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GOVERNANCE FOR QUALITY MANAGEMENT IN SMALLHOLDER-BASED TROPICAL FOOD CHAINS

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Abstract

The paper provides a framework that focuses on the linkages between several key dimensions of supply chain organization and performance of perishable tropical food products. The focus is on the relationship between governance regime and quality management. However, two other but related variables are taken into account because they impact on the relationship between governance and quality management. These variables are channel choice and value added distribution in the supply chain.

Governance regime is reflecting how to enhance coordination and trust amongst supply chain partners and how to reduce transaction costs. Quality management is dealing with how to manage food technology processes such that required quality levels can be improved and variability in quality of natural products can be exploited. Governance regimes in relation to quality management practices are discussed to the extent that supply chain partners are able, or are enabled, to invest in required quality improvements. Reduction of transaction costs, creation of trust-based networks and proper trade-offs between direct and future gains may offer substantial contributions to effective quality management and enforcement.

This framework has been applied to nine case studies on smallholder-based food supply chains originating from developing countries (Ruben et al., 2007). Three of these case studies are discussed in this paper to illustrate what challenges can be derived from the case studies. The selected case studies concern fish originating from Kenya, mango originating from Costa Rica and vegetables produced in China.

1. Introduction

The article has supply chains of vulnerable, mostly perishable, tropical food products in mind with smallholders as primary producers. Relevant products are, for example, fruit, vegetables, fish, dairy and meat. Smallholders tend to be the weakest party in the supply chain due to the distance to markets, asymmetric quality and price information and lack of joint action. They are, consequently, very dependent on the structure and performance of the supply chain for the part of the value added that they receive. The products that they grow, catch, or collect are highly heterogeneous by nature and these can be delivered to national or international market outlets. Common features of smallholder-based agro-food supply chains of tropical food products are:

- Scattered production by many smallholder producers;
- Large irregularities in supply because production is subject to weather and climate conditions;
- High variability in quality attributes;
- Thin local markets because of limited supply with oligopsonistic demand;
- High transaction and handling costs related to long distances between producers and consumers and problems with the quality of the infrastructure;
- Limited collective action;
- Deficient public regulation.

These characteristics justify a specific treatment of vulnerable products.

This article provides a theoretical framework, applied to case study results, that focuses on linkages between governance regime and quality management in smallholder-based supply chains of vulnerable tropical food products. Two factors that are closely related to this central link are channel choice and value added distribution.

Leading questions of the study are:

- a. What are the market requirements with respect to quality? This requires quality management practices in the supply chain.
- b. How can the final customer be reached in an optimal way? This is the aspect of channel choice.
- c. How to enhance coordination and trust amongst supply chain partners and to reduce transaction costs? This deals with channel coordination or governance regime.
- d. Is each partner in the chain properly compensated? This implies an analysis of value added in the chain and its distribution.

Reduction of transaction costs, creation of trust in networks and sharing of risk might offer substantial options for overcoming bottlenecks in the supply chain. This can also be helpful in finding techno-managerial solutions for improving both quality levels and value added.

The paper is organized as follows. The research framework is discussed in section 2. The demand for quality in the supply chain is discussed in section 3. Sections 4-6 discuss elements of the framework. Several case study examples are presented in section 7, whereas the challenges that can be derived from these case studies on international tropical food chains are discussed in section 8.

2. The framework

This article provides a theoretical framework, applied to case study results, that focus on the linkages between two key dimensions of supply chain organization of vulnerable tropical food products, namely governance regime and quality management.

Governance regime focuses on how to enhance coordination and trust amongst supply chain partners and how to reduce transaction costs. Quality management focuses on how to manage food technology processes to enhance required quality levels and/or to exploit quality variability. Two factors that are closely related to this central link are channel choice and value added distribution. Channel choice deals with how to reach the final customer with the corresponding quality requirements in an optimal way. Value added distribution concerns how to guarantee an acceptable remuneration to the various supply chain partners corresponding to their contributions and efforts.

Channel choice, governance regime, quality performance and value added distribution are assumed to be critical interfaces in supply chain organisation. The discussion in this paper is structured around these four dimensions and follows, where possible, the interfaces as illustrated in Table 1. The interaction matrix reflects 'meeting points' of technical, institutional and socio-economic aspects of supply chain organisation. The table will help to detect instruments or strategies that can be helpful to enhance potential supply chain synergies or to overcome possible trade-offs.

