Chapter 1

Introduction

1.1 Research Background

1.1.1 Global Coffee Production and Consumption

Coffee is one of the most consumed beverages in the world and is the second largest traded commodity after petroleum. Coffee has been consumed for over 1,000 years and today it is the most consumed drink in the world (more than 400 billion cups yearly) (Sobésa Café 2008). Coffee has a variety of species, unique taste and refreshing effect. It is sought after by coffee lovers all over the world. In the past 150 years, the importance of coffee business has been increasing stably. Today, there are more than 1.5 billion people drinking coffee around the world. It means that coffee has a high economic value in the global coffee market. Moreover, coffee also is the most valuable and extensive agricultural product in the global trade market. It is a significant cash crop for both producing and consuming countries. According to the Food and Agriculture Organization (FAO) statistics, the production of green bean is around 4 million tons annually with sales of 6 to 12 billion dollars (González, 2000). In recent years, global coffee production and consumption have increased steadily. Figure 1.1 and Figure 1.2 show the situation of global coffee production and consumption over the five years from 2012 to 2017.

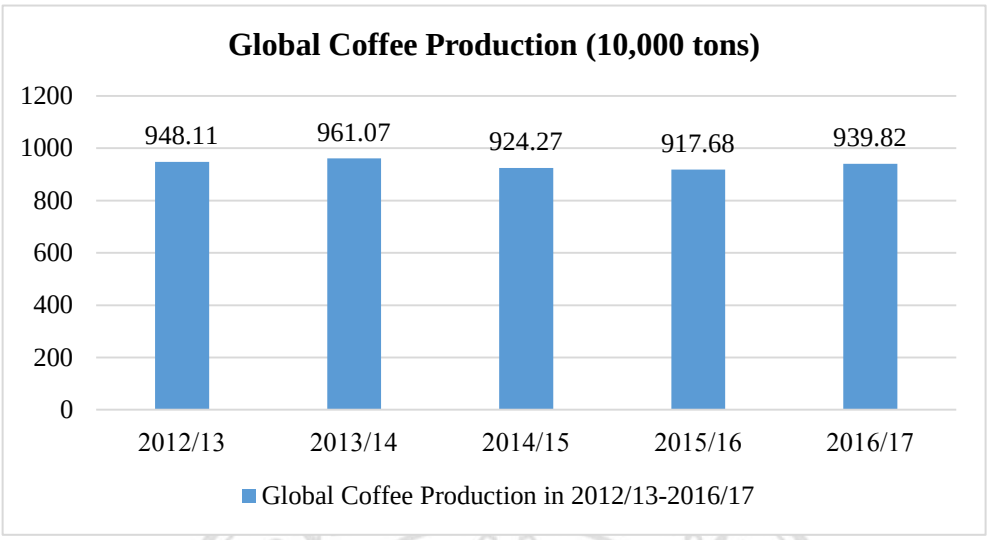

Figure 1.1 Global coffee production in 2012/13-2016/17

Source: China Business Industry Research Institute. (2017, June). Global Coffee Production, Consumption and Prospect in 2017. Retrieved from http://www.askci.com/news/chanye/20170608/09315799937.shtml

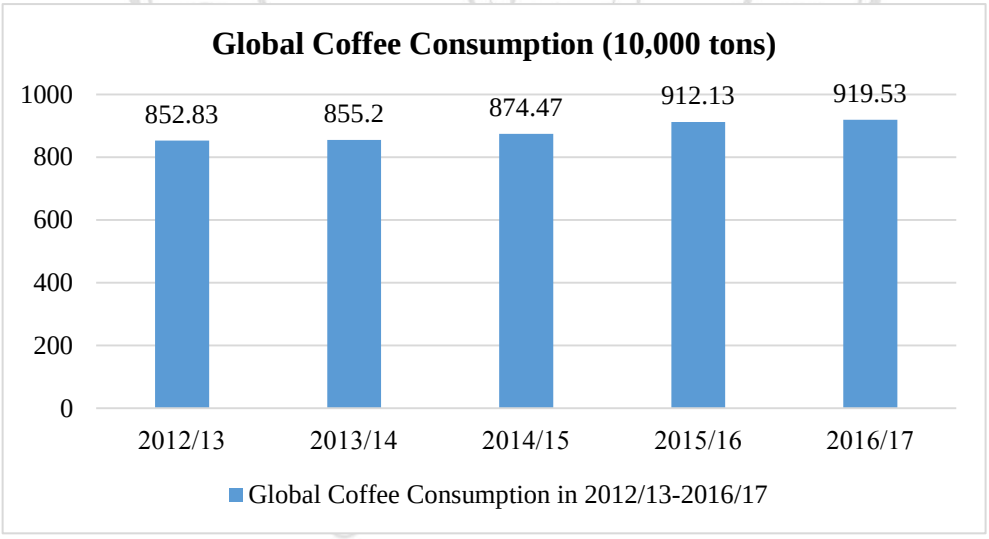

Figure 1.2 Global coffee consumption in 2012/13-2016/17

Source: China Business Industry Research Institute. (2017, June). Global Coffee Production, Consumption and Prospect in 2017. Retrieved from http://www.askci.com/news/chanye/20170608/09315799937.shtml

