

COFFEE INNOVATIONS SYSTEM IN ETHIOPIA AND RWANDA

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Abstract

We use Social Network Analysis (SNA) to investigate the networking and knowledge management in the coffee value chain in Ethiopia and Rwanda and its applicability in the agricultural innovation system (AIS). The AIS aims at putting farmers at the center of the knowledge management and innovation system. Results of the SNA show that farmers from both Ethiopia and Rwanda are not at the center of the innovation system. In the Ethiopian coffee value chain, cooperatives are at the center of the knowledge management and innovation system. In Rwanda, NGOs play a central role in the knowledge management. We found the Rwandan coffee value chain to be more connected and cohesive than that of Ethiopia. This suggests that the AIS framework has not been fully adopted by development practitioners in both countries. In conclusion, we suggest that the dependence on both international and local NGOs must be limited as is the case in Rwanda. This is because NGOs are short term project operations in nature and can therefore affect farmers' expectations once they leave the country, or runs out of funding. For the effective support to farmers, we call for strengthening organizational and knowledge management capacity of cooperatives and other players along the value chain. It is therefore important that international NGOs change the role they have been playing in leading value chain activities, to a more supportive catalytic role.

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1. Introduction

Knowledge management involves four key processes: knowledge generation, knowledge storage and retrieval, knowledge dissemination/sharing and knowledge application. The World Bank (2007) has defined knowledge management as the planning, organizing, directing and controlling of knowledge assets to help information and knowledge emerge and flow to the right person at the right time to create value. Innovations integrate the perspective, knowledge and actions of different stakeholders around a common goal and stakeholders learn from the experience of working together. This learning takes place at the individual, organizational and institutional level. In agriculture, like in other sectors, knowledge generation and its dissemination occur through cooperative interactions and co-ordination of different networks of actors along the value chain. Cooperative interaction involves different stakeholders bringing their “heads” together, organizing their efforts, managing the process and producing the outstanding results (innovations) for sustainable agricultural development.

Historically there are three approaches to agricultural research and development; the linear approach, the Innovation Systems Approach (ISA) and the Integrated Agricultural Research for Development (IAR4D). The “linear” or “transfer of technology” model assumes scientific research as the main driver of innovation which can create new knowledge and technologies that can be transferred to farmers through the extension system. On the other hand, the Innovation Systems Approach (ISA) and the Integrated Agricultural Research for Development (IAR4D) approach, while accepting the assumption of the linear model, emphasizes the importance of interaction among farmers and researchers, and supports pluralistic extension delivery. They allow for different types of knowledge emanating from a particular social, political, economical, and institutional context as the main source of innovation (World Bank 2007).

Based on the innovations framework, the World Bank has identified four key elements of innovations: Value chain actors (the chain of actors and their roles in the production, processing, marketing, etc.); attitudes and practices of the main actors (patterns of trust, collaboration, and the existence of a culture of innovation); patterns of interaction (type of networks, partnerships, and the existence and function of value chain supporters); and enabling environment (institutions and organizations who set the regulatory framework, policies, and infrastructure at the local, national, and international level). According to the World Bank (2007), the basic hypothesis of the innovation systems

framework is that the knowledge management for innovation is a function of linkages, working practices, and policies that promote knowledge flows and learning among all actors within a sector.

Social Network Analysis (SNA) is an excellent tool in mapping the value chain actors and in visualizing the knowledge management linkages (relationships, information flows or transactions), the distance between actors, and whether actors connection in network structures is characterized by dense, reciprocal, transitive, or strong ties (Krebs, V. 2011).

In this paper, we adopt the AIS and IAR4D as analytical frameworks to investigate the role of networks and knowledge management for innovation in the coffee value chains of Ethiopia and Rwanda. The general objective of the study was to assess and compare the networks and knowledge management system for coffee innovation between Ethiopia, a relatively stable country, and Rwanda, which a post conflict country. It is hoped that lessons from this study will be scaled-up/out within the study countries and to other developing countries who wish to improve their conventional agricultural knowledge management. The study, using SNA, will answer several research questions such as: (i) Who are the central actors involved in knowledge management and how do they link to each other? And are any key linkages missing? (ii) Are technologies shared and disseminated efficiently? (iii) Do collaborative and trustful alliances exist between the different actors?

Answering these research questions will help policy makers support the creation of better linkages and co-ordinations that lead to the generation of new knowledge for innovation opportunities. The results will also help policy makers understand the extent and nature of constraints that actors face due to policies and regulations that govern the value chain. The paper is organized as follows; next to this introductory part, section two reviews the coffee value chain actors and their roles in Ethiopia and Rwanda, section three deals with the methods and data sources and section four discusses the results, and finally, the paper concludes with section five by providing some policy recommendations.