Table 1: Critical interfaces between supply chain dimensions

		Performance is influenced by:			
		Channel Choice 1.	Governance Regime 2.	Quality Performance 3.	Value added Distribution 4.
Having effect on:	Channel Choice 1.	X	Transaction costs and risk management 2	Standards, labels and branding 1	Sorting & delivery contracts 1
	Governance Regime 2.	Vertical integration & trust relationships 8	X	Quality enforcement; Monitoring, control & sanctions 11	Market differentiation & Collective action 2
	Quality Performance 3.	Subcontracting or outsourcing; integral quality control 1	Quality Assurance & certification 7	X	Economies of scale & scope; Location choice 3
	Value added Distribution 4.	Market competition & Dedicated suppliers 1	Bargaining opportunities & power relations 5	Co-innovation & co-operation 2	X

Source: Ruben et al. (2007), p. 15. The numbers included in the Table reflect the number of times that the relationship is discussed in Section 7.

This framework has been applied to nine case studies about smallholder based food supply chains that originate from developing countries (Ruben et al., 2007). Three of these case studies have been selected for this article and will illustrate what challenges can be derived from this study.

3. Demand for quality in the supply chain

A food supply chain delivers food products to final consumers. Foods provide nutrients and energy (i.e., nutritional aspects), they provide sensorial pleasure, they can potentially harm consumers (i.e., the food safety aspect), and they can spoil rather easily (i.e., shelf life is important). Foods are natural products from biological origin, or they are made of natural ingredients. This implies that they are subject to biological variation that is not fully controllable. Furthermore, they are subject to change, either intentionally by processing or unintentionally by uncontrollable outside events on their way from primary production to final use by the consumer.

Different chain actors may have a different interpretation of the concept of quality. Ultimately, the goal should be that the end-user, i.e. the consumer, is satisfied, but this is

too simple a statement. For instance, pest-resistance of vegetables and fruit will not be considered to be very important by a consumer, but it is of utmost importance for the breeder and the grower. Table 2 lists several meanings of the concept of quality by different chain actors. The challenge is to reconcile these interpretations of quality. Cooperation between members of the supply chain is required to deliver a desired end quality, taking into account the needs and constraints of all chain actors involved.

Table 2. Interpretation of quality by various chain actors.

Actor	Quality aspects
grower	<i>vitality of seed, yield</i>
cultivator	<i>productivity, uniformity, disease resistance</i>
auction	<i>uniformity, reliability supply, constant quality</i>
distribution	<i>shelf life, availability, sensitivity to damage</i>
retailer	<i>shelf life, diversity, exterior, little waste</i>
consumer	<i>taste, healthy, perishable, convenience constant quality</i>

Source: Ruben et al. (2007), p. 30

The intrinsic, and to some extent also extrinsic, quality attributes are determined by certain critical control points (CCPs) at various stages in the supply chain. These CCPs are different for each commodity. For instance, for certain tropical fruits the temperature should not decrease *below* a critical temperature to avoid chill injury, whereas for milk products it is just the other way around: *above* a certain critical temperature the shelf life and safety of the product are in danger. Critical control points can be influenced by technological measures such as temperature control as well as by organizational measures that guide human behaviour. It is for this reason that quality performance is strongly influenced by channel choice, governance regime, and the distribution of value added, and vice versa.

The key question related to channel choice of perishable products is about how to reach the final customer with the best quality characteristics. Quality performance is directly linked to the choice of actors that make up a food chain. Channel choice thus offers opportunities as well as limitations for improving quality management.

Different types of consumers may be addressed through specific marketing channels, e.g. convenience shops, supermarkets or open markets. Adequate sorting of products can be helpful to tailor product categories towards specific consumer wants.

The selection of a certain delivery channel has a stronger effect on quality performance if the activities in the channel have a noticeable impact on the intrinsic product quality attributes. For instance, if a product is very sensitive to the time that it is stored at a certain temperature, then the residence time becomes critical, as well as the ability of a channel to control temperature. Optimal channel choice thus essentially depends on the ability of a channel to invoke certain required actions for good quality performance.

4. Channel choice and governance regime

Supply chains or marketing channels represent a process in which a product or service is made available for use or final consumption. Channel decisions require a broad view about how channel actors bridge the gap between supply and - sometimes distant - demand. Channel decisions regarding “long” channels tend to be taken by a channel leader or a lead firm with the aim to serve the customers better than in case of producing for anonymous (spot) markets. In this respect, a channel decision process implies planning to select the (mix of) proper channel(s) that will give an optimal result for the total channel or its leader.

