FORM SOLD BUYER 1	PRICE BUYER 1 (THB/KG)	REVENUE BUYER 1
EXAMPLE A	2	PARCHMENT	THB 1.00	THB 2.00
				THB -

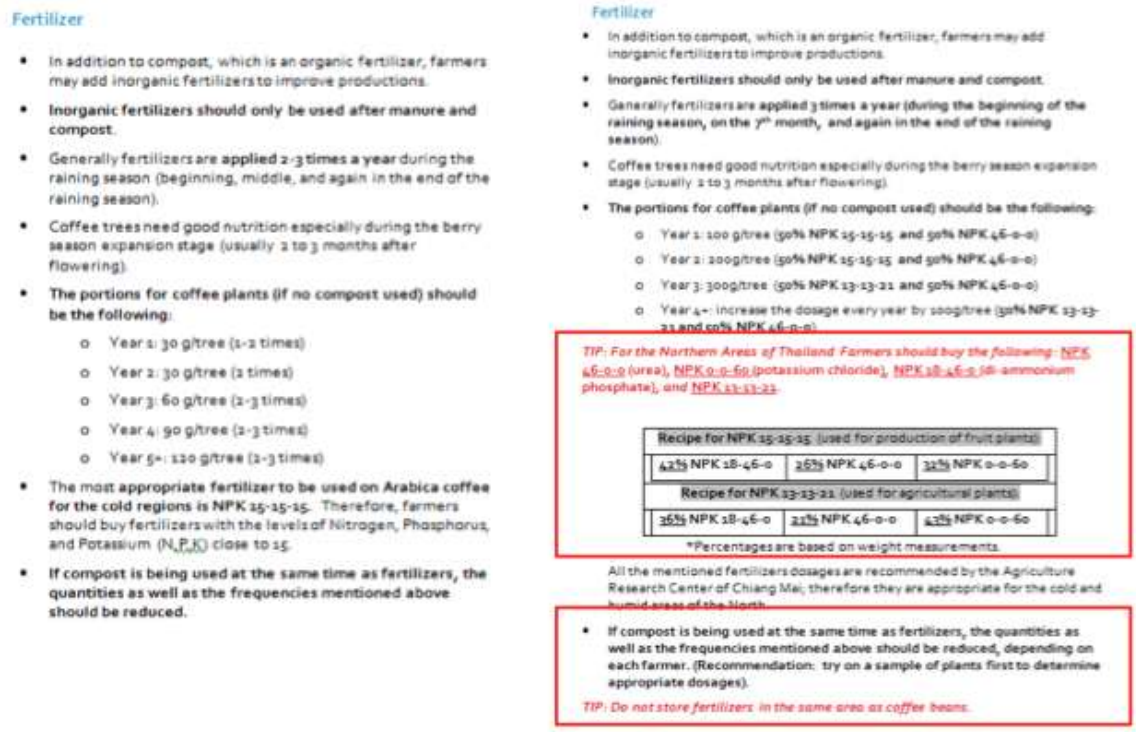
Figure 22: Khun Wut's Database with Fields about Buyers

Adjusting the Coffee Production and Processing Booklet

At meetings with Raks Thai representatives and farmers in village of Aayae, we asked for feedback on the first draft of the developed booklet. Though it was difficult for farmers to read through the entire booklet in Thai given time constraints, farmers assured us that they would provide feedback later that day. Farmers explained it was helpful to include pictures and not just text in several parts of the booklet. We quickly got their attention regarding two of the booklet's chapters: coffee production and fertilizer and pesticide control. Farmers were interested in knowing more specific information from the coffee production section. We also learned that the fertilizer suggested in the booklet was in fact the best but unfortunately too expensive for their budget. Farmers wanted alternative solutions to this fertilizer issue. Some farmers were also skeptical about to the booklet's recommended solutions for pesticide control. Their concern was with using chemicals that could potentially affect their production yield in a negative way.

Taking into consideration everything we had learned from our trip to the village, the team continued to make necessary changes to the booklet in order to better suit the needs and curiosity of the farmers. We reviewed the coffee production and processing chapters and added more detailed information to the recommended methods (Figure 23). The team reconsidered the suggested fertilizer and offered alternatives for every stage of coffee tree development, taking into consideration both cost and quality. Additionally, more research was conducted on organic methods for pesticide control as opposed to using chemicals so that farmers felt more

comfortable with testing different solutions. To address farmers' concerns with potential side effects of pesticide control, we recommended that they first try proposed methods on a sample of trees and then choose the most effective method to apply to a larger area of the farm. We hope the revisions made to the booklet will result in a useful tool for the farmers in the village of Aayae. By providing farmers with a more concrete and reliable sets of standards, our goal is to provide future generations with the ability to maintain and continue to improve coffee production in the Aayae village. The final version of the booklet can be found in Appendix O: Booklet.



Fertilizer

- In addition to compost, which is an organic fertilizer, farmers may add inorganic fertilizers to improve productions.
- **Inorganic fertilizers should only be used after manure and compost.**
- Generally fertilizers are **applied 2-3 times a year** during the raining season (beginning, middle, and again in the end of the raining season).
- Coffee trees need good nutrition especially during the berry season expansion stage (usually 2 to 3 months after flowering).
- **The portions for coffee plants (if no compost used) should be the following:**
  - Year 1: 30 g/tree (1-2 times)
  - Year 2: 30 g/tree (2 times)
  - Year 3: 60 g/tree (2-3 times)
  - Year 4: 90 g/tree (2-3 times)
  - Year 5+: 120 g/tree (2-3 times)
- The most **appropriate fertilizer to be used on Arabica coffee for the cold regions is NPK 15-15-15.** Therefore, farmers should buy fertilizers with the levels of Nitrogen, Phosphorus, and Potassium ($N_xP_yK_z$) close to 15.
- **If compost is being used at the same time as fertilizers, the quantities as well as the frequencies mentioned above should be reduced.**

Fertilizer

- In addition to compost, which is an organic fertilizer, farmers may add inorganic fertilizers to improve productions.
- **Inorganic fertilizers should only be used after manure and compost.**
- Generally fertilizers are **applied 3 times a year (during the beginning of the raining season, on the 7th month, and again in the end of the raining season).**
- Coffee trees need good nutrition especially during the berry season expansion stage (usually 2 to 3 months after flowering).
- **The portions for coffee plants (if no compost used) should be the following:**
  - Year 1: 100 g/tree (50% NPK 15-15-15 and 50% NPK 46-0-0)
  - Year 2: 200g/tree (50% NPK 15-15-15 and 50% NPK 46-0-0)
  - Year 3: 300g/tree (50% NPK 13-13-21 and 50% NPK 46-0-0)
  - Year 4+: increase the dosage every year by 100g/tree (50% NPK 13-13-21 and 50% NPK 46-0-0)

TIP: For the Northern Areas of Thailand Farmers should buy the following: NPK 46-0-0 (urea), NPK 0-0-60 (potassium chloride), NPK 18-46-0 (di-ammonium phosphate), and NPK 13-13-21.

Recipe for NPK 15-15-15 (used for production of fruit plants)		
42% NPK 18-46-0	26% NPK 46-0-0	32% NPK 0-0-60
Recipe for NPK 13-13-21 (used for agricultural plants)		
36% NPK 18-46-0	21% NPK 46-0-0	43% NPK 0-0-60

*Percentages are based on weight measurements.

All the mentioned fertilizers dosages are recommended by the Agriculture Research Center of Chiang Mai; therefore they are appropriate for the cold and humid areas of the North.

- **If compost is being used at the same time as fertilizers, the quantities as well as the frequencies mentioned above should be reduced, depending on each farmer. (Recommendation: try on a sample of plants first to determine appropriate dosages).**

TIP: Do not store fertilizers in the same area as coffee beans.

Figure 23: Example of Modifications made to the Fertilizer Chapter of the Booklet

5 Recommendations and Conclusion

Through our research and field visits we have developed numerous recommendations for the Raks Thai Foundation, farmers in the village of Aayae, and future WPI-BSAC teams. These can be categorized into recommendations regarding the Aayae village, and those regarding the model approach the team developed. The following chapter will discuss these recommendations as well as conclusions gathered from our research. More specifically, conclusions we developed about our model based on testing completed in the village.

5.1 Summary

The goal of our project was to provide coffee farmers in Northern Thailand with resources to improve coffee production, sales, and operation in an effort to promote a sustainable way of life in their communities. Our methodology had two purposes:

1) Creating a model to serve as a framework for the Raks Thai Foundation to aid villages in Northern Thailand overcome the barriers faced as they pursue a sustainable way of life and
2) Testing the model by applying it to the village of Aayae.

The fundamental principles of Participatory Action Research and capacity building served as a guide in the development of our methodological steps. The team travelled to the Aayae village twice in order to complete our objectives. We were able to interview farmers and work with them throughout our project in order to achieve results that best fit their needs.

As we applied our model, it was determined that the most significant barriers currently faced by the coffee farmers in the Aayae village were their lack of business skills and difficultly accessing information on coffee production methods and standards (as discussed in Finding 2). The team then developed two tools molded to the needs of the Aayae village: an informational coffee booklet and a database accompanied by a user's manual (as discussed in Finding 3). We hope these tools allow farmers in the Aayae village to improve coffee production and overall

marketing of their product by following standard methods and marketing tips from the booklet as well as gain greater control of their production by keeping records with the database.

We believe our methodology has the capacity to serve as a model for the Raks Thai Foundation as they work to assist small, rural coffee farming communities across Northern Thailand overcome the barriers they face (as discussed in Finding 10). The objectives we have created are general enough to be applied to coffee farming communities across Northern Thailand but methods and techniques used within each objective are specific enough to tailor strategies to individual communities seeking different solutions to the barriers they face. The team designed objectives so that each step could be used under differing circumstances and applied to many rural coffee farming communities.

In the following sections we offer specific recommendations regarding the village of Aayae and the model approach that was developed. We offer recommendations to the Aayae village specifically, to the Raks Thai Foundation, and to future WPI-BSAC project teams.

5.2 Recommendations regarding the Aayae Village

We recommend that the Aayae village use the tools provided to them to improve coffee production and marketing of their coffee.

The team developed two tools for the village of Aayae: an informational coffee booklet and a database as discussed in the Outcomes Section, 4.3. The booklet aimed to provide coffee farmers in the village with more information on coffee production, processing methods, and marketing strategies. The information included in the booklet was based on requests from farmers as well as the Raks Thai Foundation, along with observations made by the team during our first visit. The deliverables created were well received by the farmers. Farmers did not know some of the techniques and organizational methods presented in both the informational coffee booklet as well as the database, and wanted to learn more about them.

Due to the success of these tools, we recommend that the farmers of the Aayae village apply the methods specified in the booklet as they see fit to improve the quality of their coffee. We also recommend that they use the marketing tips provided to better market their product. Although the methods suggested in the informational booklet were gathered from agricultural professionals in Northern Thailand, we recommend that the farmers in the Aayae village use the additional contacts and suggested resources found in the informational booklet to obtain any critical information not adequately elaborated upon in the booklet. The database was created in order to provide farmers with a more organized method of bookkeeping. The farmers had no written records of their coffee production prior to our visit. We recommend that the farmers fill out fields of the database with data from previous years. Many of the farmers were not able to complete a number of fields, as discussed in Finding 7 as they were unsure of their importance. We recommend that farmers collect this data in order to fill out all fields of the database in future years.

We recommend that the Raks Thai Foundation further assist the Aayae village with the use of the tools provided.

Through the use of our model, we created two tools for the farmers in the Aayae village to overcome the lack of access to information and business skills barriers they faced at the time of the project. As discussed in Finding 3, the critical resources to help overcome barriers in the community were an informational booklet and a database. The final versions of the booklet and database were given to the Raks Thai Foundation to provide to the farmers. The team created a user's manual for the database in an effort to provide farmers with an additional tool to aid them in the use of the database.

However, because these tools have recently been created and are still new to the farmers, we recommend Raks Thai keep assisting the Aayae village with the implementation of the tools provided. As explained in Background Section 2.5, two key concepts to helping rural communities are working with the community and also using respected members of the community to present ideas. As the Raks Thai Foundation has worked with the village for many years and developed close ties with the community, it is suggested that they help present ideas and work with the community to use these tools. We suggest that the Raks Thai Foundation

assist with the use of the informational booklet and the database for at least one full year of the coffee cycle, which is described in section 2.3.1 of the Background chapter. The booklet provides information on coffee production, processing methods, and marketing strategies, all of which happen at different times of the year. Information from all of these steps is also necessary for the database. Therefore farmers will only be able to receive help on these methods if the Raks Thai Foundation works with them for at least one full year. Not only will this help the farmers further understand and use the materials in the booklet, but it will also give the Raks Thai Foundation the ability to see how clear and instructive the designed deliverables actually are.

We recommend that the Raks Thai Foundation use our model to identify further barriers faced by the Aayae village and assist farmers to overcome those barriers.

One of our project goals was to develop strategies for the village of Aayae to overcome barriers they face as the community pursues a sustainable way of life. The team chose to create an informational booklet to help farmers gain access to agricultural information and a database to help improve village data organization. These two deliverables were chosen after assessing many barriers the village faces and evaluating the significance of each. Specific deliverables were developed keeping in mind the farmers' needs, and team's time and budget constraints. The two barriers our team focused on, which are described in Finding 2, were significant to the village at the time of our study.

However, as mentioned in Finding 1, the farmers face many other barriers, not only the two that we addressed. As the community utilizes the tools developed to assist them, it is likely that these other identified barriers will become more significant and new barriers will also emerge. One of the other barriers found during our visit to Aayae was the limited marketing knowledge of the farmers. *We recommend that the village of Aayae, with the help of the Raks Thai Foundation, address the barrier of limited marketing knowledge*. By addressing this issue, the farmers can not only improve their marketing knowledge, but also improve product design and expand their markets. Although we believe this is the next most significant barrier to be addressed in Aayae, we recommend the Raks Thai Foundation uses our model to assess and identify barriers with the community once again to ensure this is in fact most significant. We also recommend that the Raks Thai Foundation assess the willingness and preparedness of the

farmers in the Aayae village to take on new challenges in their community. Once farmers are able, we suggest that the Raks Thai Foundation assist farmers in the community with overcoming these additional barriers.

5.3 Recommendations regarding the model

We recommend that the Raks Thai Foundation use our model to help other villages in Northern Thailand overcome barriers they face to a sustainable way of life.

We recommend that the Raks Thai foundation follow the team's proposed methodological steps to assist small, rural coffee farming communities overcome the barriers they face. The effectiveness of our developed objectives was assessed with the help of our sponsor in the Aayae village. During our visit, feedback was received from both the Raks Thai Foundation and from farmers in the community as described in section 3.4 of the Methodology chapter. The informational coffee booklet and the database were both well received by the community. Farmers wanted to learn more about the information presented in both the booklet and database, as described in Finding 9. These two tools were extremely useful in that they provided information to the farmers whole also creating an interest in further knowledge; community interest is critical in order to successfully build the capacity of a rural community. Based on these observations, we concluded that our model approach used to create the presented tools is effective and can be used by the Raks Thai Foundation to help further other coffee producing communities across Northern Thailand.

We recommend that future WPI-BSAC teams, in conjunction with the Raks Thai Foundation, continue to evaluate our model in both the village of Aayae and in other villages across Northern Thailand.

