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Innovation Through (International) Food Supply Chain Development: A Research Agenda[★]

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Abstract

This paper presents a research agenda on innovation through (international) food supply chains and networks in developing countries. It derives major topics from a multi-perspective view on international food chains (economic, technology, social/legal and environment) and from different theoretical streams dealing with chains and networks (Supply Chain Management, Industrial Organization theory and Network Theory). Three agri-supply chain projects in developing countries (Thailand, South-Africa, Ghana) are analyzed to identify focus areas in supply chain development projects and important gaps. These projects were collaborative actions between companies and research institutes to initiate international supply chain development.

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1. Introduction

Do innovations in a market induce innovations “upstream” in the food supply chain? By innovation, we mean technologies invented or adapted in the focal market, and we focus on innovations introduced by international retailers as they enter developing markets. Technology is defined in a broad sense, including information technology, product technology (e.g. biotechnology), process and transportation technology and also systems and standards (such as quality and environmental). To formulate major research themes we take two starting points: dimensions (areas of impact) of innovation through international food supply chains, and theory on chains and networks.

Whilst supply chain analysis and supply chain management has achieved a firm basis in literature (see e.g. Trienekens, 2001; Omta et al. 2001), attention to the processes of market induced innovation in and through chains and networks is relatively new (See also Omta, 2002 for a research agenda on innovation in chains and networks). Furthermore, the attention to spin-off effects of supply chain and network development is, especially in the light of economic development in developing countries, a highly important research field. Goal of this study is to improve our understanding of international food supply chains and how they contribute to social-economic and technological development. It will also serve as a foundation for research programs on innovation through (international) supply chains.

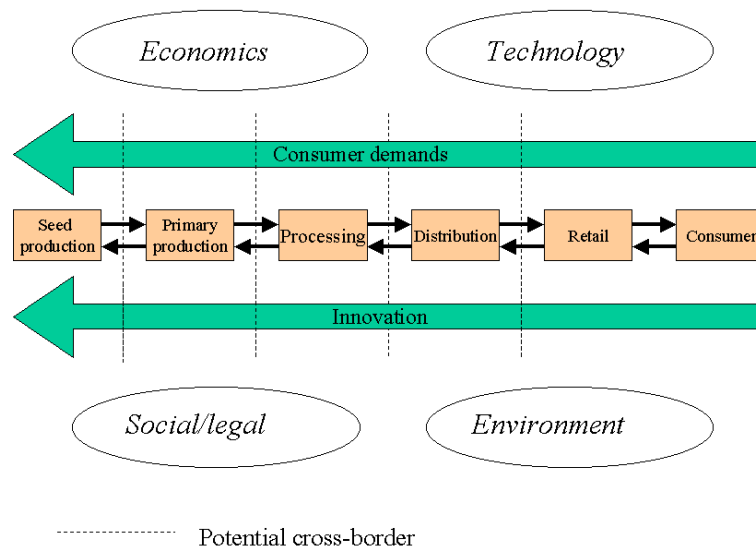
2. Theoretical background

In this section we will describe the two starting points for our identification of research themes on innovation through international food chains: identification of its empirical dimensions and analysis of theoretical streams on supply chains and networks.

2.1 Perspectives on international food chains

There are various dimensions of market induced innovation through international food supply chains. Figure one illustrates the flow of innovation through the food supply chain in the context of these dimensions.

Figure 1: Dimensions of innovation through (international) food supply chains



We recognize four dimensions of innovation through the (international) food supply chain (Trienekens and Willems, 2002):

- the economics dimension is related to efficiency (in cost-benefit perspective) and to consumer orientation. Due to changing life-style of western(ized) consumers the demand for convenient food such as pre-cut fruit, fruit salads and ready-to-eat meals is increasing. Furthermore, consumer concerns regarding animal welfare, environmental issues and social aspects, such as salary, working conditions, etc. bring about demand for products related to fair trade, organic production, etc. This offers opportunities for companies in developing countries to operate in (international) niche markets. However, the international standards for quality, health and animal welfare may have a negative impact on the competitiveness of these companies.
- the environment dimension is related to the way production, trade and distribution of food is embedded in its (ecological) environment. The integration of developing countries into international chains may form an extra burden on the environment in these countries, due to for instance deforestation, increase of mono-cultivation and the increase of pesticides and chemicals usage. Environmental sustainable development can be achieved by

supply chain collaboration of companies, for example by recycling of waste and packaging materials throughout the chain from consumer to farm and the introduction of sustainable food production systems.

