Aggregation for Sustainable Traceability in Smallholder Coffee Producers: Cases of Ethiopia

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Abstract: Ethiopia is the origin of coffee and home of genetic diversity to the *coffea arabica* species. The country is standing first in Africa and sixth in the world in coffee production *(ICO 2018)*. Arabica coffee is the main cash crop, and has been the backbone of Ethiopian economy for so long time, even though its share is slowly decreasing with emerging of other sectors in the economy. Cost reductions, sustainability, value chain and quality improvement are now the major priorities in coffee production systems which substantially require huge efforts of various actors. On the other hand, the nature of production systems dominated by smallholder farmers in a conventional way kept the Ethiopian coffee far below the level it deserve indicating determinations to improve the entire value chain toward more conveniently reliable and value addition. As a result, smallholder farmers at micro level and the country by large have been losing possible premiums and price margins supposed to be gained by sustainably traceable coffee supply. Eventually, unless smallholder famers could aggregate their products in the cooperative/union framework it will be probably less promising for them to add values and thus improve their wellbeing just only by sticking to the traditional cycles of producing coffee and supplying to collectors or local traders. Therefore, this research will figure out proper methods of customizing sustainable coffee traceability for farmers aggregating their products through cooperative union approaches. Specifically it will analyze methods of aggregation, trends in production and marketing of Ethiopian coffee with more emphasis on farmers' cooperatives/unions and appropriate traceability systems supposed to be applied also by estate farms. Accordingly simple technology supporting aggregated coffee traceability is identified to set features of the full system. This will incorporate barcode labels to be fixed on jute bags at processing stations and scanned throughout key spots of the supply chain. So that foreign buyers can finally trace coffee by the digital passport sent by cooperatives/unions and estate exporters, until the system is scaled up to globally accepted tags expected to be labeled on green-pros, jute bags or containers. Eventually, traceability approaches proposed in this research will solve the fragmentation problem of Ethiopian coffee value chain in light of millions of smallholder producers if supports from the government and other initiatives are properly placed.

Key words: coffee arabica, traceability, cooperative unions, supply chain, barcode, aggregation

1. Literature Review

1.1. What's Traceability?

As a concept, traceability developed in the context of the quality system preoccupations. Although it can be traced back to the 90s, interest in food traceability has intensified, especially in the last two decades, due to the various food crises that severely affected many countries, especially the European ones. *(Corina 2013)*
The first international definition of traceability was given in ISO 8402 standard in 1987 (also assumed later in ISO 8402:1994 edition of the standard) as "*the ability to retrieve history, use or location of an entity by means of recorded identifications*". The entity may designate: an activity, a process, a product, an organization or a person.

Subsequently, the concept of traceability was introduced in ISO 9000 series of standards on quality assurance systems as a key element of any quality management product.

Thus, ISO 9000:2005 defines traceability as the "*ability to trace the history, application or location of that which is under consideration", adding that "when considering product, traceability can relate to the origin of materials and parts; the processing history, and the distribution and location*".

Traceability is a widely used term, and a broad concept, for which there are many definitions and applications. In practical terms it is about meeting legal requirements and marketplace demands and expectations, as well as implementing internal quality management objectives and improving business performance.

There is no single universally acceptable system of traceability; it depends on many factors including the objective, e.g. assurance of food safety, product quality attribute or product identity, the nature of the product and type of production operation. Although legal requirements and adopted international standards and private voluntary standards often require traceability systems, none is prescriptive in the way traceability is achieved. It is up to the operator to define the scope of the traceability system and how it is to be achieved based on their particular needs. These issues highlight the practical difficulties in establishing and implementing a traceability system in a food business operation such as a farmer, trader or processor of green coffee.
According to Corina 2013, the process of ensuring traceability takes place in four stages:

- Identification of lots of products that have been subject to the same processes of production and/or processing,
- Recording information on the production process (on electronic or paper support),
- Establishing links between information; each economic operator in the chain - agriculture, manufacturing, distributor, point of sale - must be able to provide documented evidence of the link between batches, suppliers and customers,

- Communication - every economic operator in the chain communicates the identification elements of the lot to enable the continuous implementation of the traceability principles.

Traceability identifies the path from which a product has originated and to whom it has been supplied, and consists of an inter-linking chain of records between steps in a process operation and/or between different stages in a supply chain. Traceability systems have three basic components:

- **Supplier traceability**, which enables the source of materials used or handled to be identified (the previous point in the supply chain).
- **Process traceability**, which enables the identity of raw materials and process or handling records for each lot.
- **Customer traceability**, which enables to whom product has been supplied to be identified (the next point in the supply chain). *(UNIDO 2013)*

Traceability represents, on the one hand, the ability to restore the food chain from harvesting, transportation, storage, processing, distribution and marketing (external traceability) and on the other hand, the ability to trace the history of the product at any stage in the chain (internal traceability). *(Corina 2013)*

According to the Codex Alimentarius Commission (CAC 60-2006), traceability or product tracing means "the ability to follow the movement route of a food product through specified stage(s) of production, processing and distribution". Traceability allows thereby the tracking of a product, following its path from raw materials until exposure for selling, including their path to the final consumer.

1.2. Traceability in the Food Supply Chain

Traceability is defined as "the ability to trace and follow the movement of a food through specified stage(s) of production and trading" *(UNIDO 2013)*.

According to Machado and Nantes, due to an increasing demand for product quality by consumers, mainly in developed countries, gathering the information related to the path followed by the product becomes essential for the companies in a supply chain.

Taking all the requirements described above into account, that is as required by legislation and adopted international or private standards, then the basis of a traceability system in the food supply chain is:

- Identify and trace what is received (one step down external traceability),
- Identify and trace what is made/handled, from what, when and how (internal traceability),
- Identify and trace the delivery destination of supplied product (one step up external traceability) *(UNIDO 2013)*.

The US Food and Drug Administration (FDA) proposes the following definition: "*the ability to identify by means of paper or electronic records a food product and its producer, from where and when it came, and to where and when it was sent*"

Currently, the traceability of bulk agricultural products such as soybeans, corn and sugar does not allow identifying individual batches, due to multiple processes of product aggregation and segregation *(Thakur et al 2009).* Quality control is conducted based on product volume, not on production batches. This way, traceability is lost between different stages of the SC, making it impossible to identify the farm that provided the sugarcane that was used to produce the sugar in a specific refined sugar package. An automatic monitoring system would allow the SC as a whole to improve its traceability.

1.3. Background of Ethiopian Coffee

Ethiopia, origin of coffee and mankind, is a landlocked country located in the Horn of Africa at 8° 00 N and 38° 00 E. It is the second most populous country in Africa with an estimated population of 102 million (2016) and area of 1,104,300 sq.km. Agriculture is the major economic activity where the Ethiopian economy is highly dependent on coffee as it contributes more than 25% of country's foreign exchange earnings *(MoARD 2012)* despite this share is decreasing with other emerging sectors in the economy over the courses of time.

Ethiopia is the motherland of *coffea arabica* and thus home to the world's oldest coffee-drinking culture. Coffee is vital to the cultural and socio-economic life of Ethiopia sustaining the livelihood for over 15 million people of the country and providing important income for casual labor, for any additional poor rural society particularly in coffee growing areas. No other product wide avenue for inherent quality and high specificity.

Being coffee arabica's storehouse of genetic diversity has implications; notably, exhibiting broad diversity of flavor profiles associated with geographical location (*origin*) and harvesting and processing methods. Among these origins are Sidamo, Yirgacheffe, Harar, Nekemte, Limu and Jimma and others. On the other hand, Ethiopian coffee production offers protection for biodiversity and other environmental benefits *(Kufa 2010).*

Ethiopia is also home to more than 80 different languages and unique cultures, where main languages are Amharic, Oromiffa (*Afan Oromo*), Somali, etc. Ethiopian people are largely Christian. The Ethiopian Orthodox Church traces its roots back to the 4th century AD. There are also large numbers of Protestant Christians and Muslims where significant number of people also follows indigenous beliefs such as *Waqefana* (an indigenous belief, in which the followers worship one super natural force, *Waaqa*, literally meaning God through legendary myths passed from ancestors without written dogmas unlike many modern religions).

