FAIRTRADE MANGOES FROM INDIA

Final Project

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Abstract

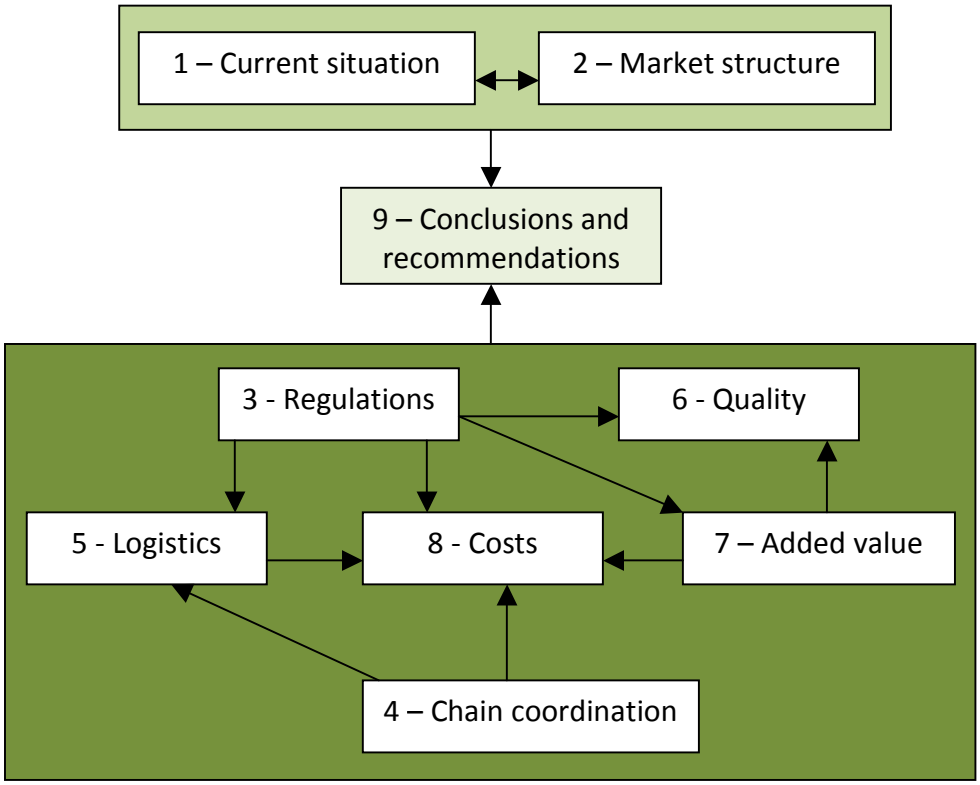
According to the World Bank (2006), Indian mangoes account for 40% of the world mango production although they are mainly meant for the domestic market. To this extent the Tamil Nadu region in India has got good opportunities for raising its income by focusing on the marketing of processed mangoes. In this report several aspects are contemplated to give an exhaustive overview on the current situation, also in order to evaluate the feasibility of a possible processed-mango business between the Tamil Nadu region and the European Union.

Te first chapter is dedicated to a description of the current situation in Tamil Nadu. Chapter 2 gives a rapid overview on the market structure as far as mangoes and processed mangoes (with a special focus on mango pulp) are regarded. Chapter 3 gives an extensive background information on the public (compulsory) and private (voluntary) regulations to be followed when it comes to export products within the EU boundaries. The hypothesis of Fair-trade is also assessed but there are apparently no chances at the moment for doing business from the Indian sub-continent.

Chapter 4 treats the topic of chain coordination: key players in the INEU (India-Europe) mango chain are analyzed from the perspective of the market and bargaining power, together with different chain types that are currently present. Chapter 5 elaborates on logistics, partly applied on this chain whereas chapter 6 gives an overview on the aspects of quality with particular focus on mango pulp. Moreover, key quality indicators and potential factors that affect the final mango pulp quality will be examined.

Chapter 7 gives insights on how mango sub-products can be obtained and what is their use and added value, whereas chapter 8 is about costs and provides an overview on the possible costs involved for setting up a processed-mango business from India to Europe. The final chapter summarizes the conclusions and provides recommendations for developing the Indian mango (pulp) chain.