- the technological dimension is related to the way technology (product and process technology, transport technology, information and communication technology) can be applied to improve production and distribution of high quality and safe food products. A range of new technologies has been developed over the past decade to improve logistics, increase the use of ICT and to boost quality management in the supply chain. Cross-border supply chains can be seen as a vehicle by which new forms of production, (on-farm) technologies, logistics, labor processes and organizational relations and networks are introduced. In this respect, technological standards and systems to guide and control processes and flows of goods and information (such as HACCP, tracking and tracing) are increasingly internationalized. Supermarkets in Brazil and Thailand, for example, have initiated total quality management programs for perishables like fresh fish, meat and vegetables.
- the social and legal dimension (norms and values) is related to societal constraints to production, distribution and trade of food and to issues like human well-being, animal welfare and sustainable social-economic development. Unequal power relationships in the chain (e.g. increasing global power of retailers) and trade barriers impact not only the organization of the cross-border supply chain (moving value-adding activities to western countries) but also the division of costs and benefits. In particular small-scale producers in developing countries are in a disadvantageous position because they have little capital to invest, use traditional techniques, depend on family labor and lack contact with (international) market players. As a result of increased competition, these small-scale producers may turn out as the losers.

All four areas of influence cover food chains from farm to table.

2.2 State of the art on supply chain and network theory

During the past decade there has been extensive theory building in the field of food supply chains and networks (Lazzarini et al., 2001; Omta et al. 2001). Scientific disciplines that add to the development of supply chain and network theory and play an important role in the project can be grouped into three approaches:

Supply chain management approach

Supply chain management is customer oriented and is aimed towards the integration of business planning and balancing supply and demand across the

entire supply chain (Bowersox and Closs, 1996; Cooper et al., 1997). It tries to bring suppliers and customers together in one concurrent business process. It spans the entire chain from initial source to the ultimate consumer (Lambert and Cooper, 2000; Stern et al., 1996). Advanced information and communication technology (e.g. E-commerce) systems are increasingly becoming the backbone of these integrated supply chains (Lancioni et al., 2001; Porter, 2001). Supply chain management research is well supported by mathematical modeling and modeling tools.

Network approach

The necessity for organizations to exchange resources is an important explaining factor for inter-organizational relationships in this approach (Hakansson and Snehota, 1995). In the network theory, forms of collaboration are not only based on economic motivations; power and trust are key concepts (Uzzi, 1997). Recently, social capital theory has become an important new branch within the network approach. Network relations may enhance the 'social capital' of a company, by making it feasible to get easier access to information, technical know-how and financial support (Coleman, 1990; Burt, 1997).

Business economics and organizational approach

The new institutional theory of transaction cost economics (TCE) and agency theory provide the rationale for the make-or-buy decisions. These theories are concerned with the governance relationships of organizational co-operation, integrating views from business economics and organizational theory. In TCE the transactions between companies are the units of analysis (Rindfleisch and Heide, 1997; Williamson, 1985, 1999). Agency theory is directed at the ubiquitous agency relationship, in which one party (the principal) delegates work to another (the agent), who performs that work (Eisenhardt, 1989).

3. Identification of research themes

From the above we can deduce a series of major research themes on market induced innovation through international food supply chains and networks:

1. The importance of innovations in agriculture production has been well documented, but the role of innovations at the consumption end of the supply chain has been less articulated. Do market innovations induce innovations "upstream" in the food supply chain? Important (supply chain management oriented) research topics in this respect are

- diffusion of packing, storage and transportation technology throughout the international food supply chain, including environmental effects (e.g. energy emissions, handling of waste and packaging materials)

- the effects of technology diffusion in international supply chains on food safety and quality and on sustainable economic development
- the design of supply chain information sharing and monitoring systems supporting technology diffusion through international food supply chains
- the design of supply chain costs and benefits sharing systems supporting international supply chain innovation
- translation of consumer values throughout the international food supply chain

2. What are the possible impacts of retail innovations upstream the food supply chain? In the chain and in the chain environment? How can these impacts be measured? Are there positive spin-off effects in different stages of the supply chain? Important (network theory oriented) research topics in this respect are:

- regional economic impacts of international supply chain development (e.g. increase of value adding activities in a region) and social-economic impacts for local communities (e.g. more jobs)
- development of sustainable food production systems (also referring to issues like bio-diversity and landscape architecture)
- the development of valid views of relevant international networks between developing and developed countries and the opportunities they contain
- the development of an optimal customer/supplier portfolio (e.g. reduction of supplier bases for better co-ordination)
- standards in relation to national and international legislation and regulations

3. Specific institutional arrangements within chains and networks are challenged by turbulence in the external socioeconomic environment and by internal disputes and conflicts of interests among agents. Which arrangements are able to deal with these tensions and are able to survive and which tend to disintegrate? Important (organizational economics oriented) research topics in this respect are:

- policy scenarios for a company in both developed and developing countries in the diffusion and adoption of innovations
- the definition of hierarchical and control abilities throughout innovative international food supply chains
- less tangible and visible concepts like trust, power, core-competencies in supply chain and network innovation processes
- design of risk avoiding mechanisms governing inter-enterprise exchanges (e.g. trust, asset specific investments)
- the enforcement ability of management in international supply chains with distinct institutional structures (Zylbersztajn and Farina, 1999).