The famous Great Rift Valley cuts right through the heart of Ethiopia and indeed many of the world's most famous coffees grow right along the valleys and mountainsides.

Ethiopians have been drinking coffee longer and more consistently than any other people on the planet. There are various legends about how coffee cultivation came about, but what we know for certain is that coffee drinking goes back at least 500 years, and most likely much longer. Coffee drinking is a deep part of Ethiopian culture, and a big part of the identity of the people. In general, all arabica coffee is Ethiopian, whether it is grown in Latin America, Asia or on hillsides in Harar or Sidama.

From modern roasteries and coffee houses in the capital of Addis Ababa, to the simplest pan-roasted coffee ceremony in a small rural hamlet, Ethiopians of all classes and ethnicities enjoy coffee. As a result, a very large portion, possibly more than half of national production ends up on the local market. Unlike the situation in many commercially-productive countries, it is often possible to get a cup of top-quality coffee on the local market in Ethiopia. This gives the people who grow, buy, and sell coffee powerful insight into what makes for a delicious cup. It is difficult to make generalizations about the flavor of Ethiopian coffee. Each coffee-growing region is home to unique flavors.

One can only say the following: Ethiopian coffees tend to be grown at middle-high to very-high altitudes, resulting in a hard-bean type, with intense flavors and aromatics. Fruit flavors are common in all regions, though the specific fruit character varies from region to region. Berry aromatics are relatively common, as are citrus and chocolate. Ethiopian coffees can be full-bodied or light in body, but in either case the mouth feel of top quality Ethiopian coffees is generally smooth and pleasing *(Willem 2011)*.

2. Patterns of Cooperative Unions on Ethiopian Coffee

2.1. Definitions[1]

- *Cooperative Society:* an autonomous association having legal personality and democratically controlled by persons united voluntarily to meet their common economic, social and cultural needs and other aspirations, which could not addressed through an enterprise jointly owned and operated on the basis cooperative;
- *Primary Cooperative Society:* a cooperative society established by individuals having similar interest and objective with a minimum number of members prescribed in the Cooperative Proclamation to produce, provide service or to engage in both activities
- *Primary Cooperative Union:* a secondary level cooperative society established by primary cooperative societies having similar objective with a minimum number of members as prescribed in the Cooperative Proclamation to produce, provide service or to engage in both activities that are beyond the capacity of primary cooperative societies;
- *Cooperative societies federation:* a tertiary level cooperative society established by cooperative society unions having similar objective with a

[1] Cooperative Societies Proclamation 985/2016

minimum number of members as prescribed in the Cooperative Proclamation to produce, provide service or to engage in both activities that are beyond the capacity of cooperative society unions.

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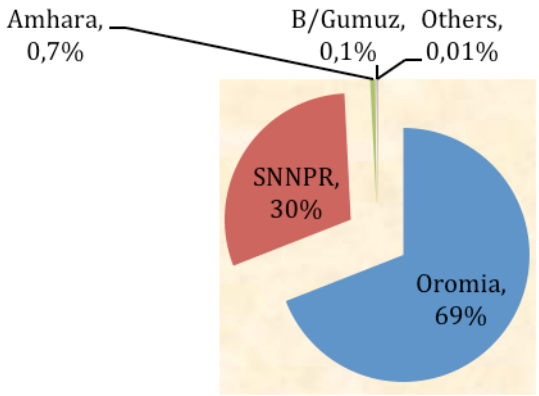
2.2 Ethiopian Coffee Growing Regions

In Ethiopia, coffee is produced within specific agro-ecological zones over numerous political divisions. Most coffee is grown in areas of humid (moist) evergreen forest. This type of rainforest is found at 650–2600m above sea level, with coffee mainly confined to altitudes of 1200–2100m. These forests are cool-tropical, distinctly seasonal and mostly comprise evergreen trees and shrubs, with a high diversity of other plants and associated fauna. In some highland areas, mostly at the higher range for Arabica coffee (1900–2100m), coffee farming is undertaken in a drier type of vegetation, dominated by evergreen trees or shrubs, and common native coniferous species, particularly in the Harar coffee zone. The main coffee growing areas are found within Oromia Region (Jimma, Wollega, Guji, Harar, etc.) and SNNPR (Southern Nations, Nationalities, and Peoples' Region) (Yirgacheffe, Sidamo, Keffa, etc), with modest production in Amhara Region and minor output in Benishangul-Gumuz Region. *(ECFF 2017)*.

Accordingly, it could be said that Ethiopian coffee growing areas are confined to the Great East African Rift Valley since the major production areas fall to East of Rift Valley (Oromia) and within the valley (SNNP & Oromia), while minor production is undertaken to the west of rift valley (Amhara, Gambela & Benishangul Gumuz).



According to the CSA 2018 data, Oromia Region followed by SNNPR is taking the lion's share in Ethiopian Coffee production, supplying 69% and 30% or respectively 44,313 & 19,340 tons of 2017/8 overall production.

The insignificant proportion less than 1% of national production is filled by few remaining regions such as Amhara, Benishangul Gumuz and Gambela.

Figure 4: Coffee Production Share of Ethiopian Regions

2.3 Ethiopian Coffee Export Trends

Ethiopia is Africa's leading producer of arabica coffee, and used to be world's fifth producer until preceded by Honduras in 2017. The export market of Ethiopian coffee seems promising with significant annual increments from year to year both in volume

and value despite highly determined by other origins, mainly Latin and Central American Countries' favorable productions.

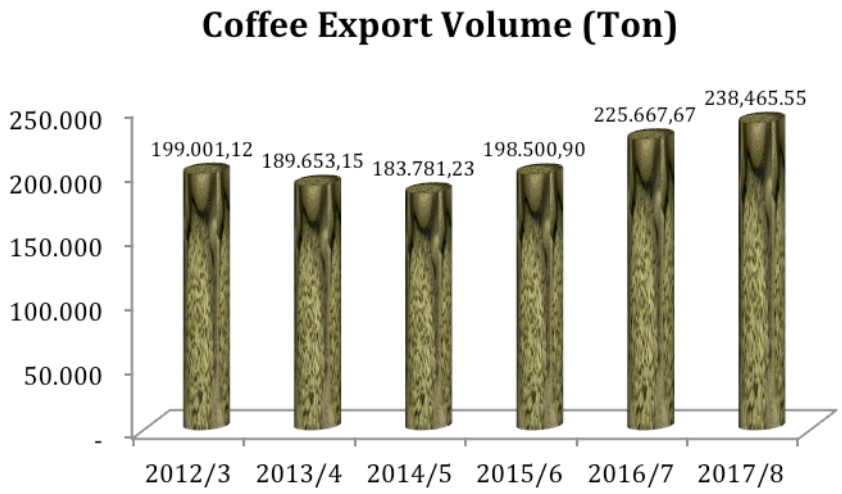


Figure 5: Ethiopian Coffee Export Volume (in tons)

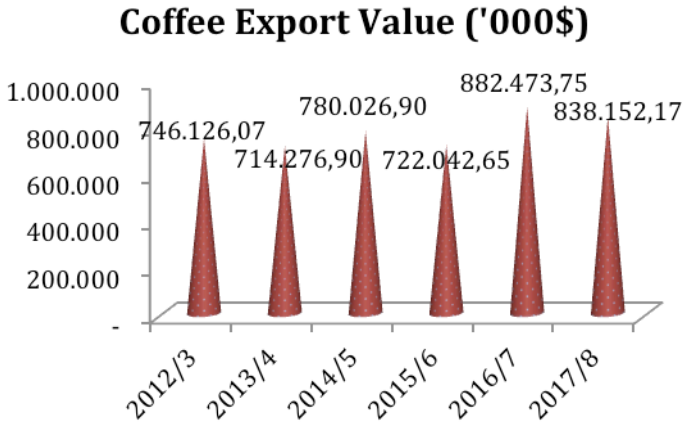


Figure 6: Export Value of Ethiopian Coffee (in thousands of US Dollars)