Linkages within the report



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Glossary

APEDA	Agricultural and Processed Food Products Export Development Authority
CBOs	Community Based Organizations
CF	Contract Farming
CMR	Road Waybill
CPCC	Control Points and Compliance Criteria
DG	Directorate General
DGCIS	Domestic & Export Market Intelligence Cell
DGFT	Directorate General of Foreign Trade
EC	European Council
EEC	European Economic Commission
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization of the United Nations Statistics
FLO	Fair-trade Labeling Organization
FT	Fair-trade
GAP	Good Agricultural Practices
GLOBALGAP	Global Partnership for Good Agricultural Practices
GMO's	Genetically Modified Organisms
HACCP	Hazard Analysis of Critical Control Points
ICT	Indian Tobacco Company
IEC	Importer/Exporter Code
INEU	Indian-European
INR	Indian Rupees
ISO	International Organization for Standardization

MFPI	Ministry of Food Processing Industries
MRL's	Maximum Residue Limits
NAAS	National Academy of Agricultural Sciences
SAD	Customs Import Declaration
SGF	Sure Global Fair
SHG	Self Help Groups
SPO's	Small Producers Organizations
TARIC	Integrated Tariff of the European Communities
TSS	Total Soluble Solid
UAE	United Arabian Emirates
US	United States
UK	United Kingdom
VAT	Value Added Tax
WB	World Bank
WHO	World Health Organization

Introduction

The rationale of this project is twofold and needs to be explained in both economic and social terms.
In the latest decades world markets have been increasingly globalized. World exports have definitely soared and the stakeholders participating in commercial exchanges do not always belong to the same region, but they are actually more likely to be scattered around. For this reason, it is fundamental for all the actors participating in the value chain of a product to be organized in a very effective and efficient way in order to be competitive and generate profits. Moreover, when the traded product deals with food (both fresh and processed), it is also important to consider a certain number of public and private standards that are being continuously established in order to guarantee food quality and safety.
However, it may be that commercial exchanges eventually make some people worse-off, especially when they have a low bargaining power and must be happy with an output price that does not allow them to get by in a proper way. Fair-trade is the second aspect of this project and deals with another private regulation that, as such, is not compulsory but is strategically adopted to conquest the increasing share of consumers who are ethically concerned.
Under these circumstances, this project will encompass not only all the qualitative and quantitative requirements that should be considered when it is to set up a conventional agricultural value chain for the European Union, but it also provides information on the requirements dictated by the Fair-trade drive.

In this world of endless competition among companies, the strategic advantage passes through the achievement of economic efficiency in ALL the steps of the value chain. However, if efficiency means deploying human and social capital belonging to the weakest party of the agreement, then new actions must be undertaken in order

to promote “trade structures and practices so that everyone, through their work, can maintain a decent and dignified livelihood and develop their full potential” (Fairtrade Foundation, 2009).

The logical consequence of this vision is to set up a supply chain that can combine both the elements of efficiency and ethics within the production stage. In particular, this project will focus on the export of processed mangoes from the area of Tamil Nadu in India to the Netherlands. To do so, these mangoes should first comply with the rigid EU requirements in terms of safety and, in order to be successfully sold to the organized distribution (e.g. supermarket chains, hypermarkets), it is advisable that they also meet a certain number of even stricter quality and safety criteria, also in order to conquest European consumers’ trust.

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Fairtrade Foundation 2009 http://www.fairtrade.org.uk

Chapter 1 - Current situation

India is the largest mango producer, accounting for about 40% of the global mango production (Hanemann, 2006). In India, less than 5% of the produced mangoes is processed and mango pulp is the main export product both in terms of volume and value (Babitha, 2009). It accounts for about 20% of the processed fruits and vegetables exported from India (MFPI). Chittoor District of Andhra Pradesh and Krishnagiri District of Tamil Nadu, both in South India, are the main sourcing centers of Indian mango pulp (Mehta and George, 2003). Krishnagiri is the largest mango producing district in Tamil Nadu, about 6000 metric tons of the varieties Totapuri and Alphonso are used for pulp production (Raj, 2008). According to Raj (2008), there are 385 fruit processing units in Tamil Nadu out of which 80% are small industries with an average capacity of 5,5 tons per day and the remaining units are medium scale with an average capacity of 80 tons per day. India has a large production base and is competitive in terms of production costs (Jha, 2002). There is strong governmental support in developing the infrastructure and there are improvements in the logistic sector that can be seen as major opportunities for the mango pulp sub-sector to function properly (MFPI). On the other hand, there are some major weaknesses and threats that hinder the performance of the sub-sector (MFPI).