Section 4 illustrates international food supply chain development with three cases based on public private supply chain development projects in practice. Focus areas will be identified and possible gaps in the research will be articulated.

4. Cross-border food supply chain development cases

4.1 Case 1: Tops fresh vegetables chain in Thailand

In this project (1998-2002) businesses (Tops, Ahold Thailand; Syngenta; SGS; producers), research institutes (Katssetsart University, Thailand; Wageningen UR, The Netherlands) and (semi-) governmental organisations worked jointly to develop a high quality and efficient fresh produce chain in Thailand from producer to retailer.

Figure 2 depicts the chain in the Tops Thailand project.

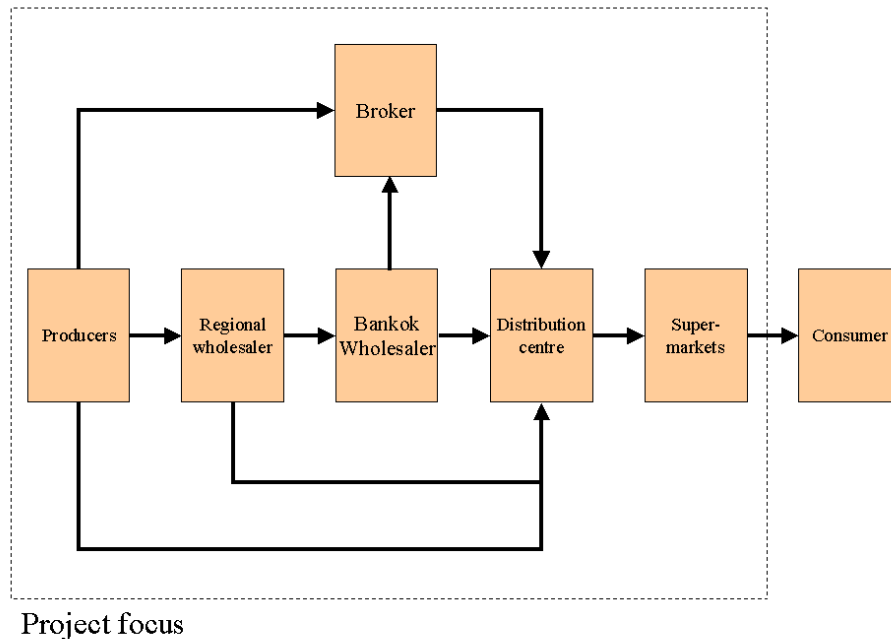


Figure 2: Fresh vegetables chain Tops Thailand

Problem description

Roughly 250 suppliers were delivering perishable products directly at the backdoor of the supermarkets at least three times a week. Incidents of out-of-stock were common and shrinkage in the store was high. The lead times between the farms and the supermarket shelves was up to 60 hours and due to the lack of pre-cooling and cooled transportation the post-harvest losses were high. It was impossible to trace products back to the farm; there was no insight into farming practices and post-

harvest practices. There were no clear uniform product specifications that could be communicated throughout the supply chain. (Boselie, 2002)

The following improvement steps were taken:

- A Preferred Supplier Approach reduced the total number of suppliers from 250 to 60 after critically benchmarking their performance and development potential. At farm level solutions generated were a.o.: Good Agricultural Practices, a safe use program for crop protection products, participation in certification programs (covering 80% in June 2001) and improved seeds and technical assistance.
- A distribution center (World Fresh) was built that also performed productive functions like quality control (GMP, HACCP), washing, packaging and processing. This value-added center was a complete 24-hour-a-day/ 7 days-a-week green-field operation at the borders of Bangkok city.
- A Lead-time reduction program has substantially reduced the lead-time between the farm and World Fresh and between World Fresh and the stores. The service level of World Fresh has been improved to 98 percent and standardised pallets & crates and a pool system have substantially lowered the handling costs.