2.4 Coffee by Farmers' Cooperative Unions

In the essence of National Cooperative Proclamation, a cooperative society shall have any one or more of the following objectives.

a. To collectively overcome, withstand and solve economic and social problems which members cannot individually achieve;
b. To achieve a better result by coordinating members' knowledge, resource and labor;
c. To promote self-reliance among members;
d. To reduce production and service costs and to offer inputs and services to members with lower costs and finding better market prices to their products or services;
e. To expand situations by which technical knowledge could be put into practice and promote entrepreneurship;
f. To develop and saving culture between members;
g. To provide loan to members and promote investment;

h. To provide loan-life insurance to members;
i. To minimize and reduce damage and loss of each individual members, if it had been undertaken individually, by sharing it to members;
j. To develop the social and economic capacity and culture of the members through education and training. *(Proclamation 985/2016)*

In order to meet one or more of the above objectives prescribed in the proclamation, a number of farmers' cooperatives/unions directly engaged in coffee export. Accordingly, the coffee traded by farmers' cooperative unions in Ethiopia for the last six years is depicted below.

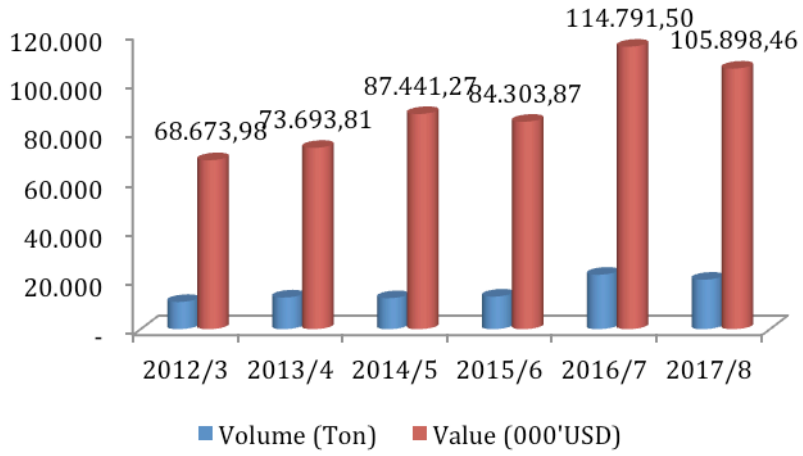


Figure 7: Coffee Traded by Farmers' Cooperative Unions

For instance, during the year 2017/8, the volume and value of coffee exported by Ethiopian Farmers' Cooperative Unions were respectively reduced by 9% and 7% when compared to the previous year of 2016/7 due to various factors.

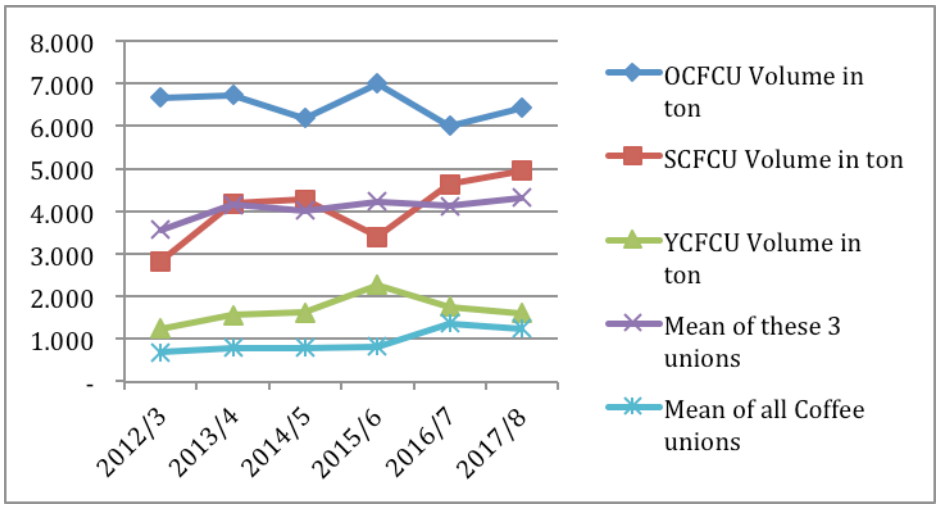


Figure 8: Mean versus Potential Unions' Export Volume in Ton

Even if there are around 16 farmers' cooperative unions engaged in Ethiopian coffee export business, only three are dominant and long lasted in the market probably exporting together more than 84% of the overall volume traded by all cooperative

unions over the last six years. These are Coffee Farmers' Cooperative Unions of Oromia (the largest), Sidama, and Yirgacheffe. Accordingly, the export volume of Oromia Union is by far above the mean volume of all the cooperative unions as well as exceeds also the average volume of these three dominant unions; where Sidama Union export volume is almost equivalent to the mean volume of these three but exceeds the mean volume of all cooperative unions. It's only Yirgacheffe Union which trades less than both mean volumes of the three leading as well as all cooperative unions, as depicted in Figure 8. However, among the reasons for reduction in volume exported by Coops/unions in this year include the new trade regulation intensified domestic competition of exporters and also favorable coffee production of other countries, like Latin and Central Americans.

2.5 Competition between Private Exporters and Cooperative Union

Apart from cooperative unions, there are large numbers of private coffee exporters in Ethiopia. For instance, there are around 230 coffee exporters in Brazil, while the figure is raised to 400 in Ethiopia *(MoT 2015)*. With the exportation in Brazil is around 33 million bags and Ethiopian average exportation is around 1.5 million bags, the average for Brazil (bags/exporter) is therefore slightly more than 143 thousand bags while in Ethiopia is 38 folds less, i.e. 3,750 bags per exporter. This implies despite the overall Ethiopian coffee production and traded is less than Brazil, large number of exporters engaged in trading which will inevitably create tough competition among actors and worsens price returns thus disintegrates the Ethiopian coffee and dismantles aggregation unlike Brazil. In fact, that's why aggregating is still remained the solitary promising method for Ethiopian coffee being dominantly held by smallholder farmers.

These private exporters eventually take the lion's share in trading Ethiopian coffee to the world market making the competition tense to cooperative unions. Because, private exporters take risks of selling their coffee below the prevailing market price only seeking foreign exchange supporting in their import business. Consequently, they will never bring thresholds of hard currencies into the country instead they facilitate importation of goods which will definitely compensate losses incurred in the coffee export, unlike coop unions. Apparently, such kind of trading system has been creating chaos and ongoing arguments especially among members of cooperative unions, which were not previously engaged in import business and merely dependent on insignificant profit margins of coffee export despite the fact that Ethiopian coffee is more profitable if sold inland.

With the coffee market dynamics, Ethiopian Commodity Exchange (ECX) is always in the loop of designing new trading systems so as to smoothly facilitate commercialization of agricultural commodities. The new approach is in fact designed following the new trade regulation of the government which set requirements to engage in coffee business, i.e. to export coffee anyone should own at least two hectares of farm or supply 20 minimum bags of green coffee. Accordingly, starting from July 2017 it has launched a new version of high level traceability approach with vertical integration

scheme allowing potential exporters (actors of the upper supply chain) directly approach farmers/suppliers (actors in the lower part of supply chain) to improve coffee quality through applying better agronomical and post-harvest practices including storage and transportation. This vertical integration scheme will certainly has a lot to contribute in the quality improvement of coffee; however there is a threat that actors who are economically better off in the upper supply chain may snatch the lands of destitute producers with tiny coffee farms, which may raise dependency rates. It's uncertain whether the local government may protect smallholder farmers not to offer their lands in a long term contract or informal lease agreement with lucrative money they are offered today.