The main weaknesses include a lack of marketing, low innovatively produce, few processing varieties, under capacity performance of the processing plants (on average of 50 days per year) and poor infrastructural works such as storage and cool chain facilities and repeated power cuts during the period of processing (Raj, 2008). The report by MFPI indicated the presence of large numbers of middlemen in the chain as another weakness for the sub-sector. This has resulted in the fact that mango growers get variably low prices for their mangoes. For instance, the farm gate price for one kg mangoes is € 0,05 (Mans Lanting, personal communication; Kruijssen & Sudha, 2008). However, the farmers cooperative in Tamil Nadu pays an average of € 0,14 per kg (Aharam, interview). The major threats for the Indian mango pulp sub-sector include the availability of other sources that supply mango pulp of good quality with relatively lower price, low volume of mangoes available for large pulp processing factories due to high fragmentation of mango growers, and increased need for high volumes and standardization in the international market (MFPI).

Furthermore, despite the fact that India is the world's largest mango producer, so far export of mangoes and mango pulp from India has not been considerable (Jha, 2002). The major trade partners for mango pulp with India are mainly located in South East Asia, Middle East and Central Asia (MFPI). The major importers of Indian mango pulp include Saudi Arabia, the Netherlands, UAE, Yemen and Kuwait (APEDA, 2008). However, only small amounts of mango pulp are exported to Europe (Babitha, 2009). As a result, European demands are fulfilled by imports from South America and Africa. The plausible reason for limited export from India to Europe could be due to transport prices and possibly quality aspects.

It is a must for Indian exporters to be HACCP certified to export mango pulp from India to Europe (MFPI). However, HACCP has not been followed by most of the pulp industries in India (Mehta and George, 2003). Aharam, a cooperative which is in Tamil Nadu with 5000 member-farmers has no HACCP certificate (interview with Ahmara). Mehta and George (2003) mentioned several reasons for Indian processors not adopting HACCP. These include among others seasonality of the industry, the small size of industries, high costs for old factories to renovate and lack of funds. Additionally, the current target markets mainly focus on price and not on HACCP (Mehta and George, 2003). Mehta and George (2003) also mentioned that it is costly to obtain ISO certification.

Other bottlenecks for the Indian mango pulp to penetrate the European and American markets are the issues of pesticide residues and other SPS requirements (Jha, 2002; Das, 2008). There are also other issues that affect quality and acceptability of the Indian mango pulp in the European market. For instance, Mehta and George (2003) indicated that mango pulp from India is brownish colored and packed in punctured bags. They also indicated that the drums in which the pulp is exported are of poor quality. This low quality packaging material could be attributed to a lack of available quality material in the domestic market as a result of either lack of technology in the country or high cost (Mehta and George, 2003).

With this in mind, the following chapters will find their reason of being by deepening this information and providing a more general overview on different topics.

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Chapter 2 – Market structure

Introduction

In this chapter the mango production at global, national and regional scale will be reviewed, with emphasis on the supplier situation in Tamil Nadu. Export relationships are described zooming in from the world market to India and more specific the region of Tamil Nadu. Mango imports to the European Union are analyzed and finally special attention is paid to the processed mango market.

Research questions

What are the characteristics of the Indian and European market structure?

- What demand side structure exists in Europe/Netherland for conventional mango pulp?
- What supply side structure exists in India, Region Tamil Nadu?
- How is the (processed) mango demand of the EU met?

Global mango production and trade

Within international trade, fresh mango is one of the main products. It possesses a fifth place on total fruit crop production globally (Tharanathan *et al.*, 2006), accounting for over one-third of the worldwide production on tropical fruits (Maneepun & Yunchalad, 2004). Mangoes are grown on all continents (Galán Saúco, 2004), at least 87 countries were involved in mango production by the year 2000 (Galán Saúco, 2004; Tharanathan *et al.*, 2006). Around 25 million tons have been grown in 2000 (Galán Saúco, 2002; 2004; Maneepun & Yunchalad, 2004) of which three-quarters in Asian countries. India is by far world leader with almost half of the global mango production, however exports only a very small amount of this. Mexico, Pakistan and the Philippines are the most important exporters for fresh mangoes with 41%, 7,6% and 7,8% of the global supply respectively (Galán Saúco, 2002; 2004). International trade in mango has risen significantly by the end of the twentieth century (Galán Saúco, 2004), enabled by improved post-harvest techniques (Maneepun & Yunchalad, 2004). Over a million tons were traded in 2006 (FAOSTAT). Large markets for fresh produce are the EU, North-America and Asia (Galán Saúco, 2002; 2004).

