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SUSTAINABLE SUPPLY CHAIN MANAGEMENT: A CASE STUDY ON COCOA INDUSTRY IN INDONESIA

Doctoral Dissertation

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Normansyah Syahruddin: **"Sustainable Supply Chain Management: A Case Study on Cocoa Industry in Indonesia"**

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EXECUTIVE SUMMARY

The term *sustainability* was introduced in 1987 in United Nation's "Our Common Future", phrasing a phenomenal sentence; *meeting the needs of the present without compromising the ability of future generation to meets their own needs.* This philosophy then becomes the ground line for the concept of sustainable development which has been adopted all over the world to date. The concept itself comprehends economic, social and environmental processes while considering but two things; the finite amount of resources and the high rate of human growth and consumption where there are urgent needs to compromise both growth and resources. Though the concept was acceptable, the implementation is varied from one another. Furthermore, discourses on sustainable development have focused primarily on the environmental and economic dimensions while the importance of social, political and cultural factors is only now getting more recognition[1].

Thus, the concept of sustainability and sustainable development has shifted into a more rigorous way that is the capability to manage resources effectively and efficiently. Moreover, to be comprehend with global concern on depleting resources, global climate change and green-house-gasses emission, researchers, practitioners and policy-makers realize that preventive actions must be taken into consideration and application to reduce environmental destruction such as forest degradation, biodiversity extinction or soil erosion as well increasing social awareness, such as humanity and equality inside business practices.

Due to globalization, companies started their vast expansion in terms of operations, manufacturing and services. Boundaries became limitless and flow of goods and materials is not limited to certain region but covering all corners of the world. In the operations basis, supply chain management became highly important in determining the

[1] International Panel on Climate Change (IPCC) (http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch12s12-es.html accessed on 08 October 2012)

success of a corporation as well as managing risk and resources. Many companies depend on the lean and agile supply chain management to maintain effectiveness and efficiency. Also, in the research field, discussions on supply chain management have been flourished in the last decade. In the recent years, a particular interest was given to the relationship between sustainability and supply chain management, thus making the term of *sustainable supply chain management (SSCM)*. The increased attention on sustainable supply chain management in the literature is evidenced by the increasing number of papers on the topic. Sustainability in supply chain management drives top management in corporations to design even more effective and efficient supply chain.

Thus, attention focuses to the sustainable supply chain in agricultural sector. While most of the literatures mainly discuss the topic from industrial to tourism, limited attention was given to agricultural sector. Considering that many agricultural products such as livestock, fruits, cereals, rubber, cocoa etc being transported across borders and the rising concern of sustainability practices, this research becomes reasonable. Furthermore, a salient factor to be considered is that the discussion on sustainable development also considers agriculture as one of the key factor to eradicate poverty.

Paper 1 (chapter 3) mapped the contributions of sustainable supply chain inside the agricultural sector. As growing attention has focused on sustainable supply chain management in different sectors, a compact understanding of the contributions of a sustainable supply chain in the agricultural sector is considerably new, although several contributions in the literature suggest the importance of a sustainable agricultural supply chain (e.g., Pagan and Lake, 1999; Smith, 2008; Giovannucci *et al.*, 2000; Tan *et al.*, 2009) as a critical feature in the agricultural industry[2]. We believe that the agricultural supply chain plays an important role in understanding the concept of a sustainable supply chain because an agricultural supply chain employs numerous actors in the chain from farmers to consumers, and it has a significant impact on economic, social and environmental performances. In this work, the main objective is to provide a structured review of the literature to increase understanding of the development of sustainable

[2] See http://www.goodinside.org/ and http://www.cargill.com/news/releases/2011/NA3045505.jsp , Accessed on 7th October 2011

supply chain management in agriculture (SASC), specifically comparing how sustainable supply chain management has evolved in other industries.

Result showed that the discussion of SASC only counted for 10% inside the SSCM mainstream, providing evidence that discussion on SASC is under-develop. In this paper, we identify 80 papers related to sustainable agricultural supply chain. Over 50% of the sample discuss how practices influence supply chain performance under sustainability context while others were dispersed between initiatives towards sustainability, the role of information technology in agricultural supply chain and the function of agricultural supply chain in providing renewable energy. Inside SASC mainstream, 50% of the papers used case study methodology followed by assessment methodology such as mathematical or conceptual modeling, accounted for more than 30% of the sample.

Our results provide evidence that while the sustainable agricultural supply chain is a developed topic, there are still many areas that require significant research and development. First, even though more than 80 publications were identified as addressing this topic, the contributions appear limited when compared to the contributions on sustainable supply chain management as the mainstream. Of all the topics covered by current literature, most researchers believe that a sustainable agricultural supply chain can be achieved if each echelon of the chain adopts sustainable practices in its operations. The previous analysis, in fact, clearly indicates that research is focusing more on how practices can be improved to achieve sustainability within the supply chain.

In chapter 4, we briefly presented cocoa market in the world and an overview on Indonesian cocoa industries that going to be used in our research. For each cocoa producer, there are some differences in the supply chain, particularly in the farmers to collector chain. For example, in Cote d'Ivoire; though accounted as the biggest cocoa beans producer in the world, the government's participation is not significant in the cocoa chain, where in Ghana; the involvement of cocoa stakeholders, including the government, is high especially in the early stage of the chain. Furthermore, buying

cocoa beans from the farmers in Ghana mostly done by Licensed Buying Companies (LBC) and sell most of it to Cocoa Marketing Company (CMC)[3].

Most of cocoa plantations in Indonesia are small-scale plantations owned by local farmers or local cooperation with long traditional supply chain management from farmers to local trader to cooperation to local market until received by buyer sometimes with high prices. The condition also affected the trade to major importing countries for instance the Automatic Cocoa Detention implemented by USA, Maximum Residue Limits (MRLs) regulation and Sustainable Cocoa implemented by European Countries which cause price discount for cocoa beans from Indonesia. Reflecting to that, Indonesian's cocoa sector still experiencing several drawbacks such as low yield, low quality beans and ineffective marketing chain (Djajusman, 2007).

Currently Indonesia is the third largest cocoa producer in the world contributing 15% of total world production under Ghana and Cote d'Ivoire. There are two types of cocoa produces in Indonesia that are cocoa *lindak* (bulk cocoa) and cocoa *edel* (specialty cocoa). Cocoa counted as the third largest contributor of agriculture export revenue in Indonesia (Ministry of Agriculture, 2008). Most of the cocoa beans in Indonesia are exported with only about 20% of the productions are used in the local production. Export to European Union still dominated by Germany with about 10.000 MT of imported cocoa beans from Indonesia in 2006.

The second paper (chapter 5) has investigated how different practices in different stages influences supply chain performance inside the cocoa supply chain particularly in Indonesia. Furthermore, although research on practices and performances flourished, less attention has been given to agricultural commodities and especially how practices impacted supply chain performances whereas discussion on agricultural supply chain is lack inside the supply chain mainstream (Syahruddin and Kalchschmidt, 2012). Hence, the aims of this research are to review the adoption of practices towards

[3] LBC is group of companies, both public and private, that are assigned to to domestic marketing activities such as buying cocoa beans from the farmers while CMC is the part of COCOBOD that in charge for export activities (Lundstedt and Pärssinen, 2009; Ghana Cocoa Board (COCOBOD), 2004) (see http://www.nek.lu.se/Publ/mfs/198.pdf and http://www.cocobod.gh/images/export_of_Cocoa_Regulations.pdf respectively for more detail, accessed on 18th August 2011)

performance and to observe how different practices in different each influence the supply chain performance.

The purpose of determining best practices in cocoa supply chain is to ensure the quality of cocoa product that produce by the chain, from farm to the consumer table. By implementing best practices each consumer in each chain in cocoa – chocolate supply chain are receiving the qualified / standardized inputs produced by its previous chain. Considering that many approaches suggested different practices, whether it is production or supply chain practices, we would like to stress the importance of practices in the cocoa industry towards performances. Therefore, we consider that *the implementation of best practices will influence the sustainable performances of the cocoa supply chain.* Furthermore, Haynak and Montiel (2009) reinforced the framework by stating that sustainable supply chain management and sustainable performance are correlated through different practices such as core quality management practices, environmental management practices and customer relation management.

We conducted case study approach on this paper and interviewed 40 farmers, 7 traders and 3 processors of the cocoa industries. In this way, we can understand the level of adoption of practices from different stage of the cocoa supply chain. Performances were assessed based on sustainability parameter; economical, social and environmental. Furthermore, in cross cases analyses, we able to identify how different practices in each stage of the cocoa supply chain influence other's performance and thus, perform a holistic supply chain performance. Later, in between case section, we want to examine how practices in different stage of cocoa supply chain affect each other and how they shape the performance of the supply chain.

From the observation, not all best practices were adopted in the operations. For example, in farmers' level nearly half of the sample is adopting fermentation practices after they harvested the beans. Farmers expect to have better bargaining position with the traders with fermented beans and thus, expecting better income. Warehousing is less adopted by most of the farmers in our sample. Farmers viewed this practice as expenditure that they have to spend, and with small profit margin, they neglected this

practice. When conjunct with performances, most of the farmers see GAP contributes in environmental preservation while around 25 – 37% of samples see that GAP affecting social and economical performances respectively. In quality management, there is fair amount of distribution on the three dimension of sustainability whereas 45% of sample considers quality management will improve their economical performance. Similarly, fermentation attributes for increasing farmers' profit but not really touched social and environmental dimension. A rather unbalance result happens in long term contract where more than 50% of sample consider it as tool for improving income but not converging social and environmental perspectives.

In the traders' level, 5 out of 7 traders viewed TQM adoption will increase their economical and environmental performances but will not affect social performance significantly. Different consideration given to the adoption of JIT where 42% of the sample considers JIT will contribute to their social performances. A rather low contemplation in adoption is the practice of transportation management where less than 50% traders consider this practice will contribute to their overall performances. It was worth noting that traders only consider supplier continuity will improve economical performance but not their environmental and social performances. In the final stage, all processors perceived the important of quality depending on the market requirement. However, in the relationship with performances, processors viewed that TQM only impacted to economical and environmental performances and not with social performance. Processors also consider the adoption of GMP, mixed practice and transparency can contribute evenly to all three dimensions of sustainability. Of all processors, only 1 processor adopting traceability practice, showing that the *concept of traceability* is lacking in the field of cocoa supply chain management. As for supplier continuity, processors viewed it as a catalyst for their economical performance but lacking in the aspect of the other two.

Then, in paper 3 (chapter 6), a framework of traceability for cocoa supply chain is proposed subsequently following the conclusion reach in the previous chapter. Previous researches have indicated that traceability is one of the key elements to reach sustainability (e.g. Epstein, 2008; Carter and Roger, 2008; Pagell and Wu, 2009) by

providing transparency as well as quality and safety issues in the agro-food chain. Especially traceability becomes important in the recent years following several recalls of many food products in several countries, leading to higher consumer concerns on food safety and hazardous materials that may be contained in food products. Thus, traceability in the agro-food chain becomes a fundamental requirement with the aim of collecting all information related to the displacement of the different products along the supply chain in a rigorous way. In the context of sustainability, Opara (2002, 2003), Epstein (2008) and Wognum *et al* (2011) that traceability can actually use to identified the level of social and environmental dimensions whereas traceability overviewed transparency in the agro-food chain.

We conducted a critical analysis in the literature of traceability to extract features that may influence the application of traceability inside cocoa supply chain. We found, information technology plays an important role for traceability in the food chain, not only for the consumers but also for the producers (Buhr, 2003). There are several methodologies applied to conduct traceability in the food chain led by the recent development in ICT to make traceability more computerized system in implementation (Chrysochou *et al,* 2009). Among them, alphanumerical code, barcoding and radio frequency identification data-RFID (Gandino *et al,* 2009; Regattieri *et al,* 2007; Sahin *et al,* 2002) is the most used techniques in agri – food chain to indentify supplier' products including process system, raw materials, number of batch, etc. Other technologies for modelling traceability are EPCIS framework and UML statecharts, which modelled transitions in food production.

Then, we also explore the literatures to identify how traceability has been employed in various food chains. We divide traceability into tracking and tracing features that enable focal company to perform holistic traceability. From the cases of traceability in agro-food chain, results showed that important factors such pesticide usage, origins and other characteristics of the cocoa products, information regarding how focal companies managed their social and environmental performances should be included in the label of the product. On the other hand, in the tracking phase the information delivered mostly covered the quality of the product, level of waste and dirt

from the growers to at least the processors level. We viewed that there is a necessity to growers to track the transmission of the price along the supply chain (Pouliot and Sumner, 2008). This is required to measure the economical performance of the supply chain in complete picture. As transparency is the important feature in traceability, we consider the *flow and openness of information* become the key figures to determine a successful traceability system. This entails on what kind of information should be provided to minimize the occurrence of food alerts. Moreover, information flow can be utilized as the tool to monitor sustainability performances should not be an economical burden since it only costs 3% of the retail chocolate price (Abbott *et al,* 2005).

CHAPTER 1

INTRODUCTION

Globalization and internationalization of the companies mostly from develop countries led to investments in other part of the world with varies reason such as low cost labor, low cost materials, relaxed regulations, strategic locations, partnership and alliance, and access to raw materials. Besides that, strategic location and time differences also accounted for deciding invest in certain place. As the investments made by most of companies in developing countries, supply chain management holds important position in maintaining the flow of the raw materials to the processing units up to supplying finished goods to the end consumer. Nowadays the word sustainability has become a popular word in business term for almost every operation in business sectors and firms across the world. The raising concern on environmental damage, depleted resources, and exploitation of child labor, endangered species, global warming and many more has shifted the traditional way of manufacturing and operation of most companies in the world to become more lean, green and friendlier towards sustainability. Thus, in explicit way, there is an urgent need for sustainable supply chain management (Cetinkaya *et al*, 2011)

1.1. Supply Chain Management

To better undertake this research, the definition of supply chain management itself must be taken into consideration. Supply chain management is the process of meeting the demand of each customer in each of stage of the supply chain itself. A *supply chain* consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only on the manufacturer and supplier, but also transporter, warehouses, retailers and even the customers themselves. These functions include, but are not limited, to new product development, marketing, operations,

distribution, finance and customer service (Chopra and Meindl, 2007). Supply chain also is the stream of processes of moving goods from the customer order. All organizations have varying degrees of supply chain depend the size of the organizations and the type of the products manufactured or services provided.

Supply chain activities end when a satisfied customer has paid for his or her purchase. The term *supply chain* conjures up images of product, or supply, moving from suppliers to manufacturers to distributors to retailers to customers along a chain. The term may also imply that only one player is involved at each stage. In reality, a manufacturer may receive material from several suppliers and then supply several distributors. Therefore, most supply chains are actually networks. A typical supply chain may involve a variety of stages. These supply chain stages are shown in Figure 1.1, and include the following: customers, retailers, wholesalers / distributors, manufacturers and component / raw materials suppliers.

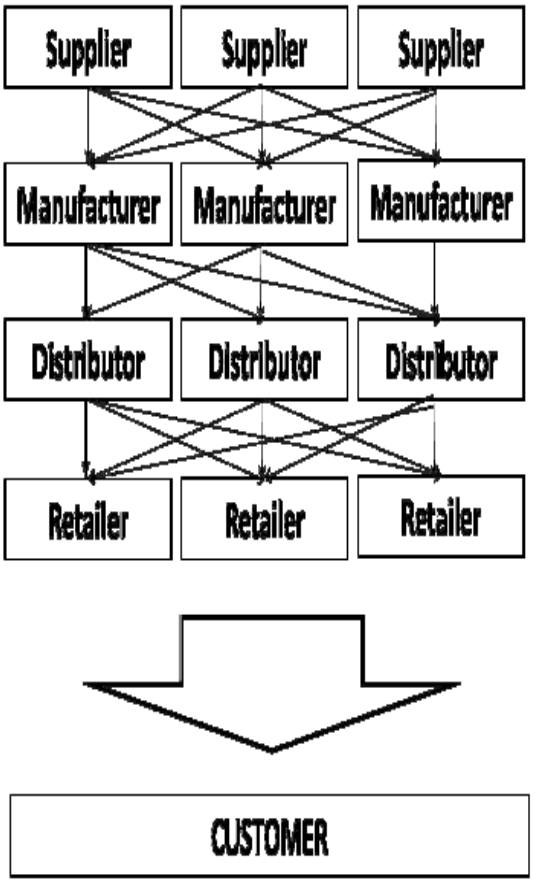


Figure 1.1. Typical Supply Chain Network

These networks obtain supplies and components, change this material into finished products and deliver it to customers. The objective of every supply chain should be to maximize the overall value generated by the supply chain, which is strongly correlated with *supply chain profitability* or the difference between the revenue generated from the customer and the overall cost across the supply chain. Mentzer *et. al* (2001) proposed another approach in understanding what is supply chain. They defined supply chain as *a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a* customer (pp. 4). Furthermore, they classify the extension of supply chain to three degrees of supply chain complexity: a "*direct supply chain*", an "*extended supply chain*", and an "*ultimate supply chain*".

To make the supply chain operate correctly, there are needs to manage the supply chain itself which often interpreted as *Supply Chain Management* (SCM). Although the term sounds familiar, researchers still argue the fixed term of SCM. Several approaches tried to defined SCM as deals with total flow of materials from suppliers through end users (Jones and Riley 1985; Cooper, *et al* 1997), synchronize between customer requirements with the flow of materials from suppliers (Stevens, 1987), and concept of integrating and managing the source of flow and control of materials (Monczka *et al,* 1998). Another definition of SCM is managing the process of chain events in the purpose to optimize the output produce by the chain as well as reducing cost and increasing efficiency, while *effective supply chain management* involves the management of supply chain assets and product, information, and fund flows to maximize total supply chains profitability (Chopra and Meindl, 2007). Finally Mentzer *et al* (2001) argue that *supply chain management* is defined as a systemic, strategic coordination of the traditional business functions and the tactics across these businesses within the supply chain, for the purposes of improving the long – term performance of the individual companies and the supply chain as a whole.

1.2. Concept of Sustainability and Supply Chain Management

The research on Sustainable Supply Chain still lack of strong definition to be consider as a baseline to start. Many papers have shown differences in determining the term *sustainable supply chain*. One earlier and most quoted interpretation of 'sustainability' is from the perspective of 'sustainable development' in the sense that of "[development that] meets the needs of present without compromising the ability of future generations to meet their own needs" (WECD, 1987). Starik and Rands (1995) then define sustainability as […] the ability of one of more entities, either individually or collectively, to exist and flourish (either unchanged or in evolved terms) for lengthy timeframes, in such a manner that the existence and flourishing of other collectivities of entities is permitted at related levels and in related systems while Shrivastava (1995) describe sustainability as the potential for reducing long – term risk associated with resource depletion, fluctuations in energy costs, product liabilities, and pollution and waste management. In such way, sustainability has been emphasized as the intersection economical, social and environmental aspects of strategic management (Elkington, 1998) that lead to the articulation of triple bottom line (3BL). Furthermore, Dyllick and Hockerts (2002) envisage corporate sustainability as the business case (economic), the natural case (environmental) and the societal case (case).

In recent years, the concept of supply chain management has venture into deeper issue and related to current issues such as sustainability, which are the sustainable supply chain management. Why we need sustainability? Why sustainability become important issue in supply chain management? Why companies consider sustainability as essential part in their operations? A perspective by Pedersen (2009) showed that companies and other business entities must address this issue to maintain the performance of the firms especially related to triple bottom line of economics, social and environmental performance. A similar recommendation also mention by Zaklad *et al* (2003) which sustainable supply chain must balanced the business process improvement, enabling technology and social system transformation whereas sometimes firms put less attention to one of the pillar. Linking between globalization and supply chain, Reuter *et al* (2010) proposed that sustainable supply chain in terms of

global supplier management must be managed carefully to reduced risks. Sustainability in supply chain management also often associated with the scarcity of resources and limited fuel drives top management in corporations to design a more effective and efficient supply chain design and management (Beamon 2008).

Similar to Beamon, Zhu *et al* (2008) shows that due to serious depletion of raw materials and environmental regulations, companies in China start to perform best practices in the operation and manufacturing of their product and consider being a closed loop system in the effort of reducing environmental damage. Another example of scarcity mentioned by Svensson (2007) that force business practices and research to acknowledge the circumstances and conditions derived […] based upon renewable and / or recycled resources towards sustainable supply chain management (SSCM).

Thus, SSCM itself considered a young field (Gold *et al*, 2010) and the terminology still varied among well-cited publication. One interpretation comes from Seuring and Müller (2008) that stated SSCM as the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking all goals from all three dimensions of sustainable development, i.e. economic, social and environmental, into account which are derived from stakeholders and customer requirements. Yet, another approach on SSCM was proposed by Carter and Rogers (2008) by defining SSCM as the strategic, transparent integration and achievement of an organization's social, environmental and economic goals in the systemic coordination of key interorganizational business processes for improving the long – term economic performance of the individual company and its supply chain. However, in reality, the social dimension often neglected in both conceptual research and in corporate practice concerning corporate risk management (Gold *et al,* 2010) whereas corporations tend to take trade-offs option between sustainability dimensions concerning business goals (Seuring and Müller, 2008). Furthermore, Pagell and Wu (2009) suggest that in SSCM, the non-economical dimensions, i.e. social and environmental had to complement the economic activities of the organization and *vice versa.*

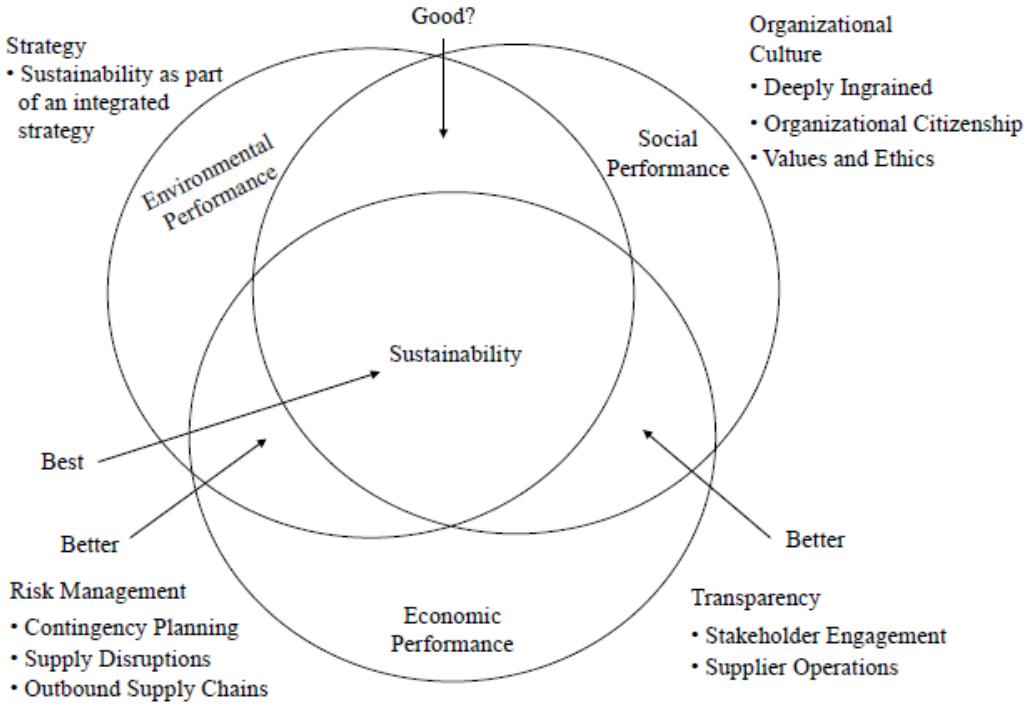


Figure 1.2. Framework for sustainability (Carter and Roger, 2008)

Although research on SSCM seems thriving the recent year, it seems that research on agricultural field still lacking. To increase market share and to address the problem for food safety and arising concern of social and environmental issues, nowadays firms that work in agriculture sector are aware that the implementation of sustainability is inevitable. Horrigan *et al* (2002) mentioned about the importance of sustainable agriculture for environmental, economic profitability and social economic equity for the society. Amongst the good practices in agriculture, good supply chain practices also being considered. Concerning consumer preference, Knickel *et al* (2002) showed that consumer preference has shifted into healthier products produced by sustainable agriculture and come from sustainable supply chain.

Smith (2008) shows that the performances of the firms very much depend on creating a sustainable supply chains while Kaynak and Montiel (2008) proposed the relationship between sustainable supply chain management and sustainable performance under several framework such as environmental management practices, core quality management practices and supplier quality management. Similar to Smith, Carter and

Rogers (2008) also proposed that firms strategically undertake SSCM will achieve higher economic performance than firms that pursue only one or two of the three components of the triple bottom line. A study in Brazilian nut supply chain by Diniz and Cortez (2007) shows some failures on supply chain management (SCM) and supply chain orientation (SCO) due to lack of communication and human resources which lead to the failure of implementing sustainable supply chain management. One interesting finding in editorial issue of Journal of Cleaner Production in 2008 is that there is lack of sustainable supply chain management paper for the region of Asia and thus, this finding also becomes one of the motivations for conducting this research. Furthermore , it seems timely for the research itself to investigated how sustainability reach further inside the supply chain up to the initial stage and not only focusing on the focal company (company-centric). By doing so, it is expected to see the complete picture of SSCM in an agricultural sector.

This dissertation is structured as follow. A brief introduction covers the terminology of sustainable supply chain management. In the chapter two, research framework is outlined followed by the evolution of sustainable supply chain management in agricultural sector. Then, we briefly discussed the market of cocoa in the world along with the development of cocoa industries in Indonesia. In chapter five, we discussed how different practices been adopted by the actor in the cocoa supply chain and how it influences supply chain performances. In chapter six, we present a framework on how traceability should be conducted in cocoa supply chain and lastly, we concluded the dissertation.

CHAPTER 2

RESEARCH FRAMEWORK

2.1. Overview on Research Framework

This research focuses on exploring the topic of sustainable supply chain management inside an agricultural supply chain. To date, agricultural sector provides an important contribution to the development of a country or a region due to its role in both the economic and environmental development. Explaining the importance of agriculture in sustainable development, the Food and Agriculture Organization (FAO), in 1994, stated, "Sustainable development is the management and conservation of the natural resource base and orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations".

Thus, attention focuses to the sustainable supply chain in agricultural sector. While most of the literatures mainly discuss the topic from industrial to tourism, limited attention was given to agricultural sector. Considering that many agricultural products such as livestock, fruits, cereals, rubber, cocoa etc being transported across borders and the rising concern of sustainability practices, this research becomes reasonable. Furthermore, a salient factor to be considered is that the discussion on sustainable development also considers agriculture as one of the key factor to eradicate poverty. Hence, there are two objectives in this research: (i) to understand how sustainability evolves inside the agricultural supply chain and (ii) how this concept is adopted inside the aforementioned. Since we want to explore the topic of sustainable supply chain management in the agricultural sector, we consider the general-to-specific approach which enable us to understand the trend of discussion inside the agricultural supply chain. Therefore, the first issue that we address is how the topic of sustainable

agricultural supply chain evolves within the sustainable supply chain management mainstream. For that purpose, we adopt the content analyses approach. Then, we take the most discussable issues to form our framework for second issue. We found that inside sustainable agricultural supply chain discussion, the topic mostly highlight the adoption of practices in each stage of the supply chain and its relations to the performance of the supply chain.

Taking that into account, the second issue that we discuss in this dissertation is what are practices adopted by different stage in the supply chain. To support our framework, we take cocoa supply chain as an example since cocoa is a world commodity well known not only for its boom-bust cycles, but also its capability to draw in and then, expel new populations, regions and nations (Li, 2002) and has the ability to create profitability for the regions (Obiri *et* al, 2007). Moreover, cocoa sector also faced various problems that linked to sustainability such as forest degradation, biodiversity destruction and child labor issue (Neilson, 2007). For such purpose, we adopt case study approach since it suitable for understanding the dynamic present with single settings, which aims at e.g. providing descriptions (Eisenhardt, 1989).