Most suppliers (and even competitors) have accepted the standard. However, a lot remains to be done in the fields of inspection, auditing and compliance. There are still suppliers who consider the new label as a kind of window dressing without actual enforcement. It also has proven to be difficult for small holder producers to become a supplier within the retail market segment. The small production volumes, the inability to supply year-round, and the non-transparent farming practices are debit to this (Boselie, 2002). So far the chain seems not to have established structural changes in regional and local social-economic structures.

4.2 Case 2: Fresh fruit chain between South-Africa and The Netherlands

In this project (2001-2002) a wide range of companies (Capespan , Intertrading, Paltrack (all South Africa), Seatrade, Safmarine, Hage International, FTK, Seabrex (all The Netherlands), research institutes CSRI (South Africa), TNO-INRO (The Netherlands), Wageningen UR (The Netherlands) and semi-governmental organizations (South African Netherlands Transport Forum, Dutch Ministry of Agriculture) worked on improvement of quality and logistics information exchange in an international fresh fruit chain between South Africa and The Netherlands.

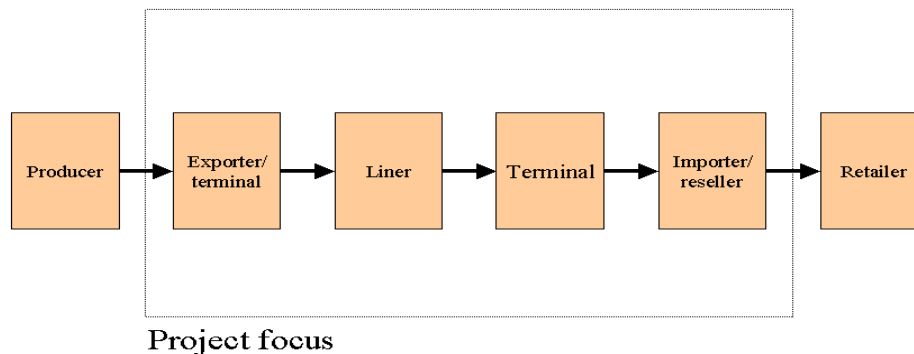


Figure 3 Fresh fruit chain between South Africa and The Netherlands

Problem description

Before this project started, the container transshipment companies and importers in the Netherlands were often not informed as to which fruit sorts would arrive at which points in time. This was the reason why people were unable to ensure that the cooling cells at the port and the importer's premises complied properly with the product climate needs. In addition, the way in which the activities in the port were organized was insufficiently coordinated to the time at which the ships arrived and the importer was therefore unable to make accurate delivery agreements with customers. By an integrated partnership between South African export organizations, international transport companies, port companies and Dutch importers, to exchange specific data on the logistical and quality aspects of the products at certain points in time during the chain, the 'island'-systems can be connected to an integral information system, thereby ensuring that the chain is organized more efficiently (www.agrichaincompetence.org). Results of this project were the design of new planning methods and procedures, standards, EDI messages for information exchange (e.g. E-bill of lading).

A shortcoming in this project was that ultimate demand (retailers/consumers) and producers were not included in the project. Analysis showed that demand and supply fluctuations are not dealt with in an efficient way. Indeed, one of the outcomes of the project was that forecasts of supply and demand were very weak and didn't contribute to solving imbalances in this chain. Furthermore, the focus of the project was on technological development (information systems), without paying much attention to social-economic and development aspects. Although information exchange throughout supply chains is essential for efficient goods flows, taking a

multi-dimensional view is essential for sustainable socioeconomic development. Future projects could pay attention to these issues (especially in the South-Africa region where currently much attention is paid to 'black empowerment', meaning that any investment should lead to sustainable social-economic development for South-Africa).

4.3 Case 3: Fruit chain from Ghana to The Netherlands

In this project (2003-2004) businesses (Royal Ahold, Bakker Barendrecht, Albert Heijn, KLM (all The Netherlands), Horticultural Association Ghana, Seafreight Pineapple Exporters Association Ghana, Exotic Fruit Exporters Association Ghana (all Ghana), research institutes (LEI-WUR, Michigan State University, University of Ghana) collaborated to develop a fresh fruit chain from Ghana to the Netherlands.