2. Actors and their Roles in the Coffee Value Chain

2.1 Coffee value chain actors and their roles in Ethiopia

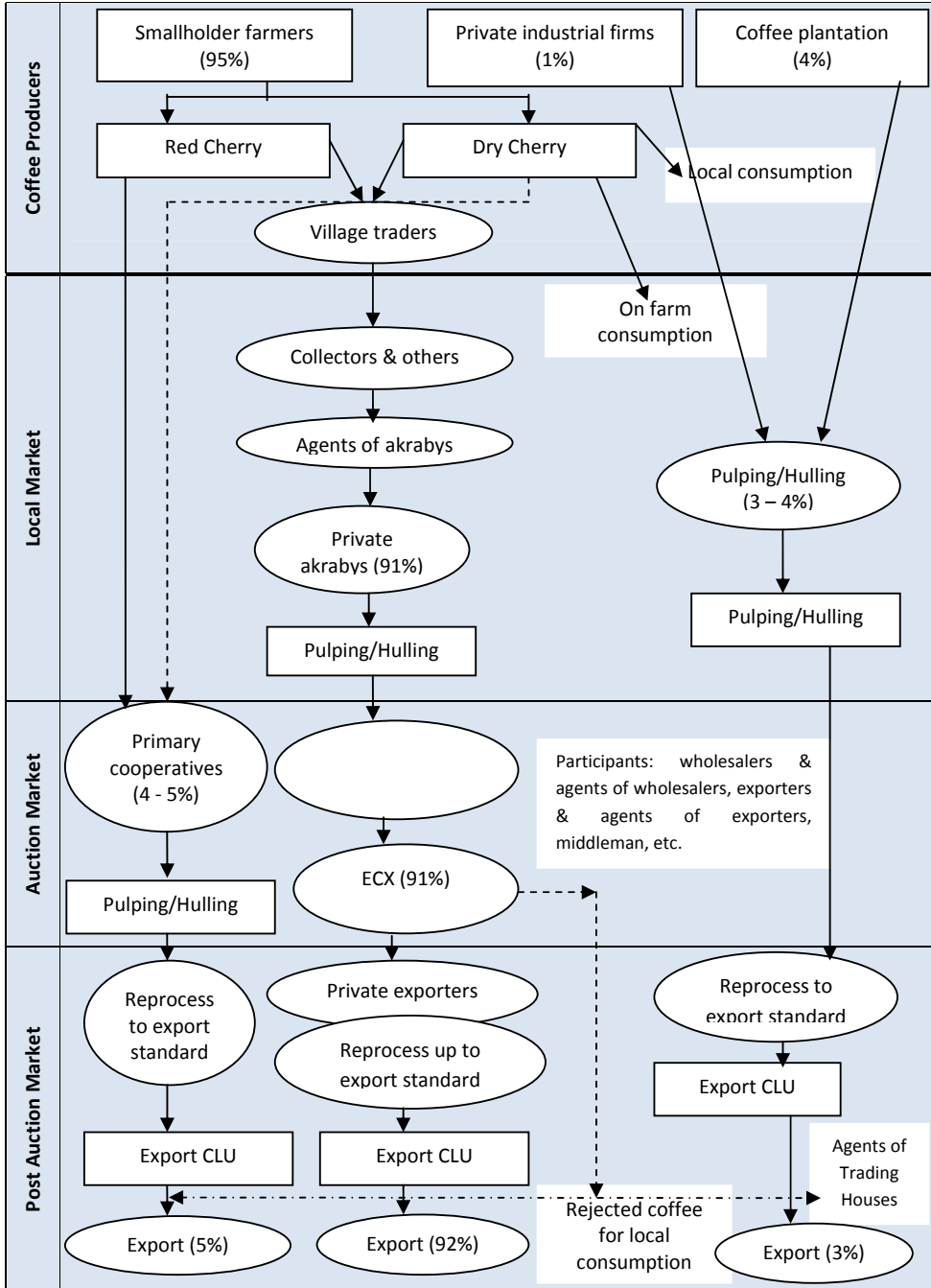
The structure of the Ethiopian coffee value chain is composed of smallholder farmers, state farms, licensed or unlicensed primary collectors (village traders), processors, private or cooperative wholesalers, unions, transporters, exporters and other stakeholders (research institutes, government institutions, NGOs, banking sectors, and development programs) together called coordination groups (Figure 1).

The Ethiopian coffee value chain starts from the producers. Although cooperatives and government extension and research assist with input supply, most farmers do not use purchased fertilizers or chemical inputs. About 1.3 million smallholder farmers produce nearly 95 percent of Ethiopia's coffee, while state-owned plantations account for 4.4 percent and the remaining 0.6 percent comes from private investor plantations. Coffee farming systems in Ethiopia are comprised of four categories: forest coffee, semi-forest coffee, garden coffee and plantation coffee (Gabre-Madhin, 2003).

Almost all commercial coffee production takes place in Oromia (60%) and Southern Nations, Nationalities, and People's Region (SNNP) (40%). The four prominent coffee producing zones, known for their special quality of coffee within Oromia region are Jimma, Illubabor, West Wollega, and Harar. Jimma, Illubabor, and West Wollega are located in the southwestern and western part of Ethiopia, while Harar is located in the East. Similarly, there are several zones that produce coffee within SNNPR. However, Sidama and Gedio are the two most important coffee producing zones that account for the lion's share of the region's production. These zones produce internationally trademarked coffees Yirgacheffe and Sidama.

According to the Ministry of Agriculture and Rural Development (MOARD) estimation, in 2006 about 15 percent of coffee production in the southwestern and western zone was smuggled into Sudan. Similarly, the annual average quantity of coffee smuggled into Djibouti was estimated at more than 1,000 tones (E.D.E Consulting for Coffee 1997 cited in Worako et al. 2008). This implies that coffee supply to the official market does not represent the country's actual coffee production.

Figure 1: The Ethiopian coffee value chain



The second set of actors in the Ethiopian coffee value chain is the cooperatives (unions) and primary private collectors and processors. The cooperatives buy, wash, and consolidate members' coffee. They also assist farmers in developing producer/buyer linkages (by facilitating organic and Fair Trade certification), providing warehouse and transport services, promoting high-quality coffee production, providing saving and credit services, and training and educational programs for members (Dempsey 2006).

Vertical and horizontal linkages between different cooperatives have improved the quality of coffee and the operational activity of cooperatives. Cooperatives help each other in arranging transportation and warehousing services and share market information. Traditionally they get market information from Radio and TV, but recently the Ethiopian Commodity Exchange (ECX) began to use Rural Electronic Price Tickers (REPT), Short Message Services (SMS), and Interactive Voice Response (IVR) through mobile, wireless, and fixed telephone in selected cities (Addis Ababa, Nazareth, Awassa, Dire Dawa, Jimma, Nekemte, Shashemene, Bahir Dar, Gondar, Mekelle, Dessie, and Harar²).

Parallel to the cooperatives and unions, locally licensed coffee traders/primary coffee collectors and processors participate in the Ethiopian coffee value chain. Primary coffee collectors purchase coffee from individual farmers. Since these collectors do not have warehouses of their own, they transfer the coffee to suppliers/wholesalers immediately. Suppliers in turn process the red coffee cherries and bring it to the Ethiopian Commodity Exchange (ECX) for sale to exporters, but they are not allowed to export it by themselves. Some suppliers have their own storage facilities. It is estimated that more than 2,291 legal collectors and 1,068 suppliers participate in the Ethiopian coffee value chain (Petit 2007).

Prior to 2008, there were two coffee auction centers in Ethiopia: Addis Ababa and Dire Dawa. All coffee beans were sold to exporters after their origin and quality was tested by the Coffee and Tea Quality Control and Liquefying Unit (CLU). Deliveries to the auction that did not meet export standards were rejected and redirected for the domestic market. Starting in 2001, cooperatives were allowed to bypass coffee auctions and directly export to foreign buyers (Dempsey 2006). However, coffee production and export in Ethiopia in general operated in line with specific licenses and rules. For example, primary collectors had to sell to suppliers, and only suppliers could deliver

² www.ecx.com.et

coffee to the auction and they are not permitted to export it. Moreover, exporters were permitted to buy coffee only from the auction.