Several “prototypes” of supply chains or marketing channels are distinguished in the literature (e.g. Gereffi, 2003). Stern et al. (1996) consider 4 major types:

1. Conventional marketing channels (CMC) "consist of isolated and autonomous units or stages, each of which performs a traditionally defined set of marketing functions. Co-ordination among channel members is primarily achieved through bargaining and negotiation at spot markets."
2. Vertical marketing channels or systems (VMS) "consist of networks designed to achieve technological, managerial and promotional economies through the integration, co-ordination, and synchronisation of marketing flows from points of production to points of ultimate use." Main types of vertical marketing systems are:
 - Voluntary co-operation or co-ordination by joint planning
 - Contractual co-operation
 - Corporate ownership
3. Networks of agents based on trust, e.g. among relatives, or people belonging to the same ethnic group.
4. Hybrid forms of governance.

We distinguish perishables (e.g. fruits and vegetables, roots and tubers, fish) from “non”-perishables which can be stored for quite a long time when properly treated in terms of moisture content and storage conditions (e.g. cereals, beans). The more perishable a product is, and the more uncertain or risky the environment of the supply chain is, the more “central” governance tend to be needed in the supply chain to guarantee that channel objectives of all channel partners and stakeholders are attained.

Modern market-oriented supply chains tend to become shorter as intermediaries between producers and parties downstream in the chain become superfluous because of the emergence of direct trading relationships between large producers (or producer groups) and downstream parties. An example is the transformation of export-oriented producers to producer-exporters in some countries to lower transaction costs and exert full control over the supply chain. Inter-company relationships in these chains are often guided by (transaction-specific) investments such as cold stores, seeds, pesticides or credit to decrease delivery uncertainty and increase quality and quality consistency of deliveries.

With increasing globalization, the physical distance between producers and consumers of food products tends to increase which implies that actors at both ends of the chain, smallholders and consumers, are not easily aware of each others needs, opportunities and constraints. Consumers might or might not be aware of the conditions under which

smallholders have to work and producers may not understand the legitimate concerns of (segments of) consumers about their wishes with respect to food safety, food quality and sustainable resource use. Food quality and safety concerns may bother various classes of stakeholders, e.g. buyers, suppliers and food-related institutions. Sustainability may refer to land degradation, pollution of the environment, reduction of biodiversity and social responsibility issues (e.g. abuse of the labour force or child labour). These concerns can be addressed by the development of institutions or governance systems such as chain or corporate social responsibility (CSR) which is generally represented by the triple P (people, planet and profit). For example, Dolan and Humphrey (2000) discuss such an approach: *“The need for governance is reinforced in certain markets by increased concerns about labour, environmental (sustainability) and/or product safety standards, either through legal regulations or stakeholder (e.g. consumer, government and NGO) pressures”*.

5. Quality performance and governance regime

Since the 1990s, Western retailers have defined various standards for the production and processing of food, such as British Retail Consortium (BRC), EUREP-GAP, SQF. Major aims of private food safety standards are (Vellema and Boselie, 2003):

- to improve supplier standards and consistency, and avoid product failure;
- to eliminate multiple audits of food suppliers-manufacturers through certification of their processes;
- to support consumer and retailer objectives by “translating” their demands through the chain;
- To provide concise information to assist with a due diligence defence in case of food incidents.

These standards are now applied by supermarkets and importers all over the world to coordinate supply chain activities and to control food quality and safety. Retailers and food industries increasingly demand for certification according to these standards of production processes and facilities of producers and processing companies in developing countries (Jahn et al., 2004). The high costs of certification and further differentiation of quality and safety standards by (Western) retailers and food industries in recent years result in strengthening vertical relationships in food chains. This is one of the major rationales for the increasing competition between (international) food chains in stead of competition at company level.

For many smallholders in developing countries it is difficult to comply with these quality standards (Vellema and Boselie, 2003; Giovannucci & Reardon, 2001). Small producers are in most cases excluded from these chains because of high certification costs (for producers) and high monitoring costs (for buyers). Professional large-scale producers tend to remain in the supply chain after introducing the new certification system. However, we observe examples of inclusion of smallholders in modern quality schemes, e.g. through cooperative governance forms or through retail or food industry programs (e.g. tea production in Kenya for Unilever).