Although we found that our model is useful for capacity building and concluded it has the potential to be effective in helping other communities achieve a sustainable way of life, future WPI-BSAC teams in conjunction with the Raks Thai Foundation must continue to evaluate and improve our model. Due to the restricted timeframe of the project along with difficult

transportation to the village, we were only able to travel to the village for a short time. This time restriction made it more difficult for the team to understand the culture of Aayae, which is very important when introducing new ideas to a community, as described in Background Section 2.5. Due to these limitations, *we recommend that the Raks Thai Foundation spend more time in Aayae evaluating our model and seeing how successful it is. We also suggest our sponsor carry out this evaluation in other rural coffee growing communities they work with*.

We visited the Aayae village twice and were well-prepared to make the most of the limited time we had. The first visit was used to gather initial data and information and the second to get feedback from farmers on the tools we developed for the community. By developing a schedule for our village visits and preparing and translating interview questions, we were able to get sufficient information and insight from members of the community. *We recommend that future WPI-BSAC teams along with the Raks Thai Foundation not only spend more time in communities to learn and further understand the culture, but to also prepare extensively for the site visits.*

By increasing the amount of time spent with farmers, a deeper connection can be made to the individual community; developing this connection will make it easier to understand the community's needs and help to develop better ways of approaching the problems they face. Spending more time in the community will help gain new perspectives on the barriers farmers face. We recommend future WPI-BSAC teams visit the new villages they work with at least twice with the Raks Thai Foundation as we did to gather initial data and receive feedback. For the Raks Thai Foundation, an additional, longer visit is just as important to present and evaluate the final tools provided to farmers. This may be split up into multiple visits depending on what tools are provided. For example, our team provided an informational booklet to Aayae farmers. However, many of the farming practices mentioned in the booklet, such as planting, pruning and harvesting, would not be performed for another few months as described in section 2.3.1 of the Background chapter. Therefore, we suggest Raks Thai plan their visits accordingly in order to evaluate all presented tools completely.

We recommend the Raks Thai Foundation facilitate communication between potential coffee buyers and the small-scale coffee farming communities they work with.

Through observations in the village of Aayae as well as interviews with representatives of Raks Thai, we found that an underlying problem in many of the villages they work with is limited contact with coffee buyers. As this is a barrier that seems to be prevalent in many communities, we recommend that the Raks Thai Foundation not only help by using our model, but also by creating relations with potential coffee buyers. If the Raks Thai Foundation does this, they will be helping many of the communities they work with.

Through background research, we learned of several coffee roasting facilities interested in purchasing coffee exclusively from rural farming communities in Northern Thailand. Doi Chaang, mentioned in Background Section 2.4, not only grows and processes their own coffee but also buys and processes coffee from these communities. The Duang Dee Hill Tribe Coffee company also buys coffee solely from hill tribes in Northern Thailand. These two companies are mentioned in the marketing portion of the informational booklet. We recommend the Raks Thai Foundation create contacts between these companies and many more to benefit the small, rural coffee farming communities across Northern Thailand they work with.

5.4 Conclusion

Small-scale farmers across the world account for the largest portion of rural poor (Hazell et al., 2010). The conditions of many small, rural coffee farming communities in Northern Thailand are poor; villages often have little running water and electricity. Healthcare and education are also limited due to their high cost. Communities lack the income and necessary resources to improve their lives. Through this project, we were immersed in a completely different culture. We learned how to handle communication issues and see the world from a new point of view. While working with our sponsor, the Raks Thai Foundation, in the Aayae village, we investigated some of the barriers small, rural coffee farming communities face to a sustainable way of life. Through the development and use of a model, we helped address these barriers by providing tools catered specifically to the village of Aayae.

A mission of the Raks Thai Foundation is to empower communities and help them achieve a sustainable way of life. “The philosophy of the Raks Thai Foundation emphasizes researching not

only for the community, but also with the community. Community participation is important because it helps us to better understand the community and receive more effective feedback." (Khun Tee, Raks Thai Foundation). Understanding the relationship between participation, empowerment, and sustainability was extremely important in the development and application of our model. We worked directly with members of a rural, small-scale coffee farming community and allowed them to take control of their learning. As a result, farmers in the community were motivated to educate themselves and were provided with the means to do so. This concept is the key to empowerment, as once community members are educating themselves, they can overcome the barriers they face and develop a sense of power and confidence. Overcoming these barriers independently is the means to a sustainable life as there is little need for assistance when a community can overcome barriers on their own. By using these concepts, as we did in our model, not only can the village of Aayae improve their quality of life, but so can rural coffee farming communities across Northern Thailand.

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Appendix A: Information On Akha Hill Tribes

AKHA Tribe

Landscape plasticity was virtually eliminated as reforestation and wet-rice projects mandated and enforced by the central government drastically reduced the strategies available to the Akha for livelihood.

AKHA Tribes Today

In more recent years the frequency of interaction between Akha tribes and outsiders and global capitalist market economic system has increased. Additionally, Thai administrative-bureacratic systems (land registration, tax system, national identity card system, formal schooling, etc) have been incorporated for most of the Akha tribes in Northern Thailand. Consequently, tribe leaders have been redefining the meaning of space and allocation.

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Lastly, it is important to understand that Akha interests have been redefined over the years as Thai government influences drove them to a slight loss of cultural difference and local autonomy.

AKHA Tribe

Indigenous hill tribe that lives in small villages, including in the North of Thailand.

Language: *Akha language*

Dress Code: *clothing with black and red as dominant colors (women skirts, breastcloths, jackets, and headpieces)*

Rituals and Traditional Events: *symbolized by the use of raw material (cotton, iron, and silver)*

Religion: *folk religion, Christianity, Buddhism*

Location: *Burma, China, Laos, and Thailand*

Tribes in the North of Thailand survive mostly on the cultivation of cash crops. Originally they cultivated opium, but in more recent years the Thai government forced them to change to alternative cash crops, such as coffee.

Akha have always allocated themselves in high altitudes with surrounding forestation. That way they would not be easily accessible to soldiers, bandits, and tax collectors.

A "ruler", known as the dzoema, and a council of elders, usually controls villages.

These *dzoema* have local control over the definition of time and space. They decide on the time for different ceremonies like "New-Year", as well as the meaning and allocation of space within and beyond the village. However, these controls are not solely based on the ruler's decision, but also by a cultural system.

WARNING: Akha people are strong believers of a spiritual world, and the interaction with outsiders can sometimes be negatively perceived, upon the coincidence of illness or disaster.

Akha People are known as:

- *Being too functionalist*
- *Following a romantic Germanic notion of culture*
- *Following a discipline-based rhetoric of holism in text construction*
- *Biologizing culture by viewing it as organic*
- *Imposing a coherent notion of culture that does not allow for contradictions and inconsistencies*
- *Naturalizing culture and ignoring the fact that it must be socially produced*
- *Exoticizing the other by placing them out of time and space*
- *Reinforcing indigenous systems of power inequalities by silencing alternative viewpoints*
- *Isolating indigenous cultures from historical forces and larger regional systems of power inequalities.*

Appendix B: Coffee Certifications

Thai coffee has many characteristics that are appealing to consumers in the global market. Coffee farming in Northern Thailand has many features that make it environmentally sustainable. Unlike mass production, which often results in poor quality control, these farms give consumers a better product because famers pay closer attention to the soil and to the product (Gresser & Tickell, 2002). Small-scale coffee farming in Thailand has the potential to meet certain organic and sustainable certifications that are sought out in the global market (Hernani, 2006). Recently consumers have become more planet and body conscious when it comes to the products they buy. A new term for "green" consumers, LOHAS (lifestyles of health and sustainability) has been coined to describe an increasing interest in personal and global health. This sense of conscientious consumerism means producers can sell more by showing how their products reduce the carbon footprint (Shankar, 2012).

Coffee and other products that receive certification are proof to customers that what they are purchasing meets certain "green" standards. "Ninety percent of Sustainable Harvest's coffee is certified using at least one of three certification systems." These certification systems include Organic, Fair Trade, and Rainforest Alliance coffee. The scope of each certification differs based on geographical restrictions, marketing fairness, as well as opportunity (Lyon, 2011). Figure 24 shows the three stamps that represent Organic, Fair Trade and Rainforest Alliance Certifications. Organic coffee is grown using sustainable agricultural practices, without synthetic chemical fertilizers and pesticides. Organic farming supports the delicate ecological balance maintained on cooperative and family farms. Fair Trade provides an alternative trade model by requiring healthy working conditions and a fair living wage for farmers, in addition to other criteria that aim to improve living conditions in producer communities. The Rainforest Alliance seal certifies that coffee is grown on farms where forests, rivers, soil, and wildlife have adequate protection. The seal also certifies that workers are paid a minimum wage, have proper equipment, and access to education and medical care.

Figure 24: USDA Organic, Fair Trade and Rainforest Alliance Stamps of Certification

Appendix C: Large Companies In Support Of Small-Scale Coffee Farming

Despite the difficult barriers many small-scale coffee farmers face, some large companies make an honest effort to support small farms and Fair Trade. Starbucks, one of the leading coffee sellers in the world, obtains over 85% of all of its coffee through small family farms across the globe (Alter, 2009). They are working to increase their amount of fair trade coffee (currently at 10%); however, fair trade often isn't as meaningful to coffee as it is to other products. Fair trade for agricultural products usually stands for better working conditions for larger farms. Although this is good for coffee production as well, more coffee is grown on family farms than on large-scale farms (Alter, 2009). With or without the fair trade label, Starbucks is still one of the largest helpers to coffee farmers around the world. Other companies, large and small, also help to aid coffee farmers, but focus more specifically on fair trade. For example Dunkin Donuts offers 100% fair trade espresso. Other corporations such as Pura Vida offer 100% fair trade, organic and shade-grown coffee (Copeland, 2011). All of these companies work directly with local farmers (both large and small) in order to try to help better the living conditions for farmers in these rural areas. However, these corporations are only in contact with a handful of the many rural farms across the world. The companies will not be able to work with every coffee farm in the world or even in Thailand, which makes it extremely important for the farmers to take some of their own initiative.

Appendix D: Farmers' Questionnaire for First Trip to Village

1. Farmers
    - Number of family members?
    - Do family members contribute on the farm work?
    - Non-family member that work on the farm?
    - Salary for family members or workers?
    - Do you own any means of transportation?
    - If not, how do you mostly travel?
2. Sizes and Layout
    - How much land is under cultivation?
    - How much of the land cultivated is intended for coffee?
    - Besides coffee what else is grown?
    - By plot, identify the location of crops.
3. Farm Description
    - How many people work on the farm?
    - How is the farm irrigated?
    - Where do farmers obtain water?
    - Which percentage of the cultivation are cash crops?
    - Which percentage of the cultivation is for personal consumption?
    - How much coffee is produced a year?
    - What is the primary cash crop? If it is coffee, please specify any secondary cash crop.
4. Observed Relationships within the Community
    - How are fields split up or shared between farmers?
    - Do farmers sell products collectively or individually?
    - If collectively, who tends to take the leadership role?
    - If individually, please describe the sale process.
    - How do you think farmers contribute to the community?

- How good is the quality of the community hospital?
- How good are the schools in the community?
- Is there anything is specific this community is known for?
- What you like to change in the community?
- How do you see this community in 10 to 20 years?

5. Coffee

- What type of coffee do farmers grow?
- What type of fertilizer is used for the coffee farming?
- How much fertilizer is applied?
- How often is the fertilizer applied?
- Do you use herbicides or pesticides? If so what type
- How do you harvest the coffee cherries?
- What processes do you use after harvesting of the coffee?
- How do you dry the coffee?
- Do you measure the humidity of the coffee when processing?
- How is the coffee stored?
- How much money does coffee generate per kilogram?
- How many times do you sell coffee per year?
- How much money does coffee generate annually?
- Do you have any machinery that aids you the coffee production?
- How did you learn to grow coffee?

6. Livestock and other Animals

- Do you have any livestock? Describe what kind and provide quantities.
- Are the livestock primarily for consumption?
- Do the livestock help in any farming process? If so, how?
- How far are the livestock located from the main residence?
- How far are the livestock located from the farms?
- How are the livestock fed?
- Are there any other animals that are not considered livestock in the farm?
- If so, what purpose do they have in the farm?

7. Costs and Revenue

- How much money do you obtain from farming alone?
- Is this value satisfying for you and your family?
- How much money do you spend on farming? Every month? Year?
- What is the main destination of any revenue from the farm?
- How much do you pay for water?
- How much do you pay for fertilizers, herbicides, and pesticides?
- How much do you save on an annual basis?

8. Please describe a typical day in the community

Appendix E: Interview Notes from Trips to Aayae Village

Field Notes – 1st Trip to Aayae Village (January 17, 2013):

- Village has been established for 32 years
- Formerly part of the Leesu village
- Aayae has no official leaders (no system of ranking/class structure)
- 1 Million Baht Campaign (the old government) – Based on population so Aayae would always receive little money because of the low number of people in the community
- Village rejected this aid anyway, because they did not want to be in debt to the government
- Previous village representative passed away, Aayae has not chosen a new representative so there is not much communication with the government.
- Crops
    - Rice - grown for food of their
    - Corn – grown for livestock
    - Ginger, Sesame, Coriander – little grown for selling, but not main product
    - Plums
    - Coffee
- Royal project
    - Came to help village, suggested growing plums
    - First period, successful sales (10 bath/kg)
    - Following first period, over production
    - Price of plum dropped (3-5 baht/kg)
    - Still grow plums, but much less (because the price is so low)
- Highland Agriculture Royal Project - gives the knowledge to people in the village
- Villagers aware shade-grown coffee is good
- Currently in the process of re-vitalizing their land (takes time to make the whole village become a shade-grown coffee area)
- For additional income community members accept jobs from the Royal Project (gardening, farming, cleaning etc.) to earn adequate income

- Main crops: Plum and Coffee
- Income currently not sufficient
    - Most money spent on sending children to the city for an education
    - Most children do not return
    - Little money left for their own family and farming needs
- Raks Thai
    - Built school for village, sponsored by Japanese foundation
    - Wants to improve sustainability of community
- Village Coffee Agriculture History
    - 2006→ Started growing 3,000 coffee trees (whole village)
    - 2007→ Planted an additional 10,000 trees
    - 2008→ 1st Harvest: 300kg of parchment, planted an additional 10,000 trees
    - 2012→ Harvested 2 tons (2011), plants an additional 20,000 trees (only 5000 trees can be harvested at this moment)
    - 2013 →Planted an additional 20,000 trees. Hope to harvest ~4 tons of coffee
- Use of fertilizers
    - Used on baby trees. Amount varies from farmer to farmer
    - Example 1
        - Farmer has 4,000 trees, uses 1 bag of fertilizer
        - Applied twice→ 2 teaspoons for baby coffee trees
        - 3 small handfuls for small-medium coffee trees.
    - Example 2
        - Farmer 10,000 trees
        - Uses 10-12 bags/year
    - Example 3
        - Farmer 6000 trees
        - 5 bags
    - Example 4
        - Farmer 1000 trees
        - 5 bags/ year

- Each farmer uses different fertilizers

    - 4 brands mainly used
    - All around same price, approximately 600-1030 baht/ bag.
- Farmers said the fertilizer give a lot more yield on cherries.
- Some farmers have tried using alternative crops, specifically corn
    - There are problems with this
        - Takes a lot of space
        - Takes a lot of fertilizer
        - Requires additional workers to help with harvesting
        - Receive 4-5 baht/kilogram
        - Pesticides destroying environment
        - Ruining soil, not good for other plants

- Coffee in Northern Thailand has had some problems this year
    - Outbreak of a disease (from the Southern region)
    - Coffee prices currently low
    - Southeast Asian conference (with Indonesia, Philippines, Vietnam) will be held to discuss diseases plaguing the plants
- Nearby village has had an issue with trying to roast their own coffee
    - Tried to earn more money through roasting
    - Head of the village brought machines and equipment to be set up in town
    - Used free of charge
    - Villagers weren't willing to come to use the machine
        - Did not have knowledge on how to use the machine
- Co-ops are important
- Roasting Opportunity
    - University of Chiang Mai
        - Low quality
        - No established standards

Field Notes – 2nd Trip to Aayae Village (February 12, 2013):

Receiving Comments on the Spreadsheet

- Farmers all looked through spreadsheet, discussing it amongst themselves for ~30 minutes
- Comments from farmers were translated from Ahka -> Thai -> English
- Wanted spreadsheet split into 2 rounds per a year
- Additional labor is hired at a price 'per day' not 'per hour' only
- Most farmers don't hire labor
    - Helping each other
    - Example: Monday all farmers work on one farm, Tuesday all farmers work on a different farm, etc.
    - Prefer this way – no payments from each other and keeps a sense of community
- Most farmers started planting coffee in year 2547
- Did not begin collecting information until 2552
- Currently 5 central farms in the community growing coffee
    - Other families starting grow coffee
    - Has yet to become the central crop in their farms

Discussion on Fertilizers

- Have been experimenting with different types of fertilizers
- Want to see which make trees grow best
- Want to find which fertilizer makes trees produce greatest amount of large coffee beans
- Most farmers use 46-0-0 mixed with 13-13-21
- Farmers want to know:
    - Which fertilizer suited for which stage of the coffee tree
    - Which fertilizer will have long-term consequence on the trees or plants
    - Which fertilizers can be mixed to give best type of fertilizer
    - What types of fertilizers are best to be used in different situations
    - First fertilizer recommended is too expensive the first time was expensive, are there alternatives?

