Chapter 2

Literature Review

2.1 Coffee Supply Chain

Coffee is one of the most loved drink in the world. It is also the second biggest product in the world after petroleum. For many people, coffee is an integral part of their daily life. There are more than 1.5 billion people drinking coffee around the world. Coffee is consumed throughout the year and the world coffee demand continues to show significant growth. In fact, the world consumes close to 2.25 billion cups of coffee every day. In the 12 months that ended in September 2016, individuals across the globe consumed more than 150 million 60-kilogram bags of coffee, according to The International Coffee Organization.

The coffee supply chain is consisting of many different elements that all have to ensure quality, starting with a cultivating process through to the roasting processes for a special taste. The supply chain process of coffee beans normally includes five processes: cultivating, harvesting, processing, roasting, and consumption.

The first process is the cultivating process. The majority of the world's coffee beans are grown in Brazil, Vietnam, Peru and Colombia, however, it can also be grown in other favorable, humid climates. In fact, coffee beans are seeds. The seeds are planted in big shaded beds. After sprouting, the young seedlings are left to grow for several days before moving them to individual pots with carefully formulated soils for the best growth. The potted seedlings are shaded from the scorching sun and watered frequently until they're vigorous enough to be moved to their permanent growing place. Cultivating is best done during the rainy season, this can make sure that the soil will remain moist as the roots get firmly established.

The second process is the harvesting process. Normally, a coffee tree can spend four to seven years before it yields its first crop of beans. The fruit, commonly termed cherries, depending on the degree of ripeness, turn from green to bright or dark red. The unripe ones being green in color. The red cherries are picked by hand, and since not all cherries are ripe at the same time, one tree must be checked many times. This process requires a significant amount of labor force and is not the only manual work that goes into harvesting coffee. The red cherries are picked and the green ones are left to ripen. Picking is carried out at 10 days spacing. This approach is labor intensive; it is used to harvest high-quality Arabica coffee.

The third process is the processing process. After harvesting, cherries are processed as soon as possible to avoid spoilage. Usually, wet-process is used to process Arabica coffee. It's called wet processing due to it uses water to both moves the coffee fruit through the process and to extract the beans. The wet method involves cleaning the cherries and removing unripe and overripe cherries. The cherries are then put through a pulping machine that squeezes out the skin without damaging the beans. It is possible that coffee beans are relatively hard. If some berries are still left with the pulp on, they are not ripe enough. These beans are hand classified and are used to produce lower quality coffee. Coffee pulping leaves mucilage, which is then put into large baskets with enzymes being added to help get rid of the sticky substance. Beans are put in large baskets and stirred often to ensure all the mucilage is dissolved. All processes take approximately 24 hours. It is crucial to remove all the mucilage to ensure beans are left with the flavor that was developed prior to this processing. After it has dissolved the beans are washed repeatedly to remove any leftover stickiness. The naked coffee beans are dried under the blazing sun for 1 or 2 days. It also can be replaced by mechanized. In this case, the coffee beans leave the processing area and are sorted into different grades. Parchment coffee in produced. The dried coffee beans are processed as follows before being taken to the market. Milling parchment coffee involves removing the dried husk; excerpt, monocarp, and endocarp. Coffee polishing is an optional step that is skipped by some millers. It involves getting rid of any silver skin that may have found its way through milling.

The fifth process is the roasting process. Unroasted coffee is called as green coffee. Roasting is carried out at temperatures of approximately 550F during which time the green coffee beans are turned continuously to avoid burning. Green beans are first dried until they become yellow and develop a roasting smell. There are different levels of roasts: light, medium and dark. Light roasting does not produce any oil on the surface of the coffee beans. Beans are light or a moderate light brown color. Medium roasting beans are a medium light to medium brown color and are developed during the first crack. The dark roasting produces dark adjust beans that have a lot of oil on the surface. Dark roasting happens after the second crack. Depending on the roasting temperature, the color can change from medium dark brown to nearly black.

The last process is the consumption process. In this step, coffee green beans are sold to coffee shops and eventually become a cup of coffee in the hands of consumers.

The five processes involved in the coffee supply chain are shown in Figure 2.1. Traceability must be developed to ensure the quality of products in each process of the coffee supply chain.