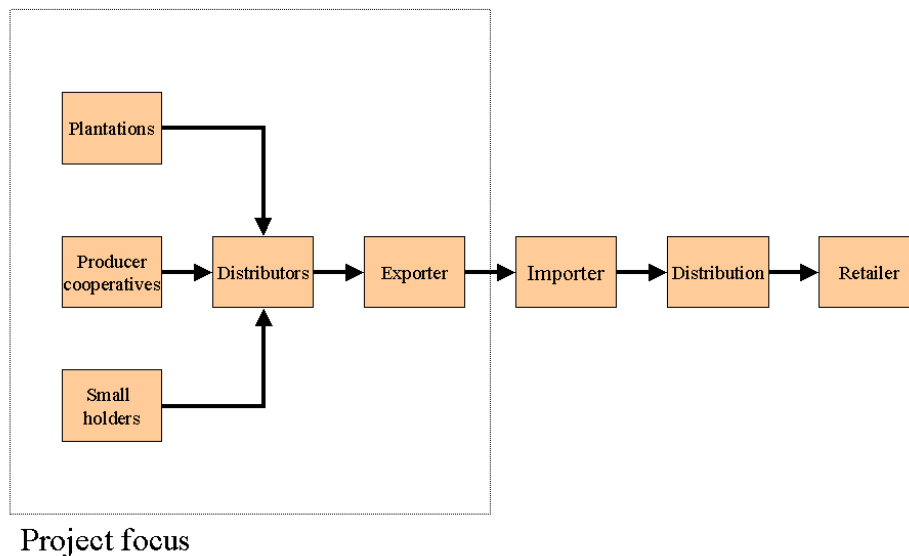


Figure 5 Fresh fruit chain from Ghana to The Netherlands

Problem description

In order to achieve economic growth, producers have to learn how to deal and process the information and demands they receive. Subsequently how to manage their farms and businesses accordingly. This implies much more than just focusing on crops, it implies a timely and opportune response to market demand and learning to interpret urban and international trends rather than local ones.

Chain integration can help to improve flows of information regarding customer's preferences, market conditions, customer's concerns on safe food and environmental friendly production processes. Besides, chain integration can improve production systems, by bringing new varieties and new technologies to the primary stage of the chain.

Goals of the project are to:

- purchase products (pineapple, mango) in Ghana (by Ahold)
- help to improve the quality of products throughout the supply chain
- develop new products, produced in Ghana and sold in local and international markets
- investigate whether value added activities in the supply chain can be moved from The Netherlands to Ghana
- initiate local social-economic development

The underlying objective is to develop commercially viable and sustainable supply chain and network relationships. This will be done through providing Ghana access to international markets, to develop products that meet international standards (Eurep Gap) and by establishing new activities to create added value in Ghana. Ultimately this should result in job creation and local multiplier effects plus opportunities for input suppliers resulting in secondary employment.

This project just has started, it takes a broader perspective on development than the other two cases and includes different theoretical streams in its research.

5. Conclusion and Discussion

All three cases focus on specific dimensions of supply chain innovation and specific theoretical streams.

Figure 5: Focus on specific dimensions of the cases

	TOPS Thailand	World Fresh South Africa	Ghana pineapple
Economic	- Consumer orientation - Quality control in chain	- Customer orientation - Quality control in chain	- Consumer orientation - Quality control in chain
Technology/standards	- HACCP/ ISO	- Information systems - ICT	- Eurep-Gap
Social/legal	-----	-----	- Regional development (weak)
Environment	-----	-----	- Eurep-Gap

Figure 6: Focus on specific theories of the cases

	TOPS Thailand	World Fresh South Africa	Ghana pineapple
Supply chain management	- Consumer orientation - Quality control - Logistics optimization	- Quality control - Logistics optimization - Information systems	- Quality control - Logistics optimization - Information systems
Organisation Economics	- Preferred suppliers contracts	-----	- Preferred suppliers contracts
Network/social capital theory	-----	-----	- Community development (weak)

Figures 5 and 6 shows major attention in our three cases to market, quality and logistics issues, while less attention is given to issues related to regional and sustainable social-economic development and environmental issues. However, the Ghana project has started with paying some attention to these issues. From a theoretical point of view the focus of all cases is on Supply Chain Management and

to a lesser extent to contract formation with preferred suppliers. Also little attention is paid to integral chain or network governance structures and to typical network issues (that have, for example, to do with regional development or community development). If sustainable socioeconomic development should be achieved we believe that also attention must be paid to these issues.

In this paper only three examples of projects have been chosen. However, because of the specific nature of these projects, with academic institutes involved with a view expected to be broader than if only businesses were involved, a similar picture could be expected to be found in other international chain development projects. Further research is necessary to test this thesis.

In general, businesses have a commercial interest in international supply chain development, which means that their attention will be focused on economic and related technological issues. Some companies, however, are starting with programs that have a broader perspective. An example is the Ghana case presented in this paper. Furthermore, it is a challenge for researchers to investigate innovation through international supply chain development and how it affects the social-economic-environmental-technological development of these countries, from a broad perspective. In this light this research is just at the start and there is still much work to be done to answer the questions posed in this paper.

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