Additional Selling Information

- Entire farm grows the coffee to parchment stage

- Sells it mainly in the parchment stage
- Khun Wut buys all parchment
- Re-sells it to coffee companies or other middle men buyers
- Spreadsheet - Can only be filled out up to the production stage
- Selling information only applicable to Khun Wut

- Raks Thai wants to play a role in helping farmers
    - Does not want village to become dependent on them
    - Serve more as a “start up” and check up on them as they progress

Coffee Manual Booklet Feedback

- Want more information in the Tips Section
- Many farmers are concerned about pests and diseases in their coffee plants
- Some of the solutions we proposed requires chemicals, but farmers want to avoid this
- Issues with chemicals
    - Difficult to physically obtain
    - Too expensive
    - Don’t know the consequences of these chemical
- Farmers would like alternatives to using chemicals
- Concerned about using chemicals, don’t want to risk damaging soil or losing their harvest
- New diseases are effecting plants
    - White fungus disease
        - Unsure of cause
        - Attacks new branches, roots, stems and eventually destroys the tree
- Aware some solutions in booklet will take time to be effective
- Farmers are willing to use part of their harvest to try out solutions
- Farmers want to be sure that these solutions are promising and from a reliable source (information we are giving them has been backed up by coffee experts)
- Would like more information on production
- Would like more information on maintenance of coffee trees
- Would like more specific details in the booklet (exact numbers and detailed pictures)

Raks Thai Comments

- Difficult for older villagers to fill them out database themselves
    - Know the information
    - Can't read or write in Thai
- Some booklet chapters might be too wordy
    - Make it more visual for the farmers because many are not fluent in Thai
- Think of new ways to collect the data you need from farmers
    - Data fields in spreadsheet are not straightforward
    - Develop new ways to ask this information then piece this information together to gain the information you need
- Provide contact information to places we got our information from
- Provide contact information for coffee companies and business that are interested in buying coffee
- Farmers don't have resources to find buyers
- Currently only learn about potential buyers by word of mouth
    - Neighboring villages
    - During visits to Phrao

Appendix F: Analyzing Interviews

Once we have collected narrative data from the interviews in the form of detailed notes taken by two or more of the group members, we will proceed to analyze this information. Analysis will consist of five steps:

1. Understanding the data: before beginning the analysis, it is important to confirm that the data is of quality and will be useful to answer the questions we have. Since interviews produce qualitative data, this will involve reading the notes multiple times. We will also make notes of our impressions while we read because reflections might become useful later.
2. Focusing the analysis: first we will review the purpose of the analysis and ensure all group members have a common understanding of what we are looking for in the data. Then, we will focus the analysis by topic. This means that we will look at how all interviewees responded to a specific topic, in order to identify consistencies and differences.
3. Categorizing information: to complete this step two sub steps have to be accomplished; identifying patterns such as ideas, concepts, terminology and phrases used and organizing them into coherent categories. During this step, it will be possible to have a better understanding of data that might not be useful and to identify additional information that we might not have originally thought of as important. We will use a combination of the preset categories technique and the emergent categories technique to categorize the information we have. This involves making a list of categories we will initially be compiling information under. However, we will be looking for recurring themes in the data as we read through notes from the interviews. By using this mix of methods, we will be able to better ensure that we have found in the data all the information we might use in the future.
4. Identifying patterns and connection within and between categories: first, we will summarize the data within each category to confirm that everything in the group belongs. This will also allow us to determine key points to be gathered from that topic. Then, we will classify categories by importance. To do this, we will be counting the number of times different key points appeared in the data. The classification of

categories provides us with a better understanding of what the communities deem more significant.

5. Interpreting the analysis: lastly we will compile key words and points, the ranking of categories, and the most important information from each category. We will summarize the analysis in an easy to understand form, such as a table or a list.

Appendix G: Referenced Coffee Farming Manuals

Prior to the creation of the informational coffee booklet, research was conducted to obtain appropriate information to be included in its contents. The information presented in the booklet primarily consisted of methods and recommendations developed in four separate coffee production manuals:

- Arabica Coffee Manual for Laos-DPR
    - This manual helped us achieve the basic design of the booklet. Several of the pictures used in this booklet assisted with explanations in the. Because Laos has a similar climate to that of Northern Thailand, this manual contained relevant information for our booklet. The booklet was designed by the Food and Agriculture Organization of the United Nations (FAO), and provided insight on planting, maintenance, harvesting, processing, and disease control.
- Arabica Coffee Manual for Myanmar
    - This manual contained information similar to the Arabica Coffee Manual for Laos-DPR. Tips on methods of planting, harvesting, and processing were obtained from this manual. The Food and Agricultural Organization of the United Nations (FAO) was the publisher of this manual.
- Manual for Sustainable Coffee Production
    - This manual was developed for small-scale coffee farmers in rural Uganda. Its contents focused on sustainable practices such as composting, mulching, water management, harvesting, and drying. It also included guidance about the use of chemicals and fertilizers. The manual was developed by Douwe Egberts (DE) Foundation.
- Pests and Diseases of Coffee in Eastern Africa: A Technical and Advisory Manual
    - This manual included information on a number of pests and diseases that affect coffee plants; some of which farmers in the Aayae village are currently dealing with. The manual provided both organic and chemical solutions to these problems. Information obtained from this booklet was used for the Pesticide

Control chapter of our booklet. This manual was developed by the Center for Agriculture and Biosciences International (CABI).

Appendix H: Farmers' Feedback Questionnaire

	Is the information in the booklet easy to understand?	Are the pictures helpful? More or less?	Is the amount of information in the booklet too little or too much?	Any information missing in the book that you think is essential?	Any information in the booklet that you think is unnecessary?	Do you like the booklet? Why?	Is there anything that you would like us to clarify?	Would you prefer this information delivered in a different way?	Additional thoughts?
Farmer 1 Name:									
Farmer 2 Name:									
Farmer 3 Name:									

Appendix I: Preview of Original Version Of The Database

NAME:	EXAMPLE		AVERAGE COST/YEAR:	THB 0.04
YEAR STARTED COFFEE FARMING:	2000		AVERAGE REVENUE/YEAR:	THB 0.05
CURRENT YEAR:	2013		AVERAGE PROFIT/YEAR:	THB 0.02
# YEARS COFFEE FARM:	13			

	COST								REVENUE	
YEAR	# OF WORKERS	# OF PAID WORKERS	SALARY/HOUR	# HOURS WORKED	FERTILIZER TYPE	# FERTILIZER (BAGS)/YEAR	FERTILIZER PRICE/BAG	TOTAL COST	# OF TREES	# OF TREES - WORM
EXAMPLE	1	1	THB 1.00	1	1	1	THB 1.00	THB 2.00	1	1
								THB -		
								THB -		
								THB -		
								THB -		
								THB -		
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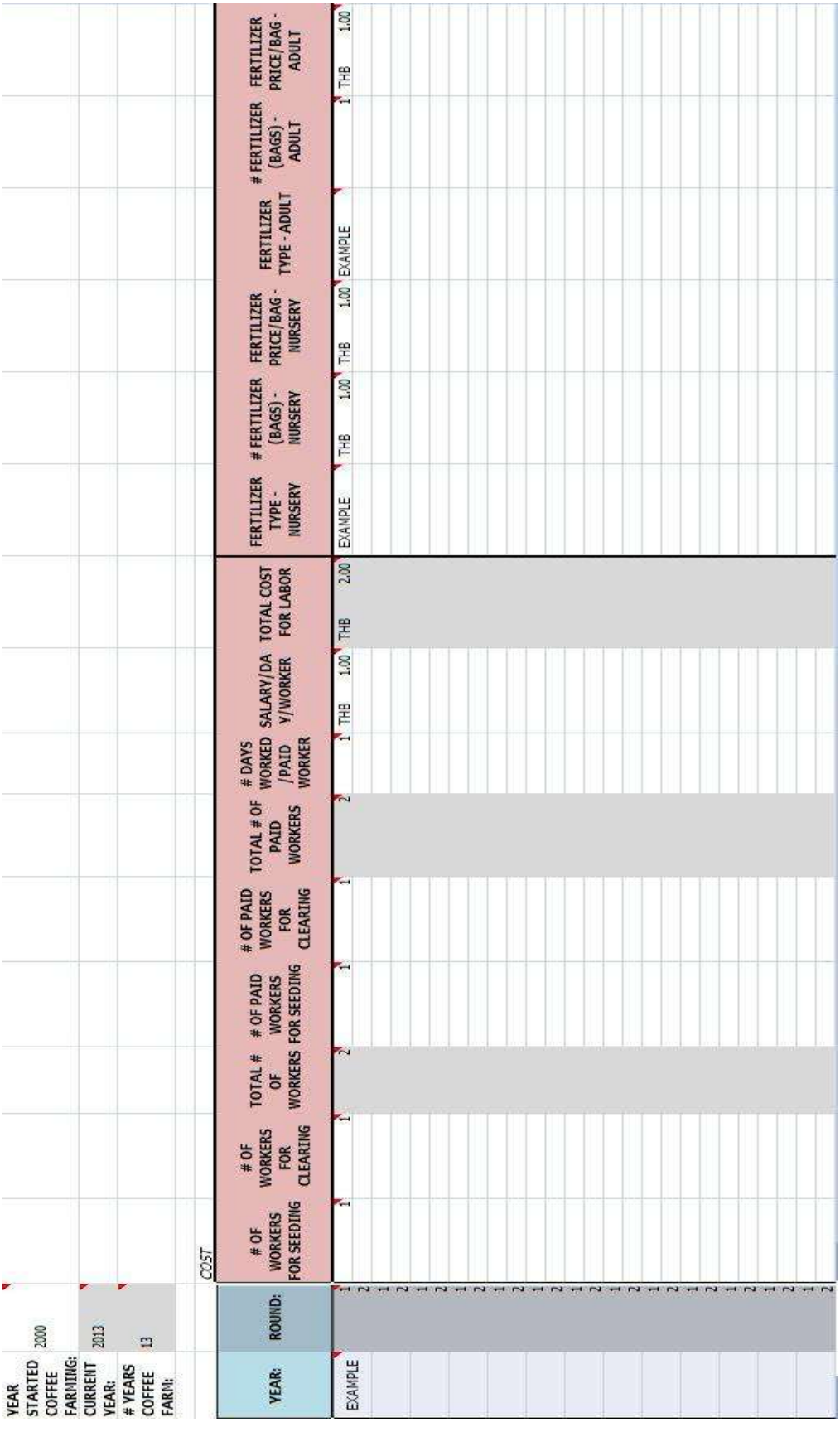
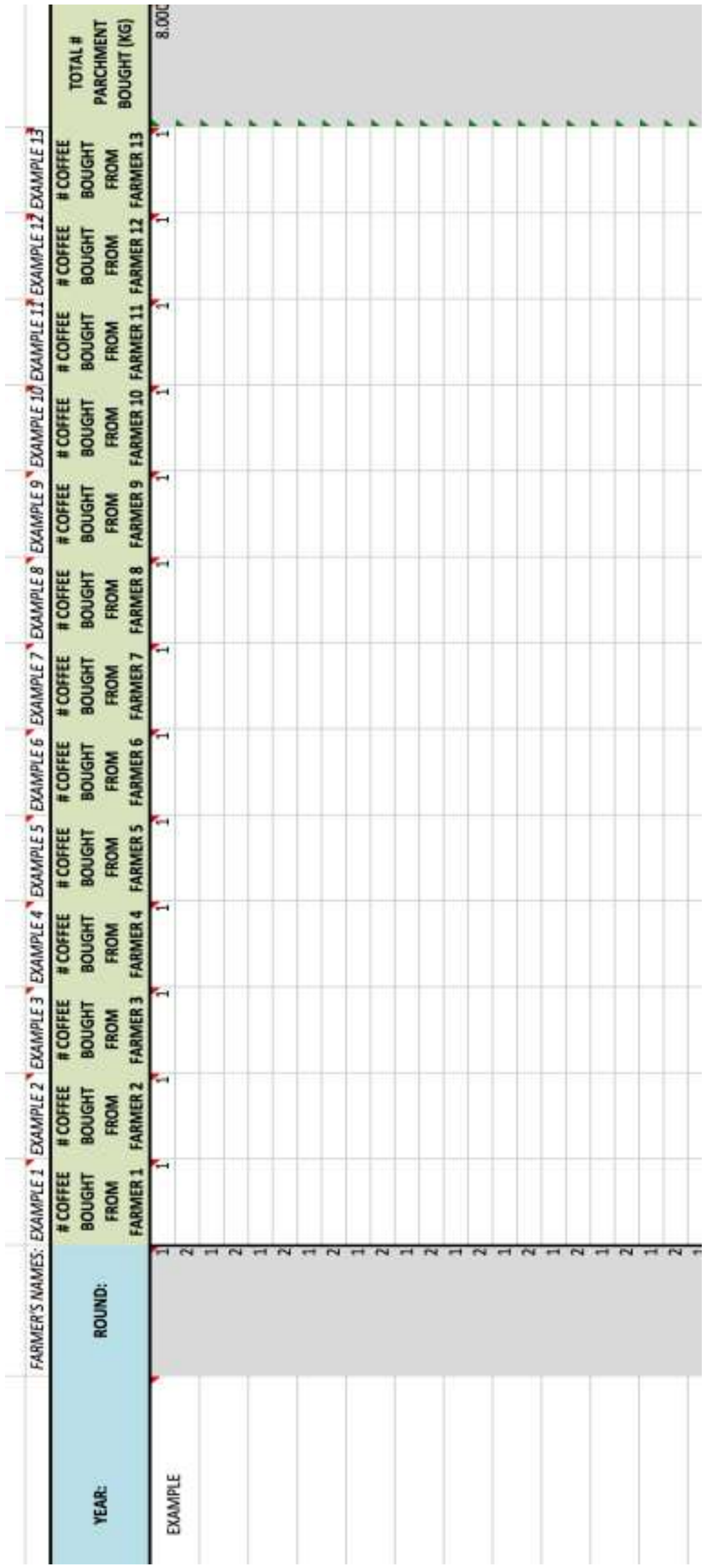
Appendix J: Preview Of Final Version Of Farmers' Database