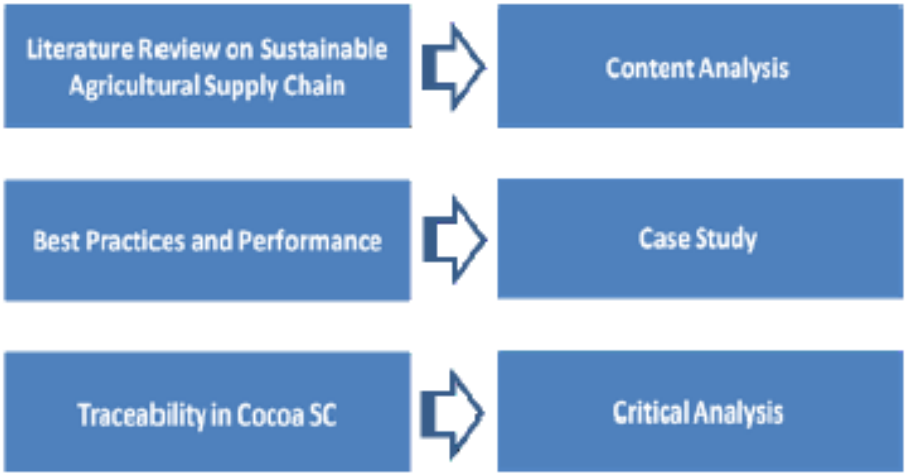


Figure 2.1. Papers and its methodologies

Later, as we conclude the second issue, we identify that there are several factors that can boost the supply chain performances. Of all factors, we explore the possibility

of implementing traceability inside the cocoa supply chain. As it is an evolving topic, we want to propose on how traceability should be conducted in the cocoa supply chain. For that reason, we adopted the critical content analysis to build a framework that is applicable to the industry.

2.2. Case Selection

This dissertation will focus on cocoa industries in particular in Indonesia. One of the reasons is cocoa sector faces the sustainability problem similar to other agricultural products (such as child labor, unfair trade, waste problem etc) while have to coop with increasing profitability. The problem itself must be observed not only from focal company point of view but the entire supply chain, making this case suitable for addressing SSCM issue from an agricultural sector. Furthermore, cocoa is the core ingredient for many chocolate and confectionary industries, and thus addressing sustainability issue in the earlier stage of supply chain is reasonably important enough for the chocolate manufacturer to deal with market requirements. From the policy side, while the consumption cocoa worldwide also showed a gradual increase per year, mostly come European and American regions (ICCO, 2012), the market share of Indonesia as one of the top producers of cocoa in the world holds not more than 3% of the total market share in European Union (EU)[4]. Moreover, this sector can be considered as one of the important sector for employment as well as a tool for poverty alleviation (Arinquez and Kostas, 2007). The detail of cocoa industry can be seen in Chapter 4.

[4] This problem has been identified as Non Trade Barriers component under the preferential tariff implemented by EU to the African region by excluding the import tariff to 0% compare to Indonesia with up to 10% import tariff (yearly report from Indonesian Representative to EU Trade Commission, 2010)

CHAPTER 3

SUSTAINABLE SUPPLY CHAIN IN THE AGRICULTURAL SECTOR: A LITERATURE REVIEW[5]

Abstract

In recent years, several contributions have been provided concerning sustainable supply chain management (SSCM), ranging from a theoretical analysis of the topic to practical applications across several industrial sectors. The scope of SSCM has been extended toward various industries and supply chains, not only domestic supply chains but also global supply chains. Transnational companies play important roles in the global supply chain as they create business opportunities and entrepreneurial activities along the chain. However, operating in global supply chains also gives rise to several issues. Environmental damage, food safety concerns, and social and sustainability issues are major topics for both domestic and global supply chain management. Many of these issues are driven by external factors such as standards and regulations as well as customer and market demand.

Even if SSCM has been a subject of much discussion in the last few years, few contributions are available for SSCM in the agricultural sector. This paper aims to provide an extensive literature review on the practice of supply chain management and sustainability in agriculture sectors to identify the extent of the discipline in this field and to highlight areas that need further research.

Keywords: *sustainable supply chain management*, *literature review*, *agriculture*

[5] Syahruddin, Normansyah and Kalchschmidt, Matteo (2012). Sustainable Supply Chain in The Agricultural Sector: A Literature Review. *International Journal of Engineering Management and Economics. Inderscience Publishers. Vol. 3. No. 3. pp. 237 – 258*

3.1. Introduction

The globalization and internationalization of companies led to investments in different parts of the world for a variety of reasons that included low-cost labor, low-cost materials, relaxed regulations, strategic locations, partnerships and alliances, and access to raw materials. Companies extended their boundaries according to the incentives and infrastructures where the investments were made. Strategic locations and time differences also accounted for decisions about investments in certain areas. As a part of the operation, supply chain management holds an important position in maintaining the flow of materials from the processing units up the chain to supplying finished goods to the end consumer (Chopra and Meindl, 2001; 2007). As a consequence of globalization, global supply chains are typically characterized by a greater use of transportation with obvious implications on the environment. These chains may also induce behaviors that are not always socially sustainable. For example, the availability of low-cost labor may push companies to outsource to developing countries where workforce safety control is limited. These factors are urging stakeholders to consider sustainability due to both the rising concern of national and international regulations and an ever-growing focus by the end consumers on the implications on sustainability.

In the last decade, there have been increasing concerns about environmental damage, depleted resources, and exploitation of child labor, endangered species, and global warming. Worldwide, these concerns have changed the traditional way of managing operations such that firms have become more concerned with the triple bottom line (Elkington, 1998; 2004), thus guaranteeing the economic, social and environmental sustainability of operations. In response to this growing concern, the number of papers that discuss sustainability has quintupled in the last decade (Linton *et al.*, 2007).

As growing attention has focused on sustainable supply chain management in different sectors, a compact understanding of the contributions of a sustainable supply chain in the agricultural sector is considerably new, although several contributions in

the literature suggest the importance of a sustainable agricultural supply chain (e.g., Pagan and Lake, 1999; Smith, 2008; Giovannucci *et al.*, 2000; Tan *et al.*, 2009) as a critical feature in the agricultural industry[6]. In this work, the main objective is to provide a structured review of the literature to increase understanding of the development of sustainable supply chain management in agriculture, specifically comparing how sustainable supply chain management has evolved in other industries. We believe that the agricultural supply chain plays an important role in understanding the concept of a sustainable supply chain because an agricultural supply chain employs numerous actors in the chain from farmers to consumers, and it has a significant impact on economic, social and environmental performances. Thus, we highlight areas that need further research.

To broaden our research, we conducted a literature review based on two approaches: a thematic approach and a coverage approach. According to the thematic approach, contributions were identified and analyzed focusing on the specific topics addressed. By using coverage analysis, we show the evolution of the topics over time (i.e., longitudinal analysis) in terms of research methodologies applied and in terms of assessment methodologies. Specifically, in the longitudinal analysis, we illustrate the number of articles available from the early stages of discussion up to recent years. We also show the extent to which different scientific disciplines have addressed these topics. With this approach, we aim to provide an overall picture of how research evolved and what the current research trends are. Additionally, by analyzing the adopted assessment methods, we aim to provide a complete overview of previous research.

This article consists of six sections. In the introduction, we discuss academic background that reinforces our proposed research. In the next section, the methodology for literature review and the collection of data are detailed. The third and fourth sections provide an extensive literature review on the seminal topic of sustainable supply chain management and its relationship with agriculture and development. Sections five and six are dedicated to the discussion and further development of the research in the field.

[6] See http://www.goodinside.org/ and http://www.cargill.com/news/releases/2011/NA3045505.jsp . Accessed on 7th October 2011

3.2. Methodology and Data Collection

Shuttleworth (2009) describes a literature review as a critical, in-depth evaluation of previous research. Thus, a literature review is both a summary and an explanation of the complete and current state of knowledge on a limited topic in the academic journal articles. Fink (1998) defines a literature review as a systematic, explicit and reproducible design for identifying, evaluating and interpreting the existing body of recorded documents. The reasons underlying the purpose or use of a literature review are various. Bourner (1996) explains that a literature review aims to identify gaps in the existing literatures, to avoid redundancy, to advance existing works, to identify other people working in the same area, to increase breadth of knowledge in a specific area, to identify seminal works in a certain research area, to provide intellectual context for one's own work, to identify opposing views and to identify methods relevant to the work.

To conduct the literature review, we defined the following specific boundaries for our search:

1. The analysis focused only on papers in peer-reviewed scientific journals published in English. Papers in other languages are excluded in this research. This was because of the difficulties associated with searching and analyzing papers in different languages and also because most (or all) of the scientific journals that address the topic are in English.

2. Similar to previous works (e.g., Linton *et al.,* 2007), the search was conducted in a single database, Scopus (www.scopus.com). Scopus is considered the largest database of peer-reviewed journals and quality web sources. It allows the tracking, analyzing and visualizing of research[7]. The selection of the database is based on the user-friendly features provided by Scopus, which enabled us to access a comprehensive database of related articles.

[7] *http://www.info.sciverse.com/scopus/about/*. Accessed on 15th February 2011

3. The structured keywords adopted in the search were limited to *sustainable/sustainability, agriculture/agricultural* and *supply chain*. In the assessment of environmental performance, we also added *life cycle analysis* and *carbon footprint* to see how these methodologies evolved in the agricultural sector. The utilization of the keywords is not limited only to the title but also includes the content of the abstract.

4. The articles were collected by inserting the keywords in the mentioned database and verified by the research team for coherence and continuity with the topic.

3.3. Sustainability: An Overview

3.3.1. Sustainability and its extension

Sustainability has been a much discussed and debated topic. Over time, the literature has addressed sustainability under different perspectives. One previous, much quoted interpretation of sustainability is from the perspective of sustainable development: "[development that] meets the needs of present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Starik and Rands (1995) define sustainability as "[…] the ability of one or more entities, either individually or collectively, to exist and flourish (either unchanged or in evolved terms) for lengthy timeframes, in such a manner that the existence and flourishing of other collectivities of entities is permitted at related levels and in related systems". Shrivastava (1995) describes sustainability as the potential for reducing *long-term risk* associated with resource depletion, fluctuations in energy costs, product liabilities, pollution and waste management. Sustainability is thus becoming an integral component of corporate strategy (Epstein, 2008). In this context, sustainability strategies should be supported by proper management control, performance measurements and reward systems. This means that sustainability can create financial value for a corporation through enhanced revenues, for example, increased sales due to an improved corporate reputation, and lower costs, for example, process improvements and decreases in regulatory fines (Epstein, 2008 p. 22).

From the seminal definition provided by the World Commission on Environment and Development (WCED), sustainability is also widely associated with the implementation or fulfillment of the three pillars of sustainable development, or the so-called Triple-Bottom-Line (3BL), which emphasizes environmental, social and economical performance for the improvement of the quality of life of the human being. Similarly, the World Business Council of Sustainable Development (WBCSD) noted that sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality and social equity where companies aiming for sustainability must perform not against a single, financial bottom line but against the triple bottom line[8]. Elkington (1998, 2004) noted the concept of sustainability as the intersection of the three components (Fig. 3.1). The term itself has been enriched with different concepts: the *five capital framework* (natural, social, human, manufacturing and financial) (Parkin *et al.*, 2000); *risk management, transparency, strategy and culture* (Elkington, 1998; Shrivastava, 1995; Starik and Rands, 1995; Sarkis, 2001; Epstein and Roy, 2003) and *ethics*, *governance*, *business relationships*, *community involvement/economic development*, *value of product and services*, and *employment practices* (Epstein and Roy, 2003; Stokes and Tohamy, 2009). Though contributions mentioning the concept of the 3BL are flourishing, the integration between the three dimensions is not fully accomplished. The literature demonstrates a lack of discussion concerning the interaction among the three components in the triple bottom line; it is evident that research is dominated instead by green and environmental issues (Seuring and Muller, 2008). This is also reflected in terms of limited attention towards a sustainable supply chain that goes beyond environmental issues.

[8] See www.wbcsd.org. Accessed on 11st January 2011

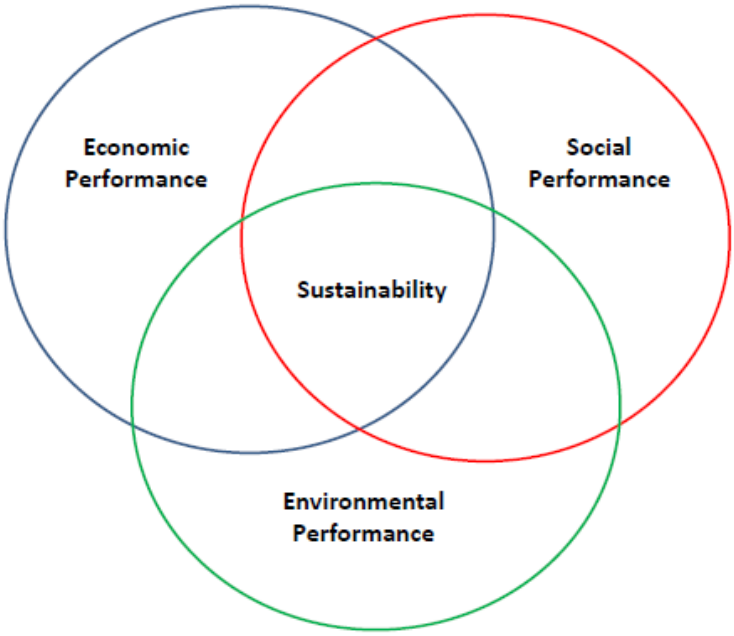


Fig. 3.1. Sustainability as the intersection of 3BL performance

Although it seems that most researchers agree on the concept of the 3BL, sustainability remains a much debated topic that requires further development. Costanza and Patten (1995) interpret sustainability as the *predictions* based on today's action that are to be implemented in the future, that is, keeping the harvest rates below the rates of natural renewal should lead to a sustainable extraction system. Another example comes from Sutton (2000) who states that "sustainability is not about the integration of social, ecological and economical issues nor is it about widespread consultation, nor is it about improving quality of life but it is about sustaining something, […….] however, it is not possible to achieve a desired level of ecological or social or economical sustainability (separately) without achieving at least a basic level of all three forms of sustainability, simultaneously". Yet another interpretation of sustainability is provided by Milne *et al.* (2006), who assert that sustainability is a journey that evokes images of organizational adaption, learning, progress and a movement away from the business-as-usual practices.

In this work, we consider the perspective of sustainability according to the mainstream of the 3BL. Thus, by being sustainable, companies and organizations can achieve greater economic performance and sustain their position in the competition by

practicing and managing both social and environmental performances in their daily operations.

3.3.2. The interaction of agriculture and (sustainable) development

The agricultural sector provides an important contribution to the development of a country or a region due to its role in both the economic and environmental development. Agricultural products become the primary goods in daily activities and sources of employment for millions of people across the globe, thus serving as a key element in elevating countries out of poverty (United Nations, Millennium Development Goals, 2000). Explaining the importance of agriculture in sustainable development, the Food and Agriculture Organization (FAO), in 1994, stated, "Sustainable development is the management and conservation of the natural resource base and orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, preserved water, plant and animal genetic resources, and is environmentally non-degrading, technical appropriate, economical viable and socially acceptable[9]". A more environmentally oriented interpretation is proffered by the United Nations of Environmental Protection (UNEP), which defines sustainable development as the process that improves people's quality of life within the carrying capacity of Earth's life support system. This definition is also supported by the World Conservation Union (IUCN). This interpretation, however, is sometimes combined with sustainable growth and sustainable use, though all these terms are different[10].

As the backbone of the development in most developing countries, agriculture plays a pivotal role in determining the stability of the country's economy. Statistical figures show that while 70% of the world population lives in rural areas, only 38% of the land in the world is used for agriculture cultivation, a number that is being depleted

[9] See *http://www.fao.org/DOCREP/006/AD238E/ad238e08.htm*. Accessed on 25th January 2011

[10] The terminology between sustainable development, sustainable growth and sustainable use sometimes creates confusion as they are used interchangeably and are often interpreted to have the same meaning where, in fact, they are different from each other (*http://www.unescap.org*). Accessed on 25th January 2011

over time due to industrial expansion and human population growth (World Bank, 2010). Statistical data also show that the consumption of food and agricultural products have fluctuated during the last decades. The typical annual rate of consumption from 1990 to 2007 ranged from 0.39% to 0.67% across the globe, excluding the food crisis period (1995 – 2002) where consumption recorded a negative growth of -0.45% (FAO Database 2010).

Harwood (1990) defines sustainable agriculture as "a system that can evolve indefinitely toward greater human utility, greater efficiency of resource use and a balance with the environment which is favorable to humans and most of species". Based on this explanation, we can expect that the adoption of sustainable agriculture will create sufficient impact on human development. Conway and Barbier (1990) describe sustainable agriculture as the ability to maintain productivity whether we are considering a field, a farm or a nation, while Arinquez and Kostas (2007) posit that agriculture is the key for rural development in the world. Similar to Conway and Barbier, Kasem and Thapa (2010) recognize the importance of sustainable agriculture development at the country level as the policy itself proves to be the crucial component for the economic growth of the country. At the organizational level, Lang (2010) shows that in reaction to the increasing sales of organic food by 20% to 25% between 1996 and 2001, a trend that continues to grow[11], the Community Supported Agriculture Program (CSAP) became very active in producing organic agricultural products by practicing sustainable agriculture in its daily operations. From an environmental perspective, the practice of sustainable agriculture is essential for preserving biodiversity on the planet.

Ronald and Adamchak (2010) note that there are two practices that can be implemented to keep a growing population fed in an ecological manner – genetic engineering and organic farming. Ronald and Adamchak (2010) explain that organic farming, which, in this case, is considered as sustainable agriculture, is an ecological-based farming method that avoids or largely excludes the use of synthetic fertilizers and

[11] The Community Supported Agriculture Program encourages local communities to plant and harvest agricultural product in the local area using Good Agricultural Practices (GAP) that have proven effective in producing organic agricultural products in response to an increasing demand on organic products

pesticides. As much as possible, organic farmers rely on crop rotation, covering crops, compost use and mechanical cultivation to maintain soil productivity and fertility, to supply plant nutrients, and to control weeds, insects and other pests. Similarly, Horrigan *et al.* (2002) mention the importance of sustainable agriculture for environmental protection, economic profitability and social economic equity of the society. Marsden *et al.* (2001) mention that sustainable agriculture and a sustainable supply chain also play an important role in rural development, while Reganold *et al.* (1990) suggest that conventional farming methods often increase the rates of erosion by depleting the organic matter in the soil. Implementing sustainable agricultural practices, however, can help to preserve the soil structure. Smith (2008) also stresses the need to improve sustainability in mainstream agriculture and international supply chains.

To increase the market share and to address the problem of food safety and rising concerns of social and environmental issues, contemporary firms that work in the agriculture sector are aware that the implementation of sustainability is inevitable. Consequently, the volume of sustainable agriculture products has increased over time and consumer preference has shifted to healthier products derived from sustainable agriculture that come from a sustainable supply chain (Knickel *et al.,* 2002). In this context, there is also an increasing trend in the sales of organic agricultural products due to increasing health awareness among consumers.

3.3.3. Sustainable Supply Chain Management (SSCM)

Recent contributions have focused attention on the relationship between sustainability and supply chain management. Carter and Rogers (2008) define SSCM as the strategic, transparent integration and achievement of an organization's social, environmental and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chain. The increased attention on sustainable supply chain management in the literature is evidenced by the increasing number of papers on the topic. For example, Pedersen (2009) argues that companies and other business entities must address sustainable supply chain management related to the triple

bottom line of economics as well as the social and environmental components to maintain company performance in the long run. Similarly, Carter and Rogers (2008) state explicitly that firms that strategically undertake SSCM can achieve greater economic performance compared to those companies that pursue only one or two of the three components of the triple bottom line.

Rao and Holt (2005) mention that the practice of greening in different stages of the supply chain will lead to an integrated green (sustainable) supply chain, which will ultimately lead to competitiveness and better economic performance. Sustainability in supply chain management drives top management in corporations to design a more effective and efficient supply chain (Beamon 2008). Similarly, Zhu *et al.* (2008) show that in China, due to a serious depletion of raw materials and environmental regulations, companies are beginning to adopt sustainable practices in operations and manufacturing and are making greater efforts to reduce environmental damage. Svensson (2007) also shows that the scarcity of natural resources in the future will force business practices and research to acknowledge the circumstances and the conditions derived from supply chains based on renewable and recycled resources. Reuter *et al.* (2010) state that a sustainable supply chain at the global supplier management level must be managed carefully to reduce risks. Research on sustainable supply chain management has been extended toward various management areas such as manufacturing (e.g., Zhu and Cote, 2004; Pagell and Wu, 2009; Seuring *et al.*, 2007), purchasing activities (e.g., Carter *et al.,* 1998; Chen, 2005; Green and Morten, 1996; and Min and Gale, 2001), hotel and tourism (e.g., Öztüren and Sevil, 2009; Goodman, 2000), the food industry (e.g., Elkington, 1998; Aiking and de Boer, 2004; Hamprect *et al.*, 2005; Ilbery and Maye, 2005; Rimmington *et al.,* 2006) and the oil and gas sector (e.g., Matos and Hall, 2007).

In reality, the integration of economic, social and environmental performances appears difficult to accomplish. Zaklad *et al.* (2003) notes that companies may place less attention on one of the three components of 3BL thus indicates the problem with achieving a balance between business process improvement, technology implementation and social system transformation. A survey conducted in 2010 by the Harvard Business Review shows that most companies tend to disregard the sustainable performances of

their supply chains primarily beginning with the 3rd tier suppliers and progressing back down the chain, providing evidence that there is lack of attention toward holistic sustainable supply chain management[12]. This occurrence stresses the importance of cooperation among companies in the same supply chain and the necessity to place additional emphasis on the entire supply chain (Seuring and Müller, 2008), designing more holistic approaches to incorporate the economic, social and environmental aspects (Dakov and Novkov, 2008).

3.4. Towards sustainable supply chain management in the agricultural sector

3.4.1. Thematic Approach

In this section, we focus attention on the literature that addresses the development of sustainability in the agricultural supply chain research area. We aim to identify the current research mainstream as a baseline for understanding the whole picture. Furthermore, we highlight major topics discussed in the literature on a sustainable supply chain in the agricultural sector.

3.4.1.1. Sustainable Agricultural Supply Chain (SASC)

Departing from the insight of Seuring and Müller (2008), we consider the supply chain of agricultural products from the initial stage of the supply chain. Linton *et al.* (2007) also find that the supply chain of a product must be examined from the initial processing of the raw material to the delivery of the product to the customer. Supporting these two opinions, Auroi (2003) recognizes the important role that peasants, small farmers and consumer associations for fair trade play in improving sustainable supply chain management in the global market. Overall, contributions toward SSAC can be broken down into four categories:

[12] Research conducted by Harvard Business Review in October 2010. Results show that there is greater concern for suppliers in the 1st tier toward their sustainable performance (33%), while among 3rd tier suppliers, the concern is reduced to 10%

- *Initiatives toward sustainability – the implementation of international and local regulations and standards, such as Common Agricultural Policy (CAP), in the agricultural sector*

  Achieving sustainability in agricultural contexts means meeting three challenges: (a) profit – the strengthening of the viability and competitiveness of the agricultural sector; (b) planet – the ecological challenge to promote good environmental practices; and (c) people – the social challenge to improve the living conditions and economic opportunities in rural areas. To respond to the three challenges, policy and regulations such as the Common Agricultural Policy (CAP) are important. The goals of such programs must include improving sustainable agriculture so that it meets the interests of both markets and governments, maximizing the potential of the supply chain to contribute to sustainable agriculture, and creating a fairer distribution of costs and benefits (Veerman, 2004; Peeters, 2010; Brigstoke, 2004). Some local initiatives, such as the concept of glocalization, have also been taken into consideration (Peter *et al.*, 2010; Lombard and Leakey, 2010; Van Amstel – Van Saane, 2007). Jöhr (2004) cites the positive impact of the Sustainable Agriculture Initiative (SAI) that prompted Nestlé, Danone Group and Unilever to adopt the sustainable agricultural supply chain concept, thereby increasing environmental awareness, sharing knowledge, tracing and monitoring practices throughout the entire supply chain and encouraging sustainable agriculture. Grimsdel (1996) mentions mutual awareness to reach sustainability.

- *Practices in agriculture*

  Nisbet e*t al.* (2005) emphasize that sustainable agriculture practices in the agricultural supply chain help to minimize the environmental impact and provide public reassurance through countermeasures both in site and off-site of the chains. Consistent with Nisbeth *et al.* (2005), Pretty *et al.* (2008) conducted a multi-year assessment research on several agricultural supply chains of different commodities such as peas, spinach, tomatoes, tea and oil palm in various

countries as a way to understand and demonstrate progress toward a more sustainable agricultural supply chain. Pretty *et al.* (2008) reported that there is an increase of the acceptance and adoptability of sustainability indicators in the agricultural supply chains that included both social and environmental performance. Similarly, Okano *et al.* (2010) conducted research using productivity indicators in the dairy industry, and Bowen (2010) employed geographical indicators to reach sustainability. Among practices considered in the literature, Good Agriculture Practices (GAP) was most frequently used in achieving sustainability (e.g., Corner and Foulds, 2004; Johansson *et al.,* 2004; Wiskerke, 2003; Grimsdell, 1996; Smith, 2008; Hettenhaus, 2006; Henson *et al.,* 2005; Tilman, 1999). Optimization in the agricultural supply chain was also a preferred option for achieving sustainability (e.g., Higgins *et al.,* 2010; Ras and Vermeulen, 2009; Krishnakumar *et al.,* 2009). Sustainable agriculture and sustainable agricultural supply chains have been found to provide healthier and safer products. Furthermore, they help to preserve nature as well as biodiversity when compared to more conventional agricultural practices, by managing irrigation and water use in agricultural production, managing the utilization of pesticides and chemical fertilizers (Soulsby and Fuller, 2004; Johansson, Paul and Finlay, 2004; Rinaldi *et al.,* 2010), and considering the land use change and minimizing the overuse of water (Rambeau *et al.*, 2004; Blackhurst *et al.*, 2010), for example, with modernized irrigation tanks (Anbumozhi, *et al.,* 2001).

- *Renewable energy – SSAC as an important feature of bio-fuels and biomass industries and as a source of renewable energies*

  SSAC also plays an important role in providing renewable energy to industries and, thus, potentially reducing industry impact on ozone depletion (Nardin and Catanzaro, 2007; Matos and Hall, 2007; Hettenhaus, 2006; Kim *et al.,* 2009; Uellendahl *et al.*, 2008; Deswarte *et al.,* 2007; Everard *et al.,* 2010; Buchholz and Da Silva, 2010; Fischer *et al.,* 2010). In terms of employment opportunities in the biomass industry, research by Thornley *et al.* (2008) indicates that the impact of bio-energy plants on employment levels in rural areas is greater than

that of conventional energy plants. They also find that not only does employment for agricultural harvesting increase, but employment along the supply chain also increases, such as in the areas of transportation, feedstock processing, staffing of thermal conversion plants, and equipment manufacturers. This finding implies that a sustainable agricultural supply chain creates greater economic impact by providing employment opportunities in rural areas than does a conventional agricultural supply chain.

- *Technological application – better access to information using available sophisticated technology*

  Technological issues have also become a critical part in the development of a sustainable agricultural supply chain over the years. Cleaver and Schreiber (1994) note that the lack of technology use in agriculture hinders sustainability in agriculture practices while Sigrimis *et al.* (2001) argues for the advancement of sensing, information, automation and control technologies in the field of agricultural production and supply chain management operations. According to Rao (2007), another key to achieving a sustainable agricultural supply chain is the implementation of information and communication technologies (ICTs) as ICTs offer a wide range of opportunities for institutionalizing knowledge management in agricultural development. The application of ICTs, however, is differentiated by the models of the supply chain, namely, open loop, closed loop and spatial data network.