Standards tend to be related to corporate social responsibility, quality or sustainability issues (e.g. Fafchamps, 2004). For example, eco-labels aim to address issues regarding the sustainability of natural resources (e.g. FSC, MSC, SAI), fair trade labels aim to address the value-added distribution in the supply chain (e.g. Max Havelaar, Fair Trade, Utz Kapeh), food quality labels aim to address consumer concerns in food safety (e.g. ISO, HACCP), and brands of food products aim to safeguard a range of consumer values including quality, reliability, food safety, texture, taste, etc. (e.g. Chiquita, Dole, Douwe Egberts). These institutions tend to consider both consumer and producer interests and are expected to play a key role in promoting social responsible behaviour. They are particularly relevant for governance systems without (much) channel leadership as is the case in the more traditional supply chains where each pair of stages in the channel is usually connected by a spot market.

Several instruments can be used to reduce uncertainty and opportunistic behaviour from a buyer's perspective (Hueth and Ethan, 2001): monitoring of supplier processes, input control (of suppliers), output quality control and residual claimancy (sanctions). Quality and certification schemes lead to increasing control and more integrated governance, such as long-term contracts. At the same time they may lower transaction costs. Mechanisms like output quality control and residual claimancy are common in any food chain. Monitoring of supplier processes and also input control are increasingly applied by both Western retailers and large food industries in developing countries. These uncertainty-reducing instruments are embedded in the more integrated governance mechanisms, such as contracts or vertical integration.

Above-mentioned instruments can be supported by operational management systems. Most relevant management systems in the context of food supply chains are quality systems and logistics systems, supported by information systems (Lancioni et al., 2000; Porter, 2001; Van der Spiegel, 2004). Inter-company quality systems concern monitoring of supplier processes and output, tuning of quality systems in the chain (harmonization), exchange of quality information (quality requirements, feedback information, etc.), and communication of customer demands and complaints to suppliers. Quality of food is also strongly dependent on logistics systems in food chains. These systems concern exchange of planning data on: harvesting, storage, transportation, post-harvest storage and transportation, order-delivery cycle, use of information and (tele-) communication technology. New communication technology can be used for quality data exchange and improved logistics planning, thereby improving the quality of fresh products.

6. Governance regime and value added distribution

The orientation of supply chains towards specific market outlets greatly influences the options and strategies for value added (re)distribution. First, the orientation towards certain market segments with higher levels of chain control enables upstream agents to gain margins in the delivery process. Second, price and non-price incentives offered to supply chain agents can be helpful to improve the delivery efficiency for particular market outlets.

Value added distribution is essentially different in buyer-driven supply chains compared to more traditional producer-driven chains (Gereffi, 1994). In the food sector, retailers and branded manufacturers play a pivotal role in setting up decentralized production networks while preserving for themselves a key role in product development and marketing. The subordination of physical production to the sales functions enables control over how, when and where production takes place, and how much profit accrues to each stage and agent of the supply chain.

The value added share that remains with primary producers is mainly dependent on their relationships with downstream partners. Specific investments for guaranteeing reliable deliveries and consistent product quality are a stimulus for more exclusive delivery arrangements. Otherwise, long-term delivery contracts are required to enable producers to invest in quality upgrading under conditions of high risk exposure (Saenz and Ruben, 2004). Sustainable access to higher value market segments is thus a key condition for capturing additional rents.

The common strategy for dealing with variability in quality has been tailoring the supply chain towards 'average' quality. This might not, however, be the most effective approach, since variability can also be strategically exploited through the management of quality differences for specific market outlets (Schouten et al., 2004; Heuvelink et al., 2004). Heterogeneity in product quality can become an opportunity for smallholder development if a better match is made between the inherent variability at the supply side and demand in different specific market segments. In this way, also sub-standard products and waste can be valorised.

Learning and (co-)innovation are nowadays considered as key components for supply chain upgrading that adds value to the produce. Under increasing competition, producer surpluses are systematically channelled into consumer surpluses, and therefore supply chains are involved in a permanent process of re-positioning. Smallholders can remain involved in this process by applying strategies for improving vertical and horizontal cooperation and enhancing economies of scale and scope (Kaplinsky, 2000).

The distribution of value added is related to the degree of complexity of transactions (uncertainty), the level of coordination between agents (frequency), and the spatial fragmentation of delivery networks. Increasing complexities - due to more demanding food safety and quality requirements - can be addressed by standardization, but also ask for additional insurance to enable the required specific investments (in cooling, packaging, etc.). Supermarket requirements for reliable deliveries and permanent shelf provision require more stable relationships with preferred suppliers. The same holds true for global sourcing strategies based on simultaneous linkages with various suppliers that cover particular time windows (e.g. in mango).