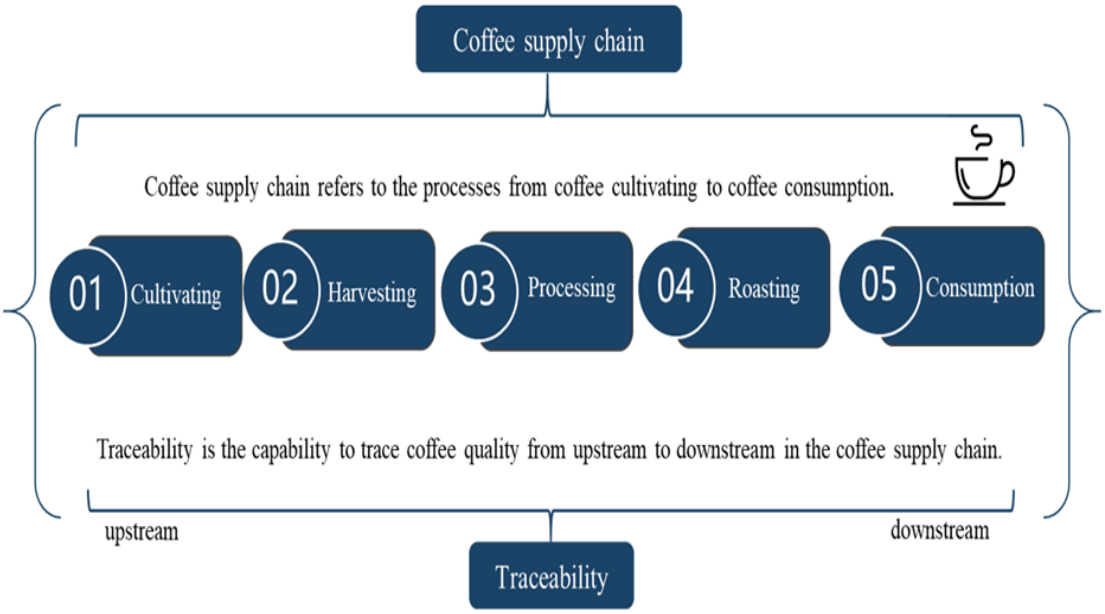

Figure 2.1 The main process of coffee supply chain

2.2 Traceability

The definition of traceability is very wide. The ISO 9000:2000 guidelines explain traceability as the "ability to trace the history, application or location of that which is under consideration" (ISO, 2000). The ISO principle further explains that traceability can refer to the origin of the materials and parts, the processing history, and the distribution and location of the product after delivery.

It is widely known that the objective of traceability can be explained as that all players in the coffee supply chain want to show their commitment to quality, and assure the reliability of their suppliers. A coffee supply chain traceability standard helps map and document a product's history, creating trust and confidence toward consumers. Nowadays, the new generation is requesting more information about anything and everything in their coffee products. It means that the coffee industry is having to figure out the content consumers desire to know and how to provide it. Obviously, this information can be just available with a traceability system that covers the whole supply chain.

Traceability is also a management tool. Traceability can add value to the whole quality management system by providing the communication connection for identifying, verifying and isolating sources of noncompliance to agreed standards and customer expectations. Traceability can be explained as many definitions and applications. Traceability identifies the path from which a product has originated and to whom it has been supplied, and consists of an inter-linking chain of records among steps in process operation and among different stages in a supply chain. There are 3 basic elements in Traceability systems: supplier traceability, it can enable the source of materials used or handled to be identified. Process traceability, it can enable the identity of raw materials and processor handling records for each lot. Customer traceability, it can enable to whom product has been supplied to be identified.

Traceability can be used in various industries that it is timely to examine the concept, particularly in relation to agriculture and food. Agricultural traceability simply explains as the collection, documentation, maintenance, and application of information related to all processes in the supply chain in a manner that provides guarantee to the consumer and other stakeholders on the origin, location and life history of a product as well as helping in conjuncture management in the event of a safety and quality gap.

About a food product, traceability shows the ability to identify the farm where it was grown and sources of input materials, along with the ability to conduct full backward and forward tracking to determine the specific location and life history in the supply chain by means of records. It devotes to the demonstration of the transparency of the supply chain through the use of verifiable records and labeling.

2.3 Related Theories

2.3.1 Knowledge Map

The knowledge map is a navigation aid to explicit information and tacit knowledge, showing the importance and the relationships between knowledge stores and dynamics.it illustrates or "maps" how knowledge flows throughout an organization. The map depicts visually the business issue or problem at hand. The pace of the group's collaborative discussions guided by questions to create knowledge sharing. Visual representation of knowledge, not a repository Identify strengths to exploit and missing knowledge gaps to fill. Can be applied in Knowledge Capture. A straightforward directory that points people to where they can. Capture both explicit and tacit knowledge in documents and in experts' heads certain expertise.