Table 3.1 provides the distribution of contributions in the different categories. As can be seen, the study of practices in agriculture dominates the literature in SASC. Several contributions can also be found on initiatives for sustainability. In the end, however, few papers have yet to focus on renewable energy and technological applications.

Table 3.1. Number of contributions for each category

Categories	Number of Contributions (N = 80)
Initiatives toward sustainability	21
Practices in agriculture	42
Renewable energy	10
Technological applications	7

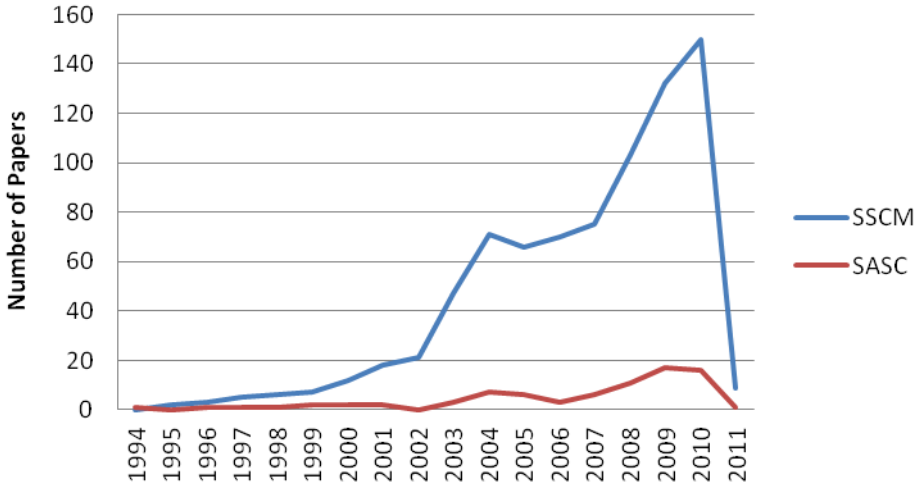
3.4.2. Coverage Analysis

The aim of the coverage analysis is to examine the evolution of the considered topics over time to understand the phenomenon and the trends in the selected literatures. We divided the section into three sub-sections: *Longitudinal Analysis*, *Research Methodologies Used*, and *Assessment*.

3.4.2.1. Longitudinal Analysis

A longitudinal analysis is based on the examination of the evolution of SSCM and SASC over time. The number of contributions has been increasing rapidly in recent years, indicating increased attention toward the topic. The significant increase for SSCM occurred between 2002 and 2004, when the number of contributions almost doubled. During that same period, the number of available contributions for SASC faced only a moderate increase. Overall, the figures show a positive trend and cover the various fields of study (see Graph 3.1 and Table 3.2).

Graph 3.1. The evolution of contribution in SSCM and SASC



Note: 1. SSCM = Sustainable Supply Chain Management

2. SASC = Sustainable Agricultural Supply Chain

As per February 20th 2011

We mapped the articles containing the keywords *sustainable* combined with *supply chain management* to obtain an overview of the distribution of the fields of study of the considered contributions. We found a total of 797 articles resulting from the two mentioned keywords. We then inserted the keywords *sustainable* and *agricultural* and *supply chain* to determine the distribution of papers on this topic. When contributions were limited only to the agricultural industry, we found that less than 10% of the total sustainable supply chain papers considered or addressed, to some extent, the agricultural sector (N = 80).

Table 3.2. The dispersion of fields of study in SSCM and SASC

Fields of Study	SSCM	SASC
Engineering	326	9
Business, Management and Accounting	256	9
Environmental Science	178	31
Computer Science	119	4
Decision Sciences	111	2

Social Sciences	83	21
Energy	67	9
Agricultural and Biological Sciences	61	25
Chemical Engineering	54	5
Economics, Econometrics and Finance	48	5
Materials Science	47	5
Mathematics	22	2
Earth and Planetary Sciences	21	4
Chemistry	18	4
Medicine	12	4
Other[13]	34	10

Table 3.2 shows the dispersion of the field of study both in the mainstream of SSCM and in the specific SASC. By means of descriptions, some contributions in the literature fall interchangeably into several categories of the study. With respect to the SSCM perspective, engineering shows the highest frequency of distribution with 326 articles followed by business, management and accounting with 256 articles. The environmental sciences share 178 articles, the social sciences account for 83 articles and agricultural and biological science account for 61 articles. There is also a significant number of articles on the application of information technology (computer science) in supply chain literature, as it is represented in 119 articles.

In SASC contributions, most of the articles are distributed in the field of environmental sciences with 31 articles followed by agricultural and biological science with 25 articles, social sciences with 21, and energy with 9. Based on these counts, the environmental issue seems to garner the greatest concern with respect to the agricultural sector. This implies that sustainability in agriculture (and in other sectors where sustainability is seldom considered) is a concern only when sustainability impacts environmental issues (Seuring and Müller, 2008).

[13] 'Other' represent *biochemistry, genetics and molecular biology; physics and astronomy; immunology and microbiology; nursing; psychology, art and humanities; health professions; pharmacology, toxicology and pharmaceutics; veterinary; multidisciplinary and undefined category.*

3.4.2.2. Research Methodologies Applied

Attention here is focused on SASC issues. We find that among the 80 papers available, case studies dominate the current literature, with 50% of the papers adopting this methodology. Case studies are followed by assessment methodology, such as simulations and mathematical modeling, which accounts for more than 30% of the papers. The remaining papers are conceptual or modeling papers. The assessment and concept papers primarily rely on direct surveys, with 85% of the papers adopting this approach compared to only 15% that used a secondary dataset. These findings suggest that the case study is the most preferred approach used by scientists in the agricultural area as there is only moderate number of conceptual and modeling papers. This last methodology, however, should be developed in the near future to provide companies with the methods and tools needed to manage agricultural supply chains.

3.4.2.3. Assessment of environmental performance

In this section, we focus on the environmental issue both in the agriculture sector as the mainstream and within the SASC. While there are several ways to calculate the environmental impact, there are two methods that are most often considered: the carbon footprint and the life cycle assessment (e.g., Hanegraaf, Biewinga and Van Der Bijl, 1998; Hagelaar *et al*., 2004; Van Berkel, 2002; Hagelaar and Van der Vorst, 2002; Seuring, 2004; Fredga and Mäler, 2010). By definition, the life cycle assessment (LCA) assesses the environmental aspects and potential impact associated with a product, process or services (US Environmental Protection Agency, 2011), while the carbon footprint specifically measures the total greenhouse gas (GHG) emissions caused directly and indirectly by a person, organization, event or product (Carbon Trust, 2011). In other words, the main differences between LCA and carbon footprint is that the LCA covers all quantifiable environmental impacts associated with products, while a carbon footprint covers only GHG emissions[14]. Based on the analysis of the current literature, we find that LCA is the most adopted methodology in the agriculture sector, as up to 59

[14] See http://www.incpen.org/displayarticle.asp?a=16&c=2; http://www.lcaforum.ch/portals/0/df34/DF34_06_Coop-Ruettimann.pdf and http://www.leonardo-energy.org/lca-carbon-footprint-and-ecological-footprint. Accessed on 20th September 2011

articles referenced the use of the LCA methodology compared to only 9 articles that referenced the use of the carbon footprint methodology. The longitudinal research also indicates that the LCA has been used since 1998, while the carbon footprint is a more recent methodology, with its first contributions appearing in since 2007.

Table 3.3. The comparison of methodologies used in agriculture and SASC[15]

No.	Components	Agriculture		SASC	
		Life Cycle Assessment	Carbon Footprint	Life Cycle Assessment	Carbon Footprint
1	Timeline	1998 – 2011	2007 – 2011	1998 – 2011	2007 – 2011
2	Number of Articles	59	9	5	1

On the contrary, we determine that both methodologies are rarely used within the SASC publications. Only 5 publications address SASC through the LCA, and only 1 contribution can be found for the carbon footprint methodology. There are no contributions that consider the adoption of both methodologies in the supply chain, especially with respect to agricultural products. We suggest considering the combination of both methodologies to understand the environmental impact of the supply chain in agriculture.

3.4.2.4. Assessment of social performance

Within the SASC publications, we find that only two publications discuss measuring social performance. Cross *et al.* (2009) mentions that a more globalized SASC that complies with international standards such as ISO should provide better social performance (e.g., better healthcare and access to education) than would a localized chain. Hospido *et al.* (2009) also note that consumer preferences and selections of agricultural products are sometimes based on an awareness of issues such as child labor and adequate working conditions.

[15] The comparisons based on keywords *sustainable agriculture – life cycle assessment, sustainable agriculture – carbon footprint, SASC –life cycle assessment and SASC – carbon footprint*

3.5. Discussion

Our results provide evidence that while the sustainable agricultural supply chain is a developed topic, there are still many areas that require significant research and development. First, even though more than 80 publications were identified as addressing this topic, the contributions appear limited when compared to the contributions on sustainable supply chain management as the mainstream. In particular, there seems to be a gap in the debate on this topic, especially when considering the relevance and impact of agriculture on both environmental and social issues.

Of all the topics covered by current literature, most researchers believe that a sustainable agricultural supply chain can be achieved if each echelon of the chain adopts sustainable practices in its operations. The previous analysis, in fact, clearly indicates that research is focusing more on how practices can be improved to achieve sustainability within the supply chain. While globalization plays an important role in promoting sustainable supply chain management, market preferences and health concerns are also becoming key drivers for sustainability (Pagan and Lake, 1999; Goodland, 1997). However, only a few articles discuss the flow of agricultural products from one echelon to the next in a sustainable way. This issue can be worth exploring in the future. For example, La Trobe and Acott (2000) address the issue of unsustainable transportation of food and agricultural products around the world due to globalization, and Corner and Foulds (2004) stress the importance of addressing sustainability in the transportation of agricultural products.

In most agricultural supply chains, transportation is typically managed by land vehicles. The adoption of different transportation modes depends mostly on infrastructure, the availability of spare parts, and the cost of petroleum. For typical agriculture supply chains, a combination of transportation modes is needed. For example, from a farm perspective, most farmers use land and water vehicles to bring their harvest to collectors because the operational cost for air transportation is very high. This typical transportation mode goes all the way up to the processing companies, and if the market is localized, then land vehicles are also used for retailers and wholesalers.

For cross-boundary transportations, ships are likely to be used for the transportation of goods. Therefore, either because of self-consciousness or because of market demand, greening the fleets would be a rational move for most of these firms. This could present a potential problem if managing the transportation modes creates a significant impact on the company's performance.

It is worth noting the kind of sustainability on which researchers are focusing. Specifically, we identified many contributions that address the environmental aspects of sustainability and some that focus on the social issues. However, very few papers address the two issues together, and even fewer include the economic issues, thus failing to provide a complete perspective on sustainability. We argue that more research is needed to understand the multidimensional problems of sustainability. In fact, the literature lacks the requisite methods to evaluate the three perspectives together, lacks contributions on practices that can contribute to improving performances in the three dimensions, and shows limited evidence of what companies are doing to achieve sustainability.

Another interesting issue refers to the distribution of papers in different research fields. Most of the contributions are focused on the typical research areas where both environmental and social issues are treated, that is, agriculture, biological science, and social science. Limited contributions can be found outside of these research fields, specifically in management and decision sciences. This gap is even more evident when we compare the development of these research areas in SSCM. For example, decision science accounts for more than 110 contributions on SSCM (out of 797 or 14% of the total), while in SASC, decision science accounts for only 3% of the total sample of identified papers. This suggests that the focus of the SASC should be devoted to the practical application of achieving sustainability rather than on how to create better policies to achieve sustainability.

The last consideration refers to the methodologies that are typically applied in this area. It is rather evident that the case study is the most adopted methodology. Very limited contributions can be found that adopt quantitative modeling approaches. This

limitation is an indication that the literature does not provide the tools and methods that company can directly use to improve their sustainable capabilities. Thus, more contributions that explore specific models and methods, combined with survey approaches, would help determine the effectiveness of specific practices of sustainability and, thus, allow research to focus more on theory testing and verification.

3.6. Conclusion

Sustainability in the supply chain of agricultural products is an evolving topic; however, specific research gaps can be identified. In the 21st century, a sustainable agricultural supply chain is not solely about practicing farm cultivation; rather, it includes warehousing, transportation, manufacturing and distribution, and it requires considering not only what it is best for the survival of the companies, but what is best for the environment and for biodiversity. Our work addresses a specific topic that is rarely discussed in the sustainable supply chain management area, and it provides a comprehensive literature review of the sustainable agricultural supply chain that, to our knowledge, has been only partially addressed in the extant literature. In this way, a better understanding of the SASC concept can be extended.

In particular, this work highlights specific areas of research that should be addressed and that could significantly contribute to sustainable development. As an overall consideration, the literature has addressed the SASC by providing sparse and diverse contributions that have not yet clustered into strong research streams. This work contributes to the literature by focusing the research efforts in specific areas, thus leading to contributions for both research and practice.

The implications of this research extend to companies, researchers and practitioners that are interested in the agricultural supply chain topic. Understanding the development of themes and topics over the last decade will allow us to view the SASC approach from a holistic perspective that is not partially limited to certain tiers of the supply chain. Further implications can be extended toward the governmental level, creating a better policy for achieving sustainability in the agricultural sector.

In the end, it is important to highlight some of the major limitations of this work. First, the research has focused on analyzing papers from one major database (i.e., Scopus), and even if that database provides access to most of the scientific journals available, it does not guarantee complete access to all possible contributions. Thus, further research of this topic should also consider those publications that the approach we adopted may have missed. Second, we conducted a literature review by selecting papers using a keyword search procedure, a method that does not guarantee that all relevant contributions have been considered.

CHAPTER 4

WORLD COCOA MARKET AND OVERVIEW ON INDONESIAN COCOA INDUSTRIES

In this chapter, we briefly presented cocoa market in the world and an overview on Indonesian cocoa industries. First, we briefly explain the usage of cocoa in the chocolate industries. Then we present the cocoa market in the world and briefly discuss top two biggest cocoa producers in the world. Lastly, we overviewed the cocoa industries in Indonesia, including its market structure and problem encounter from both market and regulations.

4.1. Cocoa and Chocolate

Cocoa is the important ingredient for making chocolate bars, cookies and other consumable goods. Cocoa or cacao (*Theobroma cacao*) grew in the tree with 4 – 8 meter tall and classified in family *Sterculiaceae* (alternatively *Malvaceace*), originated from Southern America territory before imported to Europe and spread widely in Western part of Africa, South East Asia and part of Oceania. The seed of cocoa has bitter taste and must be fermented to develop the flavor. Fermentation can be done in several ways but all method depends on removing the beans from the pod and piling it together or in a box to allow micro – organism to develop and initiate fermentation of the pulp surrounding the beans (ICCO, 2010). After fermentation, cocoa beans are dried in order to reduce moisture from about 60% to about 7.5% with two different ways, the natural drying or the artificial drying. Arriving in the chocolate manufacturing, cocoa beans then cleaned to remove dirt, stone and other debris before roasted and graded. Next, the shells are removed to extract the cocoa nib from the fruit. Then cocoa nib are grounded and liquefied to obtain pure chocolate in fluid form or the chocolate liquor. The liquor then can be further processed into two components that are cocoa solids and cocoa butter (Cocoatree, 2008).

Figure 4.1. Cocoa beans and derivatives

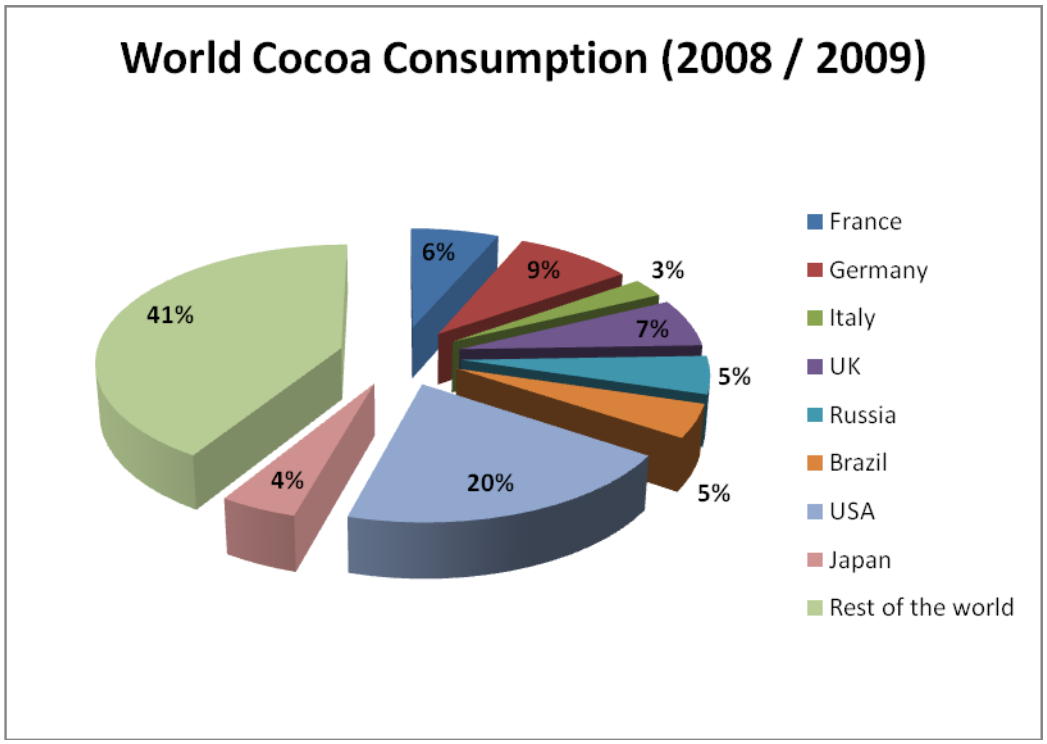
Moving to demand trend, customer preference has become standard in producing good chocolate. Producers have to know the market demand and requirement in order to stay in the competition. Beside market demand, chocolate manufacturers also have to comply with the regulations and standards set by importing countries. For example, European Union specifies that the minimum percentage of cocoa solid in milk chocolate is 25% where as in milk chocolate; there will be no cocoa solid in the mixture. To produce good chocolate, producers such as Hersey, ADM, Cargill and Mars requires high quality beans with low rate of dirt and low moisture rate. The supply of good quality beans is meant for increasing profitability and holds the market share in the chocolate industries. By achieving that, each chocolate producer can maintain customer loyalty to its brand. To maintain the customer loyalty for a brand, the chocolate manufacturers must be able to fulfill the customers' request (hope from) on a brand. In the other words, they must be able to integrate what is the consumers' need (the demand) and what can be given by the ends product or the processed cocoa (the supply). This is can be achieved through supply chain management in the cocoa industry. Regardless the distance and the transportation mode, each firm must compromise with delivery time and good quality of the products to the consumer in each stage of supply chain.

4.2. Cocoa Market in the World

As part of the food products, chocolate was considered as the source of fat, unhealthy product that can caused obesity and heart attack. Yet, a study by WHO shows that chocolate is not causing heart attack, instead one type of chocolate (dark chocolate) can strengthen the heart of human and can act as controller for blood pressure. The same conclusion also shown in a study by ICCO in 2008 which resulted in the introduction of new chocolate candies which are more dark and high content of cocoa compare to the traditional milk chocolate. A latest research on chocolate was reported by BBC in 2012 stating that chocolate even can protect human from stroke if the consumption rate of chocolate is also controlled (BBC, 2012) The study was done in US and UK market which can be considered as premium market in chocolate industry. Similar to the finding, market trend shows the consumption of the chocolate in the world is increasing by 14% on average within the period of 1997 – 2006 with USA as the leading country with about 1.600.000 tons in 2006 of chocolate consumption followed by Germany, United Kingdom and France (ICCO report, 2008).

The rising demand for chocolate affected the performance in the export of cocoa beans. In the period 2005 / 2006, European region has been accounted for the largest cocoa consumption by 49% followed by American region with 35% and Asian region with 14% of total world consumption. There is significant increase by 728.000 tons in the 2005 / 2006 period compare to the 1995 / 1996 period or equal to 27% increase. The percentage of consumption can be seen in the chart 4.1 below:

Chart 4.1. Main Consuming Countries for Cocoa



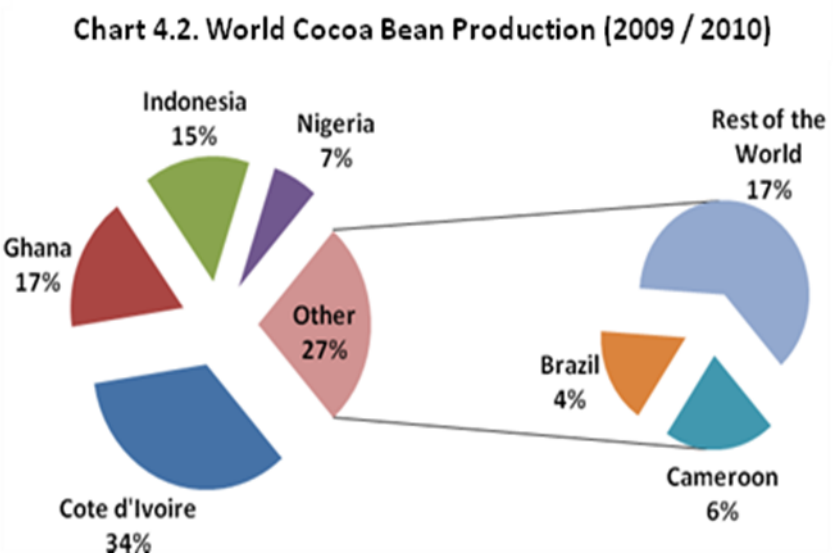
Source: International Coffee and Cocoa Organization (2011)

To meet the demand of cocoa and chocolate in the world, several companies have established manufacturing facilities in Europe and USA. Some chocolate manufacturing companies are Nestle and Barry Callebaut in Switzerland; Cadburry in United Kingdom; Kraft, Mars Inc and Hershey's in USA; Ferrero SPA and ICAM in Italy; Ritter Sport in Germany and Valrhona in France. Currently some of the companies such as Barry Callebaut, Cargill and Archer Daniel Midlands (ADM) are planning to invest on chocolate manufacturing plant in Indonesia in 2012.

There are several cocoa producers in the world, yet most of the production is come from three countries namely Ghana, Cote d'Ivoire and Indonesia which account for 66% of the world total cocoa production (Chart 4.2). For each cocoa producer, there are some differences in the supply chain, particularly in the farmers to collector chain. These characteristics were basing on the nature of regulations and business climate in each producer country. For example, in Cote d'Ivoire; though accounted as the biggest cocoa beans producer in the world, the government's participation is not significant in

the cocoa chain, where in Ghana; the involvement of cocoa stakeholders, including the government, is high especially in the early stage of the chain. The present of government entities were represented in Ghana Cocoa Board (COCOBOD)[16].

Furthermore, buying cocoa beans from the farmers in Ghana mostly done by Licensed Buying Companies (LBC) and sell most of it to Cocoa Marketing Company (CMC)[17]. Although LBCs are entitled for direct export of the minor share of their cocoa beans, export activities are still under CMC (Fold, 2002) whereas transnational sourcing and domestic regulations also highlighted for creating livelihood and creating access to markets and stable prices (Fold, 2008). This structure shows how Ghanaian government enforced tight control for their cocoa commodity, reflected to the bean's quality that their produce, although sometimes farmers sold unfermented low quality beans to LBC for immediate cash (Lundstedt and Pärssinen, 2009).



Source : International Cocoa Organization (ICCO), 2011

[16] The board of directors for COCOBOD consists of bankers, economists, worker's representatives and cocoa farmers, thus positioned it as a filter stage to ensure the quality of the beans. (http://www.cocobod.gh/index.php , accessed 6th August 2011)

[17] LBC is group of companies, both public and private, that are assigned to to domestic marketing activities such as buying cocoa beans from the farmers while CMC is the part of COCOBOD that in charge for export activities (Lundstedt and Pärssinen, 2009; Ghana Cocoa Board (COCOBOD), 2004) (see http://www.nek.lu.se/Publ/mfs/198.pdf and http://www.cocobod.gh/images/export_of_Cocoa_Regulations.pdf respectively for more detail, accessed on 18th August 2011)

Similarly, the active role and intervention from the government of Indonesia towards its cocoa sector is lacking (Neilson, 2007) and not significant as in Ghana. Though the Indonesia Cocoa Board has been established on 2006, yet the organization still in its early phase and not well established compare to COCOBOD. Reflecting to that, Indonesian's cocoa sector still experiencing several drawbacks such as low yield, low quality beans and ineffective marketing chain (Djajusman, 2007). Furthermore, Yasa (2007) mentioned that most of Indonesian beans were traded in unfermented, fat, bulk bean and volume based. He also stated that, in the smallholders' cocoa beans chain, transaction between cocoa farmers and market intermediaries and between intermediaries and cocoa processors or exporters is primarily conducted on "*cash and carry*" basis, thus driving most of farmers to sell their cocoa soon after harvest for immediate cash. This may lead to unsustainable practices (i.e. trading of unfermented beans) and has been the source of disadvantage for cocoa stakeholders in Indonesia, as they received discounted price in importing countries (Yasa, 2007; Djajusman, 2007; Dradjat *et al* 2003).

Due to the limited involvement of central government towards the development of cocoa sector, farmers are vulnerable for exploitation and left them in weak position to achieved both economical improvement and access to social enhancement. In this section, we would like to highlighted each cocoa supply chain from the top three cocoa producers in the world; namely Ghana, Cote d'Ivoire and Indonesia. To simplify, we only included the chains from farmers until manufacturing section. With this approach, we want to focused more on the earlier stages on the chain that often need more attention to reach sustainability (Auroi, 2003).

4.3. Cocoa Supply Chain in Ghana and Cote d'Ivoire

The cocoa value chain in Cote d'Ivoire starts when the cocoa beans are produced and harvested by farmers. Then farmers have three options of selling it; to farmer groups, to up-country buying station and to *pisteurs*. Then, the beans were taken into local grindings for fermentation process or can be taken to exporters for a direct selling

to overseas consumers. The fermented beans, then, usually taken to local chocolate manufacturer for further processes (graph 4.3a in *Appendix 4.1*).

Different pattern was provided by the value chain in Ghana as in graph 4.3b in *Appendix 4.2*. After the beans being harvested by the farmers, LBC's collect and bagged it before the beans were sent to the quality division of the COCOBOD. This institution is also responsible for warehousing and other logistics arrangement along with private sector. The next chain will be the marketing activities where CMC take responsibility for the trading of the cocoa beans. Most of the cocoa beans from Ghana are exported and the rest were procured by the local processors. Ghana has more structured and more controlled cocoa supply chain compare to Coté d'Ivoire, thus makes them more competitive in the market although Coté d'Ivoire still dominating the world production of the cocoa beans.

4.4. Cocoa Industry and Supply Chain in Indonesia

Currently Indonesia is the third largest cocoa producer in the world contributing 15% of total world production under Ghana and Cote d'Ivoire. Export for cocoa beans reaches as high as 515.000 tons in 2008, decreases by 10% from the export of 2006 due to the decreases of demand in major importing countries such as USA, The Netherlands and Brazil. Most of the plantation in Indonesia owned by smallholders by around 80% of the national cocoa plantation where private and Government owned the rest of the plantation. Currently there are 15 (fifteen) cocoa processing companies, both local and multinational, operated in Indonesia but some companies are idle capacity due to some technical problems such as old machines which makes costs are higher than income (Ministry of Agriculture, 2008).

Approximately there are 400.000 – 500.000 smallholder households engaged in the cocoa production in Indonesia (Panliburton and Lusby, 2006) where most of the plantations are located in Sulawesi Island. Being the 3rd largest cocoa producers in the world, the area of plantations in Indonesia reached 1.320.820 hectares with the yield reached 580 kg/hectare in 2006. The production rate was counted for 769,386 tons/year

(Djajusman, 2007). However, only 10% of cocoa beans are locally processed, while the rests were exported as raw beans. Approximately 80% of the cocoa beans in Indonesia are sold by the five main multinational affiliate exporters (Panliburton and Lusby, 2006).