Spatial concentration of smallholder producers (e.g. smallholder tea in Kenyan highlands) could provide some agglomeration advantages (or cluster effects) that facilitate the transmission of entrepreneurial information and save on external costs (Rocha, 2004). Location choice of value added activities is, however, only partly determined by cost motives (e.g. cheap labour in production countries) and may be seriously hindered by higher import tariffs charged on processed commodities. The potential competitive advantage of developing countries is strongly influenced by progressive tariffs and SPS standards that may reduce local options for adding value.

7. Case study examples

We selected three out of nine case studies that pay in particular attention to interrelationships between governance regimes and quality performance (Ruben et al., 2007) to illustrate the framework that was developed in preceding sections. The case studies concern mango originating from Costa Rica, vegetables produced in China and fish (Nile perch) originating from Kenya. In the text, references (i,j) are made to cells in Table 1 about critical interfaces between supply chain dimensions. The number of times that a particular relationship is discussed in this section is reflected in the cells of the same table.

Mango, Costa Rica, Guillermo Zuniga (Zuniga-Arias and Ruben, 2007)

Producers involved in the mango supply chain in Costa Rica tend to conduct transactions at both the export and the local market. They face strategic choices between (a) market outlets devoted to exports where quality attributes such as size, sugar content, and absence of external and internal damage are key determinants for a successful transaction and business relationship, and (b) local markets, where different qualities and delivery modes can be accommodated by wholesalers and retailers. Market selection (2,4) is hypothesized to be dependent on farm household characteristics (4,2), production system, price attributes and the market context such as specific contract configurations (3,1) including quality control (2,3), payment mode, type of agreement (1,4), volume (3,4) or rejection rate (1,3).

For the export market most of the produce originates from a producers association (4,2) delivering to a cooperative, which packs the mango and sells it to the exporter. The degree of vertical integration (2,1) is quite advanced: producers deliver on demand of the buyer and face relatively high rejection rates, but in compensation they receive access to stable market outlets, input and (subsidized) credit, and benefit from lower transport and delivery costs (1,2). While deliveries to the export market might be attractive if producers can benefit from reduced transport and transaction costs, they also incur higher input costs, have to face higher rejection rates and must pay fees for certification (3,2). Many producers who were unable to meet the certification requirements moved to the local market.

In the local market, independent producers or groups of producers deliver produce to several outlets like wholesalers, local markets and also directly to consumers. This includes produce that was rejected by the export market,

Based on a field survey on outlet choice decisions, determinants of market outlet choice by farmers were assessed. Structural, institutional and behavioural factors were assumed to determine farmers' choices for a specific market channel orientation. The empirical material for the analysis of market outlet choice was derived from a survey among 94 mango producers in the major production regions of Costa Rica. A statistical analysis, with the percentage delivery to the export market as the dependent variable, resulted in the following explanatory variables of mango export outlet choice: mango experience (+), risk attitude (+, cell 1,2), cultivated area with mango (+) and scale of production in number of boxes per week (+, cell 3,4), written agreement (+) and farmer operating in a typical mango export production area (+, cell 3,4).

Mango producers are price takers. Mango prices are based on the international prices provided by importers, especially in the season that the mango export window is open for Costa Rica. Sales to traders that visit the farm to buy rejected mangoes is an important secondary outlet for mango export producers. These traders tend to buy on credit and pay one week later.

Mango export producers are willing and able to bear more demanding and stricter delivery conditions (2,3) than producers for the local market with respect to quality standards, written contract, way of payment, higher rejection rates and buyer supervision in the plot. Many mango suppliers were not able to meet the exporter's certification requirements (3,2).

The domestic market is characterised by larger numbers of buyers both at the wholesale and retail markets implying more bargaining opportunities for the producers (4,2).

Buyers do not inspect the fields (2,3) and the spot market transactions at the wholesale market and retail markets are simple compared to the more complicated export market transactions. For the local market, the producers' experience and their historical knowledge and relationships with the market appeared to be of key importance for finding suitable market outlets.

Since price differences between local and export markets were not substantial, other market delivery conditions such as guaranteed and stable market access tended to be of higher importance. In conclusion, market outlet choice is a complex decision involving welfare objectives and risk considerations with respect to price volatility, costs for inputs and credit, and supply conditions (rejection rate). Vertical integration (2,1) is already advanced in the export market.

Vegetables, China, Hualiang Lu (Lu et al., 2007)

In China, which has become a major vegetable producer, increasing consumer concern about vegetable quality and safety (3,2) is drawing the attention of stakeholders. The case study investigated the effects of Chinese personal relationships, traditionally called *guanxi* networks, on buyer-seller relationships (2,1) and on quality performance in the vegetable sector (2,3) by means of a survey among vegetable sellers (smallholder farmers) and vegetable buyers (processors, exporters and retailers such as supermarkets).