After April 2008, the ECX replaced the auction system and has been given the authority and power to develop its own rules and oversee coffee actors and clearing Institutions (domestic banks or other financial institutions engaged in clearing and settlement of payments). The ECX is also empowered to oversee the Rules of coffee Exchange and regulation of contracts. Further, the ECX Authority, a regulatory body of ECX, has been established and empowered to investigate wrongdoing and arbitrate cases falling under its authority or to refer criminal cases to the appropriate court³. The Ethiopian Coffee Exporters Association (ECEA) plays a significant role in establishing contacts with the world market for private exporters. In addition to its principal objective of promoting coffee exports, the ECEA provides coffee trade information, lobbies on policies, and supplies technical support to its 65 members.

2.1.1 Institutional factors affecting coffee production and marketing in Ethiopia

Following government takeover in 1974 by the communist Derge regime, large scale coffee farms and many private coffee washing stations were nationalized by the military government. The rural service cooperatives and state farms were obliged to sell their washed coffee directly to the Ethiopian Coffee Marketing Corporation (ECMC) at a lower price. As a result, most private coffee operators/exporters went out of business and ECMC received monopoly power in coffee marketing. This trend continued until 1991 when the new government took power. The new regime abolished the requirements for the government marketing of coffee and reopened the sector to private operators. The reform package instituted at this time included: simplification of entry barriers (Pro. No. 70/1993), consolidation of all taxes and duties levied on coffee exporters in to a single tax family (Pro.No. 99/1998), abolishing of the quota system at auction, allowing private traders to trade washed coffee, allowing suppliers (akrabys) and exporters to sell coffee domestically at market-determined prices. In 2001, the government of Ethiopia removed the requirements for cooperatives to sell all coffee through the national auction and allowed them to export directly to foreign buyers.

The deregulation of the marketing system opened up opportunities for the private sector to participate in all levels the coffee value chain. As a result, large number of

³ See Ethiopia Commodity Exchange (ECX). <http://www.ecx.com.et/>

buyers and sellers participated in the primary coffee value chain (compared to the pre-reform period). Despite these improvements, however, there are still policy constraints to private operators under the new government. The major ones are (a) the National Bank review and approval of export sales and (b) the continuation of the requirements that all Ethiopian coffee be sold through the national auction (now the ECX). In addition to maintaining the ECX, the government controls the quality and has strict licensing rules. Moreover, international investors are not allowed to register as exporters in Ethiopia. Exporters are required to buy all their coffee only from the ECX. Producers, traders, coffee washing stations operators, and all others collecting coffee at the origin could only sell coffee to suppliers, and only suppliers can sell coffee at the ECX, but they were not allowed to export it.

2.1.2 Other institutions and stakeholders in the Ethiopian coffee value chain

The Ministry of Agriculture and Rural Development (MOARD) regulates the Ethiopian coffee value chain through two departments; Coffee, Tea Spices and Cotton Marketing Department (CTSCMD) and Coffee, Tea, Spices Development Department (CTSDD). These departments have the responsibility to supervise the agricultural sector and undertake research, quality control, and marketing. They handle policy matters and provide technical services such as extension, training, processing, and marketing to coffee growers and other market participants. The regional, zonal and woreda (district) level offices are responsible for implementing extension services and other on-farm aspects relating to coffee.

The Coffee and Tea Quality Control and Liquoring Unit is the other government agency charged with the responsibility of maintaining the quality of coffee in Ethiopia. In addition to handling liquoring (classifying by taste and appearance) washed and unwashed coffee; it gives clearance to exporters prior to export. The Ethiopian Institute of Agricultural Research (EIAR)/Jimma Research Center (JRC) plays an important role primarily in selecting disease-resistant varieties, establishing national coffee collection and protecting the genetic resource base of the crop. Another government institution involved in the coffee value chain is the Coffee Plantation and Development Enterprise responsible for the state coffee plantations. Nongovernmental organizations (NGOs) such as the USAID-financed ACDI/VOCA, Oxfam, and the World Bank are also involved in the Ethiopian coffee value chain to create the business enabling environment, the end market, supporting markets, including finance, firm-level upgrading and inter coffee union cooperation.

2.2 Coffee value chain actors and their roles in Rwanda

Coffee was introduced to Rwanda in 1904 and has been a major source of income for the rural economy. Between 1917 (first export) and 2000, coffee was the leading source of foreign exchange accounting for, on average, 57 percent of the value of all exports throughout the 1990s. (Chemonics 2006). Historically, coffee enjoyed strong political support from colonial and post-colonial authorities. The state has traditionally been heavily engaged in all phases of coffee production, marketing, dry milling, and export. However, in the 1990s, following the liberalization of coffee policies, production fell by more than half from its peak of 39,000 metric tons in 1992. This is due to the reduction of coffee growing households, producer response to low prices, and the 1994 genocide. During this period, revenues generated by coffee exports fluctuated between \$65.7 million to \$17.4 million in the face of prevailing international coffee prices and national production (Chemonics 2006).

Nationally, 55 percent of smallholders grew coffee in 1991 as compared to 30 percent in 2002 and as a result the number of farmers with coffee fields dropped from 678,375 in 1991 to 437,196 in 2002 (Loveridge et al. 2003a). Even though the use of soil fertility-enhancing measures (both organic and inorganic) increased between 1991 and 2002, large numbers of farmers did not use organic fertilizers, and less than 10 percent of growers used chemical fertilizers. The proportion of growers who use pesticides declined from 96 percent to 57 percent during same period (Loveridge et al. 2003b).