Sulawesi' island is the main producing cocoa region for Indonesia with more than 70% of total national production comes from this region beside Sumatra and Kalimantan islands. Some multinational companies owned processing plants in Sulawesi but still only for raw materials of producing chocolate and not the full processing plant of the finished good. There are two types of cocoa produces in Indonesia that are cocoa *lindak* (bulk cocoa) and cocoa *edel* (specialty cocoa). Most of the bulk cocoa was produces in Sulawesi island and for specialty cocoa, it is produces only in Surabaya region. The beans from Indonesia are well known for its high viscosity when it's melting and therefore suitable for blending (Ministry of Agriculture, 2008). The development of cocoa industry in Indonesia can be seen in the table and graph below:

Table 4.1. Area, Production and Productivity in Cocoa (2002 – 2010)

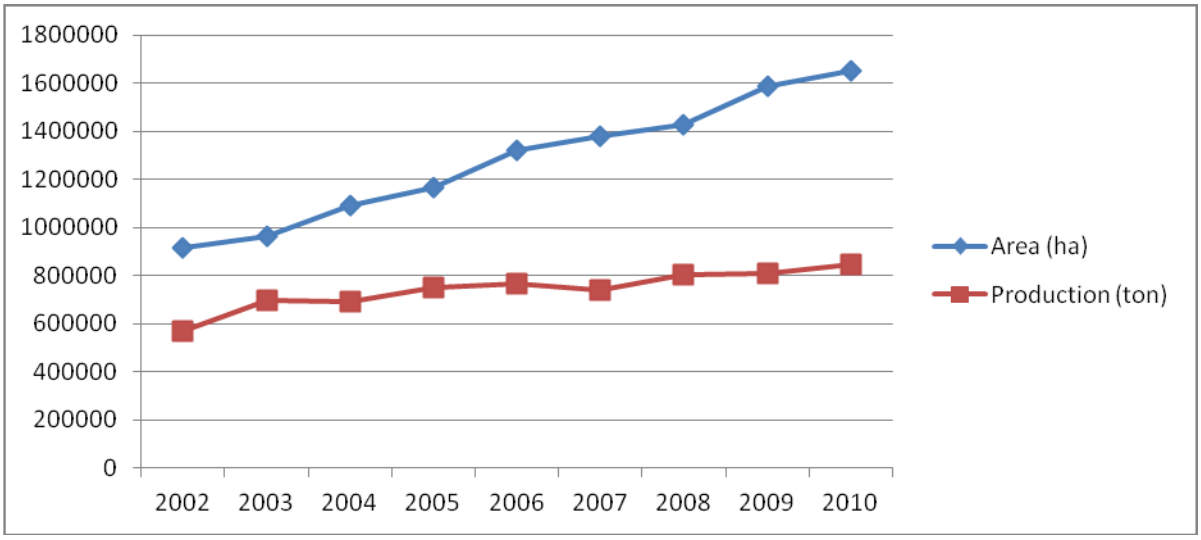
No	Year	Area (ha)	Production (ton)	Productivity (ton / ha)
1	2002	914.051	571.155	0.62
2	2003	964.223	698.816	0.72
3	2004	1.090.960	691.704	0.63
4	2005	1.167.046	748.828	0.64
5	2006	1.320.820	769.386	0.58
6	2007	1.379.279	740.006	0.53
7	2008	1.425.216	803.593	0.56
8	2009	1.587.136	809.853	0.51
9	2010	1.651.539	844.626	0.51

Source : Ministry of Agriculture, Indonesia

Despite being the 3rd largest cocoa producer in the world, the productivity of cocoa sector rather stagnant. In 2003, the productivity reaches 720 kg/ha which

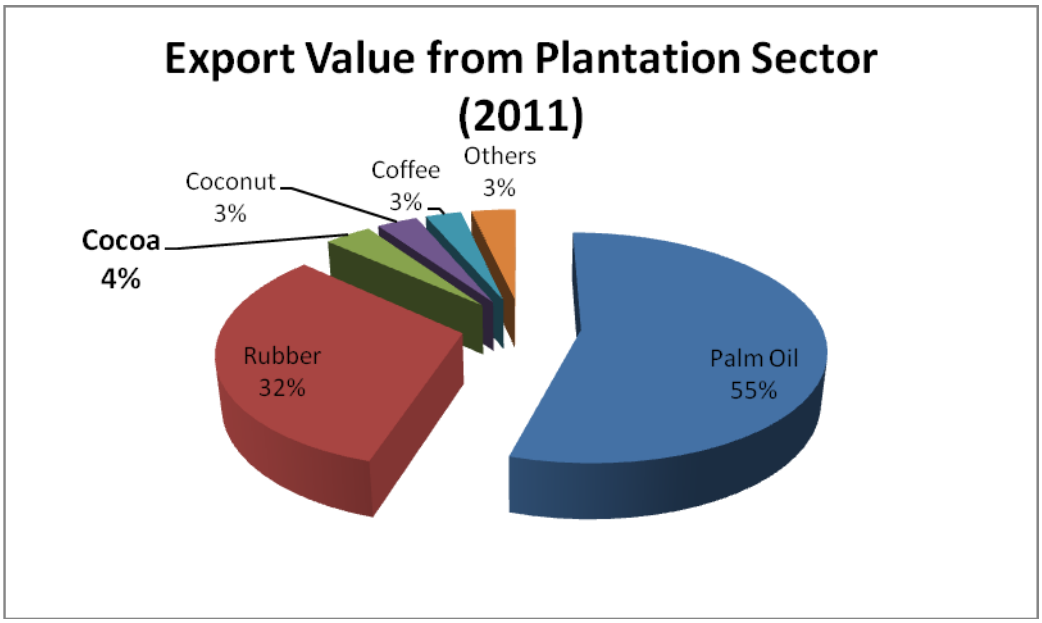
considerably high in 2002 – 2010 period. But soon after, it drops to 530 kg/ha on 2007 and even lower in 2009 – 2010 periods which were recorded at 510 kg/ha subsequently. Table 4.1 also shows that the area of cocoa is increasing in time. It was recorded 914.051 ha on 2002 and increasing significantly to 1.651.539 ha on 2010. Ironically, the increasing trend of area is not followed by the increasing production of cocoa beans that only reached 844.626 tons in 2010. Several factors have been identified such as old trees, pest and diseases, climate change etc. that affected the production of cocoa beans in Indonesia during 2002 – 2010 periods.

Graph 4.1. Area and Production of Cocoa in Indonesia (2002 – 2010)



Today, Government of Indonesia has the revitalization program called *Gerakan Nasional Kakao* (GERNAS KAKAO) that aim to increase productivity and to reduce the CPB, VSD and other diseases that often occur in the production of cocoa beans. Cocoa counted as the third largest contributor of agriculture export revenue in Indonesia (Ministry of Agriculture, 2008). The share of cocoa can be seen in the chart 4.4 below:

Chart 4.3. Contribution of Export from Plantation Sector

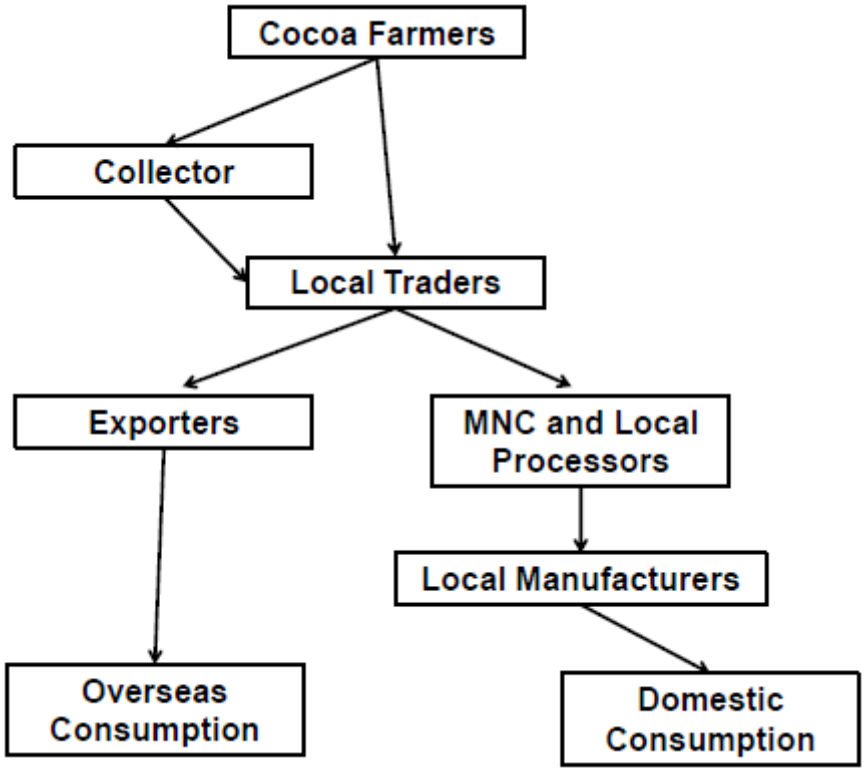


Before, most of the cocoa beans in Indonesia are exported with only about 20% of the productions are used in the local production. USA and Malaysia has been counted as the largest importers of Indonesian cocoa beans followed by Brazil and Singapore. Export to European Union still dominated by Germany with about 10.000 MT of imported cocoa beans from Indonesia in 2006. Cocoa holds economic importance for the national growth. Studies have identified the output, income and income distribution multiplier of cocoa – based industries. Output multiplier of cocoa primary industries and downstream were estimated 2.93 and 2.69 respectively which implies that one unit (e.g. US$ 1) in the industries will cause a 2.93 and 2.69 increase in the economy as whole. In addition, household income multiplier of the cocoa – based industries in the suburban area is around 1.72 and in the rural area is 0.73. This implies that the industries have a significant contribution in generating income for the suburban and rural areas. Thus, the role of these industries in providing employment and income becomes critical (Ministry of Trade, 2007).

Like others, the supply chain for cocoa in Indonesia starts from farmer's production and post harvest activities. After the beans being cultivated, then farmers transport it to the nearest selling points, either directly to the local traders or through

village collectors, which accounted for the dominant figures by geographically means. Graph 4.5 shows the typical smallholders value chain that accounted for more than 70% of the cocoa production in Indonesia while the rest is covered by state and private plantations. In this section, we want to focus on smallholder's value chain since it presumed that the chain is still unsustainable (Yasa, 2007).

Figure 4.2. Cocoa Supply Chain in Indonesia



Source: Bedford *et al* (2002)

Based on the type of producers, there are basically two types of cocoa bean marketing system. The first marketing system belongs to the private and government-owned companies. Market mechanisms are based on the contract (with traders), auction, and spot market. Therefore, price determination is based relatively competitive market mechanism. The second marketing system is associated to the smallholders. In general this marketing system has three main actors; cocoa farmers, collectors and local traders (Ministry of Trade, 2007). Generally, farmers sell the beans in the form of *unfermented fat, bulk* beans to the collectors and / or local traders. Then, the option goes to the

traders whether to sell it to the exporters for direct overseas consumption (usually the commodity still in the form of unfermented low quality beans)[18] or to the local processors. In Indonesia, there are no significant differences between unfermented and fermented beans or any incentives to increase quality given to farmers who fermented their beans, which drives stakeholders, sell cocoa based on volume transactions. Nevertheless, the farm gate price in Sulawesi, for instance, accounted for 75 – 85% of New York Terminal (Yasa, 2007). However, due to instable quality, the profit of the farmers is fall to 66% of the New York Terminal (Ministry of Agriculture, 2009).

The cocoa supply chain in Indonesia comprises of several different entity(ies) starting from the downstream industry to the exporter before the product can be shipped to the manufacturing companies in the another part of the world. The stakeholders also varied based on the nature of the stakeholder itself. The labor for cocoa industries can be separated as ***owner farmer***, ***sharecroppers***, and ***farm manager***. This definition was mentioned by Bedford *et. al* (2002) with the explanation:

a. Owner farmers are farmers that own land but in addition may used family and sometimes hired labor. Used of hired labor will depend on the range of factors including age, wealth, gender and labor availability.

b. Sharecropper farms another person's land for a share of crops – normally 25% of the production. Sharecroppers are more likely to use family labor compare to owner farmers.

c. Farm managers cultivate another's land and in return is paid a wage or fee or with future share of the holding.

Labor/s considered as the initial chain in the cocoa supply chain management. Other stakeholders that have been identified in the chain are ***middlemen or collectors***, ***traders***, ***local processors***, ***local manufacturers***, and ***exporters***. Some study on

[18] The beans, then, will be re-clean, fermented, sprayed and storage in the port of importing countries before distributed to the manufactures / grinders. This treatment costs some levy to the exporters, thus reducing income along the supply chain to the farmers

Indonesian cocoa supply chain has discussed various factors. Bedford *et al* (2002) explore the actors and how the supply chain works; Panliburton and Lusby (2006) study on problems and solutions for value chain of cocoa bean in Indonesia, Monthly Outlook for Cocoa Sector from Latuhihin *et al* (2007) that focused on the good agriculture practices in increasing competitiveness for cocoa bean in Indonesia and Siregar *et al* (2009) that highlighted the competitiveness of cocoa sector in Indonesia. Significant study was conducted by Dradjat *et al* (2007) shows the effect of rising spot prices for cocoa beans, how value chain in cocoa react to the matter and finally proposing the export tariff scheme to be implemented correlated with rising bean's price.

4.5. Problem Faced by Indonesian' Cocoa Sector

As agricultural country, beside oil and gas and services, agriculture count as one of the important sector for economic growth for Indonesia. As one component in agriculture sector, cocoa industries employ workforces in over 500.000 household in Indonesia, or accounted as the third largest agricultural industry after palm oil and rubber sectors. Several problems are identified in cocoa industries in Indonesia (Djajusman, 2008):

1. Most of cocoa plantations in Indonesia are small-scale plantations owned by local farmers or local cooperation with long traditional supply chain management from farmers to local trader to cooperation to local market until received by buyer sometimes with high prices. This system is not beneficial to the farmer since the price gain by farmer will be low and also affected the quality of the cocoa beans since the warehousing from one spot of chain to another will be required. The condition also affected the trade to major importing countries for instance the Automatic Cocoa Detention implemented by USA, Maximum Residue Limits (MRLs) regulation and Sustainable Cocoa implemented by European Countries which cause price discount for cocoa beans from Indonesia.

2. Consumer demanding for more safe food products compare particularly in European Union, Japan and USA that makes sustainable products that came from sustainable supply chain gain higher position in the market (Knickel *et al,* 2002).

3. Reganold *et al* (1990) showed that conventional farming methods often increase the rates of erosion by depleting the organic matter that helps to preserve soil structure. Concerning that most of the agricultural practice around the world still using conventional farming method instead of sustainable agriculture practices, this issue also need to be address in the sustainable development in supply chain management system to ensure consumer trust in the importing market.

4. Preferential tariff rules imposed to Indonesia but not to other cocoa exporting countries such as Ghana and Cote d'Ivoire. The evidence has been pointed by local exporter whom experiencing import tariff up to 10% for cocoa beans from Indonesia entering European Union where other exporter get tariff exemption for the same product. This situation also make Indonesian's cocoa lose competitive advantage and against fair trade agreement whereas it is clearly state in Regulation (EC) No. 178/2002 of European Parliament and of the Council regarding food safety in article 23 which state […….The Community is a major global trader in food and feed and, in this context, it contributes to the development of international standards which underpin and, it support the principle in safe feed and safe, *wholesome food in* ***non-discriminatory manner***, ***following fair and ethical trading practice***].

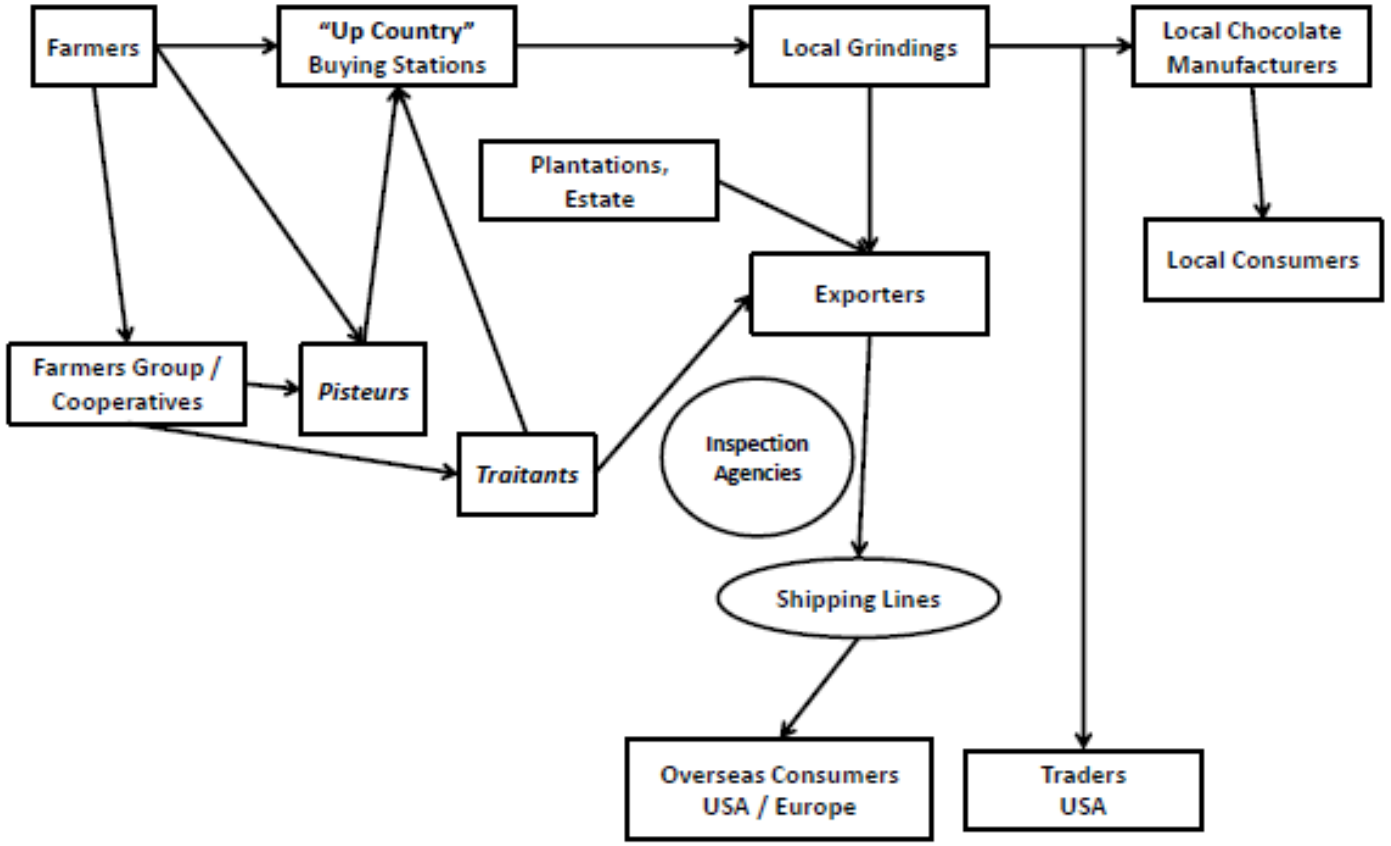
5. Minimum intervention by the government makes marketing chain highly fragmented and thus enabled stakeholders to choose several options to sell their products (Bedford *et al,* 2002). Though it seems beneficial for certain point of view, lack of control for quality and issues related to social and environment often become the obstacle for cocoa industries in Indonesia to become more competitive in the world market. Minimum access to information technology also hindered the development of cocoa in Indonesia.

6. Lastly, the traceability regulations implemented by European Union in the same regulation as the above, also should be taking account for income deflation for the farmers as the companies and collector will press the buying price at farm-gate level.

In the regional level, as the Free Trade Area concept begins to enter the Asian region in 2015 where foreign small – medium companies are free to open and invest in Indonesia, the traditional cocoa processing industry in Indonesia facing difficulties if not implementing the sustainable supply chain management system, they will losing competitiveness to foreign companies making Indonesia only become the natural resources country without value added products. In terms of supply chain, globalization, sustainable supply chain management and traceability become important issues for food safety.

APPENDIX 4.1

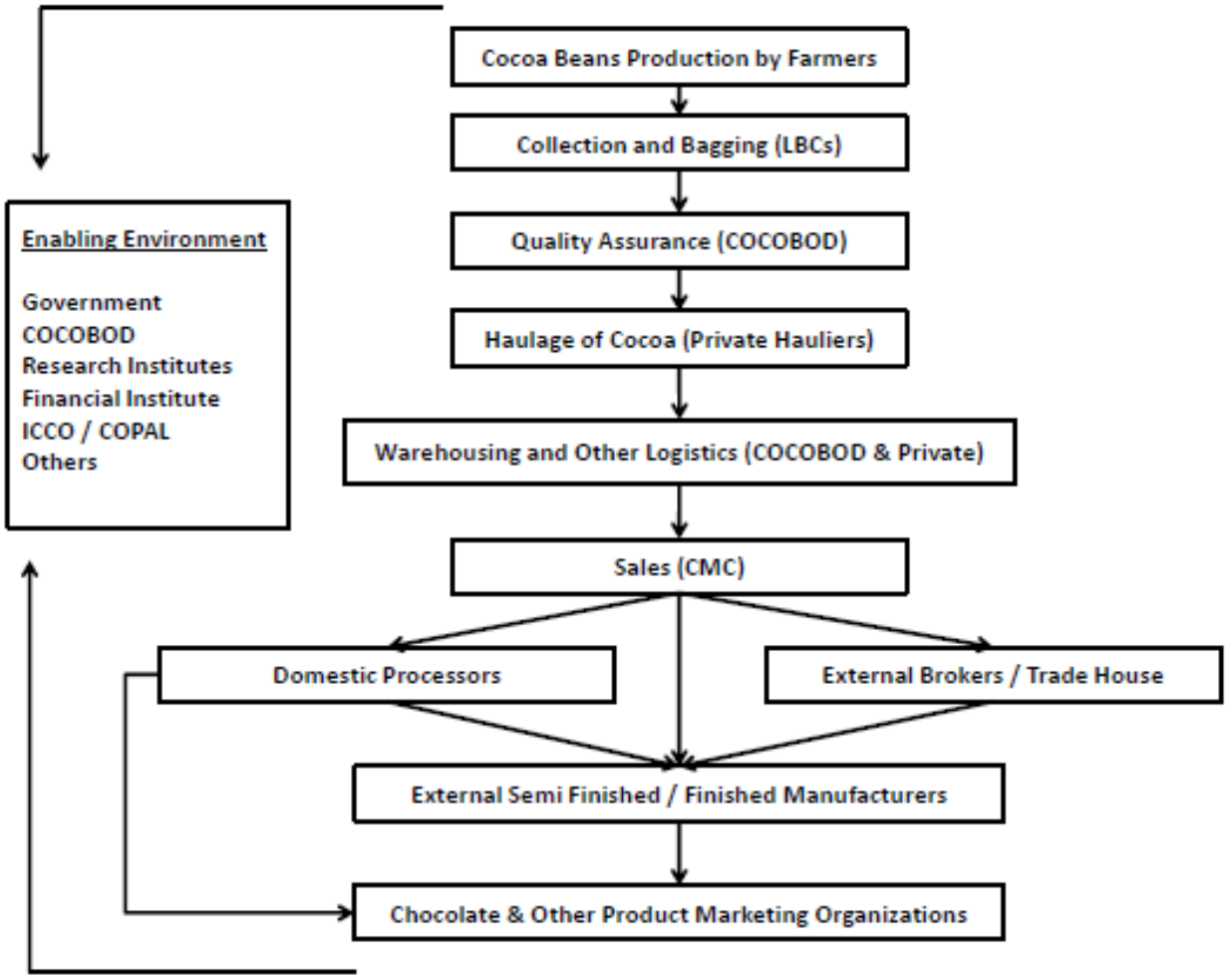
Graph 4.3a. Cocoa Supply Chain in Cote d'Ivoire[19]



[19] The Cocoa Federation Commerce Ltd. (2011). (http://www.cocoafederation.com/education/cipipeline.pdf , accessed on 13th August 2011)

APPENDIX 4.2

Graph 4.3b. Cocoa Supply Chain in Ghana[20]



[20] Osei, Issac. (2007). Sustainable practices in the global cocoa economy – a producer's perspectives in *The 4th Indonesia International Cocoa Conference & Dinner*. (http://www.worldcocoafoundation.org/scientific-research/research-library/documents/3.COCOBOD.pdf , accessed on 2nd August 2011)

CHAPTER 5

HOW BEST PRACTICES INFLUENCES SUPPLY CHAIN PERFORMANCE CASE FROM INDONESIAN COCOA SECTOR

Abstract

Sustainability has become an important issue for the global supply chain including agricultural supply chain. In the last decades, most of the fresh agricultural food such as fruits and vegetables has been moved from tropical and sub-tropical regions to the processing facilities in the northern America and European regions, and then, distributed to all corner of the world. Nowadays, food companies start to expand their purchasing activities by constructing their processing facilities near to natural resources. This movement of raw materials either globally or glocally is being highlighted in the recent decade following the global concerns on environmental degradation and critical social issues such as child labor and unfair trade treatment, there are rising awareness on the implementation of sustainability in the agricultural supply chain.

Beside the movement of the materials, different practices (such as production and manufacturing practices) have become more transparent starting from the initial stage of the supply chain to the end consumers. Particularly in agricultural sector, good agricultural practices have been the standard in producing high - quality products. This ever-expanding approach has been widely acknowledged, accepted and implemented and has been the requirement of agricultural and food companies. As one of the agricultural commodity and part of the agri-food chain, cocoa industry implement different practices at different stage of the supply chain, which can affect the sustainability performance of the chain. Hence, this research presets how different practices in each stage in the supply chain enhance and affecting the performances of the cocoa supply chain.

In this paper, we adopted case study approach supported by surveys and in-depth interviews on the sample. The surveys and interviews were administered at farmers, traders and processors level of the cocoa supply chain enabling us to understand the impact of practices on performance holistically. The results show that not all practices bear positive impact to the performance of each echelon whereas the practices that has positive impact at the initial echelon will affect the performance of the final stage of the cocoa supply chain. Moreover, results show that the contingencies such as mutual trust and affiliation play important roles in the adoption of practices

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Keywords: *Sustainability, Best Practices, Cocoa Supply Chain, Performances*

5.1. Introduction

Currently sustainability has become one of the most important issues in global supply chain management. Under its context, the movement of raw materials to the processing area in the other half of the world is being highlighted in the recent decade as a key issue. Beside the movement of the materials, different practices (such as production and manufacturing practices) starting from the initial stage of the supply chain to the end consumers are essential for both supply chain and sustainability perspectives. Particularly in agricultural sector, good agricultural practices have been the standard in producing high-quality products. This ever-expanding approach has been widely acknowledged, accepted and implemented and has been the requirement of companies if they want to buy agricultural products either locally or globally.

Now, mostly driven by market demand and standardization, the notion of good agricultural practices has ventured into longer, not only focusing on the farmer's practices, but also covering processor and trader's practices. In this paper, we overviewed the how different practices in different stage influences other chain performance inside an agricultural supply chain which then can formed the supply chain performance. Evidences in the supply chain literatures showed that improved practices,

whether in production or logistic, will enhance performances through transformative phase (e.g. Total Quality Management, Just – In – Time, Manufacturing capabilities). Moreover, Laugen *et al* (2005) mentioned that there is a need for a further research to unravel how companies make various best practices reinforce each other.