Hypotheses that were generated in this study are:

H1: Trust between buyers and sellers will be higher if buyer-seller relationships (cell 2,1) are supported by *guanxi* networks.

H2a,b: Sellers and buyers will invest more in transaction specific assets if buyer-seller relationships (2,1) are

- a. Supported by *guanxi* networks.
- b. Based on trust

H3: Quality performance (2,3) will be higher if buyer-seller relationships are associated with a higher level of transaction-specific investments.

Data were collected from 167 vegetable sellers and 84 vegetable buyers in the Jiangsu Province of P.R. China. Measurement scales were characterised by multiple items.

The hypotheses are generally supported for both the seller and buyer data sets. But significant differences were discovered. All participants in vegetable supply chains try to achieve customer perceptions by delivering high quality. The perceived vegetable

quality satisfaction in Chinese vegetable supply chains is not only closely related to buyer-seller characteristics, such as interpersonal trust and transaction specific investment, but is also indirectly influenced by *guanxi* networks.

For vegetable farmers in Jiangsu Province, transaction specific investments significantly improved quality performance (2,3), while interpersonal trust with their buyers (2,1) had an indirect contribution to quality performance. This implies that the vegetable farmers in Jiangsu province would be rewarded if they put more effort into building trust-based buyer-seller relationships. The indirect effects of *guanxi* networks of vegetable farmers on quality performance suggest that vegetable farmers in Jiangsu Province can improve their marketing performance (quality perspective, cell 3,2) by relying not only on good buyer-seller relationships but also on well developed *guanxi* networks.

For vegetable buyers, on the other hand, *guanxi* networks also showed an indirect contribution to quality performance in vegetable supply chains (2,3). *Guanxi* networks improved trust with vegetable suppliers, but *guanxi* networks showed limited influence (direct or indirect) on transaction specific investments. This implies that companies are not simply relying on personal relationships or trust (2,1) but take investment decisions based on the overall contribution of the investments to the companies' development.

In summary, farmers' *guanxi* networks positively influence buyer-seller relationships regarding the level of interpersonal trust and the level of transaction specific investments (4,3). In a trusted buyer-seller relationship, farmers are more willing to invest in specific transactional assets. Vegetable quality performance is also closely related to specific investments of the buyers. Buyers' *guanxi* networks, on the other hand, showed no direct effect on transaction specific investment behaviour.

Nile perch, Kenya, Emma Kambewa (Kambewa et al., 2007)

Small-scale primary producers participating in international food chains from developing economies face considerable challenges to meet quality standards and to implement sustainable practices (cell 3,2). The study of the fresh Nile perch fish channel from Lake Victoria in Kenya serves to understand how sustainability and coping with quality requirements of (distant) customers can be integrated in a suitable governance system. What does it mean for public and private policy, if improvement at the primary production level is needed, and what could be the intervention points that may need to be addressed?

Case study interviews were conducted in eight landing sites. Informants were the Beach Management Units (BMUs), fishermen, middlemen and three processing factories. BMUs oversee the activities at the landing sites including hygiene, fish handling, marketing, security and conflict resolution.

It is shown that small-scale primary fish producers are caught up in a cobweb of challenges ranging from lack of appropriate fish production technologies, market and price information asymmetries, ineffective enforcement for sustainable practices and welfare demands limiting fishermen's participation in international supply chains (cells 3,2 and 4,1). It is argued that these challenges would be addressed if public and/or private policy would, among other things, invest to enable fishermen to access modern production technologies both for sustainable and quality-enhancing practices (2,3).

The study has identified several intervention points that may improve quality assurance (3,2). For example, unlike the HACCP, that focuses on potential hazards, lack of proper knowledge about fish quality is an important factor to be addressed to improve quality. Lack of proper knowledge is reflected by poor handling such as throwing, beating and stepping on fish. The study also shows that lack of cooling and storage facilities - essential to keep fish fresh -, the type of fishing gears, and the time it takes before the fish is processed are factors that may contribute to quality deterioration. Although these factors are not necessarily hazardous, they are nonetheless important for quality improvement at primary level. These results imply that investment in the quality management facilities such as ice or cold storage facilities in the landing sites, or investments in larger boats that can carry ice are needed (2,3). This however may require even more structural investments such as electricity that is currently not available in the beaches studied. Poor handling practices could be minimised through educating the fishermen and middlemen on the effect of poor fish handling on quality. It may also require better motivation, for example, better prices for better quality which was not the case.