Moreover, the current Non-member Direct Trade (NMDT) System launched as a new reform by ECX enabling all individual exporters/unions without having membership in the ECX trading platform to equally compete in coffee trade. According to some potential cooperative unions, even though it was supposed to create extra trading scheme for non-members of ECX, a number of drawbacks (few listed below) are resulting from this new system.

- It is not favored by cooperative unions for creating unfair competition;
- The worst, it affects smallholder coffee producers which are not organized in primary cooperatives; since most of them are not able to fulfill the criteria of either owning two hectares of land or supplying 20 bags of coffee they will be doomed to informally join producers/exporters which are better off in meeting this criteria, this in turn increase the dependence of small producers on potential ones and could thus accelerate informal mobility of coffee among producers on the other hand. Such kind of coffee mobility could further mess up quality worsening cup profiles and finally may change presumed original characteristics.

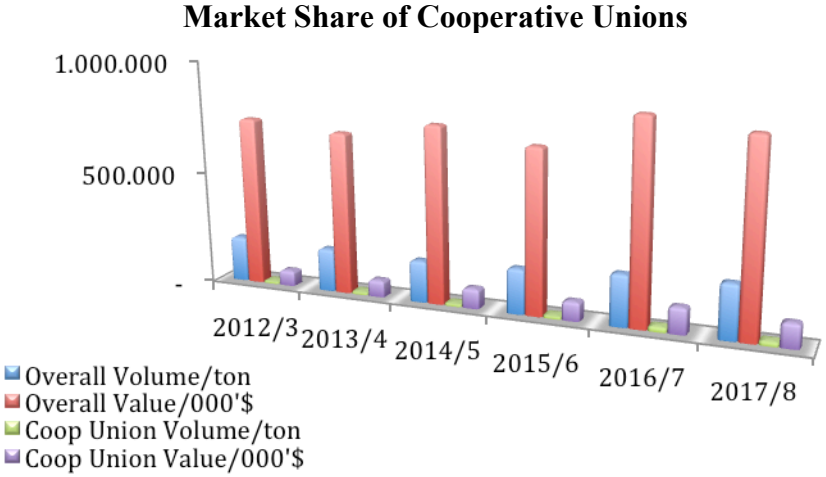


Figure 9: National versus Coop Unions' Coffee Export

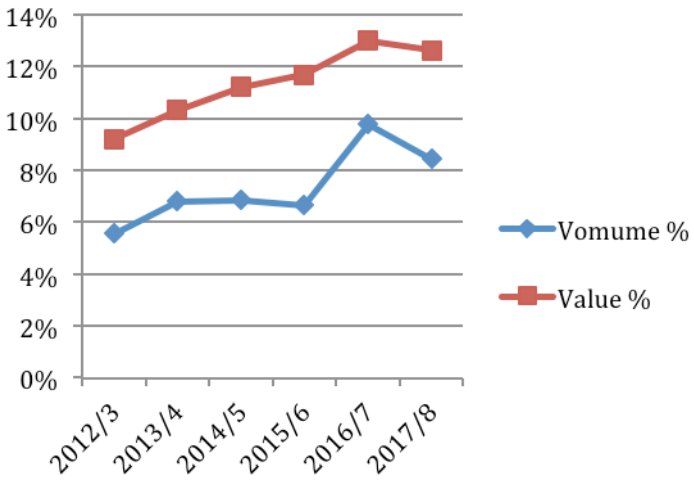


Figure 10 shows that trends of cooperative unions' coffee export volume and value are consistently increasing from year to year. Due to the fact that Ethiopia is following a bit different calendar system, the current fiscal year is not completed and thus the sales volume percentage of this year seems declined; where the coffee in the stock is expected to be sold soon to keep the trends rising.

Figure 10: Percentage Sales of Coop Unions in National Coffee Export

3. Supply Chains and Traceability of Ethiopian Coffee

3.1. Existing Supply Chain of Ethiopian Coffee

USAID helps its farmers improve productivity and the country to strengthen its coffee industry and promote Ethiopian coffees on the world stage. USAID's efforts are aligned to the Government of Ethiopia's Agriculture Growth Program and the Agriculture Commercialization Cluster strategy, which focuses on Ethiopia's world-renowned coffee growing areas in Yirgecheffe, Sidama and Jimma. Recent USAID efforts have partnered with the private sector to establish a coffee traceability system. Through Feed the Future, USAID's new Ethiopia Value Chain program provides technical assistance to help growers improve farm productivity, financial and non-financial support systems for businesses, and public-private dialogues about business policies and improvements to related public services. *(USAID 2017)*

The Ethiopian coffee supply chain could have two broad scopes: *domestic and abroad*. The domestic part of supply chain has two main levels -- lower/farm level and upper/exporter level, where the abroad channel will encompass all the routes from foreign buyer to consumers. Accordingly, the prototype of existing Ethiopian coffee supply chain looks what depicted below.

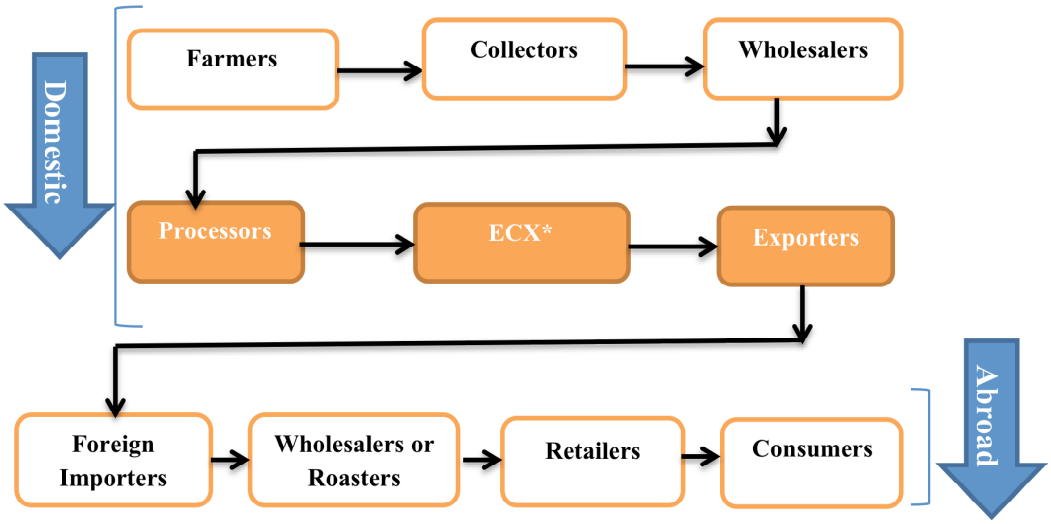


Figure 12: Ethiopian Coffee Value Chain Prototype

3.2. Aggregation by Farmer Coffee Cooperatives in Ethiopia

Most farmers in Ethiopia hold and work on very small parcels of land. Over the years, farmers (with the help of government) have formed local cooperatives and pool their coffee to create lots large enough for export. Usually these primary cooperatives have their own washing or drying station, though sometimes they use that of someone else with paid commissions. Cooperatives generally work through a cooperative union, which functions as an intermediary between the primary co-ops and international buyers. The cooperative unions include the Oromia Coffee Farmers Cooperative Union (OCFCU), the Sidama Coffee Farmers Cooperative Union (SCFCU), the Yirgacheffe Coffee Farmers Cooperative Union (YCFCU), and the Kafa Forest Coffee Farmers Cooperative Union. Oromia Union, the largest union of cooperatives with the capability to process in excess of ten thousand tons of green coffee, has recently opened a spectacular new processing facility and quality center in the industrial suburbs of Addis Ababa.