The investigation has focused its attention on the cocoa supply chain particularly in Indonesia. We took cocoa supply chain for our model as cocoa can be mirrored as a sustainability model for other tree crops (Shapiro and Rosenquist, 2004). Cocoa is a world commodity well known not only for its boom – bust cycles, but also for its capacity to draw in and then expel new populations, regions and nations (Li, 2002) and has the capability to create profit for the regions (Obiri *et al*, 2007). These facts entice, even at country level, to stimulate and develop cocoa industry as a catalyst for economic development. It is even more interesting if we consider several foods recalls that involved cocoa and cocoa products[21] whereas this condition requires the proper application of best practices in each stage of the cocoa supply chain as well as it has been adopted into national policy of food safety in Italy (Sicurelli, 2008). Therefore, there is a need to understand what practices are adopted in the cocoa supply chain. Furthermore, although research on practices and performances flourished, less attention has been given to agricultural commodities and especially how practices impacted supply chain performances (Syahruddin and Kalchschmidt, 2012). Hence, the aims of this research are to review the adoption of practices towards performance and to observe how different practices in different influence the supply chain performance in the cocoa industry.

In the next section we present a literature review on best practice and performance within the supply chain mainstream. This review helps us to build a framework for this research as well to identify what practices suit cocoa supply chain. Then, we presented the research methodology adopted and the collected data. In section four, results of are presented followed by detailed discussions covering descriptive, cross samples and between sample analyses simultaneously. Lastly, we conclude the paper.

[21] There are several cocoa and chocolate products being recalled from the the market due to various contaminations during 2006 – 2010 (for example *see* http://www.food.gov.uk/enforcement/alerts/2006/jun/cadburychoc; http://www.food.gov.uk/enforcement/alerts/2006/may/choctoffeebites;http://www.food.gov.uk/enforcement/alerts/2009/nov/sainsburyswholenutdarkchocolate)

5.2. Literature Review

5.2.1. Sustainability and Cocoa Industry

Like any other food supply chain, cocoa sector also faced various problems are linked to sustainability practices such as forest degradation, biodiversity destruction or child labor issues (Neilson, 2007) and local food security (Belsky and Siebert, 2003). Nevertheless, sustainability also influenced the practices in cocoa sectors. Most of the cocoa' stakeholders around the world are acknowledging this prerequisite for the continuity of business as well as preserving the environment and addressing social issues (Franzen and Mulder, 2007; Long, 2008). Sustainability also deemed as a strategic marketing tool (Doherty and Meehan, 2006) and positioned as the main consideration in ethical and fair trade scheme (Nelson *et al*, 2002; Smith, 2010). Although sustainability is consider as a universal approach, different type of agro-food chain may have different understanding towards it. Furthermore, the articulation of sustainability dimensions at the farmers' level might be differ from processors' level for instance.

While considering the triple bottom line approach (Elkington, 2004), at the farmers' level, World Cocoa Foundation (WCF) mentioned that sustainability principles covers (i) economical dimension which interpreted as improved and more equitable returns for the farmers; (ii) social dimension that construe as healthy and thriving cocoa farming-household and communities; and (iii) environmental dimension that refer to responsible, sound environmental-stewardship in cocoa-farming communities. In general, the sustainability principles and goals in cocoa sector at farmers' level can be summarized in table 5.1 as follow:

Table 5.1. Sustainability principles and goals[22]

3BL	Principles
Economical	Improved and more equitable returns for the farmers
	1. Productive farming practices are in place 2. Good farm management through diversification 3. Efficient and more transparent cocoa value chain 4. Farmers and their communities received equitable returns over time
Social	Healthy and thriving cocoa farming-household and communities
	1. National and international standards are implemented, with no worst forms of child labor 2. Farming practices are safe 3. Strong, effective farmers organizations are formed 4. Communities are empowered
Environmental	Responsible, sound environmental-stewardship in cocoa-farming communities
	1. Soil and water are use responsibly 2. Biodiversity benefits and environmental assets are understood, respected and valued 3. Agrochemicals are used rationally and integrated pest management is implemented

Table 5.1 shows how sustainability principles should work in cocoa supply chain. The economical dimension illustrated that in order to receive equitable returns, farmers should engage in productive farming practices and employ good farm management through diversification and more transparent supply chain is expected. On the social dimension, empowerment towards cocoa community should be achieved and safe farming practices for farmers are ensured. To support this, national and international standards should be put into practice especially concerning the worst form of child labor. And at the environmental dimension, the wise utilization of soil and water is expected from farmers as well as limited usage of pesticides and insecticides.

[22] World Cocoa Foundation (WCF). Sustainable Principles and Goals. (http://www.worldcocoafoundation.org/sustainability-principles-and-goals/ , accessed 14th July 2011)

5.2.2. Best Practices and Performances

The connection between practices and performances has received wide attention in the literature where there is growing evidence on positive relationship between practices and performances. Furthermore, the trend of discussion has ventured into supply chain management domain by suggesting that not only the practices of immediate tiers affect performances of the focal company, but also the practices of farther tiers up to the initial stage of the supply chain (Seuring and Muller, 2008). Hsu *et al* (2009), Zakuan *et al* (2010) and Stolle and Moser (2009) pointed out how different practices such as total quality management, just-in-time and innovation both directly, and indirectly through supply chain practices, affect the performances of the focal companies in which finding is coherent with our proposed research. Furthermore, Haynak and Montiel (2009) reinforced the framework by stating that sustainable supply chain management and sustainable performance of a firm are correlated through different practices such as core quality management practices, environmental management practices and customer relation management as well as other manufacturing practice such as Quality Function Deployment / QFD (Faishal and Akhtar, 2011).

Related to the collaboration in the supply chain, Kim and Lee (2010) mentioned that focal firms cannot solely increase their performance without sharing their best practices and standard to their supply chain partners. They also mentioned that the usage of information technology will foster the collaboration between firms and its supply chain partners as well as enhancing their productivity which also related to research of Vickery *et al* (2010) that mentioned information technology will enhance the agility and overall performance of the supply chain.

Considering that many approaches suggested different practices, whether it is production or supply chain practices, we would like to underline the importance of practices towards performances and therefore, we consider that *the implementation of best practices will influence the sustainable performances of the cocoa supply chain*. To

detail the research framework, we consider the approach and proposition taken by Li *et al* (2006), Hervani *et al* (2005) and Zhu and Sarkis (2007) that are outline in figure 5.1.

Figure 5.1. Conceptual Framework on How Practices influences Performances

5.2.3. Best Practices and Sustainability in Cocoa Supply Chain Management

Recent development on sustainability has showed that there is a strong relationship between it and best practices' adoption. To reach sustainability, each echelon within the supply chain must perform best practices to provide optimum performance. Thus, this performance must be conjunction with the principle and standard of sustainability itself, which mean that best practices must address the triple bottom line principles. Epstein (2008) mentioned that to achieve sustainability, several practices within supply chain must be put into practices such as level of transparency, ample communication, commitments and implementation information technology as key driver to supply chain collaboration (Richey Jr. *et al*, 2010), were important amongst other variables. Furthermore, Epstein and Roy (2003) mentioned that there are nine principles of sustainability performance at corporate level that are ethics, governance and transparency, business relationships, financial return, community involvement, value of products and services, employment practices and protection of environment. Nash and Ehrenfeld (1997) mention that best practices is a feature of accredited management standards and to meet the market demand as well as coop with the hostility of the environment (Pagell *et al*, 2007). Pagell and Wu (2009) also highlight similar facts by endorsing the relevant of best practices as foundation for sustainability.

One of the purposes in determining best practices in cocoa supply chain is to ensure the quality of cocoa products. By implementing best practices, each consumer in

each echelon will receive good quality beans or inputs from the previous chain. The definition of good quality bean was provide Wood and Lang (1985) stating that the quality of the merchantable bean must be: (*a) Fermented, thoroughly dry, free from smoky beans, free from abnormal or foreign odours and free from any evidence of adulteration; (b) Reasonably uniform in size, reasonably free from broken beans, fragments and pieces of shell, and be virtually free from foreign matter*. In this way, we also want to cover the discussion of the adoption best practices from the earliest phase of the chain (farmers) down to the processors' stage. This also often being considered the most challenging parts in implementing sustainability as farmers also frequently being blamed for the quality of food products (Pouliot and Sumner, 2008).

To increase the quality, fermentation stage is an important step should be taken by cocoa stakeholders while proper warehousing and harvesting tools also assist farmers in providing good quality beans (Schawn, 1998; Ardhana and Fleet, 2003). Under the sustainability lens, yet, from ecological point of view, unsustainable practices in the cocoa production and processing stage (i.e. usage of chemical pesticides, waste) will harm the environment (Ntiamoah and Afrane, 2008; Matthews *et al*, 2003) as well as health problem, which can be reduce by sustainability practices (Hay, 1991). Another research showed that using cocoa – gliricidia is considered as better investment from economical and ecological point of view (Smiley and Kroschel, 2008) and increase production yields (Smiley and Kroschel, 2010), though the intercropping system might caused deforestation (Osei-Bonsu *et al* 2002). Other discussion focusing on the role of organizations, partnership and cooperation state that the function of institution is important for cocoa industry to achieve sustainability (Shapiro and Rosenquist, 2004)

Best practices in cocoa supply chain management were divided according to the type of operation conducted within supply chain. For example, the preparation of field until harvest and post harvest activities can be called as production stage whereas in the factory level, production of cocoa liquor, cocoa butter and cocoa nib can also called as production stage, but using different terms, methodology and tools. On the other hand, transportation stages also require best practices in the operation to ensure the quality of the cocoa products. In other words, to provide the top notch cocoa products, holistic

best practices must be employed from the upstream to the downstream industries. To better understand which kind of practices in the cocoa supply chain, we outlined several best practices, consist of production and supply chain practices in the chain, provided by International Cocoa Organization (ICCO) and World Cocoa Foundation (WCF). In this way, we expect to have clear ideas which important practices that are applied in the supply chain.

Table 5.2. Best Practices in Cocoa Production (Farmer's Level)

No	Stage	ICCO[23]	WCF[24]
1	Establishment of Cocoa Farm	1. Suitable location with adequate rainfall density 2. Soil contains rich nutrient 3. Avoid planting over forest land 4. Site history and field layouts must be recorded	
2	Protection and Maintenance	1. Optimize the use of labor, avoid worst form of child labor 2. Apply appropriate fertilizers 3. Usage of efficient irrigation technologies and water management 4. Pruning and shading are important 5. Adoption of Integrated Pest Management (IPM)	
3	Harvesting and Post-harvest	1. Usage of sharp cocoa hook on a stick for harvesting 2. Avoid harvesting of unripe cocoa pods 3. Proper fermentation should be applied to the beans 4. Adequate drying to prevent the PAH contamination of cocoa beans	1. After removing the pods, cocoa beans are placed into boxes and covered with mat to generated natural heat and fermentation 2. Proper fermentation for 3 – 9 days with 52 degrees celcius of temperature 3. Adequate drying is required
4	Packaging and Storage	1. Cocoa beans should be packaged in clean bags, preferably food grade hydrocarbon-free jute bags 2. The bagged cocoa beans must be placed in a storage sheds that are weatherproof, well aired, free from damp and insect pests. 3. Proper quality control must be applied to avoid infestation	1. Cocoa beans should be packed in clean bags / sacks, free from germ and infestation 2. Storage facility should be clean and free from infestation
5	Transportation	1. Ideally, cocoa beans should be stored in one location of the cargo vessel, apart from other contaminant materials	

[23] International Cocoa Organization. (2008). Manual of Best Known Practices in Cocoa Production. (http://www.icco.org/economics/promotion.aspx , accessed 15th July 2011)
[24] World Cocoa Foundation (2011). (http://worldcocoafoundation.org/ , accessed on 16th July 2011)

		2. Containers for cocoa shipping should be clean and free from residue of previous cargo 3. Containers should not have been used to carry chemicals or other materials giving off strong odors	

Table 5.2 presents the production stage of the cocoa beans starting from the establishment of the cocoa plantation until the transportation management of the bean itself to the next stage of the chain. At the establishment of the farm, farmers must select a location with adequate rainfall density and rich in soil nutrient to ensure cocoa trees to receipt sufficient supplement to bear high quality fruits. Then during the maturity stage of the beans, farmers need to properly protect the plants from pest and diseases as well as maintaining its productivity. These can be done by utilizing water and irrigation correctly, carried out pruning activities, applying enough fertilizers and performed IPM. Then, when harvesting the beans, farmers are suggested to use sharp hook to cut the fruit from the stem. In this way, farmers can avoid breaking the cocoa pods. Then, proper packaging (i.e. the usage of goony bag) and storage must be carried out to maintain the quality of the bean.

5.2.4. Supply Chain Performances and Adoption of Best Practices

Several contributions in the supply chain literature mainstream have discussed the relationship between supply chain performance and practices. For example, Akyuz and Erkan (2010) mentioned that the adoption of best practices in each stage in the supply chain will lead to better supply chain performance and therefore there is a need to observe the entire supply chain performance (Pires and Aravechia, 2001). Previously, Davies and Kochnar (2002) also proposed that best practices are those that lead to improvement in sustainable performance and the investigation of best practices should be approached holistically. Aramyan *et al* (2007) underlined the importance of measuring supply chain performance based on the practices adopted by each actor in the supply chain. They highlighted several practices such as quality management, responsiveness, and flexibility that influence performance. Similarly Alessina *et al* (2010) also mentioned the importance of measuring company's performance by adding

supplier performance and adoption of practices while Martin and Patterson (2009) discussed the importance of supply chain integration towards supply chain performance.

Another example from Paulraj (2011) mentioned that different best practices can be the moderating effect for the supply chain to reach sustainable performance while Pullman *et al* (2010) stated that sustainability practices impacted market, quality and cost performances of firms that operated in the food industry. Thus, Laugen *et al* (2005) argue that adoption of best practices in each stage will eventually affect the holistic supply chain performance. Hence, we consider the opinions of the mainstream that *the combination of best practices of each actor in the cocoa supply chain will formed supply chain performances* and outline it in figure 5.2.

Figure 5.2. The Relationship between Practices and Performances

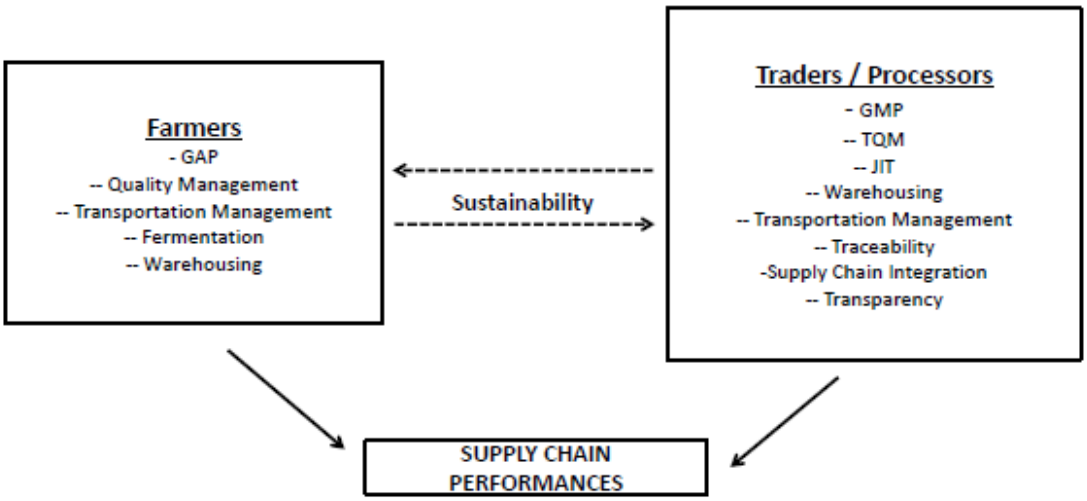


Figure 5.2 shows the relationship between practices and performances at three stages of the cocoa supply chain. At farmers' level, several best practices were identified covering good agricultural practices, quality management, fermentation, transportation management and warehousing. These practices shared similarity with other agricultural commodities except for the practice of fermentation and correlated with practices mentioned in table 5.2. Conversely, for the trader / processor's level, we consider good manufacturing practices combined with other practices such as TQM and JIT to produce high quality products and thus, improving their performances. We, then,

also consider how they manage their warehousing and transportation to preserve the quality of the products and maintaining their performances. Furthermore, several factors that related to sustainability such as traceability and transparency also identified.

5.3. Data and Research Methodology

In this research we adopted case study methodology as it is suitable for understanding the dynamic present with single settings which aims at e.g. providing description (Eisenhardt, 1989). Furthermore, case study approach fits for (a) study on specificity and particularity; (b) behavioral study on selected cases; (c) cover contextual condition that relevant to the phenomenon under study; or (d) boundary between phenomenon and context is not clear (Yin, 2003), a common methodological approach in social sciences, based on an in – depth investigation of a single individual, group or event (Tight, 2010; Baxter and Jack, 2008; Dul and Hak, 2008). Specifically, we going to conduct explorative case studies, which identifies what kind of practices adopted by the traders and processors inside the cocoa supply chain and its relevance for improving supply chain performance. There are three cases that we consider in this paper namely farmers' case, traders' case and processors' case. While considering individual case for the adoption of practices, we also want to explore how these cases are related and impacted each other and produce supply chain performance. In this way, we can have a more rigor results if the case study was conducted in two or three or more stages in the supply chain (Seuring, 2008).

To support the cases, we conduct two different approaches in collecting data, a survey approaches on farmer's level and in-depth interviews for traders and processors. There are two reasons why we differentiated the procedures. Firstly, the amount of sample is not equal; the number of farmers exceeds the traders and processors so different procedures need to be employed. Secondly, level of education of the interviewees also taken into consideration. For example, a farmer is unlikely to have an in-depth interview similar to a manager in a processing company because the answer tends to be jagged within time. For farmers' level, survey is fits for collecting information in systematic way from a sample of individuals (Bradburn and Sudman,

1988; Glynn *et al*, 1999; Groves *et al*, 2004). At this level, data is collected using direct interview method using semi–structured questionnaires with some open–ended questions which enable us to be more flexible in extracting information at the initial stage of the chain. To reduce biases, we collected data from significant amount of farmers to triangulate the results (Denzin, 1978; Jick, 1979). This procedure is effective when we want to observe certain issues from multiple reference points. Then, the in-depth interviews procedure, which applied at traders' and processors' levels, is reserved for collecting data through intensive individual interviews (Boyce and Neale, 2006). This particular methodology is useful to collect more detailed information in small sample group. Similar to the previous procedure, we conducted interview on more than one individual sample at each level. Thus, biases also tend to be reduced.

Five major cocoa regions in Indonesia were visited during March – July 2012 and composed of Makassar (South Sulawesi), Palu (Central Sulawesi), Mamuju (West Sulawesi), Ciamis (West Java) and Surabaya (East Java) (*see* Appendix 5.1 for exact location of the interviews). During the visits, we obtained the samples that consist of 40 farmers, 7 traders and 3 processors of the cocoa industries (*see* Appendix 5.2 for the structure of cocoa supply chain being investigated). These samples allow us to understand the adoption of practices in the early phases of the cocoa supply chain, which are considerably important to determine the quality of the end-products such as chocolate, cocoa-based beverages, cosmetics, etc. The list of farmers and farmers' group was obtained from local provincial agencies where plantations located and the interviews were taken at each plantation site. As for the traders and processors, we obtained the list from the Ministry of Agriculture, Indonesia.

5.4. Results and Discussion

Taking figure 5.2 into consideration we analyzed how different practices influence the performances of cocoa supply chain in Indonesia across different stages. We divided this section into two parts: in the first part descriptive statistics on the supply chain were outlined giving us the brief overview of the result. In the second part we discuss how practices, both production and supply chain practices, affect the performance of each

actor in the cocoa supply chain. For the means of secrecy, we conceal the information the names of the farmers and companies to prevent conflict of interest between sources of information.

5.4.1. Descriptive Statistics

Farmer's Level

From the survey, we identified that 85% of interviewees were located in Sulawesi island where 15% come from Java island. The composition is considered fair since most of the cocoa plantations are located in Sulawesi. Most of the farmers have their own plantation ranging from 0.5 – 1.2 ha except for cocoa farmers from Surabaya that are hired labor to a state-owned company, hence, does not own the land (table 5.3). During the interview, it was revealed that most of the farmers used from mixtures of chemical and liquid organic fertilizers (made from animal *excreta* such as from cow, goat, chicken and sheep). The utilization of chemical fertilizers was due to its practicality (farmers can acquire it directly from the store) whereas to produce organic fertilizers needs certain process and decomposition.

Table 5.3. Farmer's Affiliation and Land Ownership

No	Actors	Numbers	Location	Average Land Owned	Ownership of Land		Affiliation towards company
					Private	Company owned	
1	Farmers	13	Makassar	0.93 ha	☑		No
		12	Palu	1.2 ha	☑		No
		9	Mamuju	1 ha	☑		No
		2	Surabaya	N.A		☑	Yes
		4	Ciamis	0.5 ha	☑		Yes

(source: direct interview)

As for eliminating pest and diseases, most of the farmers use chemical pesticides, herbicides and insecticides to exterminate fungus, cocoa black pod and vascular streak dieback that spoil the quality of the cocoa beans. Farmers seldom use biological predators to reduce the insects and prune the tree branches to ensure the beans get adequate sunlight. The productivity of the farmers in sample is considerably low, yielding from 0.285 to 0.486 ton / ha. There are two ways in selling cocoa beans, through village collectors or directly to traders. Some of the farmers in Palu and Mamuju own plantation in remote areas and sold their harvest to village collectors, while others has direct access to traders.

Traders - Processors Level

On this stage, we identified seven traders and three processors that operate within cocoa sector (table 5.4). We divided the type of company based on the operations that their conduct. Typically, traders collects cocoa beans from the farmers or village collectors, makes them the initial stage after the farmers. After traders acquire the beans, normally they have two options, to export it overseas or to re-sell the beans to the domestic processors. The processors are the second stage of the cocoa supply chain that produces intermediate products such as cocoa butters and cocoa liquors. The brief description of each traders and processors is listed below:

Description:

Trader 1: The first company is a local cocoa trading company located in Makassar. We interviewed the managing director of the company who is in charge for operational and financial activities and has been worked with the company for 6 years. Typically, the company buys cocoa beans from directly from farmers and re-sells it again to processors or exports it to overseas buyers. The company adopts *Standar Nasional Indonesia* (SNI)[25] for cocoa beans from the farmers.

[25] SNI is a national standard that regulates the quality of cocoa beans including moisture level, fat level, dirt level, etc. Although SNI for cocoa already established, but the implementation still voluntary and not obligatory (http://sisni.bsn.go.id/index.php?/sni_main/sni/detail_sni/6633 , accessed in 18 May 2012)

Trader 2: Similar to the first company, second trader is a local cocoa trader and exporter located in Makassar. In this company we manage to interview the owner of the company that is active in the cocoa sustainable partnership (CSP)[26]. The company has been established for 15 years and has been engaging in trading and exporting cocoa beans overseas with the chocolate importer. Similar to first trader, the company also adopts SNI as guidance in purchasing cocoa beans from the farmers.

Trader 3: The third trader is a multi-national company that has been established for more than 10 years in Sulawesi. This company is a subsidiary to a world-wide group that mainly operates in manufacturing food and also member of CSP. The interview was conducted with the purchasing manager of cocoa division who are responsible in procuring cocoa beans directly from farmers. A quality standard of beans has been set by the company such as 7% level of moisture and maximum 2% waste level to ensure the similarity of the beans as well as adopting SNI. In the operation, trader 3 focuses only to export the cocoa beans and not engaging in the domestic trade.

Trader 4: The fourth trader is a medium size multinational company located in Sulawesi island. The main activity of this company is purchasing cocoa beans from farmers and re-sells it again to the processors. They also engage in some export activity with the buyers from United States and Malaysia. The company has established themselves more than 7 years and one of the members of CSP programme. They also adopt SNI as guidance for the quality of the cocoa bean. The interview was conducted with the purchasing manager that responsible in buying cocoa beans from farmers and / or village collectors.

Trader 5: Trader number five is a subsidiary of one of the largest chocolate producer in the world. Typically like other traders, this company acquires beans from farmers or village collectors and then re-sells them to local processors as well as export activities. This company is one of the active members of CSP and adopted SNI standard. Furthermore, they imposed company's quality standard for the cocoa beans.

[26] CSP is a public/private forum for the advancement of communication and working together between stakeholders /organizations actively engaged in cocoa development initiatives in Indonesia (http://www.cspindonesia.org/ , accessed in 18 May 2012)

The interview was conducted with the supply chain manager who in charge in purchasing cocoa beans from the farmers.

Trader 6: Alike with trader 3, the sixth trader focuses on exporting cocoa beans and not engages in the domestic trading. The company also part of world-wide food manufacturer that has been established for more than 12 years in Indonesia. The interview was conducted with the general manager of the company who is also in charge in the decision of purchasing the cocoa beans. The company complies with SNI standardization but also imposed internal standard for the beans quality according to the self-requirement.

Trader 7: The last trader is the only state-owned enterprises in the sub sample. Beside trading and exporting, it also produces both bulk cocoa (cocoa *Lindak*) and specialty (cocoa *Edel*) directly from their farm, making them the only trader that own cocoa plantation. Since they only produce raw materials, we classify them as trader along with the others. The interview was conducted with the production manager who is also in charge of supply chain activities. Instead of being a CSP member, the company set their own programme of sustainability as well as adopting SNI as standard guidance.

Table 5.4. Traders and Processors Characteristics

Company	Description	Location	Size / Ownership	Market	Products / Service
Trader 1	Cocoa beans traders and exporter	Makassar	Large / Local	Processors and overseas buyers	Re-sell and export
Trader 2	Cocoa beans traders and exporters	Makassar	Large / Local	Processors and overseas buyers	Re-sell and export
Trader 3	Cocoa beans exporters	Makassar	Medium / Multi-national company	Overseas buyers	Export cocoa beans
Trader 4	Cocoa beans trader and exporter	Makassar	Medium / Multi-national company	Processors and overseas buyers	Re-sell and export
Trader 5	Cocoa bean trader and exporter	Makassar	Large / Multi-national company	Processors and overseas buyers	Re-sell and export

Trader 6	Cocoa bean exporter	Jakarta	Large / Multi-national company	Overseas buyers	Export
Trader 7	Cocoa bean trader, producer and exporter	Surabaya	Large / State Owner Enterprises	Processors and overseas buyers	Production of bulk and specialty beans, Trade locally and export
Processor 1	Cocoa processor	Jakarta	Large / Multi-national company	Local food industry, pharmaceutical, confectionery	Cocoa butter, cocoa powder
Processor 2	Cocoa processor	Jakarta	Large / Local company	Local food industry, pharmaceutical, confectionery	Cocoa butter, cocoa powder
Processor 3	Cocoa processor and customized chocolate producer	Palu	Small / Local Company	Supermarkets, wholesalers	Customized chocolate and candies

Source: direct interview

Processor 1: The first processor is a large multinational company based in Jakarta which purchase cocoa beans from the trader and processed it into cocoa butter and cocoa powder. Then, the intermediate products will be absorbed by local food industry, pharmaceutical and confectionary. Previously, the company focuses on fisheries and other plantation commodities, but then altered their business direction into cocoa industry. The company has several branches in the cocoa production region such as in Makassar, Palu and Ciamis to get the supply of the beans. The interview was conducted with the president director of the company who has been working for more than 15 years in the company. Processor 1 adopts the sustainability principle into their strategic business and management, actively implements it, but not involved in the CSP programme. Furthermore, they take SNI standard for the quality of the bean as well as adopting ISO 22000 series for the environmental practices.

Processor 2: Similar to the first processor, the second processor is a local company also based in Jakarta. They usually acquire the raw materials from Makassar

and Palu and processed it into intermediate products. The interview was conducted with the general manager that also involve in supply chain activities. The company is not very much active in the sustainability implementation but has plans to implement it in the future. They also adopt SNI for determining the quality of the beans.

Processor 3: The last processor is the newly establish small-scale home industry owned by the local businessman. Raw materials usually obtain it directly from the farmers in Palu. They processed the beans into customized chocolate and candies for domestic consumption. There is no standard adopted in purchasing the raw materials and no sustainability principle implemented in the company. The interview was conducted with the business owner who is also in charge in marketing products and purchasing raw materials.