Appendix K: Preview Of Khun Wut's Database



FARMER'S NAMES:		EXAMPLE 1	EXAMPLE 2	EXAMPLE 3	EXAMPLE 4	EXAMPLE 5	EXAMPLE 6	EXAMPLE 7	EXAMPLE 8	EXAMPLE 9	EXAMPLE 10	EXAMPLE 11	EXAMPLE 12	EXAMPLE 13	
YEAR:	ROUND:	# COFFEE BOUGHT FROM FARMER 1	# COFFEE BOUGHT FROM FARMER 2	# COFFEE BOUGHT FROM FARMER 3	# COFFEE BOUGHT FROM FARMER 4	# COFFEE BOUGHT FROM FARMER 5	# COFFEE BOUGHT FROM FARMER 6	# COFFEE BOUGHT FROM FARMER 7	# COFFEE BOUGHT FROM FARMER 8	# COFFEE BOUGHT FROM FARMER 9	# COFFEE BOUGHT FROM FARMER 10	# COFFEE BOUGHT FROM FARMER 11	# COFFEE BOUGHT FROM FARMER 12	# COFFEE BOUGHT FROM FARMER 13	TOTAL # PARCHMENT BOUGHT (KG)
EXAMPLE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8.000
	2														
	1														
	2														
	1														
	2														
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User's Manual

for the spreadsheet version of Coffee Farmers' Database Tool

User's Manual Version 1.0

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January 29th, 2013

Summary

This manual explains how to use the coffee farmers' database. This database allows coffee farmers to maintain yearly records of their coffee production. The spreadsheet contains input fields and output fields with pre-entered formulas that calculate averages, sums, etc. A detailed description of each field and an example scenario is provided in this document.

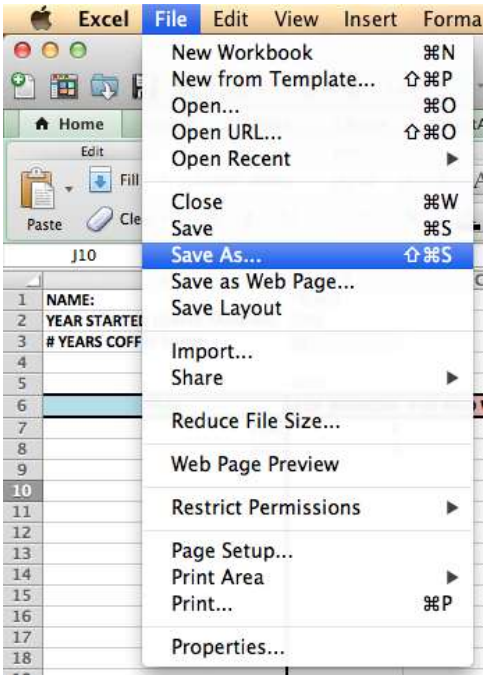
Table of Contents

Setting Up

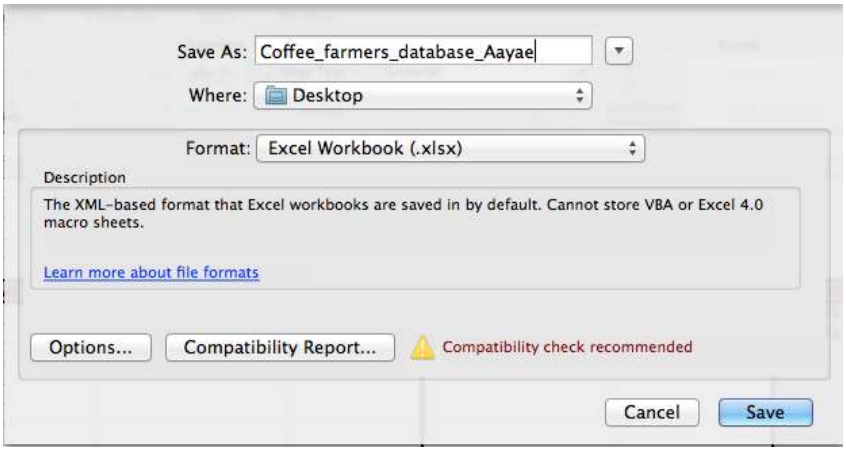
a. Renaming Template

The template is originally saved as "Coffee_farmers_database_template.xlsx". After downloading the template file, the user should follow these steps:

1. File -> Save As…



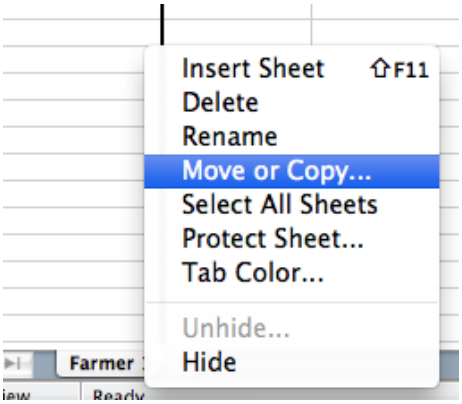
2. Name the file "Coffee_farmers_database_(Village).xlsx"
3. Click "Save"



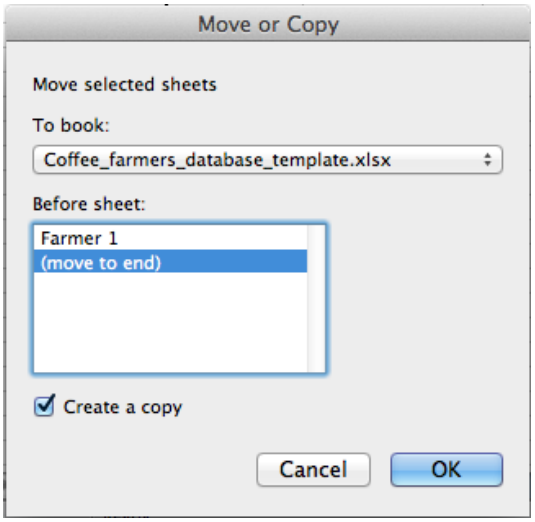
b. Creating Tabs with Farmers' Names

The next step is to create a tab for each of the farmers in the village. Tabs are located in the bottom left of the spreadsheet. This can be done in few steps as shown below:

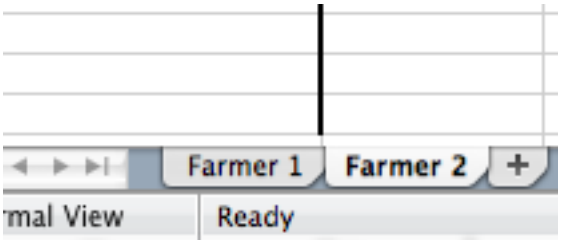
1. Right click the existing tab “Farmer 1” -> Click “Move or Copy”

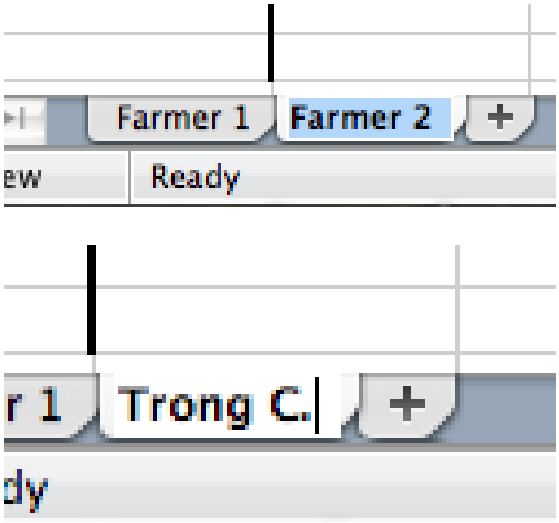


2. When the move or copy window pops up select “(move to end)” and check the “Create a copy” checkbox -> Click “OK”



3. To rename tabs, double-click the name on the tab and type the new name over the old one



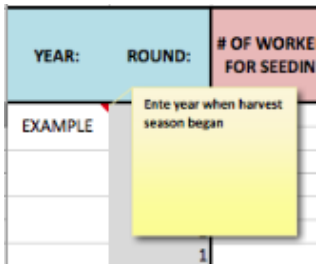


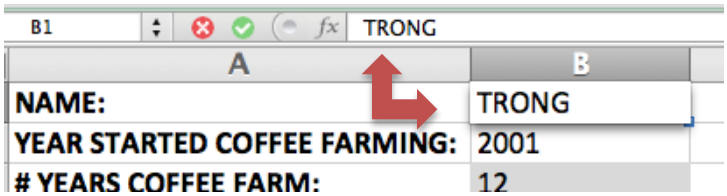
4. Repeat steps 1-3 to create tabs for all farmers

Input Fields

Explanations for all fields can be found in the template spreadsheet. Each field that contains a red triangle on the top right corner has comments attached to it that can be viewed by scrolling the pointer over it or clicking "Show Comments" in the menu bar. To input information to a field click on the field and type or use the formula bar located under the menu bar.

(insert picture of menu and "show comments" button on a pc)





a. **Name:** name of the farmer

b. **Year Started Coffee Farming:** year farmer started growing coffee. To enter this information, use the formula bar to change only the year (not the month or the day)

c. **Year:** year when the data in that row was collected

d. **Cost:** fields in this section are used to calculate total cost

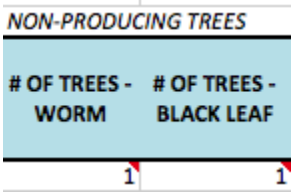
COST

# OF WORKERS FOR SEEDING	# OF WORKERS FOR CLEARING	TOTAL # OF WORKERS	# OF PAID WORKERS FOR SEEDING	# OF PAID WORKERS FOR CLEARING	TOTAL # OF PAID WORKERS	# DAYS WORKED/ PAID WORKER	SALARY/DAY/ WORKER	TOTAL COST FOR LABOR
1	1	2	1	1	2	1	THB 1.00	THB 2.00

FERTILIZER TYPE - NURSERY	# FERTILIZER (BAGS) - NURSERY	FERTILIZER PRICE/BAG - NURSERY	FERTILIZER TYPE - ADULT	# FERTILIZER (BAGS) - ADULT	FERTILIZER PRICE/BAG - ADULT	FERTILIZER TYPE - +10 YRS	# FERTILIZER (BAGS) - + 10 YRS	FERTILIZER PRICE/BAG - + 10 YRS	TOTAL COST FOR FERTILIZER
EXAMPLE	THB 1.00	THB 1.00	EXAMPLE	1	THB 1.00	EXAMPLE	1	THB 1.00	THB 3.00

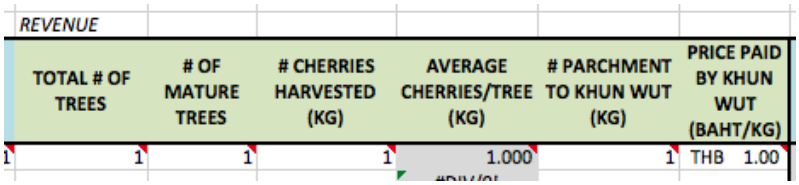
i. **# Of workers for seeding:** number of people working in the farm during that round for seeding
ii. **# Of workers for clearing:** number of people working in the farm during that round for clearing
iii. **# Of paid workers for seeding:** number of people working in the farm during that round for seeding and being paid a salary
iv. **# Of paid workers for clearing:** number of people working in the farm during that round for clearing and being paid a salary
v. **# Of days worked/paid worker:** number of days worked by each paid worker that round
vi. **Salary/day/worker:** daily salary for paid workers
vii. **Fertilizer type (nursery, adult, 10+ yrs.):** type of fertilizer used for nursery and young trees/adult trees/over 10 year trees
viii. **# Fertilizer (bags) (nursery, adult, 10+ yrs.):** number of bags of fertilizer used per round for nursery and young trees/adult trees/over 10 year trees
ix. **Fertilizer price per bag (nursery, adult, 10+ yrs.):** price of each bag of fertilizer for nursery and young trees/adult trees/over 10 year trees

e. Non-producing trees:



x. **# Trees affected by worm:** number of coffee trees affected by worm disease (Stem Borer)
xi. **# Trees affected by black leaf:** number of trees affected by black leaf disease

f. Revenue: fields in this section are used to calculate total revenue.