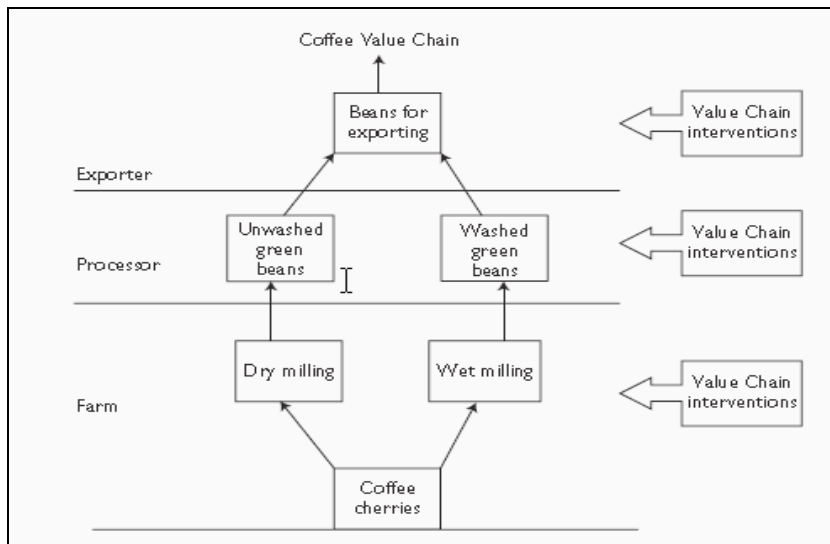
The Government of Rwanda (GOR) recognized the “low quantity–low quality” cycle the country was in and adopted the 1999-2003 Coffee Sector Strategy in response to the steady decline in production, quality, and export earnings. To support the coffee sector, the government also invested nearly \$60 million during 2005-2010 under its program “Horizon 2010 Coffee Action Plan” (Chemonics 2006). As a result of the government and other international institutions support, coffee export earnings increased from \$16 million in 2002 to \$54 million in 2006 (New Agriculturalist 2008:5).

Rwanda produces only *Arabica* coffee in three out of its four provinces and coffee plantation covers 28,000 hectares of land (Daniel 2008). The country was known for producing poor quality beans before the introduction of specialty coffee. But with the introduction of specialty coffee, improvements have been made at all levels of the value chain, from production, processing, transport, to marketing (New Agriculturalist 2008:5).

The Rwandan coffee value chain comprises many actors (See Figure 2). Coordination, technical assistance, training and financial support is provided through NGOs and universities such as USAID (ACDI-VOCA, ADAR), SPREAD supported by government and donors in the PEARL project and project Rwanda. NGOs promote technical, process, service, and market innovation such as new varieties, timely bulking, development of financial and management skills, and links to market. To support coffee marketing, the government established the Rwanda Coffee Development Authority (OCIR- CAFÉ) and has been defined a national coffee policy, established coffee standards and classification system, controlling coffee quality, and issuing certificates of origin and quality. The government thus moved from a management to a facilitation role (Lynam and Theus 2009).

In partner with international aid agencies, research centers and/or universities, OCIR-CAFÉ also provided extension services. The extension services include producer education on better crop husbandry practices and appropriate and timely use of inputs, dissemination of improved varieties, and empowerment of cooperative and association management. OCIR-CAFÉ also supports associations and washing stations by granting them fertilizer on a credit basis (GOR 2005).

Figure 2: The Rwandan Coffee Value Chain.



Source: Jones and Webber 2010

Along with extension services, there are large suppliers of inputs, which distribute seed, fertilizer, and pesticides to small retailers and to producers directly: this includes, Agrotech, Agrophar, Institut des Sciences Agronomiques du Rwanda, and Office des Cultures Industrielles du Rwanda). In the Rwandan coffee value chain there are two groups of producers: smallholders, who comprise 99 percent of the total planted area, and large producers. Large producers employ salaried labor and have their own coffee washing stations (Habyalimana 2007). Often times large suppliers, input retailers and large producers are linked to commercial banks for saving and credit facilities but small producers get credit from informal sector and micro-finances (Habyalimana 2007). Exporters are another source of credit for middlemen for the purchase of parchment coffee from farmers, which is later resold to exporters (Chemonics 2006).

Nearly 500,000 Rwandan smallholder households sell their cherries to middlemen, private or cooperative washing stations, or manual pulping stations, depending on the price they get and other factors. Many smallholders (the estimate being as much as 70%) add value to their cherries by processing them using different household based systems and sell their parchment coffee to middlemen who in turn supply to the private entrepreneurs (Swanson and Baganza 2008). Large producers use their own or private washing stations. By 2007, there were 55 coffee washing stations across the country, and this number increased to 119 in 2008. Funding for their construction came from different sources including government's credit line through OCIR-CAFÉ, donors' subsidies, and loans from commercial banks.

2.2.1 Institutional factors affecting coffee production and marketing

Policies and institutions in the coffee sector were first introduced in 1933 when cultivation of coffee was compulsory and it further strengthened when a legislation was passed to prohibited uprooting of coffee in 1963 (USAID 2006). Monopolist ownership of the input-output marketing system also characterized the pre-1995 period. For example, since 1964, OCIR CAFÉ was responsible for the distribution of inputs such as seedlings, chemical fertilizers, and phyto-sanitary products, at no cost or at highly subsidized rates. Similarly, RWANDEX, the sole dry milling and export company (majority-owned by GOR), held a monopoly on coffee exports until 1995 and farmers sold semi-washed coffee directly to RWANDEX agents, at prices pre-determined by the government. No coffee cooperatives existed until the establishment of COOPACABI coffee cooperative of Bicumbi in 1996. Even though coffee producer associations existed, they served the

limited function of input distribution (and eventual reimbursement) of products supplied by OCIR-CAFÉ (USAID 2006).

In 2006, five of Rwanda's FWC produced by cooperatives benefited from Fair Trade certification. The Fair Trade Labeling Organization requires under their Environmental Development Chapter that producers protect the natural environment and to make environment protection a part of farm management. Minimum requirements include "the protection of natural waters, virgin forests and other ecosystems of high ecological value, erosion and waste management." The high demand of specialty coffee at the international markets has positively impacted on the improvement of processing techniques and induced a new business atmosphere in coffee sector in Rwanda.

The Rwandan coffee marketing system has undergone a series of reforms that have succeeded in converting what was once a government controlled system into a fully privatized system. The National Coffee Board (OCIR CAFÉ), which was established as a parastatal marketing board to manage the coffee sub-sector is turned into public-private Corporation under majority government control. In 1995, Rwandex lost its monopoly position as private exporters were allowed to enter the market, and following a decade of progressive privatization, the company was completely privatized. Despite the privatization of the coffee marketing system, OCIR-CAFÉ continues to provide important support to the sub sector through a wide range of activities designed to increase production, improve quality, and increase export revenues.