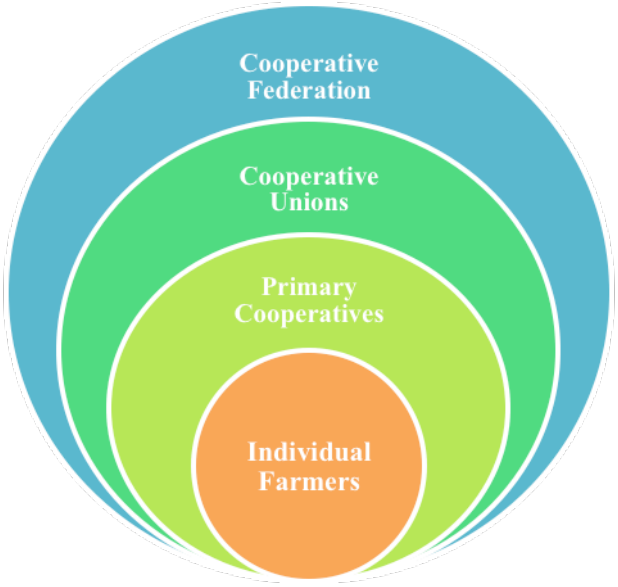
Coffees that come through the cooperative unions usually have a more specific geographical designation, down to the district level where the coffee was produced. The Sidama, Yergachefe and Kafa Unions offer coffees types from the same geographic designations as their name indicates. The Oromia Union offers beans from almost all Ethiopian types due to the extensive area the Oromia Union covers.

3.3. Aggregation Hierarchies in Ethiopia

According to the Ethiopian aggregation hierarchy, the autonomous entity placed on top is known as Cooperative/Union Federation, which comprises of various unions, and also encompass primary coops as full member. Currently there are three cooperative federations in Ethiopia, of which only two are engaged in coffee business: Oromia Union Federation and SNNP Union Federation are those engaged in

coffee marketing, unlike the remaining Tigray Union Federation which has never dealt with coffee due to its presence in a non-coffee growing region and consequently none of its member cooperatives produce coffee too.

Even though hierarchically, federations are formed by unions, primary cooperatives could also be members to it for the benefits including but not limited to access to finance, bargaining opportunities and influencing capabilities.



Certain number of individual farmers (50 and above) establishes autonomous entity called primary cooperative/s which in turn form cooperative union/s. A group of cooperative unions finally form cooperative federation, in which primary cooperatives could also be full members.

Figure 14: Hierarchy of Ethiopian Cooperatives

3.4. Aggregated Coffee Traceability Approaches

Taking the smallholder coffee producers case of Ethiopia into deep consideration, the researcher has developed three possible approaches of aggregation for sustainable traceability. These could be either in hierarchical trajectory of group formation or based on potential farm size scenarios. Accordingly, the three possible approaches developed to aggregate Ethiopian coffee for sustainable traceability are designated below together with their merits, challenges, risks, assumptions as well as technologies supposed to support the supply chain to align with the modern market demand.

- ***First Approach: Primary Cooperatives***

As most of Ethiopian coffee farmers are smallholders by nature, they are supposed to establish primary cooperatives in their village or peasant association - PA (the smallest administrative unit next to District), possibly with similar weather, soil, and coffee type. Thus the nature of coffee each and very farmer assemble to their corresponding cooperative will remain homogenous which in turn believed to ensure consistence in features of the bean and cup quality regardless of postharvest management practices like processing and storage.

A primary cooperative having 50 minimum members of smallholder farmers could be the first approach to apply aggregated coffee traceability. Those member farmers owning variable land sizes may differ in applying agricultural practices from village to household which could possibly result in harvesting different amount of cherry even from similar farm sizes. Consequently, primary cooperatives collect different amount of coffee from each member farmer, which is believed to have uniform cup profiles to be categorized into definite type based on local classifications. In other words, cooperatives are so expected to aggregate homogenous coffee from definite small areas of production. Hence primary cooperative is the instant piloting stage of aggregated coffee traceability as the first possible approach guaranteeing the entire trading channel of Ethiopian coffee.

Accordingly, while piloting traceability at cooperative level, perhaps it could have the following prototype steps.

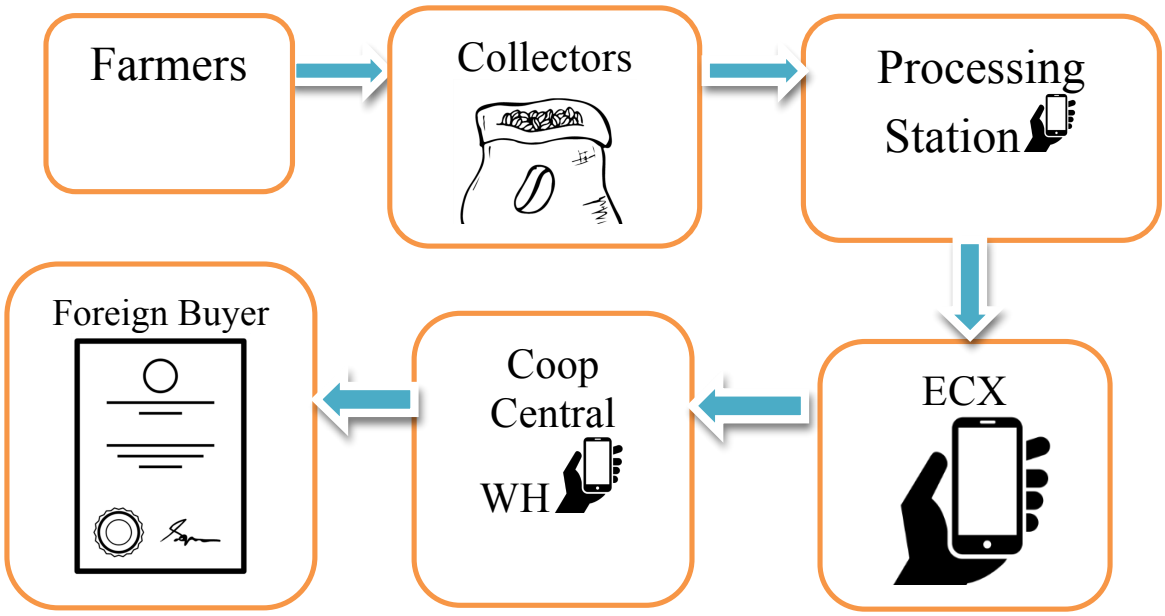


Figure 16: Traceability Approach at Primary Cooperative Level

❖ ***Second Approach: Cooperative Unions***

As already discussed in Ethiopian aggregation hierarchy a number of primary cooperatives form a cooperative union. Union is more autonomous and powerful in influencing and financial capacities, human resource as well as trade portfolio than primary cooperatives. Because large number of member cooperatives enabled a union become autonomous and potential market actor especially in terms of trading various agricultural products directly supplied by several cooperative members to their corresponding union for further aggregation and export. Coffee is the one and dominant product harvesting large amount of foreign exchange to the country. Therefore, the second possible traceability piloting method of aggregated coffee could be through cooperative unions.

In this approach, it will be more intricate to handle coffee from various primary cooperatives, where multidimensional differences varying from green bean structure to the sophisticated aroma, fragrance, flavor and ultimate cup values could be observed among coffees. For instance, the largest cooperatives' union in Ethiopia, Oromia Coffee Farmers' Cooperative Union (OCFCU), has been known by supplying almost all coffee types of the Ethiopian market classification. The coffee being fed into this giant union is supplied by over 400 primary cooperatives covering significantly large and different areas of Oromia Administrative Region . Therefore, the union is and has been obtaining Harar, Jimma, Limmu, Nekemte, Sidamo, Yirgacheffe and other types of coffee from member cooperatives located in this largest region where more than 69% of Ethiopian coffee is produced. (Oromia is.the largest region of Ethiopia both geographically and demographically).