REVENUE

TOTAL # OF TREES	# OF MATURE TREES	# CHERRIES HARVESTED (KG)	AVERAGE CHERRIES/TREE (KG)	# PARCHMENT TO KHUN WUT (KG)	PRICE PAID BY KHUN WUT (BAHT/KG)
1	1	1	1.000	1	THB 1.00

i. **Total # of Trees:** number of coffee trees in the farm

ii. **# Of mature trees:** number of coffee trees in the farm that are mature enough to produce cherries

iii. **# Cherries harvested (kg):** amount (in kilograms) of cherries harvested

iv. **# Parchment to Khun Wut (kg):** amount (in kilograms) of parchment coffee sold to Khun Wut

v. **Price paid by Khun Wut (Baht/kg):** price (in Baht per kilogram) paid by Khun Wut for the Parchment coffee

Output Fields

Output fields are fields that contain Excel formulas that make automatic calculations once data are entered in all input fields. All output fields are shaded gray and are not selectable or editable.

a. Current year: displays the current year

b. # Years Coffee Farm: number of years the farmer has been growing coffee (= current year [automatic] – year started coffee farming)

	A	B
1	NAME:	TRONG
2	YEAR STARTED COFFEE FARMING:	2001
3	# YEARS COFFEE FARM:	12

c. Round: indicates the first (1) or second (2) round of harvesting for the year

d. Cost:

COST

# OF WORKERS FOR SEEDING	# OF WORKERS FOR CLEARING	TOTAL # OF WORKERS	# OF PAID WORKERS FOR SEEDING	# OF PAID WORKERS FOR CLEARING	TOTAL # OF PAID WORKERS	# DAYS WORKED/ PAID WORKER	SALARY/DAY/ WORKER	TOTAL COST FOR LABOR
1	1	2	1	1	2	1	THB 1.00	THB 2.00

FERTILIZER TYPE - NURSERY	# FERTILIZER (BAGS) - NURSERY	FERTILIZER PRICE/BAG - NURSERY	FERTILIZER TYPE - ADULT	# FERTILIZER (BAGS) - ADULT	FERTILIZER PRICE/BAG - ADULT	FERTILIZER TYPE - +10 YRS	# FERTILIZER (BAGS) - + 10 YRS	FERTILIZER PRICE/BAG - + 10 YRS	TOTAL COST FOR FERTILIZER
EXAMPLE	THB 1.00	THB 1.00	EXAMPLE	1	THB 1.00	EXAMPLE	1	THB 1.00	THB 3.00

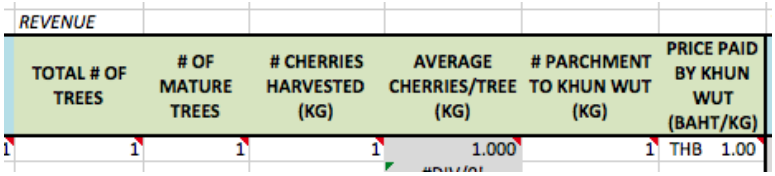
i. **Total # of workers:** total number of workers at the farm for that round (= # of workers for seeding + # of workers for clearing)

ii. **Total # of paid workers:** total number of paid workers at the farm for that round (= # of paid workers for seeding + # of paid workers for clearing)

iii. **Total cost for labor:** total cost of labor at the farm for that round (= total # of paid workers * salary/day/worker * # of days worked/paid worker)

iv. **Total cost for fertilizer:** total cost of fertilizer at the farm for that round (= # fertilizer (bags) for nursery * fertilizer price/bag for nursery + # fertilizer (bags) for adults * fertilizer price/bag for adults + # fertilizer (bags) for 10+ yrs * fertilizer price/bag for 10+ yrs)

e. Revenue:

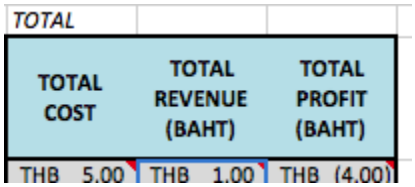


REVENUE

TOTAL # OF TREES	# OF MATURE TREES	# CHERRIES HARVESTED (KG)	AVERAGE CHERRIES/TREE (KG)	# PARCHMENT TO KHUN WUT (KG)	PRICE PAID BY KHUN WUT (BAHT/KG)
1	1	1	1	1.000	1 THB 1.00

i. **Average Cherries/Tree (kg):** average number of cherries per tree (= # of cherries harvested (kg) / # of trees)

f. Total: fields in this section are a summary of totals



TOTAL

TOTAL COST	TOTAL REVENUE (BAHT)	TOTAL PROFIT (BAHT)
THB 5.00	THB 1.00	THB (4.00)

i. **Revenue:** total revenue received from Khun Wut (= # Parchment to Khun Wut * Price paid by Khun Wut)

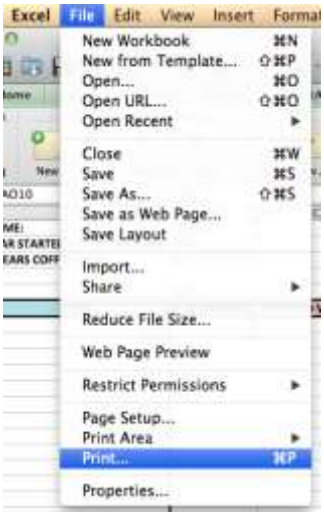
ii. **Cost:** sum of all costs for the round (= total cost for labor + total cost for fertilizer)

iii. **Profit:** total profit for the round (= total revenue – total cost)

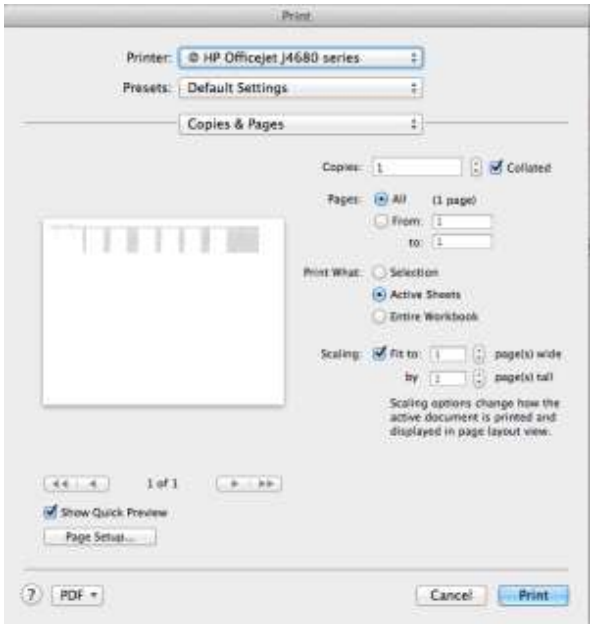
Printing

To print a blank spreadsheet the user must follow these steps:

1. Select a tab that contains a blank template of the spreadsheet
2. File -> Print



3. Select the number of copies, check “Active Sheets”, and “Fit to 1 page wide by 1 page tall”



4. Click “Print”

This will print a blank spreadsheet to be filled out by hand in one page. If the fields are two small, the user may select “Fit to 2 pages wide by 1 page tall” to split the spreadsheet into 2 pages.

Appendix M: User's Manual for Khun Wut's Database

User's Manual

for the spreadsheet version
of Coffee Farmers' Database Tool
for oversight on production and selling

User's Manual Version 1.0

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Raks Thai Foundation

Worcester Polytechnic Institute

January 29th, 2013

Summary

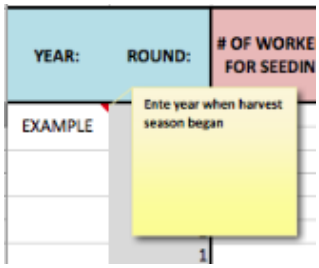
This manual explains how to use the coffee farmers' database for oversight of production and selling. This database allows the person responsible for overseeing production and selling to maintain bi-annual records of the coffee production. The spreadsheet contains input fields and output fields with pre-entered formulas that calculate averages, sums, etc. A detailed description of each field and an example scenario is provided in this document.

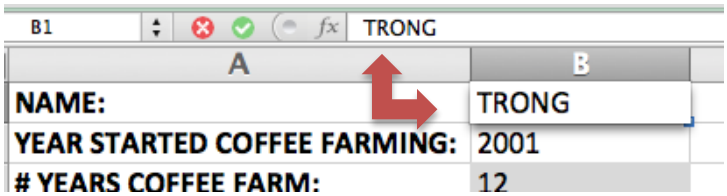
Table of Contents

Input Fields

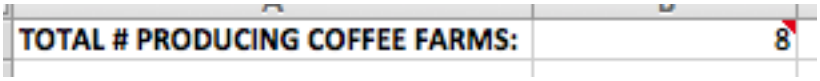
Explanations for all fields can be found in the template spreadsheet. Each field that contains a red triangle on the top right corner has comments attached to it that can be viewed by scrolling the pointer over it or clicking "Show Comments" in the menu bar. To input information to a field click on the field and type or use the formula bar located under the menu bar.

(insert picture of menu and "show comments" button on a pc)



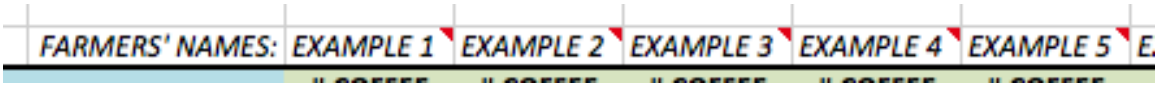


a. **Total # producing coffee farms:** total number of coffee farms in the village currently producing coffee

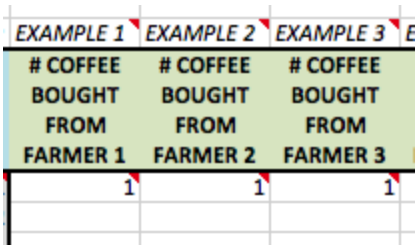


b. **Year:** year when the data in that row was collected

c. **Farmers' names:** names of farmers in the village producing coffee



d. **# Of coffee bought from farmer (1-13):** amount of parchment coffee (in kilograms) bought from specified farmer (replicated 13 times to allow multiple entries)

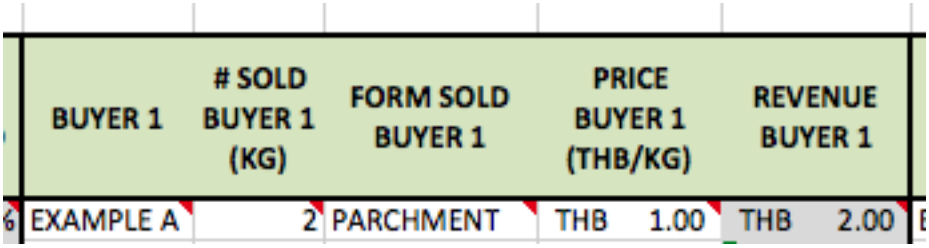


EXAMPLE 1	EXAMPLE 2	EXAMPLE 3
# COFFEE BOUGHT FROM FARMER 1	# COFFEE BOUGHT FROM FARMER 2	# COFFEE BOUGHT FROM FARMER 3
1	1	1

e. # Roasted coffee (kg): total amount of coffee that was roasted (in kilograms)

f. Buyer (1,2,3): Name of buyer (company or middleman)

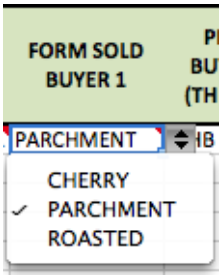
All fields about buyers are replicated three times to allow data collection from multiple buyers.



BUYER 1	# SOLD BUYER 1 (KG)	FORM SOLD BUYER 1	PRICE BUYER 1 (THB/KG)	REVENUE BUYER 1
EXAMPLE A	2	PARCHMENT	THB 1.00	THB 2.00

g. # Sold Buyer: amount (in kilograms) sold to specified buyer

h. Form sold to Buyer: form at which coffee was sold to specified buyer. This field contains a drop box with the options CHERRY, PARCHMENT, or ROASTED. To select one option, click the arrow on the right of the field and click the desired form.

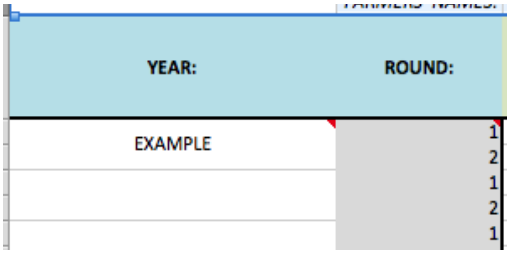


i. Price buyer: price at which farmer sold coffee to specified buyer (in baht/kilogram)

Output Fields

Output fields are fields that contain Excel formulas that make automatic calculations once data are entered in all input fields. All output fields are shaded gray and are not selectable or editable.

a. **Round:** indicates the first (1) or second (2) round of harvesting for the year

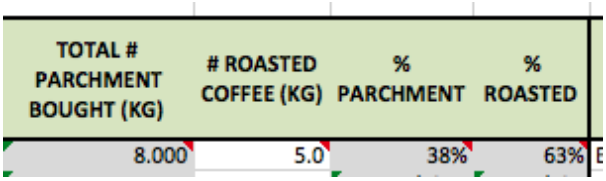


YEAR:	ROUND:
EXAMPLE	1
	2
	1
	2
	1

b. **Total # of parchment bought:** total amount of parchment coffee (in kilograms) bought during that round (= sum of # parchment bought from each farmer)

c. **% Parchment:** percentage of bought coffee that is in parchment form (= (# parchment bought (kg) - # roasted coffee (kg))/ # parchment bought (kg))

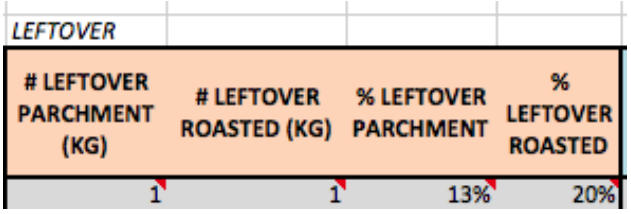
d. **% Roasted:** percentage of bought coffee that is in roasted form (= # roasted coffee (kg)/ # parchment bought (kg))



TOTAL # PARCHMENT BOUGHT (KG)	# ROASTED COFFEE (KG)	% PARCHMENT	% ROASTED
8.000	5.0	38%	63%

e. **Revenue Buyer (1,2,3):** total revenue received from specified buyer (= total amount sold to specified buyer * price paid by specified buyer)

f. **Leftover:**



LEFTOVER			
# LEFTOVER PARCHMENT (KG)	# LEFTOVER ROASTED (KG)	% LEFTOVER PARCHMENT	% LEFTOVER ROASTED
1	1	13%	20%

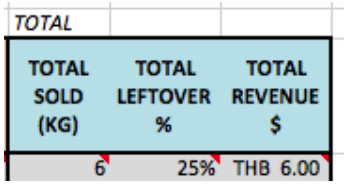
i. **# Leftover parchment:** amount (in kilograms) of leftover parchment coffee after end of selling season

ii. **# Leftover roasted:** amount (in kilograms) of leftover roasted coffee after end of selling season

iii. **% Leftover parchment:** percentage of parchment coffee that is leftover at the end of selling season (= # leftover parchment / # parchment coffee)

iv. **% Leftover roasted:** percentage of roasted coffee that is leftover at the end of selling season (= # leftover roasted / #roasted coffee)

g. Total: fields in this section are a summary of totals



iv. **Revenue:** total revenue received from all buyers (= sum of revenues received from each buyer)

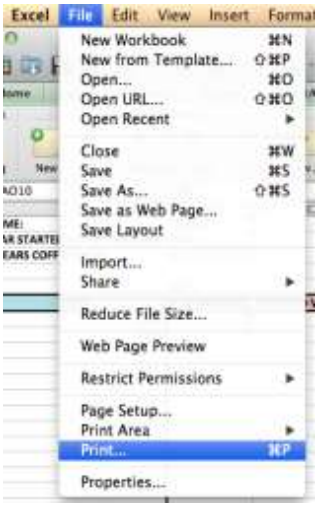
v. **Sold:** total amount of kilograms of coffee sold in the round (= sum of # sold to each buyer)

vi. **Leftover:** total amount of kilograms leftover in the round (= # leftover parchment + # leftover roasted)

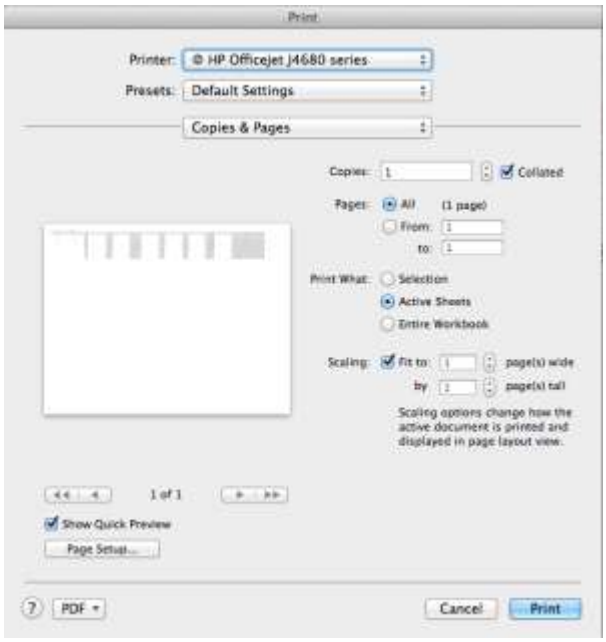
Printing

To print a blank spreadsheet the user must follow these steps:

1. Select a tab that contains a blank template of the spreadsheet
2. File -> Print



3. Select the number of copies, check “Active Sheets”, and “Fit to 1 page wide by 1 page tall”



4. Click “Print”

This will print a blank spreadsheet to be filled out by hand in one page. If the fields are two small, the user may select “Fit to 2 pages wide by 1 page tall” to split the spreadsheet into 2 pages.