As it is describe in table 5.4, most of the traders are multinational companies and involve in both domestic and international trading. In acquiring the raw materials, traders oriented to SNI standard for the quality of the bean. Some of the traders have own quality standard because they have different requirements set by the trading partners. As for the processors, domestic market is their main target and therefore, they complied with the domestic standard and regulations. Processors 1 and 2 are aware of the food safety standard and put specific attention to the hygiene of their processing facilities, while processor 3 having difficulties with financial capital and thus, lack of attention put on the cleanliness.

5.4.2. Analyses on Best Practices and Performances

In this section, firstly we want to investigate what kinds of practices are adopted by each echelon in the cocoa supply chain. In this way, we can understand the level of adoption of practices within different stages of the cocoa supply chain. Then, we explore how these practices affect the performance of the immediate actor and *vice versa*. Performances were assessed based on sustainability parameter; economical, social and environmental. Respondents were interviewed whether they know the concept of the triple bottom line of sustainability and then, they were asked whether the

practices that their adopted align with the proposed framework in fig. 2 and whether it is linked to the sustainability concept. We divided this section into two parts; *between cases and cross cases analyses*. In this way we can identify what kind of practices being adopted by farmers and trader - processor as well as how they viewed practices towards sustainable performance. Furthermore, with this approach, we able to identify how a different practice in each stage of the cocoa supply chain influence other's performance and thus, perform a holistic supply chain performance. In between case section, we want to see how each sample responds to the questions aforementioned. With this, we can identify which practices affect *their own* performances in terms of economics and non-economic value of sustainability. Later, in cross case section, we want to examine how practices in different stage of cocoa supply chain affect each other and how they shape the performance of the supply chain

5.4.2.1. Between case analysis

5.4.2.1.1. Adoption of Practices at Farmers' Level

From the literature that covers agricultural practices, sustainability and supply chain management, several practices were identified in the farmer's level that related to the production and supply chain practices of the cocoa supply chain. The practices are Good Agricultural Practices (GAP)[27], quality management (e.g. Han *et al*, 2011; Fouayzi *et al*, 2006; Caswell *et al*, 1998; Kersting and Wollni, 2012), transportation management (e.g. Ahumada and Villalobos, 2011; Vanek and Sun, 2008; Du *et al*, 2009), fermentation (e.g. Senanayake *et al*, 1997; Miller *et al*, 2006; Fold, Neils, 2001; Guehi *et al*, 2010), warehousing (e.g. Lacroix and Farangis, 1996; Gulati *et al*, 2012). Using the list of practices, we interviewed farmers from Makassar, Palu, Mamuju, Surabaya and Ciamis and divided the adoption of practices based on the region where interviews were administered. The reason for the consideration is most of the interviewees were affiliated to same farmer's group or to a certain company and there is

[27] Good Agricultural Practices are practices that address environmental, economical and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products (Food and Agricultural Organization (FAO) http://www.fao.org/prods/gap/ , accessed on 21st September 2012). In this research, we consider practices such as pruning, shading and fertilizing as part of GAP for cocoa.

a probability that farmers in the same region adopt similar practices amongst them. During the interview, we also revealed that there is one veiled practice that adopted by farmers which it long term contract, so we extract it and listed conjointly with the existing practices in table 5.5.

Table 5.5. Practices Adoption at Farmer's Level

No	Practices	Mentioned in the framework	Adoption[28]				
			MK	PL	MM	SB	CI
1	GAP	Yes				●	●
2	Quality Management	Yes	●	●	●	●	●
3	Transportation Management	Yes				●	
4	Fermentation	Yes	●			●	●
5	Warehousing	Yes					
6	**Long Term Contract**	**No**				●	●

Note: MK = Makassar; PL = Palu; MM = Mamuju; SB = Surabaya; CI = Ciamis

Source: direct interview

Good Agricultural Practices

From the observation, although the majority of farmers acknowledge GAP as one of the best practices in the production phase, only 15% of the farmers implement GAP, while others rather neglected it. For most of the farmers, especially in Sulawesi island, while practicing GAP is one of the main components in increasing productivity and reducing pest and disease, *the price incentive for doing so is relatively low* amounting less than US$ 1/kg. Other considerable factor is there is no strict obligation for implementing GAP in producing cocoa beans and there is no *transparency* on the price transmission that could affect the implementation of GAP.

[28] Based on average responds from the farmers (from direct interview)

Quality Management

Quality management is the highest adoptable practices at farmer's level. Majority of the farmers (95%) tried to provide the beans according to the standard of quality requested by the buyers although there is small fraction of the sample (around 5%) still producing low quality beans and sell it to the village collectors for cheap prices. This case usually happens to the farmers in remote area (mountainous area) that do not have contact with the traders and in particular have difficulties with *financial capital*[29].

Transportation Management

Since cocoa is a perishable good, transportation management plays in important role in the cocoa supply chain to preserve the quality of the beans. Farmers are required to manage their own transportation mode and deliver them to the buyers. In this way, they can be ensured that their beans is not mixed with others' beans or even mixed with other commodity[30]. Among the survey sample, in contrary, only 5% of the sample managed their own transportation while others depend on the buyer to provide the transportation. Lack of financial capital becomes the main reason for not buying own transportation vehicle. In the case of contract farmers that affiliated with SOE, the company provides vehicle for transporting beans from the farm to the company's warehouse which means that *the affiliation to the company helps farmers reduce cost for transportation*.

[29] In this particular case, usually collectors offer advance money as the payment for the upcoming harvest. The amount of advance money is lesser than the amount received by farmers if they sell their harvest to the trader because collectors do not consider the quality of the beans (source: direct interview)

[30] In several interview, some farmers mentioned that to reduce transportation cost, they usually rent a truck together and shared the cost among them. This practice is risky because there is possibility that the mold or fungus in the low quality beans infest the good quality bean. Some transportation mode also mixed several commodities such as cocoa, vegetables, paddy, etc together which increasing the level of safety risk for the cocoa beans

Fermentation

To develop the flavor of chocolate, cocoa beans usually are fermented for 2 – 7 days inside wooden crates or basket with banana leaves[31]. The strength of the aroma depends on the length of time and fermentation can increase profitability of farmers (Neilson, 2007; Fold, Neils, 2001; Bedford *et al,* 2002). Of all sample, around 48% practices fermentation after the bean harvested while others do not consider fermentation to be adopted in their practices. Similar to GAP, there is lack of incentives given to farmers in doing fermentation as well as lack of information and transparency on price and thus, half of the sample foresees that fermentation is not given any benefit for them.

Warehousing

Unlike other commodity where warehousing is important (Lacroix and Farangis, 1996; Gulati *et al*, 2012), for cocoa, majority of the sample do not adopt warehousing to store their harvest before they sell it. Farmers tend to store the beans without adequate facilities and easily get infested with dirt. Financial incapability is the first main cause for such behavior. The second motive is related to the fermentation and quality management; farmers oversee cocoa as fast cash-crop and source of income and tend to sell it after harvest period without any attempt for adding the value to the beans and on particular case, sell it to village collector (*see* quality management).

Long Term Contract

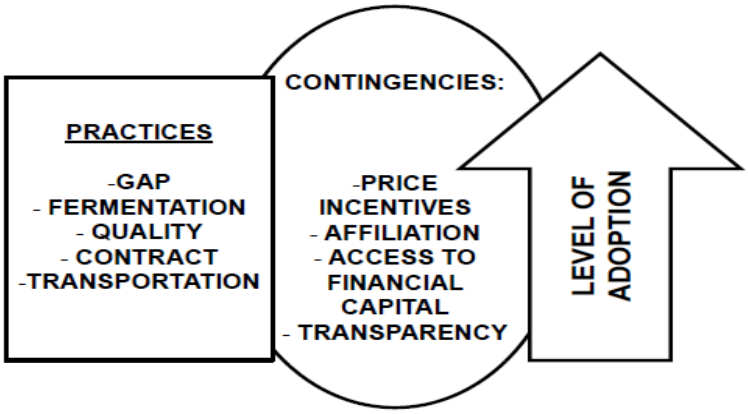
The adoption of long-term contract is disclosed during the interview and adapted in the framework. Farmers acknowledge the importance of long term contract with certain traders as a catalyst to improve their practices. In other words, the presence of long-term contract can secure the economical income of farmers as well as guaranteeing traders of receiving better quality beans. However, this contractual scheme usually not

[31] Fermentation is a simple "yeasting" process in which the sugars contained in the beans are converted to acid (Panlinburton and Meyer, 2004). *See also* http://www.cacaoweb.net/cacao-beans.html for detail, accessed on 28th August 2012

legally binding, in which, therefore infringement is likely to occur. Around 15% of the sample has long-term contract with their buyers, particularly farmers from Surabaya whom notably hired employee of the company while farmers from Ciamis have particular contract with one of the trader / processor in Jakarta. From the interview, we find that contract influences and regulates the quality of the beans supplied by the farmers. In exchange, farmers get assurance of fixed price and quantity that is beneficial for both farmers and traders.

Hence, from the observation, we can see that not all practices are being adopted by the sample. Farmers are concerned on the requirements set by the buyers so they acknowledge the quality management practices, but due to some contingencies, in reality farmers having difficulties in adopting this practice. Then, nearly half of the sample is adopting fermentation practices after they harvested the beans. Farmers expect to have better bargaining position with the traders with fermented beans and thus, expecting better income. Warehousing is less adopted by most of the farmers in our sample. Farmers viewed this practice as expenditure that they have to spend, and with small profit margin, they neglected this practice. Deriving from the interview, we want to underline that there are several contingencies that can induce the level of adoption at farmers' level. Price incentives, affiliation, access to financial capital and transparency become drivers to increase level of adoption at farmers' level. For example, price incentive will impel farmers to adopt fermentation and GAP because they expect to have higher return of the efforts that they commenced. Farmers also viewed that access to financial capital will assist them in providing proper transportation mode for their beans. Furthermore, the majority of the sample convey that these concealed factors have positive impact on the level of adoption of the practices and therefore, we conclude that at the initial stage of cocoa supply chain, *level of the adoption of practices is determined on how contingencies be complied.* The relationship between practices, contingencies and level of adoption is outline in figure 5.3.

Figure 5.3. Adoption of Practice and Contingencies at farmers' level



Then, we investigate how these practices influence farmers' performances under the context of sustainability. Farmers' were asked how they perceived practices influence their performances. We used description provided by WCF in table 5.1 to describe economical, environmental and social performances to generalize common understanding in our sample. The result of the interview is listed in table 5.6. Please note that the number of responds may exceed the number of the sample in some point. This is due that for each practice; respondent is free to choose either one or multiple answers. For example, one farmer may perceive GAP is contributing only to environmental performance while others think it can contribute to all three dimensions.

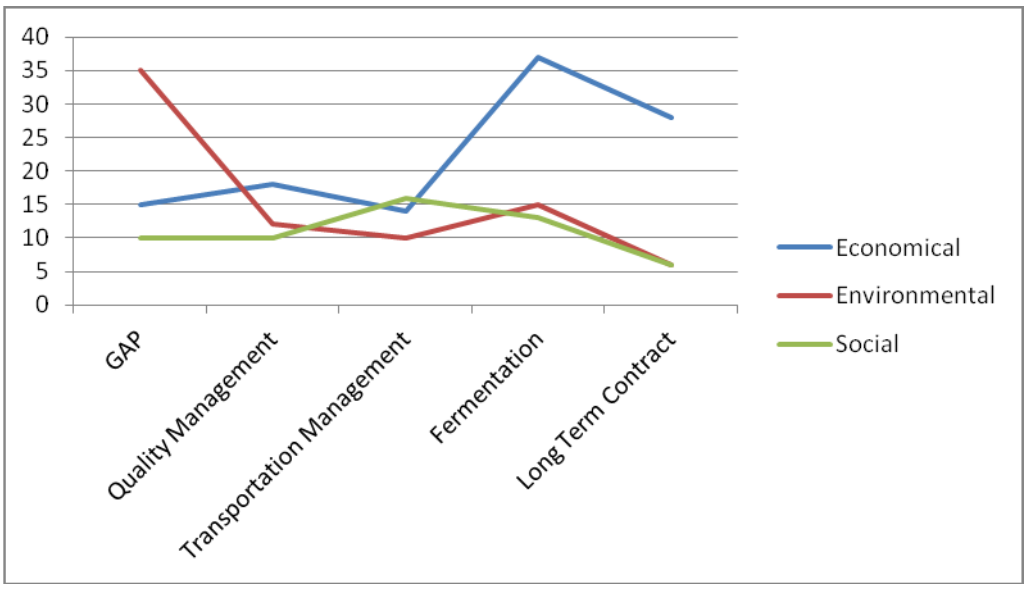
Table 5.6. The Relationship between Practices and Performances at Farmer's Level

No	Practices	Performances (n=40)		
		Economical	Environmental	Social
1	GAP	15	35	10
2	Quality Management	18	12	10
3	Transportation Management	14	10	16
4	Fermentation	37	15	13
5	Long Term Contract	28	6	6

Source: direct interview

When conjunct with performances, most of the farmers see GAP contributes in environmental preservation while around 25 – 37% of samples see that GAP affecting social and economical performances respectively. In quality management, there is fair amount of distribution on the three dimension of sustainability whereas 45% of sample considers quality management will improve their economical performance. Similarly, fermentation attributes for increasing farmers' profit but not really touched social and environmental dimension. A rather unbalance result happens in long term contract where more than 50% of sample consider it as tool for improving income but not converging social and environmental perspectives.

Graph 5.1. Contribution of Practices on Sustainability Dimensions (Farmers' Level)



Graph 5.1 showed that overall, most of farmers believe that adoption of different practices will contribute significantly to economical and environmental performance but less to social performances. Although the interviewees were clear in distinguishing different principles of sustainability, yet practices in adoption of best practices cannot provide a full set of benefit at farmers' level and consider as trade-offs between sustainability dimensions (Seuring and Müller, 2008).

5.4.2.1.2. Adoption of Practices at Traders' Level

We proceed to observe the adoption of practices at traders' level which is considered as the immediate stage (after farmers) in the cocoa supply chain. We consider trader as the intermediaries between farmers and processors and therefore, traders hold an important position inside the supply chain. We distinguish several practices to be adopted in this stage that are; Total Quality Management (TQM) (e.g. Godley and Williams, 2009; Foster *et al*, 2011; Laosirihongthong *et al*, 2010; Huang *et al*, 2008), Just-in-Time (JIT) (e.g. Claycomb *et al*, 1999; Cox and Chicksand, 2008; Kros *et al*, 2006), warehousing, transportation management, and transparency (e.g. Sinha and Kumar, 2010; Young and Hobbs, 2002). Within the interviews, we also identified one practice that being adopted in the traders (and processors) level not being identified in the framework. The practice is supplier continuity, and being conjointly listed together with the existing practices in table 5.7. The result of the interview is as follow:

Table 5.7. Practices Adoption at Traders' Level

No	Practices	Mentioned in the Framework	Adoption						
			T1	T2	T3	T4	T5	T6	T7
1	TQM	Yes	●	●	●			●	●
2	JIT	Yes	●	●				●	●
3	Warehousing	Yes	●	●	●	●	●	●	●
4	Transportation Management	Yes							●
5	Transparency	Yes		●	●				●
6	**Supplier Continuity**	**No**	●	●	●	●	●	●	●

Source: direct interview

Total Quality Management (TQM)

The result in table 5.7 showed that more than 70% of the traders adopted total quality management practices. As intermediaries, traders are obliged to provide high quality beans either to local processors or overseas importer. In fact, traders are selective in collecting the beans from the farmers, and only received based on the quality standards set by the buyers. In this way, profit margin will be increased. However, the remnants of the sample not adopting total quality management, but instead, they focused on the quantity of the beans. While wet beans possessed lesser economical value, greater amount of the items will covers the margin required by the traders.

Just-in Time (JIT)

Similar to TQM, half of the sample adopted JIT practices in their operations. Traders' viewed the adoption of JIT is essential for their strategic management. JIT is also useful when trader holds purchasing contract with farmer; essentially when traders want to export the beans. However, when uncertainties occur (such as bad harvest, natural disasters, etc), JIT will not be optimize and may incur penalties to traders. To anticipate, a trader usually has multiple suppliers from different regions in order to minimize uncertainties.

Warehousing

Most of the traders owned storage facilities with standardize pallets and shelves to keep cocoa beans from being infested by mold and to keep the quality of the beans. Warehouse also operate as shorting facilities, where beans from various farmers being shorted and classified according to the grade and quality. Then, beans were packed in goony bags and tagged and later, transported to either importer or processors. However, traders often having difficulties in identifying the origin of the beans because beans from farmers frequently are not identical and the mixture of the beans makes the

information of *traceability* receded. Thus, it was revealing that *there is a need for a complete traceability system being impose* starting from farmers' level.

Transportation Management

The result confirms the previous section in the farmers' level. The majority of the traders do not or unwilling to provide transportation management, accounting to 86% of the sample population. Only trader from SOE provides transportation to bring beans from the farm to the warehouse. This result is contrary with JIT practice adoption since JIT requires on time delivery but without proper transportation management, JIT cannot be optimized as well. Thus, *in agricultural supply chain, the adoption of transportation management will have positive effect to the practice of JIT.*

Transparency

In this section, we regard transparency as the information openness that related to the profit margin received by the suppliers. It was revealed that less than 42% of the sample adopted transparency in their operation. We consider this fact reduces the fairness of cocoa trading and will disserve farmers. We also viewed that lack of transparency will hinder farmers in adopting best practices in the cocoa supply chain (*see* Figure 5.3) since there will be no price incentives given to farmers.

Supplier Continuity

Supplier continuity is the practice that being disclose in the interview and adapted conjointly in the existing list of best practices. Traders viewed continuity is essential and therefore traders' prefer to have permanent suppliers as well as continuous supply of beans from farmers. However, the adoption of supplier continuity is determined by *mutual trust* between trader and farmer. This relationship is bounded by *commitment for mutual benefit* where farmers supply traders with the beans according to requirement and trader compensate with fair price.

As we can see from the observation, warehousing and supplier continuity are the most adopted practices in the traders' level while transportation management received less attention from the traders. Traders also consider option for having several suppliers to keep the continuity of the supply as well as adopting total quality management to ensure the quality of the beans. Although traders acknowledge the importance of being transparent, however, the adoption of transparency at this stage is not favorable even transparency is considerably important in the agricultural supply chain (Young and Hobbs, 2002) and in particular in cocoa sector (Fold, 2002; Neilson, 2007), while the reason underlying this attitude remains obscure. Thus, we argue that there is necessity for legal framework to enforce transparency in to practice inside the cocoa supply chain.

Then, we examine how adoption of practices influences the traders' (and processors) performances under the context of triple bottom line using the sustainable criteria[32] that commonly adopted in the literature. Before the interview take place, we explain the criteria that we adapt to the sample to generalize the common understanding of the interviewees. The result of practice and performance at traders' level is listed in table 5.8.

Table 5.8. The Relationship between Practices and Performances at Traders' Level

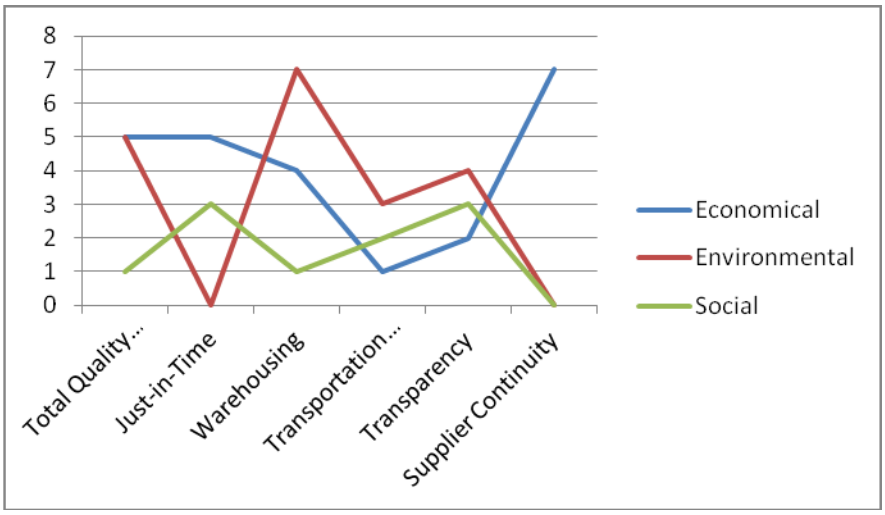
No	Practices	Performances (n=7)		
		Economical	Environmental	Social
1	Total Quality Management	5	5	1
2	Just-in-Time	5	0	3
3	Warehousing	4	7	1
4	Transportation Management	1	3	2
5	Transparency	2	4	3
6	Supplier Continuity	7	0	0

Source: direct interview

[32] We adopt the criteria on sustainability provide by Elkington (2004) that are economic viability that consider profits, environmental stewardship or the planet and social welfare that consider health and safety and access to education

From the observation, 5 out of 7 traders viewed TQM adoption will increase their economical and environmental performances but will not affect social performance significantly. Different consideration given to the adoption of JIT where 42% of the sample considers JIT will contribute to their social performances. A rather low contemplation in adoption is the practice of transportation management where less than 50% traders consider this practice will contribute to their overall performances. Lastly, it was worth noting that traders only consider supplier continuity will improve economical performance but not their environmental and social performances.

Graph 5.2. Contribution of Practices on Sustainability Dimensions (Traders' Level)



Overall, graph 5.2 shows that most of the practices adopted at traders' level are related to economical and environmental performances and less related to social performances. The adoption of supplier continuity is considered as a practice that has highest impact on traders' economical performance while warehousing is considered play important role in environmental preservation. In the case of win-win situation, the adoption of transparency can be the leverage to achieve better sustainability performance in this stage.

5.4.2.1.3. Adoption of Practices at Processors' Level

In the last stage, we investigate the adoption of practices at the processors' level. We identified several practices that being adopted by processors such as Good Manufacturing Practices[33], TQM, JIT, warehousing, transportation management, traceability (e.g. Dabenne and Gay, 2011; Gellynck *et al,* 2006; Jacquet and Pauly, 2008; Monteiro and Caswell, 2009), Supply chain integration (e.g. Aramyan *et al*, 2007; Bagchi *et al*, 2005) and transparency. We note that supplier continuity also being adopted in processors' level and furthermore, we identified the adoption of mixed practices in this stage and listed conjointly with other existing practices. The list of practices can be seen in table 5.9.

Table 5.9. Practices Adoption at Processors' Level

No	Practices	Mentioned in the Framework	Adoption		
			P1	P2	P3
1	GMP	Yes	●	●	
2	TQM	Yes	●	●	●
3	JIT	Yes	●	●	●
4	**Mixed Practice**	**No**	●	●	
5	Warehousing	Yes	●	●	
6	Transportation Management	Yes	●	●	
7	Traceability	Yes	●		
8	Supply Chain Integration	Yes	●	●	
9	Transparency	Yes	●	●	
10	**Supplier Continuity**	**No**	●	●	●

Source: direct interview

[33] Good Manufacturing Practice in cocoa sector has been acknowledged and widely adopted by cocoa and chocolate producers. This practice has been enforced by Codex Alimentarius Commission on Cocoa Products and Chocolate with certain requirement on product hygiene and eliminating contaminants in the products. This practice also related to HACCP for food industry (*see* www.codexalimentarius.org/input/download/report/263/al78_10e.pdf for detail, accessed on 28th August 2012)

As we can see at the traders' level, several practices at the processors level shared similarity to previous echelon and therefore, in this section we only highlighting practices that are not mentioned in the previous section.

Good Manufacturing Practice

The result in table 5.9 showed that processors 1 and 2 adopting GMP in their daily operation while processor 3 having difficulties in adopting GMP. Beside size and company's maturity stage, financial capital becomes one of the reasons for processor 3 not adopting GMP. Furthermore, lack of information and training become obstacle in adopting GMP and hence, governmental support in supporting small size company is needed. It was worth noting that processor 3 produce direct consumable product and thus, adoption of GMP is an obligation in the future.

Mixed Practices

From the interview, we identified the combination of several best practices is being adopted by processor 1 and processor 2. The underline reason for adopting such practice is to coop with the current business condition as well as the regulation being imposed by the government to the industry. For example, for processor 1, adopting TQM must be together with adoption of six-sigma[34] and GMP and JIT together with continuous improvement *ala* Toyota Way[35]. In this way, processors can be more flexible and durable towards uncertainties and external pressures inflicted by the external environment.

[34] Six-sigma is a data-driven approach and methodology for eliminating defects in any process from manufacturing to transactional and from product to service (*see* http://www.isixsigma.com/new-to-six-sigma/getting-started/what-six-sigma/ for detail, accessed on 12th August 2012)

[35] Toyota Way is the principle for holistic continuous improvement and lean supply chain that has been develop by Toyota since 2001 (*see* http://icos.groups.si.umich.edu/Liker04.pdf for detail, accessed on 12th August 2012)

Traceability

From the sample, only processor 1 adopting traceability practice in their operation while processors 2 and 3 not considering this practice importance to their business strategy. By adopting this practice, processor can track the movement of the raw materials to their suppliers and trace the products after point of sale. The practice of traceability has been widely adopted in the agro-food industries and increasingly received attention in the literature (e.g. Dabenne and Gay, 2011; Monteiro and Caswell, 2009) as well as in the policy applicability (Sicurelli, 2008). However, processor 1 only manages to track raw materials to the immediate supplier and not further until farmers or often called integrated traceability (Manikas and Manos, 2008) and hence, there is a need for *an integrated traceability model in the cocoa supply chain*.

Supply Chain Integration

The discussion of supply chain integration has been increase in the recent years whereas supply chain integration can affect the performance of a company (Gimenez and Ventura, 2005; Germain and Iyer, 2006; Homburg and Stock, 2004). The integration can be internal integration or external integration (Fawcett and Magnan, 2002), where the level of integration is determined by the strategic orientation taken by the company. In this case, we consider integration as external integration on how processors collaborate with traders who act as their supplier. Based on the result of interview, we conclude that processor 1 and 2 have the integration with their supplier while processor 3 has limited or even no integration with their supplier. In our case, the impact of the supply chain integration is correlated with the adoption of mixed practices, GMP and traceability whereas *integration was driven by information openness and responsiveness* of suppliers on buyers' requirement.

Then, we repeat the procedure on linking the adoption of practices and sustainability performances at the processors' level to determined how far practices affecting performances. The result is listed in table 5.10.

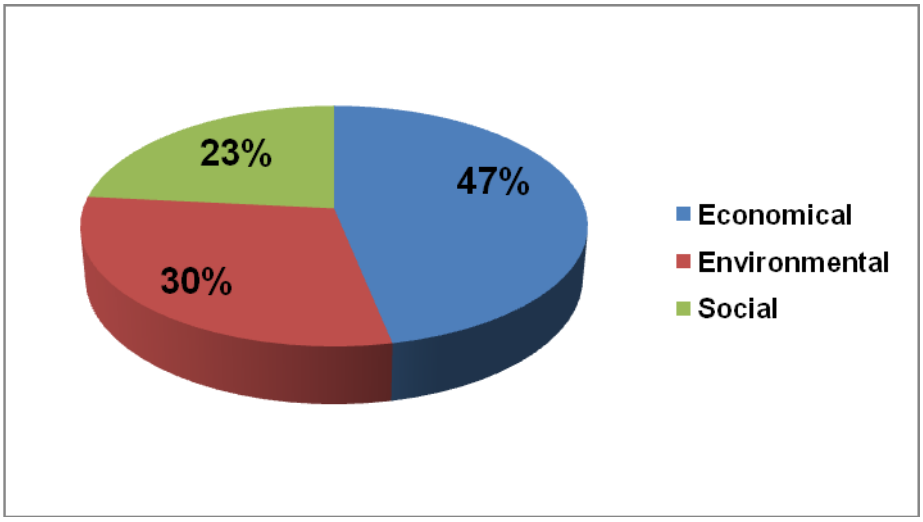
Table 5.10. The Relationship between Practices and Performances at Processors' Level

No	Practices	Performances (n=3)		
		Economical	Environmental	Social
1	GMP	2	2	2
2	Total Quality Management	3	3	0
3	Just-in-Time	3	0	0
4	Mixed Practice	2	2	2
5	Warehousing	2	2	1
6	Transportation Management	2	1	1
7	Traceability	1	1	1
8	Supply Chain Integration	2	1	0
9	Transparency	2	2	2
10	Supplier Continuity	3	0	0

Source: direct interview

From the observation, all processors perceived the important of quality depending on the market requirement. However, in the relationship with performances, processors viewed that TQM only impacted to economical and environmental performances and not with social performance. Processors also consider the adoption of GMP, mixed practice and transparency can contribute evenly to all three dimensions of sustainability. Of all processors, only 1 processor adopting traceability practice, showing that the *concept of traceability* is lacking in the field of cocoa supply chain management. As for supplier continuity, processors viewed it as a catalyst for their economical performance but lacking in the aspect of the other two. Overall, the contribution of practices in improving processors' performance can be seen in chart 5.1.