Privatization of Rwanda's coffee marketing system has been accompanied by a shift away from the production of semi-washed common grade coffee toward fully-washed specialty coffees. This shift in strategy has induced changes in production practices and organizational structures all along the coffee supply chain. With regard to production practices, the most noteworthy changes have occurred at the processing stage, where there has been a proliferation of privately owned and professionally managed washing stations capable of producing fully-washed specialty coffees.

With regard to organizational structures, an important recent development has been the launching of a number of projects linking growers, processors, and exporters into vertically integrated operations that allow for more efficient management at every stage of the supply chain and better control over the quality of the final product.

2.2.2 Other institutions and stakeholders in the Rwandan coffee value chain

SPREAD (Sustaining Partnerships to Enhance Rural Enterprises and Agribusiness Development) is an alliance of United States of America (USA) and Rwandan Universities, USA and European industries, Rwandan enterprises and institutions, and USA and Rwandan NGOs, funded by USAID. SPREAD has been involved in quality improvement through the introduction/training of “cupping” (the art of evaluating the tastes of different coffees) and support system of washing stations. It has also helped cooperatives establish links with international buyers and roasters; help cooperatives establish their own export company (e.g. Rwanda Smallholders Specialty Coffee Company -RWASHOSCCO). Additionally, SPREAD has provided coffee education through nation-wide broadcasts (SPREAD 2007).

The PEARL (Partnership for Enhancing Agriculture in Rwanda through Linkages) project, a six-year project, began operation in 2000, funded by USAID. PEARL has many partners including USA and Rwandan Universities. It provided assistance to coffee growers in cooperative formation, business plan development, credit negotiations, agronomy, coffee washing stations construction, coffee processing, Fair Trade certification, cupping and marketing. These services were also provided by ACDI/VOCA in partnership with USAID (Chemonics 2006).

The ADAR (Agribusiness Development Assistance to Rwanda) Project, a six-year project, started in 2001, provided technical assistance and training for processing and marketing to small and medium sized agribusiness private sector firms (Chemonics 2006).

Project Rwanda is an organization engaged in the design, development, advice and implementation of special use bicycles to help reduce transport times of coffee cherries from the fields to washing stations. This enables farmers to earn better prices for their cherries by delivering them within four hours of picking, ensuring they are in the best possible condition. As the first undertaking, the project distributed 2,000 coffee bikes in partnership with the Texas A&M University, their Rwanda management team, Project Rwanda⁴ and USAID/SPREAD, which funded the actual cost of the bikes (New Agriculturalist 2008:5). However, transporting cherries remains a difficult task for many Rwandans because of poor infrastructure/roads and some farmers near the Lake Kivu must use boats (Boudreaux 2007).

⁴ <http://projectrwanda.org/cargo-bike>

One of the strategies identified by the government as a means of transforming subsistence agriculture into modern one is by promoting modern agricultural practices, including by giving a greater role for farmer cooperatives and associations. Farmers seem to have understood this and associations were established even before 1994 as a condition for access to land, to receive supplies (seeds, fertilizer, pesticides), and/or to meet the members' self help needs (Munyankusi and Bingen 2002). Along with liberalization of the sector, coffee cooperatives were established and the GOR and international aid agencies provided money for construction of coffee washing stations, farmers were trained in better coffee growing and processing techniques to improve quality and hence more money would stay in the hands of coffee farmers.

Yet a recent assessment of selected SPREAD-supported cooperatives shows that they are still "fragile, unorganized and dysfunctional" after an extensive cooperative capacity building for about five years. The main reasons include lack of organizational and behavioral changes: members do not have sense of ownership of their cooperatives, but rather see them as one option, among others, for selling their coffee cherries; directors tend to run cooperatives like a social welfare organization without consideration of business principles; extreme dependency on PEARL/SPREAD project support and hence reached to the point where they may go bankrupt as soon as project support is removed (Swanson and Bagaza 2008:12-19).

3. Materials and Methods

Data collection methods included household surveys, and rapid appraisal approaches including; institutional analysis, and key informant interviews.

The survey in Ethiopia was conducted in three woredas of Jimma zone (Goma, Dale and Mana) and also from different actors in Addis Ababa. Data collection in Rwanda was conducted in the Southern Province in three districts: Gisagara, Huye, and Nyanza. In Ethiopia, 52 coffee farms were interviewed and in Rwanda, 53 households, making a total of 105 households.

SNA is an excellent tool in mapping the different coffee value actors and in visualizing the knowledge management linkages (relationships, knowledge flows or transactions), the distance between actors, and whether actors connection in network structures is characterized by dense, reciprocal, transitive, or strong ties (Krebs, V. 2011). In order to

come up with SNA, actors were classified based on their role in the coffee value chain and respondents were chosen randomly from each group of actors in the two countries. Using questionnaires and detailed interviews, respondents were asked “From/to whom do you get/send new ideas that benefits your work?”, “From whom do you access expertise that improves your operations?” And “With whom do you collaborate?” They were also asked the intensity of their interaction, type of interaction and the constraints and opportunities associated with their interaction. Based on their responses, an innovation network for each country was mapped to show how actors are positioned in the knowledge management system and directed lines were constructed to show the ties⁵ and their direction.

4. Results and Discussion

4.1 Ethiopia Social Network Analysis and Knowledge Management

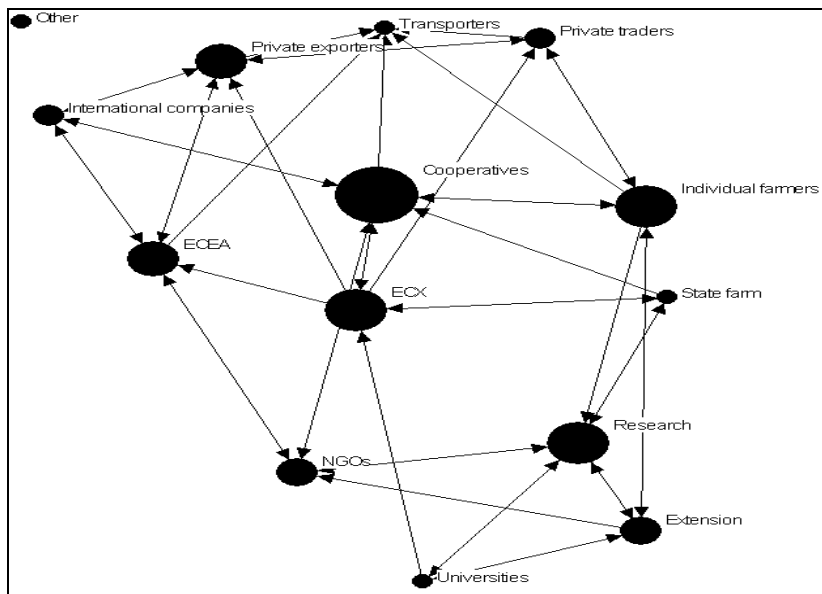
Figure 3 represents the results of the Ethiopian social network analysis (SNA). It shows that there are 13 actors⁶ involved in the Ethiopian coffee value chain and all of them are connected, except for “other actors.” However, there are differences among the actors in how they are connected. Some actors’ connections are reciprocated (e.g., farmers with extension and cooperatives) and other not (e.g., ECX with exporters and local suppliers).