Appendix N: Formula Sheet for Databases Output Fields

Farmers' Database

How to Calculate Output Fields (Grey Fields):

- **# Years Coffee Farm = current year – # years coffee farm**
- **Total # of Workers = # of workers for seeding + # of workers for clearing**
- **Total # of Paid Workers = # of paid workers for seeding + # of paid workers for clearing**
- **Total Cost for Labor = total # of paid workers * salary/day/worker * # of days worked/paid worker**
- **Total Cost for Fertilizer = # fertilizer (bags) for nursery * fertilizer price/bag for nursery + # fertilizer (bags) for adults * fertilizer price/bag for adults + # fertilizer (bags) for "10+" yrs * fertilizer price/bag for "10+" yrs**
- **Average Cherries/Tree (kg) = # cherries harvested (kg)/# of trees**
- **Total Revenue = # Parchment to Khun Wut * Price paid by Khun Wut**
- **Total Cost = total cost for labor + total cost for fertilizer Profit = total revenue – total cost**
- **Total Profit = total revenue – total cost**

Symbols:

+ ADD

- SUBSTRACT

** MULTIPLY*

/ DIVIDE

Khun Wut's Database

How to Calculate Output Fields (Grey Fields):

- **Total # of Parchment Bought = sum of # parchment bought from each farmer**
- **% Parchment = (# parchment bought (kg) - # roasted coffee (kg))/ (# parchment bought (kg))**
- **% Roasted = # roasted coffee (kg)/ # parchment bought (kg)**
- **Revenue Buyer 1 = # sold to buyer 1 (kg) * price buyer 1 (BHT/kg)**
- **Revenue Buyer 2 = # sold to buyer 2 (kg) * price buyer 2 (BHT/kg)**
- **Revenue Buyer 3 = # sold to buyer 3 (kg) * price buyer 3 (BHT/kg)**
- **# Leftover parchment = # PARCHMENT COFFEE (kg) – (# PARCHMENT sold to buyer 1 + # PARCHMENT sold to buyer 2 + # PARCHMENT sold to buyer 3)**
- **# Leftover roasted = # ROASTED COFFEE (kg) – (# ROASTED sold to buyer 1 + # ROASTED sold to buyer 2 + # ROASTED sold to buyer 3)**
- **% Leftover parchment = # leftover parchment (kg)/ # parchment coffee (kg)**
- **% Leftover roasted = # leftover roasted (kg)/ # roasted coffee (kg)**
- **Total Sold (kg) = # Sold Buyer 1 (kg) + # Sold Buyer 2 (kg) + # Sold Buyer 3 (kg)**
- **Total Leftover (kg) = # leftover parchment (kg) + # leftover roasted (kg)**
- **Total Revenue = Revenue Buyer 1 + Revenue Buyer 2 + Revenue Buyer 3**

Symbols:

+ ADD

- SUBSTRACT

** MULTIPLY*

/ DIVIDE

Appendix O: Booklet

The Coffee Manual

A guide to sustainable coffee farming in Northern Thailand

Interactive Qualifying Project (WPI)

&

Interactive Science and Social Project (Chulalongkorn)

TABLE OF CONTENTS

I Chapter I: What Is This?

This booklet is a guide to promote sustainable coffee production, processing, and marketing in Northern Thailand, where hill tribes grow Arabica coffee. The booklet is not a tool to educate farmers on appropriate methods and practices, but rather a tool to facilitate such.

Providing knowledge and resources to rural farmers so they can successfully produce and sell coffee independently coincides with the mission of the **Raks Thai Foundation**, the sponsor. One of this organization's goals is to work with underprivileged communities to help with challenges they face. This includes developing skills to help achieve a sustainable living and source of income.

The booklet is a result of a social project by students from the **Chulalongkorn University** (Thailand) and from the **Worcester Polytechnic Institute** (USA).

Chapter II: Coffee in Thailand

Coffee is one of the most popular beverages; consumed by millions of people on a daily basis. It is one of the most important commodities worldwide and ranks second, only after crude oil, among all commodities today. About 60 tropical and subtropical countries produce coffee extensively. For some of the countries, it is the main agricultural export product (Esquivel and Jimenez, 2012).

In Thailand, the Royal Project introduced coffee as an alternative crop to opium in 1972. After extensive research conducted by the Royal Hill Tribe Assistance Project, it was decided that Northern Thailand's colder weather and higher altitude was ideal for growing Arabica coffee (Angkasith, 2001). Since then, it has dramatically contributed to the income of many communities in the North of Thailand.

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Chapter III: Coffee Production

Planting

The first step in the coffee production is planting. There are three (3) methods of planting coffee:

1. Direct Sowing (introducing the seeds directly to the soil)
2. Sowing in a seed-bed and transplanting to the soil
3. **Sowing in a seed-bed, transplanting into a nursery and then introducing the young plant to the soil. (Recommended)**

- Seeds should be planted with the crease facing down, and covered with a thin layer of soil.
- Only seeds from coffee plants free of any disease should be used.

TIP: Only plant seedlings with straight tap-roots.

- When transplanting young plants to the soil, they should not be planted deeper than the depth at which they have been growing in the nursery.
- Coffee plants should be planted after 6-12 months in the nursery (preferably in the beginning of the raining season).
- To protect young plants' roots when transplanting, their roots should be dipped in mud.
- Planting fruit plants (plums, bananas, etc.) around coffee trees provides shade, and protects the coffee trees and the beans from being blown away by regular winds. **(Recommended)**

TIP: It is better to grow coffee in tree shade, because coffee grown directly in the sun requires more pesticides and fertilizers.

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Mulching

Mulching is the process of protecting the soil underneath a plant with vegetative material.

- The best materials are **dried grass and dried banana leaves**.
- Mulching should be done during the beginning of the raining season.

TIP: Adding dry leaves and grass (mulching) underneath coffee trees preserves moisture in the soil during the hot and dry months. Additionally, weeds do not grow as much when covered by mulching.

Weeding

Weeding is the process of removing small plants and grass (weeds) that may grow around the coffee tree and compete for its resources.

- **Weeding should be done throughout the year.**

Watering

- Watering is mainly done to young plants after the raining season.
- **Each plant should be fed 5-10 liters of water per week during the dry season.**
- As each coffee plant gets older less watering is required.
- In more **wet and humid areas less watering is required, as the soils tends to be moist.**

TIP: For the coffee trees planted on the side of mountains, trenches should be dug to allow the collection of water. 124

Pruning

Pruning is the practice to cut or remove branches from a tree.

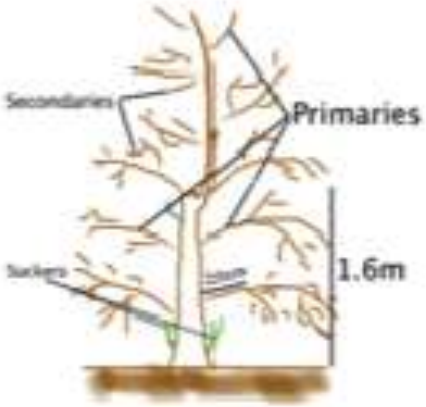
- Maintain a **single stem system for the first year plants,** to avoid competition from suckers.
- In the third year when trees are capable of producing good cherries, **cut the main stem to a height of around 1.6m-1.8m from the ground. (Recommended)**

TIP: The height of 1.6m-1.8m allows the tree to yield the most berries, and allows farmers to pick up cherries more easily.

- **Remove secondary branches within approximately 20cm of the main stem. (Recommended)**

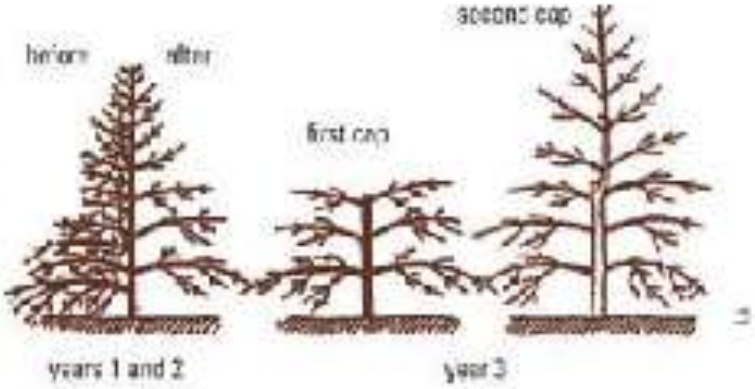
TIP: By removing secondary branches around 20cm from the main stem, allows farmers to pick cherries easier, and prevents some pests to spread to nearby branches.

- When one branch is no longer producing as much as the other branches, it should be removed (after harvesting) and let one new primary take place.
- **Pruning should be done after the harvesting period, and the pruning should be done with a saw (to leave a clean cut).**
- De-suckering should be carried out several times through the year.



- All cherries produced by trees either in their first or second year should be completely removed.

TIP: Cut branches so that the tree is shaped like a small bush, so that cherries can be easily collected.



Composting

- Pit Composting is advisable because it is effective, cheap, and easy to set up.
- **Three (3) pits should be dug out for a 45 days decomposing cycle.**
- The compost material should be passed from pit to pit every 15 days. (From the third pit it is ready to be used on the fields).
- The Compost after 45 days should look dark brownish like the soil.
- The layering should be the following:
    - **Wood materials and other heavier and hard to decompose materials should be placed in the bottom.**
    - **Easier to decompose materials (like fruit and vegetable peals, plant leaves, animal manure, and coffee shells) should be placed on the top.**

This picture shows the first step of the decomposing cycle, after 15-days it will be moved to the next pit.

- Water should be added during layering, to increase the moisture level, and the **pits should be covered with soil**.
- **The compost should be applied underneath coffee trees in beginning, middle, and again in the end of the raining season.**
- The following portions should be used (if not using fertilizer):
    - Year 2: 0.7 kg/tree
    - Year 3: 1.0 kg/tree
    - Year 4: 2.0 kg/tree
    - Year 5+: 2.5 kg/tree

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TIP: Compost should be used more regularly than fertilizers, and farmers

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Fertilizer

- In addition to compost, which is an organic fertilizer, farmers may add inorganic fertilizers to improve productions.
- **Inorganic fertilizers should only be used after manure and compost.**
- Generally fertilizers are **applied 3 times a year (during the beginning of the raining season, in the 7th month, and again in the end of the raining season).**
- Coffee trees need good nutrition especially during the berry season expansion stage (usually 2 to 3 months after flowering).
- **The portions for coffee plants (if no compost used) should be the following:**
    - Year 1: 100 g/tree (50% NPK 15-15-15 and 50% NPK 46-0-0)
    - Year 2: 200g/tree (50% NPK 15-15-15 and 50% NPK 46-0-0)
    - Year 3: 300g/tree (50% NPK 13-13-21 and 50% NPK 46-0-0)
    - Year 4+: increase the dosage every year by 100g/tree (50% NPK 13-13-21 and 50% NPK 46-0-0)

TIP: For the Northern Areas of Thailand Famers should buy the following: NPK 46-0-0 (urea), NPK 0-0-60 (potassium chloride), NPK 18-46-0 (di-ammonium phosphate), *and* NPK 13-13-21.

Recipe for NPK 15-15-15 (used for production of fruit plants):		
42% NPK 18-46-0	26% NPK 46-0-0	32% NPK 0-0-60
Recipe for NPK 13-13-21 (used for agricultural plants):		
36% NPK 18-46-0	21% NPK 46-0-0	43% NPK 0-0-60

*Percentages are based on weight measurements.

All the mentioned fertilizers dosages are recommended by the Agriculture Research Center of Chiang Rai; therefore they are appropriate for the cold and humid areas of the North.

- **If compost is being used at the same time as fertilizers, the quantities as well as the frequencies mentioned above should be reduced, depending on each farmer. (Recommendation: try on a sample of plants first to determine appropriate dosages).**

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TIP: Do not store fertilizers in the same area as coffee beans.

Chapter IV: Coffee Processing

Harvesting

Harvesting is the process of collecting ripe cherries.

- The quality of the coffee can be seriously be affected by how the cherries are picked and dried.
- Farmers should **only pick the mature red cherries,** and should leave the greens ones to ripen in the tree.
- **Cherries should not touch the ground at any circumstance. Similarly, cherries on the ground should not be picked up.**
- It is ideal for farmers to use a tarp (or any other material that would avoid contact between the cherries and the ground) under the tree while harvesting, so that the cherries do not touch the ground.

TIP: Sort the cherries according to sizes, prior to the next step (Pulping).

Pulping

Pulping is the step where the skin of the coffee cherry is physically removed.

- This can be done either by hand or by the use of Pulping machines.
- The process requires clean and cold water; therefore farmers may **use thermal gloves or rubber gloves** to remove the cherries' skins in the water.

TIP: It is advisable to use the pulping machine (if available), because it is cost efficient, and a perfectly good way to ensure constant quality.

Pulping Machine

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Fermenting

Fermentation is the process in which the mucilage is fermented for easy removal through washing.

- Clean water should be added and **left with the beans for 1-2 days to allow fermentation**.
- Fermenting tanks should always be clean prior to fermentation use.

Washing

Washing is the processing of removing the fermented mucilage.

- If using the hand process, the beans should be washed 2-4 times with clean water to remove any traces of mucilage.

TIP: A demucilager machine is preferred (if available) because it is cost efficient, and it is a good way to ensure constant quality. The unit uses around 0.5L of water per Kg of parchment, and prevents over-fermentation.

Demucilager Machine

Hand Process

Drying

- After washing, the beans should be **dried until they acquire a moisture level of 12%.**

TIP: Parchment coffee dries in 9-10 days. Biting the dry parchment is a form of checking the 12% moisture level and the teeth texture should barely mark. If the parchment breaks then it over-dried (7-10%).

- The **drying should be done with full sun, and should not be done on the ground directly** (use a tarp, or similar tool).
- Make sure the beans are thoroughly spread out, and move them around a couple of times.

Hulling (Optional):

Hulling is the process of removing the parchment.

- This process is very hard to do by hand; therefore a hulling machine should be used.
- **This step should only be performed in the event of a buyer's request.**

TIP: Hulling should always be done days before transportation, so that the green beans are stored in jute sacks and for no longer than a week.

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Chapter V: Quality Maintenance

A guide to assure the highest quality is met during the coffee production and processing.