Based on the data of the past five years, global coffee production keeps a stable increasing trend. Meanwhile, global coffee consumption is also increasing year by year. This proof that coffee is a popular drink with high economic value and a huge market in the world.

1.1.2 Arabica and Robusta Coffee

Coffee is one of the most popular commodities in the world because it has a unique flavor. The difference flavor comes from two different species. There are Arabica and Robusta species. Arabica coffee grows at high altitude. Arabica coffee has low resistance to pests and diseases, but it has a strong flavor. Nowadays, Arabica coffee is mainly top class coffee. Based on these reasons, around three-quarters of coffee is Arabica in the world. Robusta coffee grows at low altitude. It has high resistance to pests and diseases. Moreover, Robusta has a high yield per tree. However, Robusta flavor is bitter and mild. It is mainly used to make instant coffee. Consequently, Arabica coffee has a better reputation than Robusta coffee. The global coffee production structure of Arabica and Robusta coffee in 2016 can be shown in Figure 1.3.

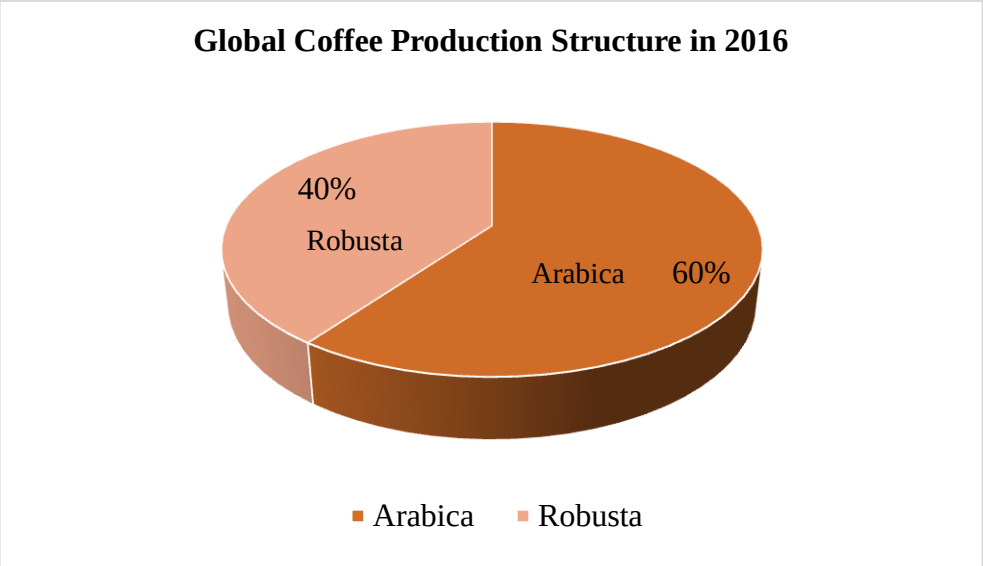

Figure 1.3 Global coffee production structure in 2016

Source: China Business Industry Research Institute. (2016, October). Analysis of Global Coffee Production, Consumption, Import and Export in 2016. Retrieved from http://www.askci.com/news/chanye/20161003/17194267051.shtml

Figure 1.3 shows that the global coffee production structure in 2016. Arabica coffee occupied 60% global coffee production in 2016. In contrast, Robusta coffee occupied 40% of global coffee production. Thus, Arabic coffee is more popular than Robusta coffee in the international market. It also proofs that Arabica coffee economic value is higher than Robusta coffee.

1.1.3 Arabica Coffee in Chiang Mai, Thailand

Coffee revenue is a major income for Thailand. Thailand is the third largest coffee producer in Southeast Asia - after Vietnam and Indonesia (Angkasith, 2001). Thailand coffee production mainly comes from both Northern and Southern Thailand. Southern of Thailand mostly produces Robusta coffee beans. In contrast, Arabica coffee is commonly produced in northern Thailand. Arabica coffee production was promoted by the Royal Project Foundation since the 1970s mainly to replace opium production (Angkasith, 2001).