Generally, in social network analysis, actors with high means such as farmers, extension, research, cooperatives, ECX, private suppliers, private exporters, and Ethiopian Coffee Exporters Association (ECEA) act as information sources (information senders). This implies that these actors have the potential to be influential source of information. However, this is only true if they are connected to the right other actors, otherwise they have very little influence.

⁵ Ties represent the connections between the network members (relationships)

⁶ Nodes represent individual network members involved in the coffee value chain

Figure 3: Coffee information exchange in Ethiopia⁷



From Figure 3, nonetheless, actors such as research and transporters seem to be more of information receivers from farmers rather than information senders. The Ethiopian Commodity Exchange (ECX); a marketplace where buyers and sellers come together to trade, assured of quality, quantity, payment, and delivery, is more of an information sender to exporters and suppliers rather than receiving from them. The most important actors in the chain, the farmers, seem to be at quite some distance from other equally important actors such as private exporters.

Looking at information receiving, research, cooperatives, transport, NGOs, private exporters and ECEA are relatively high receivers of information implying that they are powerful in the coffee innovation system. Actors such as research, cooperatives, private exporters, and ECEA are high in sending and receiving information, so they act as “communicators and facilitators” in the Ethiopian coffee innovation system.

We find that in Ethiopia, coffee farmers send information to relatively more actors. Unfortunately, they do not receive information directly from many sources. For instance, they seem not to get information from research and exporters. Similarly, universities in

⁷ Note: Arrows denote the direction of information flow and size of nodes indicates degree centrality of actors.

the Ethiopian coffee value chain do not send nor receive much information. The implication is that Ethiopian coffee farmers are “out of the loop”, meaning they are not at the center of the knowledge management and innovation system. Universities that are expected to generate knowledge seem not to be a useful part of the value chain as they are somewhat isolated from the knowledge management and innovation system.

From Table 1, the density of a network also gives some insights into the speed at which information diffuses among the actors or the extent to which actors have high level of social capital and/or social constraints. Looking at the Ethiopian coffee value chain, the density of the information exchange is 0.25, implying that only 25% of all the possible ties are present.

The network’s low density might mean that other coffee actors are there but not known and hence key connections are missing in the Ethiopian coffee value chain.

Table 1: Ego network measures for Ethiopian Coffee value innovation system SNA
Density: 0.25; Reciprocity: 59%; Efficiency: 0.79

Actors	Size	Ties	Pairs	Density	Reach Efficiency	Betweenness	Deg. Cent.	Close cent.	Mean	
									Info. sending	Info. receiving
Farmers	5.00	4.00	20.00	20.00	52.38	12.00	23.1	27.1	0.385	0.231
State Farm	3.00	2.00	6.00	33.33	73.33	4.00	15.4	24.6	0.231	0.154
ECX	6.00	5.00	30.00	16.67	45.83	12.00	23.1	26.0	0.385	0.231
Exporters	5.00	6.00	20.00	30.00	40.91	5.33	30.8	27.1	0.308	0.308
Int’l companies	3.00	2.00	6.00	33.33	57.14	2.00	23.1	26.0	0.231	0.231
Extension	3.00	3.00	6.00	50.00	66.67	2.50	23.1	25.5	0.308	0.231
Research	4.00	4.00	12.00	33.33	57.14	6.50	38.5	27.7	0.308	0.385
Cooperatives	5.00	3.00	20.00	15.00	50.00	13.00	38.5	28.9	0.385	0.385
Transporters	5.00	8.00	20.00	40.00	20.00	6.00	38.5	37.1	0.000	0.385
Private traders	4.00	3.00	12.00	25.00	52.38	3.50	23.1	26.5	0.231	0.231
Universities	3.00	2.00	6.00	33.33	69.23	2.00	15.4	23.2	0.231	0.154
ECEA	4.00	4.00	12.00	33.33	47.37	1.50	30.8	27.7	0.308	0.308

Source: Authors computation

According to the Ministry of Agriculture and Rural Development (MOARD) estimation, in 2006 about 15 percent of coffee production in the southwestern and western zone was smuggled into Sudan (EDE Consulting for Coffee, 1997). Similarly, a study by Worako et al. (2008) estimated that the annual average quantity of coffee smuggled into Djibouti to be at more than 1,000 tones. The missing actors in the network analysis (Figure 3) could therefore represent this group of private actors, who, although not openly available in the chain, play an important role in knowledge management and innovation system.

The relationships within a network should not focus around one or few central network members. Figure 3 also shows that most of the connections among the actors are short distance. Additionally, there are multiple shorter pathways from the farmer to the international and local markets. This suggests information flow is not likely to break down due to the availability of these multiple paths. There is new actor in the Ethiopian coffee value chain. After April 2008, the ECX replaced the auction system and has been given the authority and power to develop its own rules and oversee coffee actors and clearing Institutions (domestic banks or other financial institutions engaged in clearing and settlement of payments). The ECX is also empowered to oversee the Rules of coffee Exchange and regulation of contracts. Further, the ECX Authority, a regulatory body of ECX, has been established and empowered to investigate wrongdoing and arbitrate cases falling under its authority or to refer criminal cases to the appropriate court. Assuming some actors may not happy with the role of ECX, the exchange commodity may face difficulties in its efforts to become a power broker in the value chain. This is because most actors have many possible ways of connection to many other actors and hence actors can easily bypass local regulatory bodies and ECX.