The results also show that degradation of the fisheries is largely blamed on the use of bad fishing gears which is attributed to high prices for the good gears and ineffective and biased enforcement (against fishermen) by relevant authorities (2,3). This implies that public institutions should improve their effectiveness in enforcing sustainable fishing practices and the recommended fishing gears should be made affordable to all fishermen. Therefore, a change in the approach on how sustainable practices are enforced is needed.

Supporting the BMUs may take different forms such as establishing micro-credit schemes to enable fishermen registered with BMUs to buy fishing gears at reasonable prices or low interest loans. Having better access to fishing gears would mean that fishermen who use bad gears under the pretext of high prices or lack of credit facilities would no longer have an excuse. Moreover, enabling fishermen to obtain fishing gears through BMUs would enhance their bargaining power (4,2) like for prices and other terms of transactions.

The results also show that fishermen's position in the channel is compromised by lack of price information and interlocked fish/credit markets (cells 4,2 and 2,4). Information asymmetries especially over price lead to abrupt price changes and conflicts between fishermen and middlemen. There is need therefore to create market information systems and institutions through which price information could be communicated to the fishermen rather than the fish buyers, e.g., by sending daily a sms with current prices to subscribed BMU's or fishermen.

In conclusion, integrating small-scale primary producers into integrated supply chains (2,1) faces many challenges. Addressing these challenges would imply that either public or private policy or both should invest in the primary stages to enhance the capability of fishermen to compete (4,3). That can be achieved through providing them with such investments as quality management tools (2,3). They should also invest in making recommended fishing gears affordable for the poor fishermen. Above, private and public policy should strive to improve the socio-economic environments so that fishermen who use survival as an excuse for using destructive fishing should no longer have an excuse.

8. Challenges Ahead

The challenges that can be derived from the case studies on international tropical food chains are discussed in this section.

Supply chains of vulnerable tropical products are facing multiple challenges in terms of market integration and quality upgrading. While economic reforms in developing countries may have reduced some binding constraints related to high transaction costs and overall competitiveness, still major limitations remain in the field of market transparency and trust relationships required to enhance better quality compliance and equitable revenue sharing. Several case studies emphasize the importance of improving access to information regarding the consumer's demand at different market channels. Dovetailing producers' interest with market demand asks for suitable incentives that satisfy the objectives perceived at both sides of the supply chain. Therefore, an integrated appraisal of effective governance structures which link stakeholders throughout the chain is considered of vital importance. Within the four key areas that have been addressed we identify (see also the numbers included in the cells of Table 1) several issues that influence the structure and performance of (inter)national supply chains and networks of tropical foods and the position of smallholder producers therein.

Linking smallholders to market channels

Market access of smallholders was originally mainly related to limited infrastructure and scarce information that resulted in high market entry costs. In addition, the high risk related to deliveries to distant markets with – sometimes unknown – customers' preferences imply that high investments are required to guarantee competitiveness. Traditional traders played a critical role for providing pre-finance as an insurance device within this framework.

With the liberalization of many local markets in developing countries, the position of smallholders generally hardly improved, since thin markets tend to meet limited agency competition. Moreover, local organisations in charge of resource pooling and promoting joint action by farmers experienced serious drawbacks. When input provision and credit supply services became privatised, the opportunities for innovation and resource use intensification became even more constrained.

Under the influence of increased urbanisation, smallholder participation in exchange networks is partly recovering through greater reliance on contractual deliveries to supermarket chains and (inter)national brokers (e.g. case study on Nile perch from Kenya). This implies that farmers should be able to comply with new demands regarding product quality and safety and need to maintain stable and frequent deliveries. In several markets we notice the emergence of preferred supplier relationships based on co-investment in quality upgrading. Elsewhere, new market opportunities are created that enable risk diversification (e.g. through engagement in future exchange). Finally, new local and regional initiatives for smallholder organisation arise in response to market demands...

Supply chain governance for enhanced competition

Given the emerging new relationships between smallholders, traders/processors and retailers, the internal organisation of supply chain interactions is subject to important modifications. New governance regimes are required to guarantee stable deliveries of high quality, while providing suitable incentives to all stakeholders and complying with established contractual arrangements.

Supply chain governance used to be focussed on establishing coordination regimes between supply chain actors mainly for efficiency purposes. In the current era of quality competition, other governance functions become increasingly important. Supply chain partners adopt common standards and certification procedures as an incentive framework that enables specific investments in product and process upgrading. This, in turn, asks for collective action and farmers' organisation to control free-riding behaviour. Vertical supply chain integration might thus create new demands for strong horizontal organisation.