Indian mango production and trade

Being the major economic fruit crop within India, production of mangoes comprises cultivation of a large number of varieties and at present over a thousand are known (Tharanathan *et al.*, 2006). Andhra Pradesh is the main production area while Uttar Pradesh, Bihar, Karnataka, Himachal Pradesh, Maharastra, Orissa, Tamil Nadu, and West Bengal also produce mangoes in large quantities (Tharanathan *et al.*, 2006). In 2000 total Indian fresh mango export did not exceed 50.000 tons and has been calculated as 0,4% of global exports (Maneepun & Yunchalad, 2004). Export volumes of fresh mango, mangosteens and guavas have risen fast since the year 2000, from little under 40.000 tons to over 250.000 tons in 2006 (FAOSTAT). According to FAOSTAT, India's largest export partners in 2005 were Saudi Arabia (50.000 tons),

United Arabian Emirates (41.000 tons), Bangladesh (35.000 tons), Yemen (17.000 tons) and the Netherlands (12.000 tons).

Mango production and trade in Tamil Nadu

Tamil Nadu accounted for 4 to 5,6 % of the total Indian mango production in recent years (National Horticulture Board). The number of farms in Tamil Nadu was 7.858.887 in 2000 with an average farm size of 0,89 ha, the vast majority were small scale farms (Statistical handbook of Tamil Nadu). According to the same source, in 2007 four cooperatives of fruits and vegetable growers existed in Tamil Nadu and in 2005-2006 fresh and processed fruits, nuts, peels, citrus fruits and melons made up 1,3 % of total Tamil Nadu exports, based on economical value. Since the mid-nineties an expansion of the area under mango cultivation was recorded to the double by 2005-2006, in the same time span productivity was lowered by 27% and this resulted in a total production increase of 50% (Season and Crop Report of Tamil Nadu 2005-06). Within the region, significant differences exist in productivity: the three main mango producing districts together yielded in 2005-2006 over 50 % of total Tamil Nadu production as shown in table 2.2. High production in a district can be either attributed to a large area under cultivation e.g. Krishnagiri, or high productivity e.g. Theni (Department of economics and statistics). For the Tamil Nadu region major export partners for fresh mangoes and mango pulp are presented in table 2.1:

Table 2.1: Major export partners of Tamil Nadu for fresh mangoes and mango pulp.
Source: Domestic & export market intelligence cell

	Fresh mangoes	**Mango pulp**
1	Bangladesh (58%)	Saudi Arabia (32%)
2	United Arabian Emirates (18%)	United Arabian Emirates (18%)
3	Saudi Arabia (6%)	Netherlands (8%)
4	Kuwait (3%)	Kuwait (7%)
5	UK (2%)	UK (4%)
6	Belgium (2%)	Germany (2%)
7	USA (2%)	Sudan (2%)
8	Bahrain (1%)	Canada (2%)
9	Spain (1%)	
10	Oman (1%)	

Table 2.2: Estimated mango production in Tamil Nadu per district (2005-2006).
Source: Department of economics and statistics
[a] calculated values
[b] sum of the 15 not mentioned districts

District	Area (ha)	Average Yield (tons ha^{-1})	Total yield (tons)
Kancheepuram	2.666	7,1	19
Thiruvallur	9.944	3,6	35
Villupuram	1.153	2,5	3
Vellore	12.327	3,0	36
Thiruvannamalai	672	8,8	6
Salem	2.274	4,9	11
Dharmapuri	8.799	3,5	31
Krishnagiri	34.780	2,9	102
Coimbatore	3.805	1,9	7
Tiruchirappalli	2.346	2,2	5
Madurai	6.066	5,4	33
Theni	8.582	12,3	106
Dindigul	14.074	5,3	75
Virudhunagar	2.000	7,0	14
Tirunelveli	4.343	2,5	11
Kanyakumari	1.648	2,6	4
Other [a,b]	9.625	4,2	40
Tamil Nadu	**125.104**	**4,3**	**538**