Arabica coffee is mainly used for roasting in Thailand. Arabica coffee normally plants at 800 masl high attitudes. Wet processing can produce high-quality green coffee bean. Catimor has high rust resistant, it is also a recommended coffee species. Arabica coffee can help farmer increasing income and reduce the problem of traditional slash-and-burn shifting agriculture (Pongsiri K,2013). According to FAO statistics in 2013, Thailand coffee production was 50,000 tons with 51,000 hectares. Each hectare can produce 980 kilograms. Therefore, Thailand was placed at 18th of the world coffee production ranking.

It is widely knowledge that Arabica coffee is planted in the shaded area. Chiang Mai is located in northern Thailand, surrounded by mountains. There are many mountains in Chiang Mai. The geographical environment and climate are suitable for Arabica coffee cultivation. In 2015, Doi Chang received protected designation of origin (PDO) status from the European Union. Northern Thailand is the main area of Arabica coffee production, there are 40% of the total Arabica coffee plantation areas in Northern Thailand. Table 1.1 shows the Arabica coffee production in Northern Province of Thailand from the year 2011 to 2014.

Table1.1 Arabic coffee production in northern province of Thailand: 2011-2014

Province	Harvested Area(ha)	Yield(tons)			
	2010/11	2010/11	2011/12	2012/13	2013/14
Chiang Rai	2,323	2,400	2,950	3,980	3,864
Chiang Mai	1,896	1,967	2,340	3,050	3,202
Mae Hong Son	382	341	350	395	387
Nan	323	224	240	325	381
Lam Pang	206	182	211	280	291
Tak	198	89	100	130	207
Phrae	141	96	110	110	114
Total	5,469	5,339	6,300	8,270	8,451

Source: Uthai Noppakoonwong, Chatnapa Khomarwut.(2015, April). Research and Development of Arabica Coffee in Thailand. Retrieved from: https://www.researchgate.net/publication/280740360

According to the production of Arabic coffee in seven northern provinces of Thailand from 2013 to 2014, Chiang Rai and Chiang Mai are the highest coffee production and the biggest plant area in Northern Thailand, which larger than other 5 provinces. Especially the coffee production in Chiang Mai is increasing year by year. This shows that the market demand for Chiang Mai coffee is huge.

1.1.4 Traceability in the Coffee Supply Chain

Coffee supply chain refers to the processes from coffee cultivating to coffee selling to consumers. In general, the coffee supply chain consists of five processes: cultivating, harvesting, processing, roasting and consumption. In cultivating process, the coffee seed should plant in a humid climate. After seed sprouts, it takes around four to seven years to be mature and to produce the coffee bean. The second process is harvesting; the red coffee cherries are mainly picked by hands. This process needs a lot of labor force. The third step is processing; the wet method is used to process coffee. This product can be called parchment coffee. In addition, make coffee bean to be roasted coffee with the roasting process. The last step is consumption. Except for these processes, there are many activities involved in the coffee supply chain. Because the

coffee supply is a very complex process. In order to ensure that consumers who site at the downstream of the coffee supply chain can drink quality coffee. Coffee enterpriser have to effectively track and monitor the core processes and have to ensure the good quality of the coffee.

Traceability is the capability to trace coffee quality from upstream to downstream in the coffee supply chain. In some cases, it refers to the ability to verify the history, location, or application of an item by means of documented recorded identification. In the coffee supply chain, there is no sustainability without traceability. If a traceability system is to be established, it must be supported by traceability information. This traceability information must cover all stakeholders in the coffee supply chain. All Stakeholders must have responsibility for the quality of coffee in each process. According to traceability information, the customer can trace the information that they want to know. Therefore, traceability information can satisfy customers' demand, create product loyalty. Today, the customer new generation request more information about coffee products. This means that the coffee industry has to understand customer demand and provide customer wants.

1.2 Research Problem

Nowadays, coffee is not only a drink but it is also a kind of people lifestyle. Customer is concerned about the quality and more information about coffee. Additionally, good quality coffee comes from a reliable origin place. However, due to lack of traceability information, customer hardly acquires these coffee's information. It is known to all that coffee process is a very complex process. It involves cultivating, harvesting, processing, roasting and consumption. In the coffee supply chain, each process is interconnected, it shows that the upstream problems will affect the downstream products. In other words, the problems of processes will damage the value of coffee.

Obviously, there are many coffee industry challenges in Northern Thailand. Due to the lack of complete coffee traceability information in many sectors of the coffee industry, customers do not know the details of coffee products. In other words, it is hard to let the customer know how the quality of coffee is. In this situation, if the enterprise can provide the information that customer wants to know, the customer would have

satisfaction on the coffee product. Meanwhile, the enterprise will get product trust and loyalty. Moreover, developing traceability information can help enterprise proofing the quality of the coffee products. Additionally, it also can add more value to coffee products to make more economic profits.