The new governance framework surrounding tropical food chains is based on a regime where smallholders and other chain partners engage in contractual regulations to enhance their competitive position. Several case studies indicate that an active role of the state is required to define minimum standards (at least for exports), but also to enhance market transparency to enable smallholder participation.

Contracting regimes for quality upgrading

Market competition at outlet level is increasingly determined by delivery frequency and quality performance. Where (inter)national trade networks used to be shaped by competitive advantage at country or enterprise level, competition is nowadays becoming more an issue of successful supply chain integration and quality management.

Long-term contracts that include facilities for input provision, credit, and implements, enabling upgrading of production systems and product management practices, tend to be based on inter-linkages with traders and retailers with market access. Better security regarding market outlets and prices are for many smallholders a key condition for engaging in quality upgrading. External agents can contribute to market transparency in several ways, e.g. by providing certification services.

Organization for bargaining power and value added sharing

Supply chain integration poses new challenges to collective action, both for enhancing economies of scale and scope in production, and for increasing bargaining options in market exchange. Traditional reasons for agency organization were mainly restricted to the smallholder domain, but these are now further extended towards other supply chain partners. This also implies that different forms and degrees of coordination – ranging from loose coupling to

contracts – receive attention as vehicles for creating dynamic cooperative advantages. Supply chain coordination thus provides opportunities for improving management and investment intensity as basic pre-conditions for quality upgrading.

Successful agency cooperation critically depends on the availability of suitable incentives for enhancing investment efforts. Effective enforcement of delivery contracts and compliance with product specifications requires reward systems that recognize existing interdependencies. In addition, upstream agents may rely on group action – through cooperatives and other forms of producer organizations – to improve their bargaining power. Value added distribution in tropical fruit chains increasingly depends on effective channel coordination. While smallholders may have lost part of their traditional comparative advantage (mainly based on location), the emergence of new types of delivery relationships provides opportunities for creating specific skills and abilities that guarantee products with quality-based value added.

Conclusion and agenda for further research

From the cross-sectional appraisal of tropical supply chains four main conclusions emerge:

- Comparative studies of different case studies from a common perspective provide the required critical mass for drawing more generic conclusions regarding market access, governance and quality management in tropical food chains
- Even if there is no ‘one size fits all’ outcome that arises from the case studies, the nature and character of the interactions at the interfaces provide new insights in the options for addressing quality problems through interventions in governance;
- Several studies emphasize the importance of ‘learning by doing’ and the requirement of experiments for improving quality management and governance regimes;
- Improving supply chain performance is basically a matter of private sector interactions, but there remains certainly room for public involvement in standard setting, regulation and enforcement.

This article intends to increase our insights in institutional, technical and socio-economic factors that influence the performance of tropical supply chains based on smallholder production. Further research on supply chain integration and management regarding tropical food chains has to face the following main challenges:

- Scientific support for improving the quality performance of tropical food chains at different stages of the supply chain will increasingly be based on the capacities to develop an integrated and interactive framework. Dovetailing technical and socio-economic approaches to tropical chain management and governance is therefore required for adequately addressing the strategic interfaces;
- Strategic research focussing on the improvement of supply chain integration of tropical food networks asks for new instruments which

enable the monitoring and prediction of quality change for particular market channels;

- Supply chain performance analysis from an integrated perspective should consider multiple performance indicators to assess the impact of these interventions and refer to their potential contributions to increased value added, income and employment creation, and risk reduction.
- Several of the suggested solutions are likely to be based on close cooperation between private and public partners, and could be undertaken within the framework of public-private partnerships. Consequently, potential policy implications of the study, that may require experimentation before implementation, are:
 - Access of smallholders to tropical supply chains can be supported by reducing entry costs through co-investment and insurance mechanisms that enable smallholders to undertake specific investments;
 - The establishment of supply chain governance regimes asks for a legal and institutional framework that offers equal opportunities to stakeholders groups for participation and exchange;
 - With the increasing importance of grades and standards, public agencies should assume a leading role in enhancing market transparency, creating legal enforcement systems and guaranteeing compliance with minimum standards.
 - The creation of dynamic competitive advantages based on supply chain cooperation needs to be supported by public research and development activities that provide sector-wide assistance to product and process upgrading;
 - Improving bargaining options throughout the supply chain asks for public support for the establishment and training of local leadership and the promotion of community-wide voluntary organisations.

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