Mango varieties in Tamil Nadu

The main varieties of mango grown in Tamil Nadu comprise Totapuri, Sendhuri/Sentharu, Peter and Neeham. Totapuri accounts for approximately 80% of the total production while the others are mainly grown for the regional market with respectively 5%, 5% and 10% of total production. A small percentage of Alphonso is grown in Tamil Nadu; this variety is predominantly grown 400-1500 km north of the studied area (M. Lanting, personal communication).
For the purpose of processing, Totapuri is the main variety of interest; Alphonso might be interesting as well, although not grown by smallholder farmers, for prolongation of the harvest and processing season (M. Lanting, personal communication).
Synonyms for Totapuri are Bangalora, Collector, Kallamai, Killi (Gillig), Mukku, Sandersha and Thevadimuthi. Quality is relatively low. Ripening is late midseason and fruits are fibrous and large with 800-1100 gram a piece. Productivity is high compared to other varieties and bearing quite regular (Okie, 1999).
Alphonso is also known under the names Appus, Badami, Gundu, Haphus, Kagdi, Khader and Khader Pasand. It is a low fibrous, high quality variety with an average fruit weight of 226 grams. Alphonso ripens during the late midseason and bears irregularly (Okie, 1999).

European mango imports

The EU imported over 170.000 tons of fresh mangoes yearly by the end of the twentieth century (Galán Saúco, 2002; 2004). By 2006 the total import of fresh mangoes, mangosteens and guavas to the EU had increased to little less than 330.000 tons (FAOSTAT). Brazil supplied one third of the European market demand by the year 2000 and thereby is the main exporter to Europe (Galán Saúco, 2002; 2004). The Netherlands are the major European importer with over 60.000 tons in 2000, followed by France, Germany, the UK and Belgium/Luxembourg (Galán Saúco, 2002). AgroFair is one the European importers working in the Netherlands and more information can be found in Box 1.1 below and Appendix 1.1 at the end of this chapter. However, the Netherlands and Belgium are redistributors for the European market which results in a biased overview on the actual import (Pamco). Major import partners for the Netherlands in 2005 were Brazil (50.000 tons), Peru (13.000 tons) and the USA (5.000 tons), furthermore small quantities were obtained from several countries in southern Europe, South America and Africa [FAOSTAT].

Box 2.1 Mango pulp as niche product

AgroFair is a large Dutch importer of Fair-trade fresh and processed fruits. Import of mango pulp is seen as a service to facilitate farmers in selling (part) of their mangoes not suited for fresh export. According to AgroFair's manager Frank Gruijs, the imported quantities are small and demand is limited. Therefore mango pulp is considered a niche market and no major efforts are put on expanding this business.

Processed mango market

Less than 0,02% of the global mango production enters the world market as processed produce (Galán Saúco, 2004). In 2000 little less than 7.000 tons of mango pulp (13°-18° Brix) has been traded according to the FAO, with Thailand as major exporter accounting for 97% (Galán Saúco, 2004). By 2006 this has risen to 12.500 tons (FAOSTAT), whereas concentrate (28° Brix) was exported to Europe in small quantities from India and Colombia mainly (Galán Saúco, 2004). Following the same authors, mango was traded in 2000 for a total of 18,6 tons of which India supplied around 70% and Egypt almost 20%; moreover, chutney produced from mangoes was imported to the EU predominantly by Germany, the Netherlands and the UK and consisted of 5.549 tons mainly from India.

In contrast to the above stated numbers, DGCIS reported substantial mango pulp exports from India. In the annual volume 2004-2005 Saudi Arabia (29.562 tons), Yemen (14.530 tons), the United Arabian Emirates (8.228 tons) and the Netherlands (7.189 tons) represented the largest importers of Indian mango pulp, with a total export of 90.989 tons (DGCIS annual volume 2004/2005; Pamco). According to figures of Pranav International, India would supply over 60% of the global exported mango pulp followed by Mexico and Colombia with respectively around 10% and 7,5%of the global supply (Pamco).

Demands for mango pulp are increasing by 8% between 2003 and 2008 according to projections of Pranav International (Pamco). Areas with a high demand are South-East Asia, Middle East, South Asia, North America and Africa, all with a demand ranging from 50 to 85 thousand tons (Pamco). The demand in the European Union is projected at 16.200 tons for 2008, which is less than 5% of global demands (Pamco).