The extent to which actors in the innovation system are characterized by reciprocated ties may show the degree of cohesion, trust, and social capital that is present in the knowledge management. This in turn determines the stability of the network. In the case of Ethiopia, 59% of the networks have a reciprocated connection. This does seem to suggest a considerable degree of institutionalized connections within the Ethiopian coffee value chain. The institutionalized way of information exchange is not bad as long as the right actors are properly connected and information flow does not overburden actors for the efficient management and utilization of information. As indicated earlier, in the Ethiopian coffee innovation system, a number of actors do not receive information from many others with no overlap of information flow between them. The whole network structure can be regarded as efficient at the 79% score mark.

The positioning of individual actors in the entire innovation system and the opportunities and constraints facing them are important. As can be seen from the ego network measures in Table 1, ECX has the largest ego network followed by farmers, private exporters, cooperatives, and transporters. This gives ECX the opportunity to play the role of brokerage service in the Ethiopian coffee innovation system. But its effectiveness as a broker is under a serious threat as it works in an environment where the ties between actors are not dense.

By normalized brokerage and betweenness⁸ measures, with the score of 13.00, it shows that cooperatives are actually playing the role of brokers and are the “movers and shakers” of the innovation system rather than ECX. This suggests cooperatives are at the center⁹ of the innovation system in the Ethiopian coffee. The centrality of cooperatives can also be observed from the degree centrality¹⁰ and closeness centrality¹¹ measures. Cooperatives are central in the innovation system because they have high degree centrality and because they are connected to many actors in the coffee value chain. Because of “organic coffee” and fair trade” arrangements, cooperatives have better external links outside of the community to bring in new information and ideas for their members. The organic coffee arrangement brought a unique opportunity for effective knowledge management and innovation in cooperatives because everything depends on cooperatives that are the hubs in the coffee farmers’ network

It seems that the coming of the ECX to govern the coffee market has meant that some of the links between exporters and farmers, and also between exporters and local suppliers, are no longer available. There is a possibility that this might hamper the knowledge management and innovation in the Ethiopian coffee value chain. This is because, first, exporters have been in the coffee business for many years and they have better knowledge management expertise and the social skills to connect to diverse farmers, local supplies and transporters and have good international linkages to make information flow to and from them. The exporters usually have external links outside of the local value chain actors to bring in new information and ideas. The Ethiopian Coffee Exporters Association (ECEA) also plays a significant role in establishing contacts with the

⁸ Denotes whether an actor plays a (relatively) important role as a broker or gatekeeper of information flows with a high potential of control on the indirect relations of the other members.

⁹ “Brokerage and betweenness” are ways of indexing how “central” or “powerful” an actor is within the network.

¹⁰ Measures the incoming and outgoing connections held by an individual network member

¹¹ Measures the reachability of members by including indirect ties

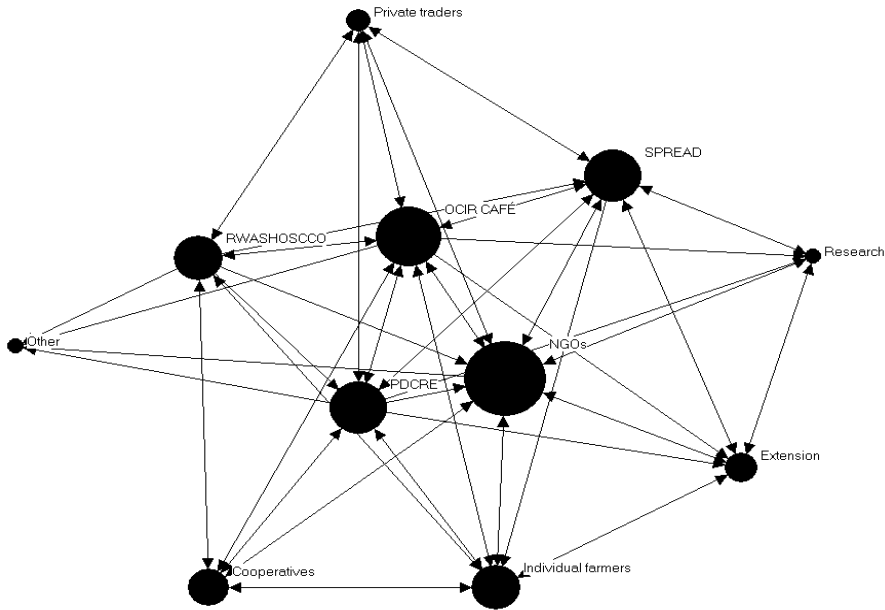
world market for private exporters. In addition to its principal objective of promoting coffee exports, the ECEA provides coffee trade information, lobbies on policies, and supplies technical support to its 65 members. Discontinuing the outside information linkages may result in the removal of all possibility for new ideas and innovations. Nonetheless, as a broker, ECX's has good storage facilities and unique capabilities in disseminating marketing information through Rural Electronic Price Tickers (REPT), Short Message Services (SMS), and Interactive Voice Response (IVR). These allow it to reach core actors with information.

4.2 Rwanda Social network analysis and knowledge management

In the Rwandan coffee value chain, 10 actors have been identified and Rwanda Coffee Development Authority (OCIR CAFÉ), the Rwanda Agriculture Diversification Project (PDRCE) and NGOs such as USAID (ACDI-VOCA, ADAR), are the most important information senders and receivers than the other actors. This implies that these actors are at the center of the information exchange and they serve as the communicators and facilitators of the Rwanda coffee innovations system. Unlike in Ethiopia, Rwandan farmers are more of information receivers than senders, implying that they are in a better position to adopt new technologies with so much information and advice. However, similar to Ethiopia, Rwandan farmers are not at the center of the Innovation system (Figure 4).

The speed of information flow within the Rwandan coffee value chain is so fast that it spreads by 59 percent. This implies coffee farmers in Rwanda have better opportunities to improve their networks and coffee knowledge management. NGOs that are playing a central role in Rwanda, especially after the 1994 genocide, might have created the opportunities for farmers in Rwanda to have better access to information and innovation. The central role of NGOs that have better connections with the global world might also have created the social capital in the Rwandan coffee value chain to have such high flow of information and better organized network structure.

However, the central role played by NGOs in Rwanda coffee knowledge management should be only of a temporary step. NGOs central role should not stay for long because Rwandese coffee network and innovation will be back to a fragile state if international NGOs leave the country, or the local NGOs reduce their funding.