Chart 5.1. Contribution of Practices on Sustainability Dimension (Processors' Level)



Hence, the result in the processors' level differs from traders' and farmers' level. While in the earlier stages, less attention given to the social performance, in this stage however, the gap is reduce. Processors give more attention to the social performance especially when it is related to access of education and health. Yet, profitability received higher consideration than the other twos, showing that economical performances still the highest priority when adopting different practices in the daily operations while considering the adoption of environment and social perspective (Pagell and Wu, 2009).

5.4.2.2. Cross cases analysis

In this section, we observed how different practices in different stages of the supply chain influence the performance of other actors in the supply chain and thus, affecting the entire supply chain performance by interviewing actors at different stage of cocoa supply chain. We identified each practices discussed in section 5.4.2.1 and linked them to other's performance. For example, we want to observe how the practice of GAP in farmers' level affected traders' economical or environmental performances and how the adoption of warehousing in traders' level affected processors' social performances and *vice versa*. We classify the relationships into 4 different connections that are farmers – traders; traders – farmers; traders – processors and processors – traders. In

this way we can which practices that are positively affect others' performances as well as practices that negatively affected performances. We also consider that there is possibility that some practices may consider has low impact on the performance. The results of the interview are listed in table 5.11.

5.4.2.2.1. Farmers – Traders Relationship

In this stage, we interviewed traders on how they perceived practices adopted by the farmers towards their performances. Of the entire sample, 3 traders consider the adoption of GAP by farmers can increase traders' economical while others consider it will decrease their profitability. For environmental performances, all samples consider the practice of GAP will increase their environmental performance while in the other hand, GAP have low impact on the social performance. Similarly, 4 traders view the adoption of quality management will increase their economical performance while others consider it negatively impact the performance. However, majority of the sample consider quality management does not significantly impact their social and environmental performances.

On the adoption of transportation management, majority of traders view the adoption of transportation management in farmers' level will increase their economical performance in terms of reducing the cost for providing transportation to haul beans from farm to their warehouse. On the adoption of long term contract, there is variance in the respond where only 28% of the sample view this adoption will increase economical performance while 57% sense long term contract will cause negative impact to them. In overall, 54% of the sample perceived that the adoption of best practices in farmers' level will positively increase their economical performance while 42% consider it will negatively affect performance. In the environmental value, less than half of the sample population considers adoption of best practice as positive impact while other 57% of sample considers it irrelevant to their environmental performance. Lastly, the adoption of best practice in farmers is viewed less important in increasing social value of the traders.

5.4.2.2.2. Traders – Farmers and Traders – Processors Relationships

In this stage we observed two relationships that are traders – farmers and traders – processors relationship. We interview farmers and processors on how they deemed the adoption of best practices in traders' level towards their performance. On the first round we examined the association between practices and performances at traders – farmers' level. On the adoption of TQM, 62% of sample viewed it will increase their economical performance while 30% considered it will have negative impact on their performance. One of the reason underlining such behavior is farmers assume that the higher quality standard being enforce by trader, cost in producing high quality beans will be increase and thus, reducing their profit margin. On the other hand, TQM also contribute positively to farmers' environmental performance while more than 80% of the sample think that TQM have low impact on social performance. Furthermore, the adoption of JIT is being considered negatively impacted farmers' economical and environmental performances but viewed has low impact on the social performance.

In the adoption of warehousing practice, we found evidence that more than 82% of the farmers' sample consider it can improve their economical and environmental performances while it shows no correlation with the social performance. We also want to highlight that transparency adoption by traders was viewed as a trigger to improve farmers' economical performance as well as social performance while continuity is being considered has negative impact towards environmental performances but positively affect social performance. Then, in the second round, we observed how processors perceived the adoption of practices by traders towards their performance. The result showed that the adoption of practices in traders' level will dominantly increase the sustainability performance of the processors. Amongst them, transparency and transportation management were viewed to have highest impact on the three dimensions of sustainability.

Overall, in traders – farmers' level, 65% of the sample population perceived that the adoption of best practice by traders will positively increase their economical performance while 22% of the population consider in contrary. A rather equivalent

result provided by environmental performance whereas 39% of the sample consider positively while 25% consider it oppositely. About 35% of the sample viewed the adoption has low impact on environmental performance. Lastly, 63% of farmers consider best practices has low impact on social performance while one-third of the sample population consider best practice can positively impact on economical performance. Then, in traders – processors level, the adoption of best practice is positively increase all dimensions of sustainability giving 50 – 80% rate while the rest consider it has low impact towards performance.

Table 5.11. Practices impact on supply chain performances

Practices	Sustainable Performance								
	Farmers			Traders			Processors		
	Economical	Environment	Social	Economical	Environment	Social	Economical	Environmental	Social
Farmers									
GAP				3Y, 4N	7Y	2N, 5L			
Quality				4Y, 3N	7L	7L			
Transportation				7Y	5Y, 2L	7L			
Fermentation				3Y, 4N	3Y, 4L	2N, 5L			
Contract				2Y, 4N, 1L	7L	7L			
Traders									
TQM	25Y, 12N, 3L	27Y, 13L	6Y, 33L				2Y, 1L	2Y, 1L	2Y, 1L
JIT	33N, 7L	33N, 7L	40L				3Y	3L	3L
Warehousing	32Y, 8L	28Y, 9N, 3L	6Y, 6N, 28L				2Y, 1L	2Y, 1L	1Y, 2L
Transportation	25Y, 9N, 6L	25Y, 15L	40L				3Y	3Y	3Y
Transparency	40Y	40L	30Y, 10L				3Y	3Y	3Y
Continuity	35Y, 5L	15Y, 19N, 6L	31Y, 9N				3Y	3L	2N, 1L
Processors									
GMP				6Y, 1N	4Y, 3L	7L			
TQM				7Y	3Y, 4N	3Y, 4N			
JIT				5N, 2L	4Y, 3L	2Y, 5L			
Mixed Practice				5Y, 2L	4Y, 1N, 2L	5Y, 2N			

Warehousing				4Y, 3L	7Y	1N, 6L				
Transportation				5Y, 2N	2Y, 2N, 3L	2N, 5L				
Traceability				5N, 2L	7N	5Y, 2L				
SC Integration				5Y, 2N	4Y, 3N	7Y				
Transparency				7Y	7Y	3Y, 4L				
Continuity				7Y	3Y, 4N	5Y, 2N				

Source: direct interview

Note: Y = positive impact; N = negative impact; L = low impact

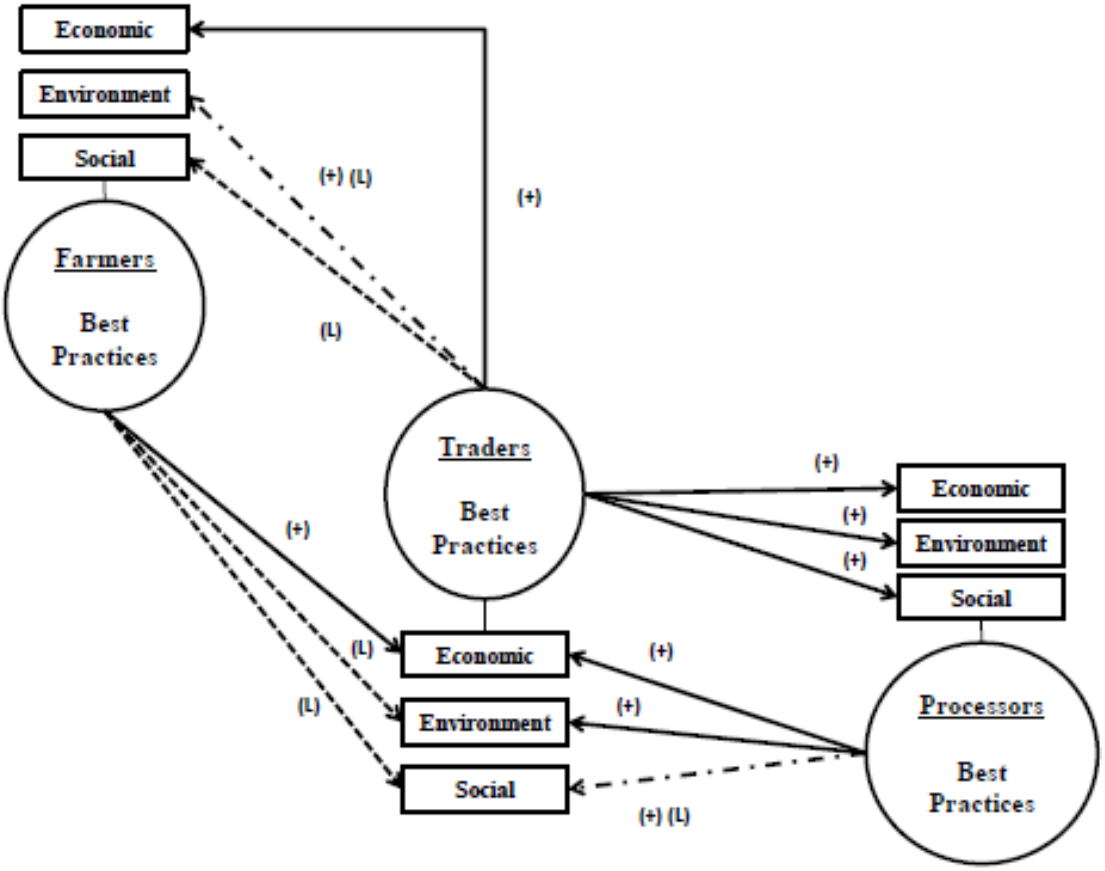
Number of sample: farmers = 40; traders = 7; processors = 3

5.4.2.2.3. Processors – Traders Relationship

Lastly, we observe how traders distinguish the adoption of practices by processors on their sustainable performance. For the practice of GMP, traders viewed this adoption can increase economical performance but only 50% of the sample view GMP as a catalyst for increasing environmental performance. This result is similar for TQM but rather different for adoption of JIT. The observation showed that the adoption of JIT will negatively decrease economical performance but moderately increase environmental performance of traders. On the adoption of mixed practice, 50% of the sample suggest that it can increase environmental performance while 70% of the sample viewed it can increase their economical performance.

However, traders view that the adoption of traceability low impact on improving their economic and environmental performance but can increase their social performance. Similarly, the adoption of supply chain integration can significantly increase economical as well as social performance while moderately increase traders' environmental performance. Transparency becomes one of the constructive practice that being consider positively impact economical and environmental performance while supplier continuity can channeled improvement both economical and social performance. In general, 65% of the sample considers the adoption of best practices in processors' level will increase traders' economical performance while 21% consider it can negatively impact their performance. On the environmental dimension, 54% of the sample considers adoption of best practices will have positive effect will 30% consider in contrary. However, interesting fact is presented in social dimension where 43% of the sample considers best practice can increase their performance while 41% consider it has low impact on performance. This fact shows the evident that focal company has significant contribution towards social development of their supplier (Andersen and Skjoett-Larsen, 2009; Jöhr, 2004).

Figure 5.4. Adoption of Best Practices and Supply Chain Performance



Thus, to summarize, we outline our findings on the correlation between adoption of practices and supply chain performances in figure 5.4. Here we can draw conclusions based on the result obtained from the interview. First of all, in the cocoa supply chain, *the adoption of best practices in the initial stage will increase profitability of the intermediaries and vice versa*. In this sense, the adoption of best practices will add value to the products and will increase price margin received by both actors in the chain. However, it does not necessarily increase or affected the non-economic performances although the adoption of best practices by the intermediaries may have low positive impact to the environmental performance of the farmers.

Secondly, *the adoption of best practices by the intermediaries will positively affect the sustainable performance of the processors and vice versa.* In other words, the

adoption of best practices will endorse the improvement of supply chain performances as a whole. Lastly, we consider that *the adoption of best practice in the initial stage will influence the performance of the final stage of the supply chain and vice versa through the intervention of intermediaries*. Hence, the sustainable performance of a supply chain is determined by the level of adoption of best practices by each actor inside the chain.

5.5. Conclusions

This study explores the adoption of best practices and sustainable performance from an agricultural supply chain perspective. We consider several best practices that are commonly used in the supply chain and operation such as TQM, JIT, warehousing, etc. Not all practices are positively correlated with the performance; there are some practices that negatively correlated with performance especially when we consider non-economical performances. Hence, our finding is correlated with Wade *et al* (2010) that stated to manage trade-offs between cocoa yields, biodiversity and ecosystem services, including carbon storage options in cocoa agro-forests, all stakeholders must consider different practices and strategy. Our finding also suggested that there are some contingencies to be considered. Contingencies like mutual trust, long term relationship and degree of information openness will determine how practice(s) be successfully adopted and hence, increasing performance(s). Another interesting fact drawn by this research is that the adoption of a single standardized practice might not be sufficient to a certain stage of supply chain. Instead, the combination of several practices will sustain a company's performance in cooperating with dynamicity of the market demand. Furthermore, our findings also underline that there are necessity of observing several practices that correlated closely with sustainability such as traceability and supply chain integration where as discussion of these practices is evolving in both agricultural sector and sustainable supply chain management.

Thus, we want to highlight the contribution of this work. Besides the contribution in the body of literature, our work contributes in two fold. Firstly, it enables each actor in the supply chain identified what practices will enhance their performance especially when considering sustainability dimension and secondly, in respond to Laugen *et al*

(2005), it has managerial implication towards focal company to understand what practices that have positive impacts in their supply chain and thus, managing their strategy to increase overall business performance. We want to emphasize that there is possibilities to replicate this work into similar commodities that share common problems and structure like cocoa industry and thus, improving their performances.

However, this study has some limitations. First, the sample data is limited to some extent and therefore, a future in-depth research supported large dataset is required. Secondly, focusing on one industry might not provide a full spectrum of sustainable supply chain management practices (Pagell and Wu, 2009), therefore it is reasonable to view the application of best practices towards sustainable performances into a broader industrial dimension. Lastly, we want to emphasize that the evaluation of performances is based on the perceptions of the actors in the supply chain and therefore, a longitudinal research to examine the actual performances is needed.

APPENDIX 5.1

Figure 5.5. Locations of where interviews took place

APPENDIX 5.2

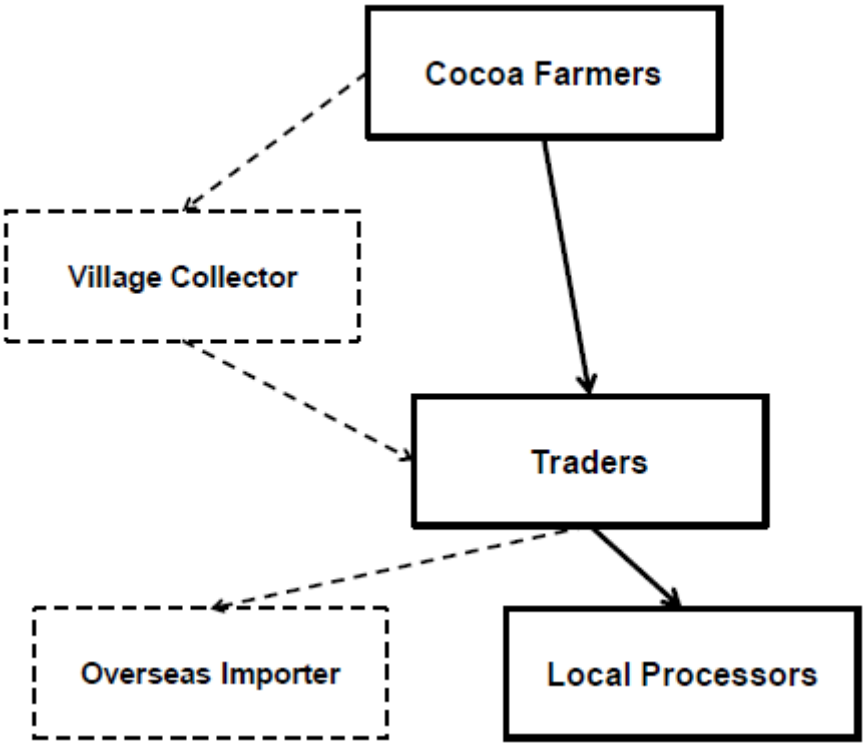


Figure 5.6. Cocoa Supply Chain in Indonesia

Note: we investigate the practices and performances for three actors in the cocoa supply chain namely farmers, traders and local processors. There are other actor in the supply chain such as village collectors and overseas importer (in dashed boxes), but we did not explore it due to lack of data.

APPENDIX 5.3

Table 5.12. Data on Traders and Processors

No	Actors	Location	Type of Company			Size of Employee			Supply of raw materials			Certification			
			MNC	Local	SOE	1-50	51-100	>100	Own	Farmers	Traders	ISO 9000	ISO 14000	ISO 22000	SNI
1	Traders	Makassar		☑				☑		☑					☑
		Makassar		☑				☑		☑					☑
		Makassar	☑				☑			☑					☑
		Makassar	☑				☑			☑					☑
		Makassar	☑					☑		☑					☑
		Jakarta	☑					☑		☑					☑
		Surabaya			☑			☑	☑						☑
2	Processors	Jakarta	☑					☑			☑			☑	☑
		Jakarta		☑				☑			☑				☑
		Palu		☑		☑					☑				

Source: direct interview

CHAPTER 6

TRACEABILITY IN COCOA SUPPLY CHAIN AN INDONESIAN CONTEXT[36]

Abstract

The multi – events of food alerts and food risks which occurred in a lengthy period and various locations, grows concern of consumers to question the safety of the food that they consumed. For food producers, occurrences of food alert forced them to review their supply chain to identify what went wrong in their supply chain. To do this, they need a good traceability system capable in revealing the problems occurred along the chains. In general, a typical food supply chain consists of farmers, middlemen, manufactures, retailers and consumers, which can be well represented by the cocoa supply chain. This paper is the initial stage in identifying cocoa supply chain and proposes a conceptual framework of its traceability system. Moreover, this paper aims at linking the traceability to performances of the chains as a driver to reach sustainability. We refine literatures discussing traceability on several agro–food chains to determine what factors should be considering for conducting traceability on cocoa supply chain. The result shows that several factors such as price identification, transportation mode, the quality and the origin of the products influences the adoption of traceability of the agro – food chains, and thus, should be taken into account for the cocoa supply chain.

Keywords : *Cocoa, Supply Chain, Traceability, Indonesia*

[36] Syahruddin, Normansyah and Kalchschmidt, Matteo. (2012). Traceability in the cocoa supply chain: an Indonesian context. *The 23rd POMS Conference Proceeding. ISBN 978 – 0 – 615 – 61858 – 6*

6.1. Introduction

Globalization and internationalization of companies led to investments in different parts in the world due to various reasons such as low cost labour, low cost materials, relaxed regulations, strategic locations, partnership and alliance and access to raw materials. For the food industry, that the movement of the products mostly starts from developing countries, where raw materials are usually still abundant, to the developed countries, where most of the processing industries are located. In order to respond this trans-boundaries and trans-national supply chain, companies needs to carefully arrange their supply chain in order to meet the consumers' demand and managing uncertainties. In other words, companies need to outlook carefully their supply chain from the first echelon to the end tier/s, expecting that there will be minimum flaw between echelons that could damage their reputation or even their existence in the competition. This situation may incur to opportunistic behaviour that may lead to falsified of the documentation that must accompany foodstuffs, usually in order to increase profit (Martinez and Friis, 2004). Traceability systems become important to identify what supplier's produce, how they produce and when the products will be delivered among echelons (Deasy, 2002) as well as identification of inputs or raw materials.

Previous researches have demonstrated that traceability has become a major issue in the food chain (e.g. Dabenne and Gay, 2011; Gellynck *et al,* 2006; Jacquet and Pauly, 2008; Monteiro and Caswell, 2009; Opara, 2002; Regattieri *et al*, 2007) and in particular, quality and supply concerns are merging with traceability issues (Kaplinsky, 2004). This particular sector is volatile to the hazardous contaminants that can infect the materials or processed products which will eventually, affected consumer at the end and considering the speed of internationalization of food supply chains, there is a need for faster, cheaper, real – time, more sensitive accurate and validated testing method for food safety and quality assurance (van der Vorst, 2006). This also extends to the need of over viewing what are techniques that are common on detecting contamination when food alert occurred where we found that there are limited contributions discussing this across various food industries. Thus, we highlighted some of the content analysis

techniques in food industry that available in the literature and presented it in the section 2 as show what techniques related to what industries.

Then, we turn our focus on the traceability for cocoa supply chain. We found that this could be an interesting example due limited discussion on traceability in cocoa supply chain (Gilbert, 2009). It even more interesting if we consider several foods recalls that involved cocoa and cocoa products[37] and it also has been adopted into national policy of food safety in Italy (Sicurelli, 2008). A recent study on traceability in cocoa supply chain was provided by Saltini and Akkerman (2012) focusing on economic simulation if food recalls take place. While providing this information, they concentrate their attention on focal company perspective and not the entire supply chain, in most cases, the initial stage of the chain bear the liability (Pouliot and Sumner, 2008). Furthermore, considering the complications, there is a need to understand what information should be convey in each stage of the supply chain. Thus, the objective of this paper is to propose a conceptual framework on how traceability should be done in cocoa supply chain industry. The framework is also intended to cover the initial stage of cocoa chain up to the producing country where the traceability law are not complied (Saltini and Akkerman, 2012).

To broaden our research, we conducted critical content analyses in two different approaches: based on the techniques and technologies taken by various industries to examine its current development. Secondly, we took several case studies in the different industries to observe what kind of traceability approaches that they took. With this approach, we aim to provide a detail conceptual framework for traceability in cocoa industry from the initial stage to the end customer including the extent of information that should be passed from one chain to another.

This paper is comprised onto four sections, where in introduction we discussed some background that enforced our proposed research. In the second section, we briefly discuss what are traceability and its content analysis. We also provided discussion on

[37] There are several cocoa and chocolate products being recalled from the the market due to various contaminations during 2006 – 2010 (for example *see* http://www.food.gov.uk/enforcement/alerts/2006/jun/cadburychoc; http://www.food.gov.uk/enforcement/alerts/2006/may/choctoffeebites;http://www.food.gov.uk/enforcement/alerts/2009/nov/sainsburyswholenutdarkchocolate)

the extent of technology that used for traceability identification as well as the relationship between traceability and sustainability. Then we move to our core discussion on traceability in cocoa supply chain. In the last section, discussion and further direction are provided.

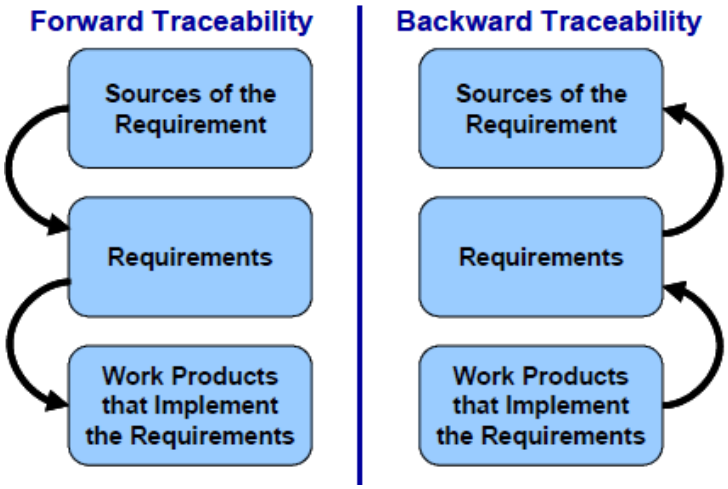
6.2. Traceability at a glance

The concept on food traceability started in 1994 followed by some food alerts and food recalls[38] which occurred in a lengthy period and various locations that grow concern of consumers to question the safety of the food that they consumed. An earlier definition was provided by International Standard of Organization (ISO) that defined traceability as *the ability for the retrieval of the history and use or location of an article or an activity through a registered identification* (ISO 8402, 1994). Later, a more concrete description provide by the European Union through Regulation (EC) No. 178 / 2002 defining traceability as *the ability trace and follow a food, feed, food – producing animal or substance intended to be, or expected to be incorporated into food or feed, through all stages of production and distribution*[39]. The widely accepted and common methodology employed for food traceability is based on one-up-one-down principle (European Commission, 2002).

There are two type of traceability; backward traceability and forward traceability. Backward traceability implies on tracing products back to requirements to ensure that the requirements have been kept current with design, code or tests. Forward traceability performs tracing activities from the requirements to the products to ensure the completeness of the product requirement specification. The combination of forward and backward traceability often referred as *bidirectional traceability* (Westfall, 2006) as in figure 1.

[38] Food Standard Agency. http://www.food.gov.uk/enforcement/alerts/. Accessed on 16th April 2011
[39] European Community. http://ec.europa.eu/food/food/foodlaw/traceability. Accessed on 15th April 2011

Figure 6.1. Forward and Backward Traceability



Source: Westfall, 2006

Traceability in food chain is nowadays a fundamental requirement, which is becoming mandatory in almost all developed countries. The aim of a traceability system is to collect in a rigorous way all the information related to the displacement of the different products along the supply chain. Understanding traceability's impacts requires shifting perspective in order to encompass the vast array of interests, particularly because how each interest is incorporated into the system will determine how, who and what the human locational database embraces (Popper, 2007). Furthermore, traceability itself offers the promise that the individual can know the full story – the places, people, processes, and practices – of items raised and routed all over the world to end up in one's own mouth.

This information proves essential when facing food safety crisis, and allows efficiently managing the consequent product recall action (Dabenne and Gay, 2011). To ensure the safety and quality of food products, consumers can indentify extrinsic indicators and cues convey information about the products through certification and labelling, which available on the point of purchase (Caswell, 2006) and obtained standard information of the food products (Gellynck *et al*, 2006). One of the biggest challenges with supply chain traceability is the exchange of information in a

standardized format between various links in the chain (van der Vorst, 2006; Thakur and Donnelly, 2010).

The context of bidirectional traceability has evolved in recent years and complies with principle of EU traceability, that each chain is able to trace the product at least with their first tier supplier(s) and consumer(s). In the context of agri – food supply chain, consumers gain benefit from increased traceability to the marketers by having better chances of receiving compensation in case of a food safety event and by consuming safer food. Additional traceability from the marketers to the farms does not increase consumer's compensation because it does not change the marketers' liability. However, additional traceability to the farms allows marketers to impose liability costs on farms and thus creates incentives for farms to supply safer food (Pouliot and Sumner, 2008). Thus, t*raceability must be treated as holistic context compare to partial sight limited to one chain before and after the viewed chain.*

In this way, we stresses on the importance of holistic traceability compare on focusing only on one or two chains. This also in line with Manikas and Manos (2008) stating that the efficiency of a traceability system depends on the ability uniquely *each unit* that is produced and distributed, in a way that enables the continuous tracking, *from the primary production to the retail point of sale*.