Conclusions

From the supply side, the Indian mango market is characterized by a high level of fragmentation. Many small-scale farmers grow mangoes in an extensive system. Mango supply is high in India and Tamil Nadu, with great differentiation in productivity between districts and an uneven allocation of mango cultivation. Imports of mango pulp to the European Union are relatively small on a global scale. A major part of the European imports come through the port in Rotterdam which makes the Netherlands the main importer of mango pulp in the EU. As far as information has been found, only a small number of importers of mango pulp are present.

Indian exports are predominantly focused on Asia and the Middle-East, while the domestic market is as well an important outlet. European demands are fulfilled with imports from South America and Africa. Probably this separation of markets is caused by transport prices and possibly quality aspects like hygiene play a role in preventing importers from trading with India as well. Both demand and supply of mango pulp are expected to increase. South America and Africa produce mangoes in a more commercial way than India and can therefore compete very well while they also grow chiefly varieties which are rewarded better by the consumers. For India the domestic and regional markets seem more suited as trade focus while they provide a better fit to the current production practices and are in general less quality oriented but more focused on the price.

After giving a sound overview of the current macroeconomic situation in the mango business, it is now possible to explore which laws and regulations should be followed for importing mango pulp from India to the Netherlands, and this will be accurately done in the following chapters.

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Chapter 3 – Regulations

Introduction

In order to set up a working and efficient value chain from India to Europe it is fundamental that both public and private regulations are followed and their requirements are met. Generally speaking, public regulations are always compulsory and set up a minimum level of (quality and safety) standards which actors and products must stick to. On the contrary, private standards are always applied on a voluntary base although the latter are actually those who really add value to the product and the process. This chapter is divided in two parts, the first part deals with public regulations and the private regulations are treated in the second part.

Importing mango pulp into the European Union requires meeting several legislations, constraints and quality levels: exporters in the entire world know well that the European market is the most difficult channel to enter in terms of quality of the product. The mango pulp imported in the EU territory must comply with general conditions and specific provisions designed to prevent risks to public health and protect consumers' interests. It has to face some tariffs and duties and needs to be accompanied with several documents, depending on the country of origin and of the type of product.
In the coming paragraphs at first the Codex Alimentarius requirements referring to the international mango pulp trade are introduced, then a review is presented and the relevant information coming from the European legislative bodies is summarized. General principles and requirements of Food Law will conduct to the General hygiene rules and to the other specific Regulations. Concepts about the conditions concerning contaminants and residues applicable to the mango pulp, the conditions of product preparation and the official controls will be given. The first part concludes with the calculation of tariffs and duties applicable to mango pulp and a review of the most important and mandatory documents traders have to deal with. When reading this chapter it is important to have in mind that many requirements and recommendations will reveal to be determinants in the interpretation of succeeding chapters of this report, from the transportation to the mango pulp quality, to the processing methods and to the costs, up to the supply chain coordination.

The chapter’s second part deals with private quality and safety standards and Fair-trade requirements. These private regulations are often regarded as those factors that can add value to both process and product and make the difference in terms of marketing possibilities. In the second part private regulations are regarded that may be interesting to meet in order to improve farmers’ living conditions and increase income. In particular, the possibility of starting a mango pulp business under the moral of Fair-trade from India is considered but has to be rejected for the moment as is explained. This chapter concludes with a general overview on private quality standards that are recognized to give the product more chances to be marketed on the niche markets.

Research questions

What are the regulations which influence the organization of the India – Europe (INEU) mango supply chain?

- Which are the constraints set up by the European Union (EU) to import conventional processed mangoes in terms of traceability, GMO, contaminants, packaging and processing?
- How do the main private regulations (GLOBALGAP, HACCP, ISO, etc.) contribute to the INEU Mango Supply Chain?
- How do Fairtrade regulations contribute to the INEU mango chain?

3.1 - Public regulations

The Codex Alimentarius

The Codex Alimentarius Commission is an international organization with the aim at gathering the FAO/WHO Food Standards Program elaborating worldwide food standards and recommendations. The Codex Alimentarius established some specific standards for the liquid pulpy mango in the document: CODEX STAN 149-1985 regarding various aspects, from the maximum level of contaminants to the labeling characteristics.