In conclusion, there are three research problems in this research. Firstly, customer concerns about the quality of coffee, but they cannot get more information details about coffee product. Secondly, the coffee supply chain is a complex process, upstream problems would affect the downstream processes. Finally, many enterprises completely lack of coffee traceability information in the coffee industry.

Therefore, this research focuses on the design of a traceability data structure of the coffee supply chain. It can help to screen out core processes and traceability information in the coffee supply chain. In order to acquire that traceability information, the researcher begins with an overview of the scope of the coffee supply chain, comprised of relevant stakeholders, products, processes and activities to produce coffee bean. Next, analysis the relationship among the stakeholders, products, processes and activities in the coffee supply chain is also implemented. And then, using risk analysis to evaluate high-risk activities. After that, critical knowledge by using a knowledge map is presented. Finally, the data dictionary is designed as a traceability data structure.

1.3 Research Questions and Objectives

1.3.1 Research Questions

1) What are the core processes and related information in the coffee supply chain?

2) How to analyze traceability information in order to a traceability data structure in the coffee supply chain?

1.3.2 Research Objective

Developing a traceability data structure along the coffee supply chain by using risk analysis and Knowledge management content.

1.4 Research Scope

1.4.1 Scope of Areas

Coffee supply chain partners from Lanna Thai coffee hub project, Chiang Mai. Faculty of Agriculture, Chiang Mai University received the fund support from the

annual budget of 2017 (additional) for the enhancement capacity of quality Lanna coffee project in the upper Northern Thailand area 1 called "Lanna Thai Coffee Hub" to carry out activities with the upper Northern provinces area 1. Moreover, the project was launched to develop and improve the quality and safety of coffee in the area to meet the standard and market demand. (https://www.lannathaicoffeehub.com)

1.4.2 Scope of Population

To ensure the correctness of coffee stakeholders, products, processes, activities and critical knowledge involved in the research process, the researcher interviewed four experts. They are experts from different fields of the coffee industry and are all involved in the Lanna Thai coffee hub project. The four experts are:

1) Mr.Daecho Chaitub Managing director of social enterprises Chiang Mai Co., Ltd.

(นายเดโช ไชยทัพ กรรมการผู้จัดการวิสาหกิจเพื่อสังคม ประชารัฐรักสามัคคีเชียงใหม่ จำกัด)

2) Researcher who comes from Postharvest Technology Research Center, Faculty of agriculture, Chiang Mai University

(ดร.ณัฏฐวัฒณ์ หมื่นมาณี นักวิจัย ศูนย์วิจัยเทคโนโลยีหลังการเก็บเกี่ยว คณะเกษตรศาสตร์ มหาวิทยาลัยเชียงใหม่)

3) Coffee business owner of Dibosco Company

4) Naruemon Taksa-Udom, Managing director of Hillkoff

1.4.3 Scope of Content

Lanna Thai coffee hub project, Chiang Mai.

1.4.4 Research Time

The research started in August 2017, the research process includes collecting explicit knowledge and acquiring tacit knowledge through interviewing experts. The whole research would last 17 months. The specific schedule is shown in Table 1.2.

Table 1.2 Research plan

Step	Research plan	Aug-Oct 2017	Nov-Dec 2017	Jan.-Apr 2018	May-Jun 2018	Jul-Aug 2018	Sep 2018	Oct 2018	Nov-Dec 2018
1	Reading Journal Problem Identification								
2	Overview scope of coffee supply chain								
3	Data collection								
4	Data analysis								
5	Risk analysis								
6	Knowledge validation								
7	Design data dictionary								
8	Writing papers								

1.5 Definition of Terms

1) Coffee supply chain: Coffee supply chain describes the processes of coffee cultivating to consumption. In addition to the process, this research also includes stakeholders, products and activities from upstream to downstream.

2) Traceability: Traceability is the capability to trace coffee quality from upstream to downstream in coffee supply chain

3) Data structure: Arabica coffee data structure in Chiang Mai, Thailand.

1.6 Benefits and Significance of the Research

The goal of this research is to design a traceability data structure in the coffee supply chain. Along the development of the coffee industry changing in Chiang Mai, Thailand, the lifestyle of coffee consumption is also changing. The results of this research are significant to both coffee entrepreneurs and customers. For coffee entrepreneurs, it helps coffee entrepreneurs adding more value to coffee products, which

also can increase the economy of Thailand. For customer, the developing traceability information in the coffee supply chain, it is helpful to satisfy customers' demand that customers would like to know more information about coffee. Meanwhile, it also improves consumer satisfaction with good quality coffee. This research focuses on the way to acquire critical knowledge and traceability information. This critical knowledge and traceability information can be used to design a traceability database system of the coffee supply chain. It could be used into real coffee industry.