From the country's prior experiences, coffee beans with similar local classification have been blended by private exporters and also cooperative unions. However, such practices may deteriorate the traceability effort and assemble coffee probably from vast area; where the buyer may not easily find again the original supplying cooperative either for recognition or liability. Therefore, the main threat of piloting traceability in aggregated coffee at union level is the risk of blending similar coffee types of various cooperatives based on local market classification.

Accordingly a lot of effort is required to pilot coffee traceability at union level. With slight differences from the cooperative traceability approach, the following diagram shows the steps of union level approach.

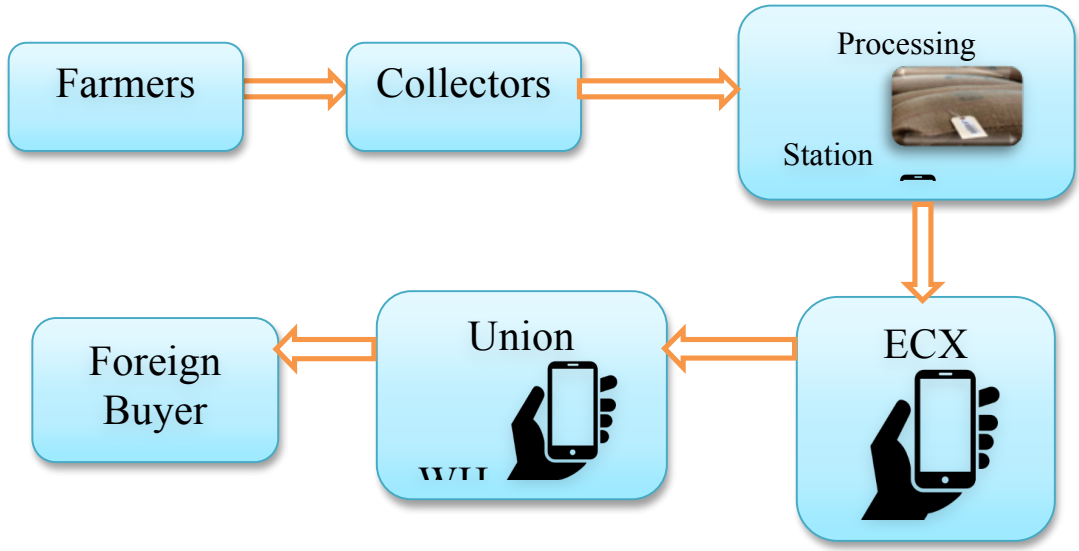


Figure 17: Traceability Approach at Cooperative Union Level

❖ ***Third Approach: Estate Farms/Plantations***

According to Ethiopian new trading directives, every farmer owning two hectares of land or supplying 20 bags of coffee could engage in direct export business. This directive is creating conducive environment for estate farms as they already met the requirement. Albeit they are very few in number, approximately taking 5% of

Ethiopian coffee production, estate farms will be the last and final alternative to acclimatize aggregated coffee traceability in Ethiopian case.

As they are already favored in market access and mass production relatively with better and uniform agricultural practices than primary cooperatives/unions, estate farms could easily aggregate their coffee and pilot the traceability in a more efficient and feasible way. Essential to say that if farms are properly handled and appropriate postharvest management practices are applied, the overall production of estate farms could be fully traced with limited risks unlike cooperatives/unions.

However, the main challenge in this scenario is only five percent estate farms of coffee in the country despite the remaining more than 85% is owned by stallholder farmers, and the remaining is forest or semi forest coffee. The key risk of this approach is smallholder farmers having plots of land adjacent to estate farms could be threatened; estates may takeover on the basis of long term lease contract. If unpleasantly the risk of susceptible small farmers' lands is supposed to happen, social crisis will inevitably emanate to the area, worsening the dependence of the poor (smallholder farmers) on those which are better off (estate farms).

The following figure shows how estate farms could aggregate coffee for sustainable traceability.

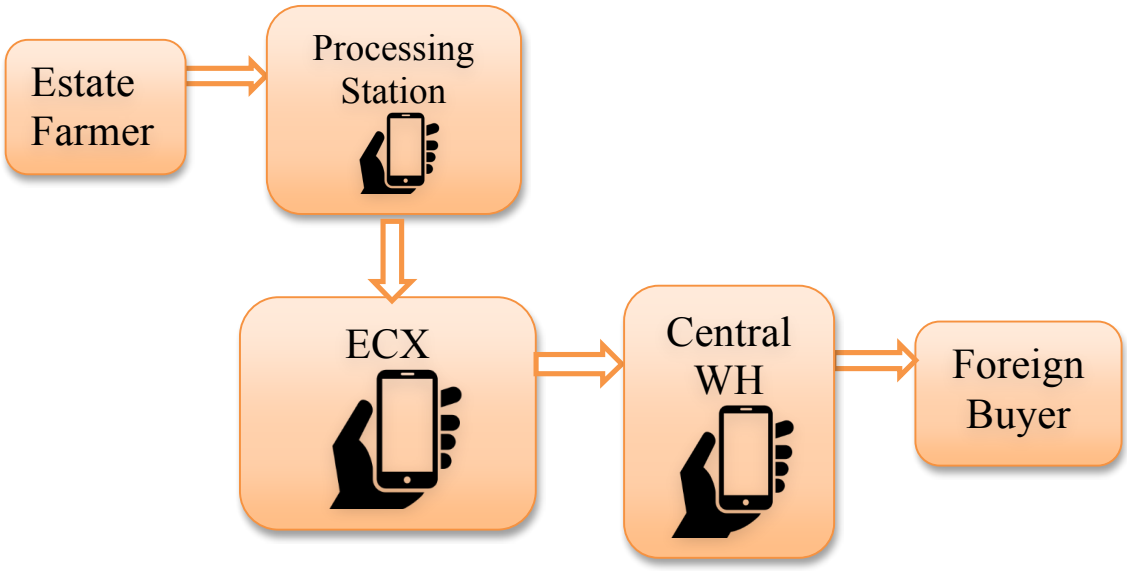


Figure 18: Traceability Approach at Estate Farm Level

Table 1: Key Activities in Traceability Approaches

Key Activities	Cooperative Level Approach	Union Level Approach	Estate Farm Approach
Profiling	Register cooperatives' coffee profiles	Summarize coffee profiles of each cooperative	Register coffee profile of plantation
Upload profile	Handled by each cooperative	Handled by union	By each plantation

Harvesting	Cooperative member farmers	All cooperatives' member farmers	Estate farms
Collection	Cooperative collectors	Coop collectors	Estate processing stations
Processing	Cooperative owned station	Stations of each cooperative	Farm owned station
Barcode Fixing	At Coop processing Station	At Coop processing Station	At plantation processing station
Departure Scanning*	While loading from cooperative station	While loading from cooperative station	While loading from estate farm station
ECX Scanning*	While loading after grading	While loading after grading	While loading after grading
Arrival Scanning*	Cooperative Central WH	Union WH	Exporter WH
Story Attaching	Coffee story will be attached by coop	Coffee story attached by union	Coffee story will be attached by estate exporter

* Represent every scanned data will be uploaded to the database.

According to the above table, processed green coffee bags will be tagged and scanned just before transporting to ECX for the green bean and cup evaluations and the scan data should be synchronized with the master database supposed to be handled autonomously by key assigned government wings like Coffee & Tea Authority or Ministry of Trade. After evaluation, when the coffee leaves ECX branches with definitely known grade it will be scanned again and uploaded to the master database. The last and final scanning will happen on arrival to the central warehouse (literally exporter warehouse) belonging to either cooperatives/unions or estate farms.