Figure 4: Coffee information exchange in Rwanda

This requires NGOs to change their role from being direct leaders to indirect support players. They can play a supportive role to new domestic leaders, such as OCIR CAFÉ or PDCRE, to play a leading role in the Rwandese central network and knowledge management. The transition is necessary to rebuild coffee institutions in post conflict Rwanda and training on network building is important to increase the scale and impact of institutions on coffee knowledge management.

Looking at the direction of information flow, actors in Rwanda have more reciprocity (67 percent) information exchange. This implies the coffee innovation system in Rwanda is more cohesive and more stable. The high degree of institutionalized connections (35 percent) within the Rwanda coffee value chain shows a relatively efficient network structure. Again, this implies that there are a number of actors who receive information from many others in the Rwanda coffee innovation system. So the whole network structure can be regarded as efficient.

From the ego network measures in Table 2, NGOs, OCIR CAFÉ and PDCRE have the largest ego network, followed by SPREAD, RWASHOSCCO and farmers. This gives NGOs, OCIR CAFÉ and PDCRE the opportunity to play the role of brokerage service in the

Rwandan coffee innovation system. But, based on the normalized brokerage and betweenness measures, NGOs are actually playing the role of brokers and are the “movers and shakers” of the innovation system better than OCIR CAFÉ and PDCRE.

Table 2: Ego network measures for Rwandan Coffee value innovation system SNA
Density: 0.59; Reciprocity: 67%; Efficiency: 0.35

Actors	Size	Ties	Pairs	Density	Reach Efficiency	Betweenness	Close cent.	Mean	
								Info. sending	Info. receiving
Farmers	7.00	30.00	42.00	71.43	17.54	4.45	45.5	0.60	0.700
Extension	6.00	24.00	30.00	80.00	20.00	0.83	43.5	0.40	0.600
Research	5.00	17.00	20.00	85.00	22.73	0.00	41.7	0.30	0.500
Cooperatives	5.00	17.00	20.00	85.00	22.22	1.00	41.7	0.50	0.500
NGOs	10.00	48.00	90.00	53.33	14.71	10.68	50.0	0.80	0.900
SPREAD	8.00	37.00	56.00	66.07	16.39	5.50	45.5	0.70	0.700
OCIR CAFÉ	10.00	48.00	90.00	53.33	14.71	5.80	45.5	1.00	0.700
Private traders	5.00	16.00	20.00	80.00	21.74	1.83	41.7	0.500	0.500
RWASHOSCCO	8.00	37.00	56.00	66.07	16.95	2.20	38.4	0.800	0.400
PDCRE	10.00	50.00	90.00	55.56	14.71	4.52	43.5	0.900	0.600
Others	4.00	9.00	12.00	75.00	26.32	0.00	62.5	0.000	0.400

Source: Authors computation

5. Conclusion

In this paper, we have demonstrated how the ISA and IAR4D paradigms could be used as analytical framework to assess and compare the networks and knowledge management system of coffee innovation in Ethiopia, which is a relatively stable country, and Rwanda, which is a post conflict country.

In the Ethiopian coffee value chain, our results have shown that cooperatives are at the center of the knowledge management and innovation system. Because of “organic coffee” and fair trade” arrangements, cooperatives have better external links outside of the community to bring in new information and ideas for their members. The major limitation on the centrality of cooperatives, however, is that they cover only few members and, therefore, their impact in the whole innovation system is minimal. In addition to their small coverage, the central roles of cooperatives have been constrained by poor technical and management operations, lack of finance for marketing and for investments in production and processing. This calls for strengthening the organizational and knowledge management capacity of cooperatives so that they can improve their poor technical, marketing and managerial operations.

We have also shown that some actors are unknown in the Ethiopian coffee value chain. For effective network and knowledge management, therefore, core actors need to be known. Hence there is need for the government to look at its policies and the role of ECX. It will be valuable to check the main role of ECX in the value chain. This arrangement will give ECX a unique opportunity to become center of coffee knowledge excellence where major market gathering took place and become a physical network hub where other coffee value actors ran into each other to talk and often reach some kind of deal such as better price, a new idea that improves their coffee operations and innovations.

We have also shown that the speed of information flow within the Rwandan coffee value chain spreads by 59 percent compared to Ethiopia’s which flows only by 25 percent. We concluded that coffee farmers in Rwanda have better opportunities than the Ethiopian farmers. NGOs are playing a central role in Rwanda. However, we questioned the longer term role NGOs can play in value chain. We justified this due to funding source for NGOs. In most cases their funding are not long term.

When we compare the Rwanda coffee knowledge management and innovation system with Ethiopia, we can reasonably generalize that the Rwandan coffee value chain is more connected and cohesive than that of Ethiopia. But, similar to Ethiopia, farmers in Rwanda are not at the center of the innovation system and hence the ISA and IAR4D perspective is not working in both countries. For the ISA and IAR4D perspective to work, i.e., to put farmers at the center of the knowledge management and innovation system,

Rwandan farmers need to be connected with other central actors such as NGOs, OCIR CAFÉ and PDCRE and Ethiopian farmers with actors such as cooperatives and ECX.

In general, from careful examination of the whole innovation system and the position of individual actors in the innovation system, we infer that the Ethiopian coffee value chain is not highly connected, as opposed to Rwanda. Based on the IS and IAR4D perspective, this has serious implications for knowledge management and innovations in the coffee value chain. Information and innovation may not spread quickly in situations where there are low rates of connection, and actors that are less connected may be constrained to mobilize their resources and may be unable to bring multiple and diverse perspectives to solve their problems. From the Ethiopian coffee ego networks, farmers are constrained to information access and innovation in the sense that many of them are not members of cooperatives and they are disconnected from exporters who are the knowledge hubs. However, Rwandese farmers are not restricted by low to have links with NGOs.

We suggest that the role of ECX be evaluated as it is seen to be hampering the links between exporters and farmers, and also between exporters and local suppliers. This affects the knowledge management and innovations in the Ethiopian coffee value chain. Effective knowledge management requires ECX to stick only to its current role of providing market information, assured of quality, quantity, payment, and delivery, while core actors such as farmers, exporters and local suppliers implement what is discovered and deemed useful for coffee knowledge management. This arrangement will give ECX a unique opportunity to become center of coffee knowledge excellence where major market gathering took place and become a physical network hub where other coffee value actors ran into each other to talk and often reach some kind of deal such as better price, a new idea that improves their coffee operations and innovations.

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