6.2.1. Traceability and sustainable supply chain management

Of all sustainability elements, traceability has been highlighted (Epstein, 2008) as the driver for transparency (Carter and Roger, 2008) in recent years following recalls of many food products in several countries, leading to higher consumer concerns on food safety and hazardous materials that may be contained in food products. As part of operations, supply chain holds an important position in maintaining the flow of the materials to the processing units up to supplying finished goods to the end consumer (Chopra and Meindl, 2001; 2007). As a consequence of globalization, global supply chains are typically characterized by greater use of transportation with obvious implications on the environment and induce local behaviours that sometimes may not be

socially sustainable (e.g., exploitation of low cost labours). These factors are urging stakeholders to take sustainability into account due to both rising concern of national and international regulations and an ever growing attention of end consumers of the implications on sustainability. In the last decade, there have been raising concerns on environmental damage, depleted resources, exploitation of child labour, endangered species, and global warming. Reuter *et al* (2010) state that sustainable supply chain in terms of global supplier management must be managed carefully to reduce risks, which also implies to the globalized food supply chain.

These concerns have shifted the traditional way of manufacturing and operation of most firms in the world so to become more concerned with the triple bottom line (Elkington, 1998; 2004), thus guaranteeing both economic, social and environment sustainability of operations. In response to this growing concern, the number of papers that discuss sustainability has increase in the last decade by quintuple-fold (Linton et.al 2007). In the context of performance, traceability provides companies with supporting framework in understanding what practices that been applied by their suppliers. Within this perspective, where the level of trust between suppliers and consumers plays an important role (Barrett *et al*, 1999; Choe *et al,* 2009), traceability also can be extended as ethical approaches and ensures certain consumers to acknowledge information related to the food products that may lead to sustainability[40] (Beekman, 2008).

Similarly, Epstein (2008) pointed out the importance of traceability in identifying sustainability while Kaynak and Montiel (2008), Beamon (2008) and Smith (2008) summarize the relationship between sustainability and supply chain performance, where traceability is identify as one of the key element in the performance for reaching sustainability. This matter also being highlighted by Opara (2002, 2003) and Wognum *et al* (2011) that traceability can actually use to identified the level of social and environmental dimensions whereas traceability overviewed transparency in the food chain (Skilton and Robinson, 2009). However, they also mentioned the difficulties in

[40] Ethical traceability can be functioned as public management tools used to ensure consumer that consumers are provided are provided with food that respect some threshold level of animal welfare, sustainability or fair trade and as public – private tool, used to allow certain consumers to be provided with food products and sufficient information about these products (pp 70 – 71)

applying traceability as the major tool to assess sustainability performances in the food chain especially when suppliers have high degree of complexity. Therefore we also adopted the mainstream perspective that *traceability has positive direct impact on supply chain performances.*

6.2.2. Features of traceability in food chains

In this section, we focus attention on the literature that addresses different feature for traceability in the agri – food chains. We divide the analysis into two categories; content analysis in traceability measurement and information technological application. We aim to identify different techniques that applied for content analysis over various industries to classify what techniques that suitable for certain industry as well as the application of information technology for traceability identification.

6.2.2.1. Content Analysis in Traceability Measurement

Content analysis in traceability measurements in the food chain comprises of various techniques applied both for natural and genetic modified foods (*see* Marmiroli *et al,* 2008 for literature review). The application is typically focused on the identification of the origin of a product, but it has also been extended to other scopes such as the computation of the maturity of a food product (e.g. in wine industry). Different methodologies have also being designed to serve different purposes. In most of the fishery and aquaculture chains identification techniques (*see* Moretti *et al,* 2003 for literature review), DNA based identification is the most applicable techniques to categorize species identification, production methods and geographical origin of species (e.g. Schröder, 2008; Ardura *et al*, 2010; Maldini *et al*, 2006; Fernández – Tajes *et al*, 2008) as well as in meat (Aslan *et al,* 2009) and wheat industries (Scarafoni *et al,* 2009).

High – performance Liquid Chromatography (HPLC) is performed to identified nitrate concentrate in several vegetables to see whether the level of concentrate can be acceptable for daily intake (Castanheira *et al,* 2004), carbon and sulphur stable isotope composition for geographical identification in beef industries (Schmidt *et al,* 2005;

Bahar *et al,* 2008). In the honey industry, solid – phase microextraction technique was often used for identified honey's origin and to reduce the potential of honey adulteration (Cajka *et al*, 2009), while more robust approach such as bottleneck neural network was intend to identify the origin based on the wider set of chemical content inside the honey (Novic and Grošejl, 2009). Different technique employed in the wine industry by utilizing temperature monitoring from grape production until the end consumer to ensure the quality of the wine as well as to identify the origin of the wine products (Boquete *et al,* 2010)

Table 6.1 presents an overview on how content analysis has evolved in the traceability mainstream literature. Overall, fishery and aquaculture industries received high attention in the traceability mainstream followed by the meat and vegetables products. This is due to the fact that scientists are interested in the origin of the consumable fish in the market as well as the treatment received by the fish products before reaching the consumer's table.

Table 6.1. Content Analysis in Traceability Measurement for Food Industries

Industries	Methodology	Literature
Fishery and Aquaculture	DNA Identification	Schröder, 2008; Ardura *et al*, 2010; Maldini *et al*, 2006; Fernández – Tajes *et al*, 2008; Filonzi *et al*, 2010; von der Heyden *et al,* 2010; Ogden, 2008; Pérez *et al,* 2005
	HPLC	Orban *et al*, 2007
	Stable Isotope	Sant'Anna *et al,* 2010
Meat and Cattle	DNA Identification	Aslan *et al,* 2009; Goffaux *et al,* 2005; Losio *et al,* 2004
	Stable Isotope	Schmidt *et al,* 2005; Bahar *et al,* 2008; Guo *et al,* 2010
Soybean	DNA Identification	Bogani *et al, 2009*

Wine	Temperature Monitoring	Boquete *et al,* 2010
	MALDI – TOF Mass Spectometry[41]	Chamberry *et al,* 2009
Honey	Solid – Phase Microextraction	Cajka *et al*, 2009
	Bottleneck Neural Network	Novic and Grošejl, 2009
Vegetable Oil and Products	DNA Identification	Caramante *et al,* 2011; Montemurro *et al,* 2008; Pafundo *et al,* 2010
	HPLC	Castenheira *et al,* 2004; Cserháti *et al,* 2005
Rice and Wheat	DNA Identification	Cirillo *et al,* 2009; Scarafoni *et al,* 2009
Dairy Products	HPLC	Cserháti *et al,* 2005; Fernandez *et al,* 2003
Cocoa	High Temperature Gas Liquid Chromatography	Buchgraber *et al,* 2003
	HPLC	Cambrai *et al,* 2010

6.2.2.2. Information Technological Application

Currently, information technology plays an important role for traceability in the food chain, not only for the consumers but also for the producers (Buhr, 2003). There are several methodologies applied to conduct traceability in the food chain led by the recent development in ICT to make traceability more computerized system in implementation (Chrysochou *et al,* 2009). Among them, alphanumerical code, barcoding and radio frequency identification data-RFID (Gandino *et al,* 2009; Regattieri *et al,* 2007; Sahin *et al,* 2002) is the most used techniques in agri – food chain to indentify supplier' products including process system, raw materials, number of batch, etc. In fast moving consumer goods (FMCG) labelling becomes important feature to identify, not only the brand of the product, but also the ingredients contained in the food products (Banterle and Stranieri, 2008), enabling consumer to observe chemical materials inside the food products. Besides that, other approaches conducted are

[41] Matrix – assisted laser desorption / ionization – Time of flight mass spectometer

capillary electrophoresis (Vallejo – Cordoba and González – Córdova, 2010) and application of biosensors on food products (Terry *et al,* 2005)

An interesting case study comes from the soybean supply chain showing that only information that will be delivered to the next link is considered important (Thakur and Donnelly, 2010), which means that information only passed to immediate supplier(s) or customer(s) of the echelon. The study also provided evidence of the utilization of Electronic Data Interchange (EDI) and Extensible Markup Language (XML) for standardize data exchange. Other technologies for modelling traceability are EPCIS framework and UML statecharts, which modelled transitions in food production. However, EPCIS specification does not cover all of the events (transitions) described in the previous sections (Thakur *et al*, 2011), thus not revealing all relevant information within the supply chain.

6.3. Traceability in Cocoa Supply Chain: An Indonesian Context

6.3.1. Cocoa industry at a glance

Previously, there was stigma that chocolate is the source of fat, unhealthy product that can cause obesity and heart attack. Yet, it was revealed that chocolate is not causing heart attack, while instead, one type of chocolate (dark chocolate) can strengthen the heart of human and can lower the human blood pressure[42]. This finding indirectly promotes the production of dark chocolate due to shifted preference on healthier products (Knickel *et al* 2002). Similar finding also provided by International Coffee and Cocoa Organization or ICCO (2008) showing that chocolate candies are more dark and high content of cocoa in the recent years. The study was done in US and UK market which can be considered as premium market in chocolate industry. Relevant to that context, market trend shows the consumption of the chocolate in the world is increasing by 14% on average within the period of 1997 – 2006 with USA as the leading country

[42] WebMD. *http://www.webmd.com/diet/news/20030827/dark-chocolate-is-healthy-chocolate*. Accessed on 16th April 2011

with about 1.600.000 tons in 2006 of chocolate consumption followed by Germany, United Kingdom and France.

The rising demand for chocolate affected the performance in the export of cocoa beans. In the period 2005 / 2006, European region has been accounted for the largest cocoa consumption by 49% followed by American region with 35% and Asian region with 14% of total world consumption. There is significant increase by 728.000 tons in the 2005 / 2006 period compare to the 1995 / 1996 period or equal to 27% increase. Trend showed significant improvement in the organic or sustainable chocolate that comes from sustainable supply chain management due to for example environmental issues and food safety reasons.

In the production side, Ghana, Cote d'Ivoire and Indonesia dominated the cocoa production in the world, accounted for more than 70% of total world production. Market for Indonesian' cocoa beans in European countries still counted as a niche market since only less than 15% of market share is available (Ministry of Agriculture, 2005). Moreover, the challenges for Indonesian' beans are the standard for quality set by European countries and General System of Preferences (GSP) rules in trading, where EU gave zero percent tariff to several beneficiaries (Coté d'Ivoire, Ghana, Brazil, Cameroon and Ecuador), compare to Most Favored Nation (MFN) rules that set 3.5% tariff for Indonesia. In general picture, most of the beans produced in Indonesia are unflavored cocoa beans, which counted for discounted price in the destination countries and subject to importing tariffs (Dradjat *et al*, 2003) and government intervention (Neilson, 2007), while additional fermentation will increase the value added to the beans (Latuhihin *et al,* 2007; Ardhana and Fleet, 2003) Like any other food chain, cocoa also faced sustainability problems such as forest degradation, biodiversity destruction or child labor issue (Neilson, 2007; Schrage and Ewing, 2005) that often occurred in food supply chains.

6.3.2. Cocoa Supply Chain in Indonesia

Typical like other food chains, the cocoa supply chain in Indonesia consists of growers, collector, local traders, exporters, multinational (MNC) and local processors and local manufactures (Bedford *et al,* 2002). Farmers cultivate cocoa beans nurture them before finally harvest the beans. The typical characteristics of cocoa growers can be divided into three that are owner farmer, sharecroppers and farm managers where these characteristics were determined by the ownership of the cocoa plantation. Collectors are part of the supply chain that buys and collect cocoa beans from the farmers before sell it to the local traders. They also often referred as *tengkulak*, whereas they usually lend the money to the farmers in the off – farm season (*see* Neilson, 2007 for further detail). Collectors usually operate in the regions where farmers do not have the capability and capital to bring their harvest directly to the local traders.

Later, traders act as the marketing point where cocoa beans marketed to exporters, where the beans then sell to the overseas buyers, and to the local and MNC processors, where the beans processed for the domestic consumption. In the processing stage, beans are extracted into several by – products such as cocoa cake, liquor and butter that are used for confectionaries, cosmetics, chemical and medicines in the manufacturing stage.

6.3.3. Traceability in Cocoa Industry in Indonesia

Currently there is limited traceability application in cocoa supply chain in Indonesia and needs certain framework to be adopted. Furthermore, it requires certain technology and regulation that are legitimate and binding, such as EC 178 / 2002, to support the implementation of traceability in cocoa industry in Indonesia. The problem occurs in the collectors and local trader's stage when different cocoa beans arrives and mixed together without proper recording system where this entails to the possibility of data mismatch during the supply chain (Thakur and Donnelly, 2010). The later predicament will occur if food safety problem take place, it will be difficult to identify in what stage the problem should be address.

6.3.4. Traceability in Other Food Chains

In this section, attention is given to how traceability is implemented in different food supply chains. By doing so, we want to understand the development of traceability in this particular sector and try to extract a framework from it and built a conceptual framework that applicable for cocoa industry in Indonesia. In particular we want to highlight the concept of *tracking* or also referred as forward traceability and *tracing* that has been numerously discussed in the recent years (Fritz and Schiefer, 2009) which already being briefly discussed in the section two. By employing tracking and tracking in the food supply chain, a complete picture of traceability can be presented from initial stage to end customer.

To serve our purpose, we refine literatures that relates to traceability in agro–food chain using the university internal search engine with specific keywords such as *traceability* and *food industry*. Then, we examined the papers whether it has discussion of tracking and tracing in its contents. Furthermore, we focus on the traceability papers that employed tracking and tracing for their products from the initial to the end consumers. After refinement, we identified five papers from different industries namely live fish (Hsu *et al*, 2008), processed meat (Mousavi *et al*, 2002), live animal (McGrann and Wiseman, 2001), cereal (Schiefer, 2008) and coffee (Light, 2010) that match to our requirement.

Table 6.2 summarize how traceability has been employed in various food chains. In the first column, we classify different industries based on the product. Then, we identified the depth of the supply chain which represents the length of the supply chain from the producers to the end customer correlated with the number of actors involved in the supply chain. Typically, agro–food chain has short length and dominated with vertical relationship with low intensity of horizontal integration. We also differentiated how traceability been imposed by each industry as well as the information technology tools used while conducting traceability.

Table 6.2. Various Traceability in Food Chains

Industry	Depth of Supply Chain	Number of Actors	Traceability System		Information Technology Tools	
			Tracing	Tracking	Tracing	Tracking
Live Fish	Short	7	Ingredients, food quality, origins, processes, transportation mode	Control of distribution, warehousing management, query of delivery system, food safety	RFID	RFID
Processed Meat	Short	8	Breed type, category and grade, origins	Distribution system, numbers of queries, stocks, food safety	RFID, barcoding	RFID, barcoding
Live Animal	Very Short	2	Movements of animal, health, animal welfare, animal origins, animal breed	Movements of animal, health, transportation mode	EDI	EDI
Cereal	Short	6	Pesticide residues, food safety, origins, possible contaminants	Distribution of products, warehousing, food safety and quality	EDI, RFID	EDI, RFID
Coffee	Short	6	Pesticide residues, wastes, quality, origins	Distribution of products, warehousing arrangement, food safety	EDI, labelling	EDI, labelling

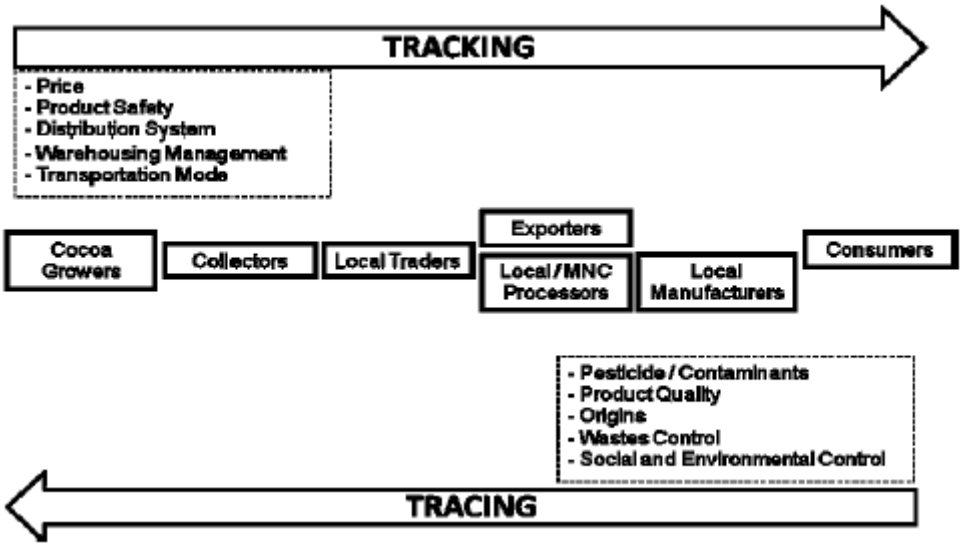
As we can see from Table 6.2, there are information similarities that gathered in tracking and tracing processes. For example, live fish industry requires information on the origins of the fish in the compliance of standards and regulations, similar to cereal and live animal industries. In the tracking phase, controls of distribution and movement of the products as well as warehousing management hold important position in determining a successful traceability system. Beside the origin, the quality of the product and the pesticide level were among the information required for traceability

identification. For the technology application, computer based identification such as RFID, EDI and barcoding were among the popular choice for tracking and tracing phases in agro–food industries. For bulk products, such as coffee, labelling is also common for product identification.

6.3.5. A Conceptual Framework of Traceability for Cocoa Supply Chain in Indonesia

In this section, we discussed on how traceability employed in different agro–food chains. In particular, we overviewed the tracing and tracking features, including the technology as the enabler, that enable each actor in the supply chain recognizes the flow of the product even from the initial stage. Taking the consideration by the information provided by Table 6.2, the traceability in cocoa supply chain should also imposed information such as product safety, distribution systems, price transparency, pesticide level, etc. in the holistic way. By this approach, manufacturers can identify not only their immediate suppliers, but also went back to cocoa growers and *vice versa* and thus, able to identify which stage those are responsible for the food alerts. When the food recall or alerts occurred, farmers or growers as the initial echelon often subjected to the party that is responsible for such occurrence due to, for example, pesticide use or lack of quality control (Pouliot and Sumner, 2008) and subject to economic exploitation where sometimes growers must bear the cost of the recalls. Moreover, we want to highlight which other information should be inserted in the label including information on sustainability performances. Thus, we highlight the framework for traceability for cocoa supply chain in Indonesia as in figure 6.2.

Fig. 6.2. Conceptual Framework for Traceability in Cocoa Supply Chain



As transparency is the important feature in traceability, we consider the *flow and openness of information* become the key figures to determine a successful traceability system. This entails on what kind of information should be provided to minimize the occurrence of food alerts. Moreover, information flow can be utilized as the tool to monitor sustainability performances. Taking this into consideration, beside usual information such as pesticide usage, origins and other characteristics of the cocoa products, information regarding how focal companies managed their social and environmental performances should be included in the label of the product. On the other hand, the tracking phase meant for tracking the movement of goods downstream and must go as far as the consumer in case of food alert. This mean the information delivered mostly the quality of the product, level of waste and dirt from the growers to at least the processors level. Concerning the point raised by Pouliot and Sumner (2008), we viewed that there is a necessity to growers to track the transmission of the price along the supply chain. This is required to measure the economical performance of the supply chain in complete picture.

As for information technological tool, labelling can be considered as the tool for identification in the earlier stage of supply chain. Later, the database from labelling identification can be synchronize with computer based application such as EDI to

simplify the identification process in the manufacturing stage and even in the retail phase of the product.

6.4. Conclusion and Further Development

Traceability becomes important figure to identify products, materials, service and processes that had been conducted by the suppliers within the supply chain particularly in the food chain. Traceability also acts as the tool for improving consumer trust towards supplier and product quality (van Rijswijk *et al,* 2008; Verbeke *et al*, 2007) although consumer should pay more for the food product (Xu and Wu; 2010), a counter instrument for misinformation and mislabelling on food products (Jacquet and Pauly, 2008) and by definition, it can be used to measure uncertainty in the supply chain (Bièvre, 2004) as well as a component for controlling and monitoring (Hamprect *et al,* 2004). Moreover, it can provide a significant impact on the pursuant of sustainability (Phillips and Tallontire, 2007). In this context, traceability can provide more detailed information, not limited to the products, but also to the sustainability performance of the supply chain (i.e. social and environmental performances). Thus, traceability must be conducted by all elements in the supply chain and not limited to certain chain.

However, regarding the information' availability, certain chains should possessed complete information regarding the traceability. Nor the consumer nor the farmers, but chains that have better financial performances (i.e. retailers, manufacturers) whereas consumers have strong preferences that other stakeholders, retailers and governments, in the chain possessed information on traceability and available upon request (Gellynck *et al*, 2006). Furthermore, economic incentive can be applied to organizations that employed more stringent traceability (Charlier and Valceschini, 2008; Hirschhauer and Musshoff, 2007) and taking into account all stakeholders concerns (Doluchitz *et al*, 2010, Narrod *et al,* 2009).

This paper also provides a view on how traceability in cocoa supply chain should be done. While taking into account the necessity of having a bidirectional traceability, intelligent transportations for perishable products (Hsueh and Chang, 2010) should also

be considered and it can be a prerequisite as prevention against food alert and can be use as a detection tool for pesticide usage (Bateman, 2008; Kaplinsky, 2004). Another possible approach that can be implemented for traceability in cocoa supply chain is the Failure Mode Effect and Critically Analysis (FMECA) proposed by Bertolini, *et al*(2006), which extend the industrial application to food industry. Implementing traceability should not be an economical burden for cocoa supply chain in Indonesia since it only costs 3% of the retail chocolate price (Abbott *et al,* 2005). Furthermore, farmer‘s acceptance towards also must be taken into account considering that rates of traceability adoption at the farm level may be lower in regions or countries where the majority of producers market their products independently (Monteiro and Caswell, 2009). Moreover, there is an urgent need for regulation that stresses on the substantial responsibilities of farmers and processing companies for the food quality assurance and therefore, need to prove the diligence and traceability practices in their operations and supply chain (Savov and Kouzmanov, 2009).

In the end, it is important to highlight some limitations of this work. First, the research has focused on analyzing papers from one database, and even if that database provides access to most of the scientific journals available, it does not guarantee complete access to all possible contributions. Thus, further research of this topic should also consider those publications that the approach we adopted may have missed. Second, we conducted a literature review by selecting papers using a keyword search procedure, a method that does not guarantee that all relevant contributions have been considered.Next, it would be interesting to extend the supply chain until the end consumers, not only confectionary industries, but also chemical and pharmaceutical industries that used the fraction of cocoa as one of the ingredients of their products. A cross industries sample selection will provide wider perspective on how traceability works in the cocoa chain.

CHAPTER 7

CONCLUSION

Sustainability in the supply chain of agricultural products is an evolving topic; however, specific research gaps can be identified. In the 21st century, a sustainable agricultural supply chain is not solely about practicing farm cultivation; rather, it includes warehousing, transportation, manufacturing and distribution, and it requires considering not only what it is best for the survival of the companies, but what is best for the environment and for biodiversity. In particular, this work highlights specific areas of research that should be addressed and that could significantly contribute to sustainable development. Our work addresses a specific topic that is rarely discussed in the sustainable supply chain management area, and it provides a comprehensive view of the sustainable agricultural supply chain that, to our knowledge, has been only partially addressed in the extant literature. In this way, a better understanding of the SASC concept can be extended.

The research carried out in this dissertation contributes to the literature of sustainable supply chain management by (i) exploring the trend of discussion of sustainability inside the niche agricultural supply chain and (ii) by investigating the adoption of best practices along the cocoa supply chain and its relationship with the supply chain performances. This dissertation includes a brief introduction (chapter 1), research framework (chapter 2), industrial description (chapter 4) and three essays (chapters 3, 5, and 6 respectively).

The Introduction gives an overview on the terminologies of sustainable supply chain management and thus, forming the conceptual framework in this research. The first paper analyzes the trend of SASC discussion inside SSCM mainstream. The result proves that SASC received low attention in the mainstream giving a further possibility

for development. Our research also note the kind of sustainability on which researchers are focusing. Specifically, we identified many contributions that address the environmental aspects of sustainability and some that focus on the social issues. However, very few papers address the two issues together, and even fewer include the economic issues, thus failing to provide a complete perspective on sustainability. We argue that more research is needed to understand the multidimensional problems of sustainability. In fact, the literature lacks the requisite methods to evaluate the three perspectives together, lacks contributions on practices that can contribute to improving performances in the three dimensions, and shows limited evidence of what companies are doing to achieve sustainability.

We also note that literatures suggested that sustainable agricultural supply chain can be achieved if each echelon of the chain adopts sustainable practices in its operations. The previous analysis, in fact, clearly indicates that research is focusing more on how practices can be improved to achieve sustainability within the supply chain. This fact also becomes our main ground in the second paper.

This research contributes to the supply chain management and sustainability mainstream. In particular, this research explores particular topic that still need further development. Furthermore, this research has managerial implication on the adoption of practices in different stage of the supply chain, which can lead to better performance of the supply chain. The implications of this research extend to companies, researchers and practitioners that are interested in the agricultural supply chain topic. Understanding the development of themes and topics over the last decade will allow us to view the SASC approach from a holistic perspective that is not partially limited to certain tiers of the supply chain. Further implications can be extended toward the governmental level, creating a better policy for achieving sustainability in the agricultural sector.

The second paper analyzes the adoption of best practices in each stage of the cocoa supply chain. The impact of this adoption towards performance was also investigated. The result showed that not all practices are positively correlated with the performance; there are some practices that negatively correlated with performance

especially when we consider non-economical performances. Our finding also suggested that there are some contingencies to be considered. Contingencies like mutual trust, long term relationship and degree of information openness will determine how practice(s) be successfully adopted and hence, increasing performance(s). Furthermore, our findings also underline that there are necessity of observing several practices that correlated closely with sustainability such as traceability and supply chain integration where as discussion of these practices is evolving in both agricultural sector and sustainable supply chain management.

Hence, based on our findings, the adoption of best practices in the initial stage will increase profitability of the intermediaries and vice versa. In this sense, the adoption of best practices will add value to the products and will increase price margin received by both actors in the chain. However, it does not necessarily increase or affected the non-economic performances although the adoption of best practices by the intermediaries may have low positive impact to the environmental performance of the farmers. Secondly, the adoption of best practices by the intermediaries will positively affect the sustainable performance of the processors and vice versa. In other words, the adoption of best practices will endorse the improvement of supply chain performances as a whole. Lastly, we consider that the adoption of best practice in the initial stage will influence the performance of the final stage of the supply chain and vice versa through the intervention of intermediaries. Thus, the sustainable performance of a supply chain is determined by the level of adoption of best practices by each actor inside the chain.

Furthermore, our findings also underline that there are necessity of observing several practices that correlated closely with sustainability such as traceability and supply chain integration where as discussion of these practices is evolving in both agricultural sector and sustainable supply chain management. Thus, we want to highlight the contribution of this work. Besides the contribution in the body of literature, our work contributes in two fold. Firstly, it enables each actor in the supply chain identified what practices will enhance their performance especially when considering sustainability dimension and secondly, it has managerial implication

towards focal company to understand what practices that have positive impacts in their supply chain and thus, managing their strategy to increase overall business performance.

In the third paper, we analyzes the literature focusing on traceability in the agro-food chain to determine the construct that going to be use in the model for cocoa supply chain as a response to the result from the second paper. We conclude that, as transparency becomes the key element in traceability, the flow and the openness of information becomes the key driver in the traceability of most agro-food chains. Furthermore, type of information might be differing for each chain. For cocoa supply chain, it is recommend to information such as pesticide usage, origins and other characteristics of the cocoa products, information regarding how focal companies managed their social and environmental performances should be included in the label of the product quality of the product, level of waste and dirt from the growers to at least the processors level. It is also consider to tracks the transmission of the price along the supply chain to measure the economical performance of the supply chain in complete picture.

Furthermore, farmer‘s acceptance towards also must be taken into account considering that rates of traceability adoption at the farm level may be lower in regions or countries where the majority of producers market their products independently. Moreover, there is an urgent need for regulation that stresses on the substantial responsibilities of farmers and processing companies for the food quality assurance and therefore, need to prove the diligence and traceability practices in their operations and supply chain.

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