After sorting, cleaning and rebagging with green pros or better jute bags, all synchronized scan data of preceding steps summarized from the master database will be printed out and sent together with the coffee as a passport. This passport telling back stories of the coffee will have all information including the origin, type, grade of coffee, pre-harvest ingredients used, climatic condition of production area, processing station, processor and supply capacity information, exporter, date of departure and etc.

3.5. Technology for Traceability

According to Metzner 2014, the main technologies used for traceability purposes are: electronic spreadsheets, bar codes, quick response codes (also known as QR codes) and radio frequency identification (also known as RFID). Among these technologies, RFID is the only one that can be fully automated, allowing companies in the SC to monitor the product, boxes, pallets, containers or batches of bulk products with minimum human intervention. If implemented together with the wireless sensor networks (WSN) technology, it allows monitoring the environmental variables related to the product. These are mainly: temperature, humidity, lightness, vibration and mechanical shocks.

In the following paragraphs, a description of the proposed traceability model will be provided. This will include the description of the information to be collected and the technology that will be used for that purpose, the way it will be transmitted and how it may influence the operations of that specific supply chain link.

At the first stage of the traceability model, which comprises the production of coffee at the farms, most of the processing information will be gathered and inserted in a spreadsheet at the farm computer system. Especially this system works well for estate farms, which have relatively better and fully fledged computer system than primary cooperatives/unions. This will be connected, via internet, to the master database, where the web server that contains all the traceability information is located, probably in Coffee and Tea Authority, Ministry of Trade, Cooperative Development Agency or ECX.

The cooperative/union/estate farm will then enter the production dates, crop varieties, inputs used and their quantity, and the main processes considered important for traceability purposes. In an ideal condition, the information inserted in the spreadsheet will be automatically synchronized with the database, minimizing transcription errors.

At the second stage, the coffee is transported to the washing/hulling station where coffee will be processed and cleaned. Then barcodes will be fixed to each and every bag after cleaning and sorting the coffee before transporting to ECX for grading purpose; barcodes are tag labels assigned to each cooperative/union/estate farm to identify the products among cooperatives. When the truck enters the industry to unload its cargo, tags on the bags will be scanned using simple digital devices while loading. During this scanning phase, the coffee type, date, truck number and volume transported to ECX will be revealed by synchronizing the information.

The third stage is after green bean and cupping evaluations held at ECX, where scanning is supposed to be done while loading coffee for transportation to the central warehouse. Because once grading is complete, coffee will be transported to central cooperative/union's warehouse; while it's to the exporter warehouse for estate farms. Accordingly in above cases, the industry will transfer data to the master database for close follow up and support to track the product.

When the vehicle arrives at the central WH (Warehouse) or estate farm, the coffee with known grade matrix will be scanned again indicating proper piling of the coffee based on coffee type, origin, cooperative, etc. the data which goes through a scanner similar to the one at the entrance of the processing industry and this will link the product story being unloaded at the warehouse with the original batch type.

The last stage is related to exporting product with full preceding story of the coffee to foreign distributors, roasters and consumers. The challenge in this case is to provide useful and easy to access information to the end consumer, who will be able to access it online, through a web portal, using information contained in tags, which is replaced with attachment of the full story.

Traceability should be committed to building the most direct possible relationship between the farmers (producers) and buyers who distribute green beans to the other world or roast and retail to customers serving it in their restaurants, cafes or on their kitchen

tables. This means sourcing directly from the producers—family farmers and their cooperatives—but it also means dismantling this idea that a producer's coffee should be piled up in a big container and sent to the port with full story of the origin including grower/area, processing method and seller history.

In the aggregated traceable coffee marketing, the beans will pass through the following chains of supply in the case of smallholder farmers. All smallholder coffee producing farmers which are cooperative members will be the initial point of the product; directly delivering in collection centers and then coffee will be passed to processing stations of cooperatives. Once the red/dry coffee cherries are processed and bagged, it will be taken to ECX branches for evaluation where both the bean and cup profile of coffee are examined using standardized SCA grading system. After that, cooperatives will either export directly or through parallel union or sell to potential exporters, if they are unable to access markets or unable to form a union.

3.6. Advantages of Aggregated Coffee Traceability

Apart from those benefits of coffee traceability previously anticipated by ECX, there could be other direct or indirect positive rewards especially if the products of smallholder farmers are aggregated in the form of cooperatives/unions. These include:

- **Transparency:** Traceability enables transparency in a big way so that marketing loses its tendency to propagandize rather creates a chance to tell authentic stories, i.e. telling the whole story of coffees. That's why people are actively posing for authentic experiences, which includes the flavor of the coffee itself but also its story.
- **Full information:** traceability helps to provide reliable information to product users, to guarantee products' authenticity and to ensure consumers that certain production practices have been followed. This means that traceability can be used to:
  - Ensure fair practices in trade,
  - Protect consumers from fraud, and
  - Safeguard producers from unfair competition.
- **Brand promotion:** leading to the establishment of trust in consumer loyalty regarding the goods provided by the producer/exporter, ensuring the originality of goods for which the mark has been created;
- **Price markups:** This will eventually encourage cooperatives to renegotiate the price based on the strong traceable supply chain; and thus buyers will be willing to pay markups for consistently traceable quality coffee;
- **Premiums:** if substantial values added through traceability system to the supply chain, cooperatives will look for various certifications which will attract them better market and thus premium prices per lot or single unit volume of coffee sold. Therefore consistent traceability will favor small scale producers to apply certifications as a cooperative. Certifying organizations will be inspired with the traceability system as well. Finally trading traceable

quality coffee will result in premium price for all the actors in the supply network.

3.7. Barriers to Traceability & Supply Chain of Smallholder Farmers

However, all the cooperatives are eligible to export coffee there are various challenges prohibiting them from the business especially in aggregating for sustainable traceability.

- **Administrative Awareness:** with limited coverage of extension supports due to vast coffee growing plots even in the smallest administrative areas of Ethiopia, the level of awareness among farmers on the value of traceability is insignificant; or merely to the potential farmers. On the other hand, farmers in remote coffee growing areas are producing and supplying coffee in a conventional way inherited from their forefathers. Even cognitive skills of some farmers to be well acquainted with traceability framework and add values to their coffee in short period of years is eventually questionable. Thus, the level of awareness creation vertically from top to community level through extension workers is really intact and need to be addressed well in order to improve coffee value chain in a rewarding manner.
- **Low productivity:** is one among overarching challenges of Ethiopian coffee. More tangibly, the approximate number of coffee growers in Ethiopia is above four million which is six times Vietnam and 15 times of Brazil; however the Ethiopian production volume is less than four times of Vietnam and seven times of Brazil. On the other hand above 400 private exporters are engaged in coffee marketing in Ethiopia, whereas only 230 exporters are dealing with coffee marketing in Brazil, the global leading producer and exporter of coffee. From this comparison, one could easily recognize that Ethiopian coffee is less productive despite being attracted by large number of businessmen. Apparently, Ethiopia is securing more than 25% of foreign exchange only from coffee export, while astonishingly it's only 6% for Brazil. *(ITC 2017)*
- **Finance:** there are about 19 private and 3 public banks, and 13 micro finance institutions in Ethiopia. Despite this fact, the possibilities on the table for smallholder coffee farmers to access loans from either of these financial sectors is still remaining a huge gap due to various reasons including poor credit history of smallholder farmers, limited liquidity allocated for loan, unwillingness of credit institutions due to seasonal uncertainties of agricultural productivity, farmers' inappropriate management of loans, and etc. Therefore, access to finances particularly at smallholder coffee farmer level is still in vacuum in Ethiopia. Moreover there are no sufficient funds/subsidies encouraging farmers, processors and exporters due to less developed financing systems of the country. These gaps left the coffee sector in general and traceable supply chain in particular without financial support.
- **Landscape:** Ethiopian coffee potentially growing in sloppy difficult landscapes is one of key hindrances to efforts promoting coffee value chain.