Knowledge maps typically point to people as well as to documents and databases to enable a person to find an appropriate knowledge source. A knowledge map is a visual aid that shows where knowledge can be found within a group or organization, and how to find those with the most expertise. Often referred to as an "inventory of knowledge", these maps are organized using various interconnected nodes to make it easy to find out where to look for information.

Conventional knowledge maps locate the holders of knowledge when their expertise is needed rather than spending time with imperfect solutions or searching for explicitly documented knowledge. However, the static nature of most knowledge maps is an obstacle to disseminating tacit knowledge. More recently, the role of knowledge mapping has been changed to expert locator, which allows users to search through a set of biographies for an expert on a particular knowledge domain.

Knowledge mapping process, consisting of the following steps:

1) Acquire data (through, e.g. survey) (In KM call Knowledge capture);
2) Manipulate data (to produce first order data);
3) Store data (to form knowledge mapping database);
4) Process data (analysis, aggregation and contextualization to produce higher order data);
5) Visualize data (to produce knowledge maps).

The benefits of knowledge mapping:

1) The map depicts visually the business issue or problem at hand.
2) The pace of the group's collaborative discussions guided by questions to create knowledge sharing.
3) Facts presented to the group to focus on the realities of the problem.
4) Nature of the collaborative discussion among peers should be an open environment, facilitated by a coach.
5) Post-session follow-up activities are reviewed, and conclusions are drawn
6) Visual representation of knowledge, not a repository.
7) Identify strengths to exploit and missing knowledge gaps to fill.
8) Can be applied in Knowledge Capture.
9) A straightforward directory that points people to where they can find certain expertise.
10) Capture both explicit and tacit knowledge in documents and in experts' heads.

2.3.2 Risk Analysis

Risk analysis is the process of defining and analyzing the dangers to individuals, businesses and government agencies posed by potential natural and human-caused adverse events. Risk analysis is a technique used to identify and assess factors that may jeopardize the success of a project or achieving a goal. It is a rule of operation, which focus on analyzing potential failure modes within the system, in order to classify them according to severity or confirm the impact of failure on the system.

Risk includes two parts: the probability of something going wrong, and the negative consequences if it does. Risk analysis is a basic tool when your job involves risk. It can help you identify and understand the risks that you could face in your role.

Accordingly, this helps you manage these risks, and minimize their impact on your project.

Risk analysis is a process that helps you identify and manage potential problems that could undermine key business initiatives or projects. To carry out a risk analysis, you must first identify the possible threats that you face, and then estimate the likelihood that these threats will materialize. The first step is to identify the existing and possible threats that you might face. The second step is the estimated risk since you've identified the threats you're facing, you have to calculate out both the likelihood of these threats being realized and their possible impact.

The risk matrix is a matrix that is used during risk assessment to define the level of risk by considering the category of probability or likelihood against the category of consequence severity. This is a simple mechanism to increase the visibility of risks and help management decision making. Practically, the risk matrix is a useful method where either the probability or the harm severity cannot be estimated with accuracy and precision. A risk assessment matrix is a chart that plots the severity of an event occurring on one axis, and the probability of it occurring on the other. You can also format the matrix as a table, where the risk likelihood and impact are columns, and the risks are listed in rows. By visualizing existing and potential risks in this way, you can assess their impact, and also identify which ones are highest-priority. Based on this, you can create a plan for responding to the risks that need the most attention.

A risk matrix chart is a simple snapshot of the information found in risk assessment forms, and is often part of the risk management process. These forms are more complex, and involve identifying risks, gathering background data, calculating their likelihood and severity, and outlining risk prevention and management strategies.

RISK RATING MATRIX

ACUTAL RISK OUTCOME			
LOW (Green)	MODERATE (Yellow)	SIGNIFICANT (Amber)	HIGH (Red)

LIKELIHOOD	CONSEQUENCE				
	INSIGNIFICANT 1	MINOR 2	MODERATE 3	MAJOR 4	CATASTROPHIC 5
ALMOST CERTAIN 5	5 (Yellow)	10 (Amber)	15 (Red)	20 (Red)	25 (Red)
LIKELY 4	4 (Yellow)	8 (Amber)	12 (Amber)	16 (Red)	20 (Red)
POSSIBLE 3	3 (Green)	6 (Yellow	9 (Amber)	12 (Amber)	15 (Red)
UNLIKELY 2	2 (Green)	4 (Yellow)	6 (Yellow)	8 (Amber)	10 (Amber)
RARE 1	1 (Green)	2 (Green)	3 (Green)	4 (Yellow)	5 (Amber)

Figure 2.2 Risk rating matrix

Source: Anthony Rocheford. (2018, October). Risk Matrix Example. Retrieved from: https://community.intelex.com/library/peer-resources/risk-matrix-example

As Figure 2.2 shows, during risk evaluation, we can divide risk evaluation into 5 levels. From low level to high levels, there are insignificant, minor, moderate, major, catastrophic as horizontal coordinate show off. Meanwhile, as vertical coordinate shows off, there are 5 levels from the low level to high level: rare, unlikely, possible, likely, almost certain. Then, the value of the horizontal coordinate multiplies the value of the vertical coordinates, the result can express the risk level. 1-25 point indicates the risk level from low to high. The risk matrix is simple and clear, easy to use. However, the disadvantage is that the possibility of confirming risk depends on expert too much.