In first place it declares that the minimum content of mango as ingredient of the concentrated pulp fruit ingredient shall not be less than 30% m/m [mass/mass]; that the soluble solid content of the product has not be more than 20% m/m (determination by refractometer at 20 °C) and that the maximum ethanol content is fixed at 3 g/kg. Only lemon juice, lime juice, honey and sugars accepted by the Codex Commission may be added to the product. During transportation, the mango pulp shall occupy at least 90% v/v [volume/volume] of the water capacity of the container (where the water capacity of the container is the volume of distilled water at 20 °C which the sealed container will hold when completely filled). In the matter of contaminants, especially having in mind the materials of transportation of the product and the methods of processing of the pulp, the maximum levels for the relevant metals are as follows:

Arsenic (As) 0.2 mg/kg
Lead (Pb) 0.3 mg/kg
Copper (Cu) 5 mg/kg
Zinc (Zn) 5 mg/kg
Iron (Fe) 15 mg/kg
Tin (Sn) 250 mg/kg
Sum of copper, zinc and iron 20 mg/kg
Sulphur dioxide 10 mg/kg

Citric and Malic acid maximum levels are limited by the GMP, but more importantly, limits are set in the above EU food Law.

In the same document the Codex Alimentarius Commission recommends preparation of the produce in accordance with the International Code of Hygienic Practice for Canned Fruit and Vegetable Products (Ref. No. CAC/RCP 2-1969) and the General Principles of Food Hygiene (Ref. No. CAC/RCP 1-1969, Rev. 2-1985). Moreover the product must be free from micro-organisms capable of development under storage conditions and from any substances originating from these in amounts potentially dangerous for the health, in order to preserve the quality of the mango pulp. This will be better explained in he below mentioned EU Regulations and in chapter 6 which is dedicated to quality.

Moreover the trader, during the transportation procedures, has to take in consideration the articles of the Codex General Standard for the Labeling of Pre-packaged Foods (CODEX STAN 1-1985, Codex Alimentarius, Volume1). For this reason the name of the product shall be "mango nectar" or "pulpy mango nectar" or, in case the amount of fruit contained is more than 50% m/m, also "mango juice" or "pulpy mango juice". Only images of mangoes or of mango nectar are allowed to be represented on the label and the "minimum fruit content" (as percentage), the "date of minimum durability" (in month and year) and the storage conditions, should appear on the label. If the product is transported in containers, the labeling information required from the Codex shall be shown on the container or in an accompanying document as well.

EU directives and regulations

Before digging into the European legislation it is important to clarify some concepts referring to the EU Directives and Regulation: both of them are legislative acts of the EU which apply to all the EU territory with the same importance. The Directive is addressed to the member states to achieve a particular result in a certain matter without dictating to the member states the means of achieving that result. Regulations are different because these are self-executing and do not require any implementation measure from the member state.

Principles and requirements of the General Food Law

Some basic food law requirements that can be applied to all food imported into the EU are laid down in Regulation (EC) No. 178/2002, the so-called General Food Law, which among others, covers three main topics.

First, the “Compliance or Equivalence”: Imported food must comply with the relevant requirements of all the EU food laws or to the food requirements of other states recognized as equivalent by the EU.

Secondly, the “Traceability”: General Food Law addresses this requirement to all the food business operators and defines it as “the ability to trace and follow food and ingredients through all stages of production, processing and distribution”. So also EU importers are affected since it is requested to identify from whom the product was

exported in India. Specific provisions for further traceability exist, but the main issue of the traceability is to ensure that the business operators are at least able to identify the actors in the step before and the step forwards of their own supply chain, to match the lots of material purchased from their suppliers and the lots of product sold to their customers.

Third issue: the responsibilities of the food importer. Which states: "*Food business operators at all stages of production, processing and distribution within the businesses under their control shall ensure that foods satisfy the requirements of food law which are relevant to their activities and shall verify that such requirements are met*". If a food business operator realizes or has reason to believe that the handled food is not in compliance with the EU food safety requirements, the only procedure to undertake is to immediately initiate the procedures of withdraw of the food in question and to inform the EU competent authorities.
Matters described in the General Food Law as traceability and responsibility of the food importer are of extreme importance and not often executed from the operators, but in case a sustainable coordination of the supply chain is projected, these requirements become the first procedures the Indian actors have to pinpoint.