From the very beginning it is tough even for extension workers to conduct farm to farm visit and timely access farmers at their disposal as supposed to be, where the worst case is time taking delivery of coffee cherries/beans to next station for unavailability of modern transportation facilities which may impact also coffee quality especially during peak harvest season. Hence, the topography of coffee growing areas of Ethiopia is among key barriers to promote traceability in aggregated framework.

- **Infrastructure:** not only the full cycle traceability, but also strong value chain of any product seeks well developed infrastructural facilities, mainly logistics remaining challenge. The deeper challenge is the time required to explore all of the possibilities within certain farm or cooperative. Even though traceability doesn't guarantee anything; creating traceable systems allows to experiment in a controlled way, which is a long-term process. However, in the case of Ethiopia there are limited facilities to apply full traceability which include:
  - poor transportation services in remote coffee production areas,
  - lack of reliable internet connection,
  - unfavorable warehousing systems which is also fully labor intensive,
  - less computerized coffee quality control system (especially moisture content),

- **Coordination:** however a number of sectors work in the coffee business, they have no joint efforts; instead run independently their own missions toward individual goals. Lack of integrated strategies and joint efforts in Ethiopia is thus hampering coffee yield and quality improvement at the same time remaining one of the key factors for poor traceability system in the coffee value chain. Therefore, all relevant public & non-governmental sectors, research institutions, individual experts, coffee connoisseurs and others should combine their efforts in order to improve the overall aspects of Ethiopian coffee.
- **Market Access:** not only primary cooperatives and unions, but also individual coffee exporters are facing challenges in finding markets for their products. With the increasing competition and prevalence of free market, in addition to aforementioned barriers, Ethiopian farmers' cooperative unions are merely limited to only few global coffee buyers. This is probably due to their limited capacity in assessing potential market and preparing smart profiles for introduction which is in turn due to little knowledge of the global scenario of coffee marketing. On the other hand, as most of cooperative unions are led by local experts, there could be possibly skill gaps to pull up those unions into higher competition level. Such efforts could be fruitful through building trusts with single buyers by keeping quality and time compliances against signed contract and samples delivered.

- **Lack of platform:** despite the Ethiopian Coffee and Tea Authority is supporting coffee growers and exporters, and EXC is facilitating coffee grading and marketing, there is no decentralized coffee platform engaging all coffee actors including smallholder producers. Lack of a strong national coffee platform is diminishing returns to be gained from coffee as a country and also lowering income of individual farmers due to lack of sufficient information through a decentralized system across all coffee growing regions; which is also true for other cash crops like sesame.
- **Management of Cooperatives/Unions:** referring back to the Ethiopian saying "Every house seems its owner", the tough and active the management of a cooperative/union, the strong and competent a cooperative/union will be, and vice versa. It's not only the quality or quantity of coffee supplied or traded by cooperatives/unions, but also the transparency, fairness, responsiveness and alertness to regulations as well as market access and the way management is exercised toward benefiting smallholder farmers under each cooperative union that determines the sustainability and competition of many unions. Unfortunately except few, most of the unions are not lucky to be led by the right leadership and eventually will be susceptible of losing competition in this tough free marketing system.

3.8. Opportunities and Efforts for Aggregating Ethiopian Coffee

1. **Successful Cooperative Unions:** as the current market situation is seeking traceable supply chain, it may need substantial resources and efforts to develop and execute sustainable traceability in countries dominated by smallholder coffee producers like Ethiopia. In order to pull up such kind of producers into the global market, organizing smallholder farmers in the form of cooperatives is well understood and used to be experienced all over the country. Accordingly those cooperatives formed a number of unions taking into consideration various issues like administrative locations, coffee types, and willingness of member farmers. Hence their success stories will be used as an opportunity to aggregate more coffee to ensure sustainability.
2. **Increasing Demand of Global Buyers:** it could be recalled that almost all international coffee buyers will be pretty much interested in traceable coffee which they could easily order again and access with already experienced bean and cup quality.
3. **Vertical Integration:** currently the Ethiopian government has developed new trading schemes in which coffee exporters directly meet smallholder suppliers to work closely on required parameters ensuring production and trading of coffee with better quality. On the other hand, many global buyers are recently opening their representative offices or assigning focal persons in Ethiopia which are the key approaches to enhance vertical integration in the coffee supply chain. Such potential companies are investing in the coffee value chain including pre and

post-harvest handling techniques to improve the quality of naturally favored Ethiopian coffee by directly working with cooperatives, individual/group of farmers. This kind of direct interventions will eventually maintain business relationship among actors, improve coffee quality, pave ways for sustainable traceability, and end up with better prices.

4. **Collaboration of Roasters and Aid Organizations:** the remarkable example for such integration could be that of illyCaffe and UNIDO. The UN Industrial Development Organization in collaboration with illyCaffe is running a project encouraging primary cooperatives to improve the quality of their coffee and thus increase values for aggregation and traceability. Basically, this initiative is targeting two potential shade coffee growing areas of Harena Buluk in Bale (Oromia) and Aleta Wondo in Sidama (SNNP) in order to provide either working capital, material support and develop capacities of prioritized primary cooperatives. The number of cooperatives in Bale and Sidama embraced by this scheme are respectively 12 and 3 in number while the large numbers of cooperatives in Bale are relatively weaker in management. Apparently, potential roasters like illycaffe are promoting mono origin coffees which will be another opportunity to trade traceable coffee for primary cooperatives and unions.
5. **Conducive Environment within Ethiopia:**
    - ❖ Government's commitment and favorable policy,
    - ❖ Diverse agro-ecology and climatic conditions or unique and distinct characters of coffee quality and genetic biodiversity,
    - ❖ Well established brand and positive image of the country as birth place of coffee and locally strong coffee culture,
    - ❖ Volume/quality variant: huge coffee volumes with a lot to do on quality,
    - ❖ Cheap labor and land: potential to improve quality and volume,
    - ❖ Efficient and effective domestic marketing system, etc.

3.9. Future Perspectives of Coffee Traceability

Sticking to the findings of this research, barcodes supposed to be fixed on jute bags or green-pros could be produced adjacently by the same company (producing bags) to minimize time lapse in the procurement process form different sources. Such motives will improve, speed up and smooth the mobility of coffee within the supply chain.

On the other hand, the barcodes tagged on the bags/green-pros will be shipped to foreign destinations enabling end users easily identify the origin, type, processing type, supplying farm & cooperative/union, and etc. The database supporting traceability systems could be accessed by foreign potential buyers enabling them rely on Ethiopian coffee and thus invest to improve more either through vertical integration or assigning representative.

Accordingly, once primary cooperatives engaged in trading aggregated traceable coffee, all the remaining smallholder producers will be doomed to form cooperatives and thus prevailing fragmentations in the Ethiopian coffee supply network will be

spontaneously improved. On the other hand, it's optimistically believed that all actors including coffee initiatives and policy makers will back up the system so that traceable coffee export will thus harvest substantial returns.

Currently, potential market segment especially for food and beverage is highly demanding traceable products ensuring accountability and trust beside end users. In line with the radical changes in technological advancements, a lot of values will be added to food and beverage products. For instance, the capsule stage of coffee industry will not sustain in the market for many decades, where other technologies will come up soon with simple and easy to use coffee products may be in the form of candy, gums, soluble pods, tablets, and staple food ingredients of which some are yet to come and few are already introduced to the market of economically advanced nations. Hence such technological shift will strongly rely on traceable ingredients to enhance and guarantee increasingly consistent consumption of all products. Apparently with the global market is highly doomed to practice block chin system, it's believed by the researcher within a very short period of time Ethiopia will enhance its technology outreach to engage coffee export business into block chin. Therefore, in the near future aspects of aggregating coffee traceability will be scaled up with the steady technological shift and dramatic values being added to the coffee.

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