2.3.3 Pareto Principle

Vilfredo Pareto has developed a principle which name is the Pareto Principle. During analyzing the wealth distribution of people in society, he found that roughly 80% of the wealth was held by 20% of the population. Therefore, this principle is also known as the 80/20 principle. The 80/20 rule observes that most things have an unequal distribution. He thinks the most important thing just occupied 20 percent within a group thing, the other 80 percent is less important. Therefore, the Pareto Principle also be

called as Trivial many rules, which means vital few, trivial Many. Normally, the Pareto Principle is used in economics and management. Meanwhile, this principle is meaningful for person to manage their time to avoid wasting of time. 20% of the input accounts for 80% of output.

The Pareto principle can effectively recognize and confirm key risk. The method is recognizing the risk factors that you are facing. Then, collecting any information that has relationship with event. After that, analyzing risk events to get the consequence which will lead to bad results. Moreover, evaluating risk factors' possibility and effect. At last, using priority rule divide and confirm 20 percent risk that should be management and controlled.

These critical risks can be expressed by Pareto diagram. The Pareto diagram is based on the Pareto Principle. The purpose of the Pareto chart is to highlight the most important among a (typically large) set of factors. In quality control, it often represents the most common sources of defects, the highest occurring type of defect, or the most frequent reasons for customer complaints, and so on.

The Pareto chart is a bar chart of frequencies sorted by frequency. The most popular incarnation of the chart puts the highest bars on the left and includes a line showing the scores produced by adding the heights in order from left to right. A Pareto chart, the left vertical axis is the frequency of occurrence, the right vertical axis is the cumulative percentage of the total number of occurrences. The Pareto diagram can help you segregate the defects and their cause. Once you get this information, you can focus on the cause which lead to the most defects.

Normally, this phenomenon can be interpreted as follows: Roughly 80% of the problems will be due to 20% of the causes, or the majority of issues will be due to a small number of causes. Drawing a Pareto chart is easy. This diagram helps you segregate the problems and their causes. It helps you focus on solving the few causes which are generating the maximum amount of problems. It presents you the problems to focus and get the greatest improvement. This chart helps visualize problems quickly. Therefore, this is a good visual communication tool.

2.4 Related Research

U,Noppakoonwong (2015) investigated development of Arabica coffee in Thailand. This paper shows although coffee is one of the economics commodities which gives a significant national income, its low productivity and high cost of production still needs to be addressed. Good Agricultural Practices (GAP) are needed to increase the number of farms in order to reduce the cost of production and improve quality and productivity. Diversification of coffee products and value added would provide more income and sustainability for coffee farmers, processors and exporters.

Linus U. Opara (2002) reviewed the concepts of supply chain management and traceability in agriculture; and highlight the technological challenges in implementing traceable agricultural supply chains. The paper found that the emergence of traceable agricultural supply chains is the outgrowth of a long line of developments in improving food quality and safety management. The aims of agricultural traceability are to permit the full backward and forward tracking of a product and its life history in the supply chain.

Samsi, Ibrahim, and Tasnim explored how knowledge management can be a commanding tool for an effective traceability system in Halal food industry supply chain by reviewed concept of Halal, knowledge management, and traceability system. The result shows that Halal food industry supply chain needs to be developed and modeled being it a critical aspect for the industry to survive in the global halal food market and industry.

Ong, Chen, Sung, Zhu (2004) investigated a knowledge map for online new. This research tried to create high-quality hierarchical knowledge maps and to recommend effective map-based visualizations. The research also employed knowledge map theory to generate hierarchical knowledge map by using a statistical Chinese Indexer to show news article as a vector of phrases. The result shows that user's performances can be developed by using visual cues of the 2D SOM display

M.H. Jansen-Vullers examined the managing traceability information in Manufacture. The paper use go into graph model for traceability of the goods flow; use a reference data model for tracking and tracing. The result shows that These composition data can be used to recall any items having consumed a certain component

of specific interest, but also to certify product quality or to pro-actively adjust production processes to optimize the product quality in relation to its production characteristics.