Process step	Factors reducing quality	Potential problem
Harvesting	Harvest green cherry	*Green or grassy flavor*
	Harvest over-ripe cherry	*Fermented or fruity flavor*
	Pick fallen old cherry from the ground	*Fermented or fruity flavors. Mold contamination producing moldy or musty flavors*
	Hold fresh cherry for long periods before pulping	*Fermented or fruity flavors*
Pulping	Poor quality pulping equipment or poorly adjusted equipment	*Nipped beans causing stinker beans*
Fermentation	Over-fermentation	*Fermented, fruity, sour or onion flavor*
	Poor hygiene in fermentation tanks leaving a small number of extremely over fermented beans	*Stinker beans producing foul rotted or sour flavors*
Washing	Poor washing leaving mucilage on parchment	*Mold growth producing moldy or musty flavors*
	Contaminated by drying on the ground or dirty drying surfaces	*Earthy flavors. Mold contamination producing moldy or musty flavors*
	Stored partially dry for long periods or rewet during drying	*Mold growth producing moldy or musty flavors*
	Machine drying too fast, too hot, or uneven	*Poor, mottled or faded color, dull or bland flavor*
	Coffee is over-dried	*Poor, faded bean color. Damages easily during hulling*

Process step	Factors reducing quality	Potential problem
storing dried parchment	Stored dried parchment too wet	*Mold growth producing moldy or musty flavors*
	Stored near fuels or chemicals	*Contaminated with foul odors*
Hulling	Incorrect huller setting	*Bean damage*
	Coffee too dry	*Bean damage*
storing green beans	Storing too wet	*Mold growth producing moldy or musty flavors*
	Stored near fuels or chemicals	*Contaminate with foul odors*
	Stored in jute bags made on machinery lubricated by petroleum oils	*Contaminated with baggy or oily taints*
	Stored in hot humid condition for long periods	*Mold growth producing moldy or musty flavors. Surface oxidation of beans causing woody flavors. Faded bean color*
Transport	Rewetting of coffee due to leaky tarpaulins or containers	*Mold growth producing moldy or musty flavors*
	Stored near fuels or, chemicals	*Contaminated with foul odors during storage*

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Chapter VI: Selling Strategies

Seller

A seller is important in two aspects: their knowledge of the product and their charisma.

Knowledge

- In order for them to be successful they must be well-versed in their product in preparation for any questions that will be asked by potential buyers. Especially for coffee, knowing stats of the coffee form they are selling will also give confidence to the buyers to rely on the sellers in return

- Having a forecast of what has been produced and what is the expected outcome for future production will also give the buyers a better idea of your product and production.

Charisma

- Choose someone who has a natural ability to talk to people.

- They should be able to create a relaxed professional atmosphere while presenting the product to the buyer. They should be well-versed and well informed of the information as they will be leading the presentation.

How to Find Buyers (Customers)

- Word-of-mouth about buyers is a great way to find reliable buyers that have been doing business with other sellers.

- Constant communication with other sellers is also a great way to know about other buyers and current trends

- Network with people in the same business. This will allow you to be133 on equal footing with everyone.

- The internet is a treasure box of potential buyers looking for sellers. Researching there will also give you many options while keeping up to date on the current trend of the market as well.

- To get an audience with the buyers, we as sellers must be the first to approach them and go to them to introduce them to our product.

- Establishing a point person within the buyer's company will allow you to communicate with the company better and set up a first meeting.

- Finding buyers is all about the first meeting. If a good impression is made you'll be a likely candidate for future business together.

Presentation of Product

- Focus on the advantages, benefits and the originality of your product in comparison to others in the market.

- Keep it straightforward and simple by showing why they need your product in the first place.

- Concentrate on the background of your product. Emphasize it.

- Highlighting your product's physical form (i.e. size, quality) by showing them examples from your best coffee sample collected will allow them to appreciate your product better.

- Persuasion is the key - therefore BE persuasive throughout the presentation. Choose someone who has a way to speak with people for the presentation.

- Concentrate on the processing of the product. Explain how processes have been optimized to produce the best quality.

- Emphasize the strengths of your product, whether it has been organically planted, the logistics, cheap prices or reliability. 134

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- Background research should be done about the buyer prior to the presentation in order to be prepared for any questions coming from them.
- Have a sample of your best coffee to present to them, so they can appreciate it with their hands.

The Relationship between Buyer and Seller

- The relationship between the buyer and seller will depend on how the first contact is as it is the most fragile point to establish a reliable and trusting connection.

- Confirm how much your prospective buyer wants or needs your product. Gauge your audience's feelings. Observe their reactions, listen to them carefully, and ask them clear questions about what they actually need.

- Reconsider the nature of your product (i.e. how it appears to the buyers, what you are trying to emphasize). Put yourself in the position of the buyer and see if the presentation appeals to you.

- Consider how your presentation may have made promises to the buyers- in what ways will you have to continue marketing your product for customer satisfaction?

- Know your customers. Do background research on them. This will allow you to gauge how to approach them, know what to do and not to do.

Chapter VII: Maintenance of Old Trees

When a tree is old and is no longer producing after 2 years, it should go through a rejuvenation cycle, which involves the growth of a new main stem. There are two ways of doing such:

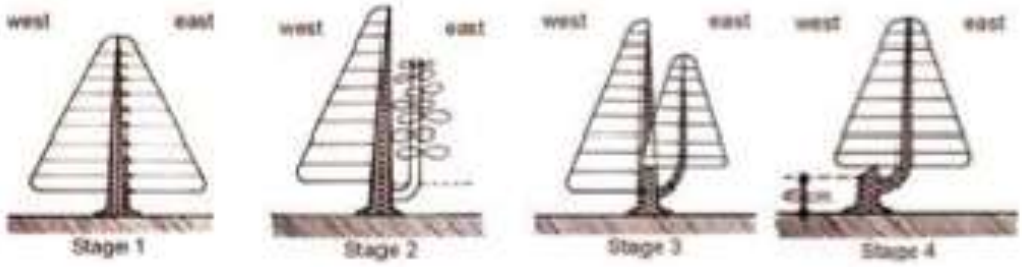
(1) Cut half of the primaries and once a new sucker grows remove the original stem.

a. Cut the primary branches of the east side of the tree.

b. Allow one sucker to develop into a stem in the east side.

c. After 2 years the main stem should be cut 40-50cm above the ground, at an angle of 45º with a saw (producing a clean cut).

d. The following year the tree should produce coffee.



(2) Cut the main stem and then allow a sucker to become the new main stem.

a. Cut the main stem 40-50cm above the ground, at an angle of 45 º with a saw (producing a clean cut).

b. Allow one sucker to develop into a stem, and on the third year the tree should produce coffee.

TIP: The (1) method should be adopted if the tree is old and is producing very little coffee. The (2) method should be used if the tree is no longer producing any beans.

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Chapter VIII: Pesticide Control

Berry Borer:

Coffee Borer is a pest that can seriously damage coffee yields (as much as 50%). The coffee borer is a small beetle that feeds of the green beans; it can easily reproduce, and can last for a long time. It is a very prevalent pest among Arabica productions, therefore it is important to know how to deal with the pest. Very often it comes as the result of not harvesting all the cherries on the tree or even disposing of the beans on the ground.

The pictures above are evidence of the presence of berry borers. When this pest affects coffee beans, the beans fall prematurely, the leaves turn yellow, and small holes can be observed on the tip of the beans.

Solutions:

1. **Old berries on the tree and in the ground should completely be removed before the flowering stage, to prevent the new crop from being affected.**
2. Drying the parchment to 12% moisture keeps the pest from surviving in the beans.
3. Use Beauveria Bassiana (Follow instructions of the product).
4. Use ChiangMai University's CMU-C1, which is similar to Pheromone chemicals (Follow the instruction of the product).
5. Prepare a solution of 50% ethyl alcohol and 50% methyl alcohol, place it in an open container and place near affected trees (not directly bellow the trees).

Coffee Berry Disease:

The coffee berry disease (CBD) is caused by a fungus that if not controlled can damage yield as much as 75%. Affected beans quickly turn brown and black in affected areas, and eventually the entire bean becomes covered.

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The disease is very hard to treat with traditional methods pesticide stores might be the best approach.

Solutions:

1. **Use organic eradicants/protectants (such as Cholorothalonil)**
2. Use copper based fungicides (such as Dithianon , Anilazine, Cobox, and Funguran; and follow instructions on the product).

Sooty Mold:

Sooty mold is a pest that develops when the coffee plant is infested with scale or mealybugs. Mealybugs and scales excrete sweet material, which attracts ants and causes them to spread the pest around the tree. The Mealybugs and scales feed on moisture from newly grown branches, suckers, and baby cherries.

Solutions:

1. **Cover infected area with soap solution.**
2. Use mulch, manure, compost and fertilizers to maximize the plant's growth and resistance.
3. Badly affected (completely covered with sooty mold) branches should be cut-off and destroyed
4. Use petroleum spray oil (white oil) for the mealybugs, and any ant-pesticide for the ants.

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Stem Borers (Pesticide Control):

Stem borers are very common on Arabica trees, and they eat the inside of the stems and branches, causing the tree to weaken (the leaves of the tree become yellow and fall). There are two predominant species of stem borers (and they can be observed bellow).

White stem borer adult (left) larva (right)

Red stem borer larva (left) adult (right)

Stem borers infections can be identified by holes in the stem of the tree of about 1cm in diameter, by the yellowing of the coffee leaves, and by branches that break very easily. Well-maintained coffee trees hold a lower chance of getting attacked by stem borers. The adult borers lay their eggs in the crack of the coffee tree bark near the base of the stem, and when the eggs hatch into worms, they begin to decay the tree.

Solutions:

1. Growing trees under shade reduces the frequency of stem borers.
2. Burn affected trees before the raining season begins.
3. Apply a solution of water with lime (10%) to the stem of the tree with a brush.
4. Use a knife or scissors to rip out the worms and kill them.
5. Use backlight (Ultraviolet) to attract and kill the adult borers.
6. Smooth the bark of the tree for about 0.5m up from the ground level. Use a rough cloth, dried maize cob, or even a knife, but make sure not to hurt the tree itself.
7. Apply any diluted Fipronil (according to the instructions: usually 1L per 20L

Evidence of the presence of stem borers

White Mealybug:

The white mealybug is a mealybug that feeds off young branches, shoots, and suckers. They are generally a bigger problem in the dry season when rains are infrequent. It can be identified by white waxy colonies on the underside of tender leaves and in soft stem areas around berries.

Since a mealybug also provokes this problem, solutions should be similar to that of sooty mold.

Solutions:

1. Cover infected area with soap solution.
2. Use mulch, manure, compost and fertilizers to maximize the plant's growth and resistance.
3. Badly affected (completely covered with sooty mold) branches should be cut-off and destroyed.
4. **Use petroleum spray oil (white oil) for the mealybugs.**

IMPORTANT NOTICE:

- If any chemicals are used to fight pesticides and diseases, the containers should be kept in a safe place, away from children and away from processed beans.
- Chemical alternatives should only be implemented once organic solutions have been tried and have failed.
- Before using any chemical, read the instructions on the container and use the required protective gear.
- Recently disinfected plants and trees should be kept restricted (especially for children).

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Chapter IX: Resources

General Information

- Research and Development of Highland Agricultural in Chiang Rai (Doi Wawee/Doi Chaang)

  Email: wawee.doa@doa.in.th

  Tel: 0-5360-5941, 0-5360-5955

- Chao Thai Pu Kao Highland Agricultural Project (Hillkoff)

  Email: info@hillkoff.com, hillkoff@windowslive.com

  Website: www.coffeethai.org

  Tel: 0-5321-3078 ext. 7, 0-5321-3030

- Highland Coffee Research and Development Center (Chiang Mai University)

  Tel: 053-944-052

Buyers

- Doi Chaang

  Website: www.doichaangcoffee.net

  Tel: 087-031-1919

- Duang Dee Hill Tribe Coffee

  14/23-24 Soi Insuan, Maneenoprat Road, A. Muang, Chiang Mai, 50000

  Email: duangdee@iname.com

  Tel and Fax: 0-5321-9361

Fertilizer Companies

- Pui Orient Co., Ltd.

  191 Moo 1, Mae-Phing, A. Prao, Chiang Mai, 50210

Chapter X: References and Sources for Further Reading

The following list includes sources where information and images were obtained for the creation of this booklet (manual), which are useful references for further information.

- Winston, E., Laak, Op de Laak, J., Marsh, T., Lempke, H., Chapman, K., Aung, O. and Nyunt, T. (2005). Arabica coffee manual for Myanmar. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.

- Winston, E., Laak, Op de Laak, J., Marsh, T., Lempke, H. and Chapman, K. (2005). Arabica coffee manual for Lao-DPR. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.

- Rutherford, M. A., & Phiri, N. (2006). Pestsand Diseases of Coffee in Eastern Africa: A Technical and Advisory Manual. CAB International.

- Manual for Sustainable Coffee Production. (2005). Ibero. DeFoundation, Uganda.

- McCormack, Mark H. (1984). What They Don't Teach You at Harvard Business School. Bantam Books, Toronto and New York.

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Glossary

Corporations (Co-ops): a business that is owned and administered by a group of farmers rather than individual farmers.

De-suckering: the act of removing suckers from the coffee tree. *See suckers.*

Eradicants: tools (ex: chemicals) that destroy something completely.

Fungicides: chemicals that kill fungi.

Insecticide: a substance used to kill insects.

Manure: fertilizer made from animal fecal matter.

NPK: reference use for fertilizers, which signifies Nitrogen-Phosphorus-Potassium concentrations.

Nursery: a place where plants grow for the first months; involves a protected site where farmers can upkeep the plants thoroughly.

Parchment: the hard coating around the green beans.

Pesticides: a chemical substance used to kill pests, especially insects.

Primary (branches): are the branches that grow out of the main stem of the coffee tree.

Secondary (branches): are the branches that grow out of the primary branches. *See primary (branches).*

Seed-bed: a wooden box with soil constructed to grow coffee seedlings. *See seedlings.*

Seedlings: a young developing plant that has been grown from a seed.

Soot: black powdery substance that covers leaves when they are infected with mold.

Sowing: the action of planting seeds in the soil to grow crops.

Stem: is the main stalk (body) of a plant, which primary branches grow on.

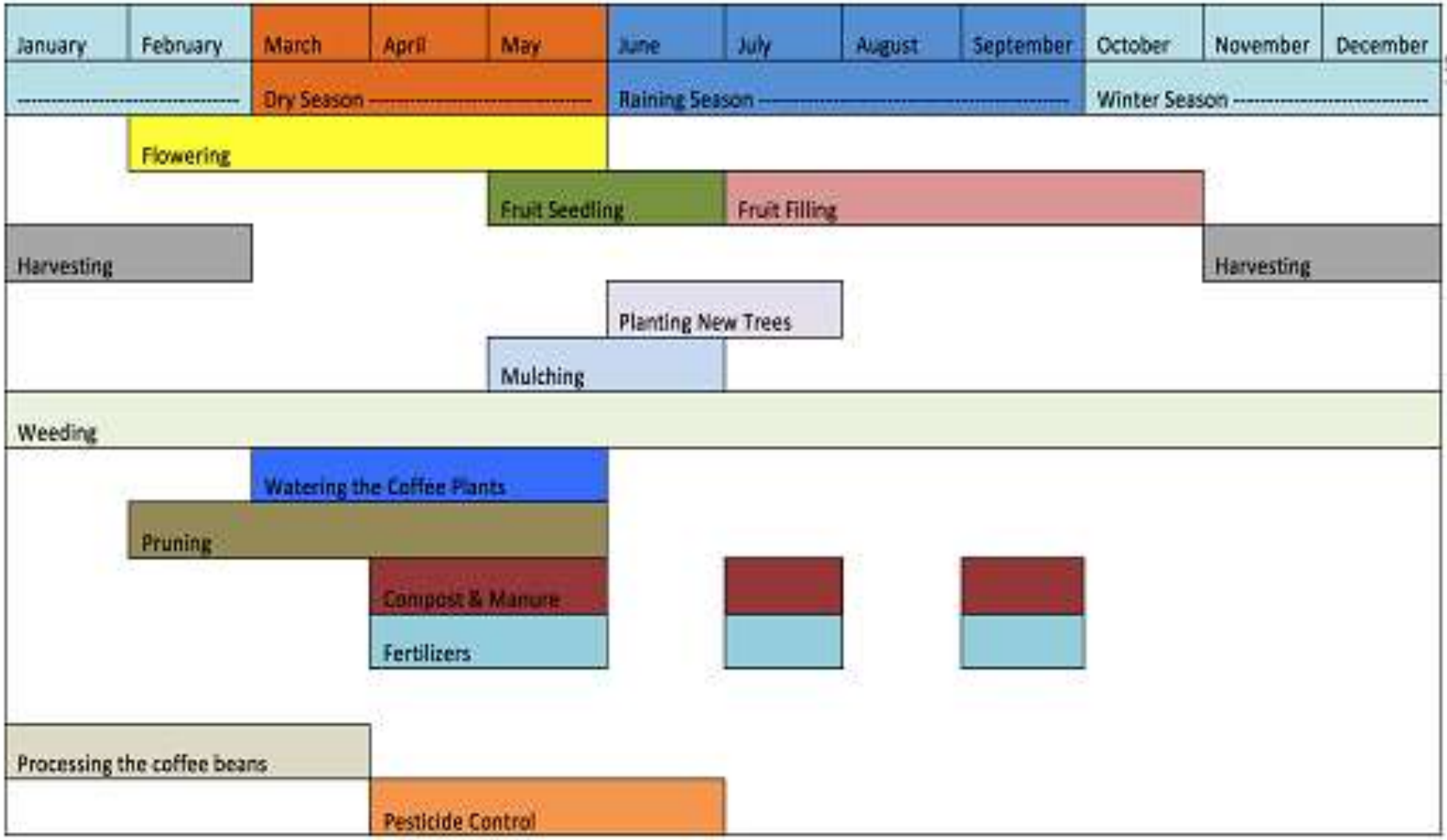
Sucker: a shoot (baby stem), which often grows at the bottom of the main stem.

Sustainable: able to sustain itself for a long period of time.

Tap-roots: the main root of a coffee tree that extends downwards.

Tarp: *same as Tarpaulins*.

Tarpaulins: a waterproof material that is used to protect things from moisture.



The calendar highlights conditions for the North of Thailand, and suggests steps of production.

Acknowledgments

The authors would like to thank all those who contributed to the creation of this booklet. Our many thanks are extended to the Raks Thai Foundation for giving us such a unique opportunity to create a tool that can initiate change. Additionally, all the help provided by the people in the village of Aayae, as well as the support provided by Khun Direk, Khun Songwut, Khun Tee, Khun Tik, Khun Nut, and our project advisors (Orawan Chailapakul, Seth Tuler and Stanley Selkow) cannot be left unmentioned; therefore Thank You for everything.

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IQP-SSP6 (2013) The Coffee Manual: A Guide to Sustainable Coffee Farming in Northern Thailand.

Authors:

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Contact:

bkk13-coffee@wpi.edu

https://sites.google.com/site/bkk13coffee

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NOTES:

Appendix P: Additional Pre-Project Interview Notes

Ms. Veriya (HCD)- January 11, 2013

Background

- Use ido.org:
    - Download tool kit
    - Conducting interviews, etc.
- Middlemen in the community
    - Organized conference to implement new policy
        - How to make locals listen to project ideas
    - Need implementation partners
        - Instead of middlemen
        - Look at current local resources
        - What are the next steps?

Recommendations

        - How does community interact with one another? With buyers?
        - Change dynamic of the community/intermediaries
        - Introduce community to new technology (i.e. PowerPoint) if available.
    - For middlemen project
        - Who are the social leaders of the community? - Get a sense of their lives, etc.
    - Removing middlemen
        - Competitive alternative, not instead of
        - How to implement
    - Options and why they rely on this system
    - Link between time and money
- Pictures- collect demographics with interviews and other information
    - 2 people teams- one note taker and one interviewer
    - Large paper- key to interview different people
    - Economic troubles, social influences, key insights

    - Do all of this before developing a solution
    - Immerse yourselves along with the community into the project
- DI- Design Intelligent framework
- Translate, DO NOT interpret
- Ask questions to get root of the problem

Brandon Boyle (Root Capital)

Background

- 4 ½ years of fair trade
- Social lending, etc. before 10-15 years

Root Capital

- 12 years old
- Measure output by money dispersed
- Latin America focus
- Made it into deliverable project
    - If people had money, wouldn't they help?
    - Money supports fair trade certifications
    - Linking farmers to international market
    - Sell directly to buyer
- Africa
    - Cooperatives are not supported
    - Not formed easily, no government initiatives
    - Oldest cooperatives are corrupt
- See what cooperatives are available in Thailand
    - Indonesia-microfinances system
- Business relies on buyers
    - Steady supply of coffee is the main goal
    - Have invested money to RC
- Asia –too expensive, can only do so much
    - Lend money to agriculture
    - 60-70% coffee, 30% fruits, etc.
- 2 ½ % interest
- 10 ½ % charged to pay bills
- The 8% margin is still too small
    - Have fundraiser each year1-2million to cover bills of lending

Main goals

- Show others that this is possible and profitable

- Hope private sectors bring in more money
- Self sufficiency for company
- Cutting Asia helped them achieve this

Lending

- Trade credit
    - Producer needs money to pay bills
    - Pay you back when product sells
    - Cooperatives handle money better than farmers
    - Except for microfinance
    - Coffee and cacao are high risk
    - Cooperatives come to RC with contract from buyers
    - Fair trade certified
    - Cooperatives have no money when coffee is being picked, banks do not like this
    - Problem: farmers cannot wait for money
    - Middlemen come directly to farm say what they are offering- smart business
    - Cooperatives have slower turn around than middlemen, need money upfront
    - RC gives out loans to help solve this
    - Works with some farms even if its not fair tradeoff organic
    - More difficult especially new products
    - Cooperatives usually processes some part of product
    - “Cup-it” – way of taste testing coffee
    - If sample is okay, it ships to buyer
    - Pay 60% of the contract
    - Rest goes back to farmers, etc.
    - Some cooperatives lend farmers money before harvest
    - Farms need money for seeds, fertilizer, etc.
    - Some are ethical, transparent
    - Can be abused – price of coffee can be adjusted/swindled through this loan

    - It can happen at industry
- Africa
    - ¾ sales stream
    - Buyers tell RC to go to certain locations
    - Certifications; FLO certified agricultural companies
    - Trade shows – SCAA specialty coffee association of America
    - Send 1-2 cooperatives representatives to sell to buyers
    - Around 12 social lenders
    - Around 3 have 90% of the market
- Success
    - Impact first – measure outcomes not profit/loans
    - These are how many people impacted
    - Always have other crops/stores
    - Income diversified
    - Small profit for these farmers
    - Can count on income
    - Plan on it instead of being such a varied market
- School is optional, must be paid for
    - Kids go to school each day once they can count on income
- 5% needs to go to some social benefit the community
    - Fair trade deal
- Technical Assistance- advisory program
    - Used to show financial staff how to pay bill, etc. in order to apply for loan
- Accessing Credit
    - Financial training – organizations want and will pay for
    - Can be packaged in shorter time period
- Lots of models out there
    - Need people to want to form it
    - Show how cooperatives work, and provide recommendations
    - Can be brought together quickly
- Technical Assistance Advisors – run by non-profit

- Techno service – provide recommendations on agricultural practices.

Needs Assessment – 1st thing to do

- Level of commitment, organization, focusing on a goal
- If they want money, discuss options, models
- See what they want, can do
- Ethnic issues, gender issues
- Who's processing coffee?
- Work with them to see if they are FTC, etc.

Additional Information

- 3% loss rate for loans
- Coffee is the safest market 1 ½% loss rate
- Always on demand
- Fresh fruit needs cold chain
- Quality of coffee: do not give any agriculture recommendations on quality of coffee.
- Oiko Credit – Netherlands (supports microfinances)
- Responsibility
- Triodos
- Rabo Bank (Bank and Foundation)
- Talbert Foundation
- Shared Interest - England

Michael (Dean's Beans)

- Get a sense from the farmers
- Information comes from the community itself

Cooperatives

- Respect, they know more than we do
- What do they want? Form our goal to fix their goal
- Long term solution

Fair Trade

- Intermediaries
- Don't know what coffee prices are
- FT – know who you are buying from
    - Transparency throughout the chain
- Cooperatives
    - Farmers collectively sell and market coffee
    - Small farms cannot export on their own, not enough
    - Cooperatives can help
- Problems: farmers usually do not have any business skills and become owners
- FT coffee buyers usually only work with corporations

How do we find them?

1. Needs – organic, etc.
    a. Reach out to networks to find co-ops
    b. Successful co-ops get outside their area
2. Small new co-ops vs. large established?
    a. Getting Co-ops organized and strong is important
    b. Some are fragile
    c. Link them with networks in region to have a support system
    d. Large: innovations of social problems and solutions
    e. Both have large impacts, but are different

Difficult for small farmers to market for themselves

Organic assumes certification

To get certified

- Find organic certifier, certify to the US specifically
- People who are not using fertilizer, etc.
- Should look into it

Co-ops should apply for organic certifications

Profit is key, but not how all success is measured

Coffee is a commodity trade and on stock market in England

- Forex.com will give price of each type, per pound
- Many coffee "pegged to the C"
- Organic C-price is $0.25 more
- FT C-Price is additionally +$0.20
- Come up with totals

Co-op farmers are competitive

- Need to pay farmers right away
- Co-ops usually pay farmers C price and then at the end of the year they split up the rest

Fair Trade – gives a minimum price for the market

- At the moment, C price is above Fair Trade price

Culture

- Be respectful, hang back and be nice
- Communicate, be engaged

Corruption, Competition

- The idea of corruption will lead to unsuccessful programs
- Farmers need to trust each other.

Co-op strong leaders

- Farmers hire general manager who is a super leader
- Usually someone from the community
- Often times very little experience in their part
- Sometimes general managers think they have more power than everyone else, but in reality farmers are the bosses.

Appendix Q: Interviews for Video

Video: Interview with the Villagers of Aayae

1. **What do you think of the coffee manual presented to you today?**

We believe the coffee manual will go hand in hand with new marketing strategies. I believe the first step would be to improve the coffee production process. We really wanted a manual that would give us information and knowledge on how to improve our coffee production. However, we want to keep in mind the importance of being environmentally friendly as well. I would like the environmentally friendly aspect of our coffee to be a factor when we promote our product in the coffee market.

2. **What would you like to see more developed in your farms in the future?**

We would like to focus on the quality of the coffee because there is an ever increasing number of farmers that grow coffee, increasing competition in the market. Additionally, more consumers are choosing and demanding better quality coffee. We have to improve the quality of our own coffee in order to meet the demand of the consumers. If we do not attempt to meet this demand, coffee prices fall.

Currently, we have made an initial attempt to improve the quality of our coffee. We started using chemical fertilizers to rejuvenate coffee trees but in the future we must work towards organic farming. We want to reduce the impact on the environment.

3. **How have your coffee farming methods changed in comparison to when you first started?**

First, it decreased the amount of free time we all had. The majority of the villagers often had jobs concentrated at certain times of the day and had nothing to do at other times. Harvesting rice was considered a source of additional income but the amount of income from it was very much. When we started coffee farming our lifestyle became more stable as our income stabilized. From this, we hope that in future years we see some revenue from coffee sales. This

will hopefully create an enthusiastic atmosphere for the villagers to want to work more in agriculture.

Coffee is considered to be a type of fauna that can have a long life of up to 20-30 years and it is a crop that can be cultivated in the shade. Thus, we see coffee as a crop that we can rely on.

Another positive thing about coffee is that it builds relationships between generations. The free time we had before coffee farming can now be used to help each other harvest coffee. For instance: 'which farm are we supposed to go help out today?', 'which farm are we going to tomorrow?'; we have to help each other out. When we are cultivating in the coffee fields, conversations are a natural thing. This is what helps build and strengthen relationships between us all.

4. About education in the village:

Regarding the village's education, there are two different opinions:

Education outside the system is based on passing knowledge down from older generations and learning the village's way of life from other experienced people in the village. Another way to get educated is through the education system. In this system, children go to educational/learning centers because currently the village does not have a nursery, primary or secondary school to support its children. This causes the children to be separated from their parents at the age of 4-5 years old. The villagers agree that this is not a suitable situation for the kids because they are not old enough to take care of themselves yet. This impacts how they grow up since they end up less aware of the community's way of life, fluency in their native language, and society rules. Still they are forced to go live in a strange and alien society to them at such a young age. For those kids that are educated outside the system, the village chooses a person (it could be an elder even) from their own community to teach them their ways. For example, they are taught what to call their dad and mom, their native language, and ways to express their ideas to others within the community. Unfortunately, we had to stop teaching this way since there aren't any sponsors that are willing to help us support this method.

Video: Interview with Khun Tee (Raks Thai Foundation)

1. **In your opinion, what is the goal of this project?**

We would like a focus of this project to be on the environment. The objective is to focus on ways for villagers to be able to co-exist with nature, and preserve it. By doing this, the villagers' quality of life will hopefully keep improving. They will be able to maintain the environment, without destroying it. The Raks Thai mission is similar to this.

2. **How many villages is the Raks Thai working with right now?**

Every village in the northern region of Thailand has problems that are similar to each other, but not exactly the same. Regardless of how big Raks Thai is, it is not possible to solve every one of these problems in each community. We have decided to begin helping in the Chiang Mai region, which consists of Phrao, Mae Chaem and Aom Goi and others provinces. This totals up to 90 villages in the area. Our plan is to develop these villages through the use of a model, which can then be applied to other villages in the area and eventually all of Northern Thailand.

3. **Comments on Capacity Building and PAR**

The way Raks Thai works is through the emphasis of researching both with and for the villagers themselves. Their participation is important, as it will help us to understand and receive more effective feedback. In the end, when we are no longer in the community, they should be able to independently sustain themselves and their way of life. From past experience this is the best way to approach things. We have tried to use other "Top-Down" methods but no matter the number of people or organizations, when work is completed using this method, villagers are unable to sustain their own living. The work and effort that has been put in is unsuccessful once those helping the community leave.

Appendix R: Video

Supplemental Material: Video

The team created a short video about our project work. It serves several purposes.

1. Provide the Raks Thai Foundation with a way to explain and describe the work they have been completing in small-scale coffee farming communities across Northern Thailand.

2. Promote the efforts and approaches of the Raks Thai Foundation. The use of Participatory Action Research, capacity building, and empowerment are significant to the philosophy of this organization. Our video aims to show this and how their approach applies to working with rural communities.

3. Provide a visual explanation of the work we completed and our experience in the village. We hope our project serves as a "foundation" for future WPI-BSAC teams. This video aims to explain how we approached the project and what we hope to see in years to come.

   The video can be found on the team's project website.
   https://sites.google.com/site/bkk13coffee/