General hygiene rules

Regulation (EC) No. 852/2004 of the European Parliament and of the Council of 29 April 2004 contains the relevant hygiene rules that processors and importers of mango pulp have to comply with; in general the operator has to pay attention to monitor the food safety of products and processes under his responsibility. This regulation also refers directly to the procedures based on the Hazard Analysis and Critical Control Point principles. In the current situation of the Indian processes, the HACCP is the most difficult goal to achieve both in term of added costs and in term of certification of the quality of the process, as will be shown in the following chapters.

In case any trouble related to the safety of the food incurs, in articles 19-21 of this regulation is stated: [Article 19]*"The food from a third country that does not comply with the food law shall be placed under official detention by the National authority and the food business operators responsible for the consignment shall take the following measures: order that such feed or food be destroyed, subjected to a special treatment in accordance with Article 20.1".* This means that the only alternative ways at destroying the product are treating [Article 20.1]*" ..or processing to bring the food into line with the requirements of Community law"* or re-dispatch the *"consignments outside the EU in accordance with Article 21.1".*This last possibility only can be undertaken in case [Article 21.1] *"a)the destination has been agreed with the feed or food business operator responsible for the consignment; b)the food business operator has first informed the competent authority of the third country of origin or third country of destination; c)when the third country of destination is not the third country of origin, the competent authority of the third country of destination has notified the competent authority of its preparedness to accept the consignment".*

Furthermore Article 27 states that *"Member states may collect fees or charges to cover the costs occasioned by official controls"… " they shall make public the method of calculation of fees".*

Finally, in coherence to assure the equivalence of standards of foreign countries with the European ones (first point explained of the General Food Law), the last relevant article is n.46.1, which establishes the possibility of EU official controls "..*in third countries in order to verify the compliance or equivalence of third-country legislation and systems with the EU food law".*

The following link provides the possibility to obtain background information by accessing the Food Hygiene & Safety magazine from the Health and consumer protection Directorate-General for the implementation of HACCP
http://ec.europa.eu/food/food/biosafety/hygienelegislation/index_en.htm

General conditions concerning levels of pesticide residues in the food

"Residues" are those substances that can occur in any foodstuff because of phytosanitary products and that can remain in the final product and arrive to the final consumer. For this reason the EU food law, in order to ensure a high level of health protection, has determined the Maximum Residue Limits in order to lay down officially the permissible limits of residues and contaminants. Member states of the EU will not accept products containing pesticide residues exceeding the quantity of MRL's, since these limits are set for all the substances present in the food that can reveal toxic thresholds. The Regulation (EC) No 396/2005 sets up all the harmonised maximum levels of pesticide residues for agricultural products, also intended for food to be used as processed in so far as they may contain pesticide residues.
The relevant MRL's for Fresh mangoes can be found under this link:
http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=commodity.selection
and are presented in the literature accompanying this report. Mango pulp has to comply with these MRL's in the measure that is needed, taking in consideration the Article 20.1 of this regulation, which states: *"The MRL's applicable"* have to take *"into account changes in the levels of pesticide residues caused by processing and/or mixing".* In any case, drawing on the suggestion of some Indian mango growers and some mango processor, the quantities of pesticides spread in the Totapuri fields of Tamil Nadu are considered really scarce and not comparable to the European common usage. So we suppose that the imported mango pulp will difficultly incur in residual emergencies.

General conditions concerning levels of contaminants in the food

"Contaminants" have to be intended as substances that can unintentionally enter the food (mango pulp) during its production or the whole supply chain. These can include environmental pollutants, especially dioxins and metals (among these "tin" is relevant, widely used as package in the wholesale logistics, as explained below). Certain foodstuffs (in this case fruits and fruit juices) may not contain higher contaminant levels than specified in regulation (EC) 1881/2006 when placed on the market.

This regulation covers four different categories of contaminants: nitrates, aflatoxins, heavy metals (lead, cadmium, mercury) and 3-monochloropropane-1,2diol (3-MCPD). The MRL's relate to the final product but apply also to the ingredients used for production.

Packaging: materials intended to come into contact with the food

Materials and articles intended to come into contact with mango pulp must be manufactured so that they do not transfer their constituents to food in quantities which could endanger human health, change the composition of the food in an unacceptable way or deteriorate the taste and odor of foodstuffs.
The regulation (EC) No. 1935/2004 establishes a list of groups of materials and articles (such us plastics, ceramics, rubbers, paper, glass) which may be covered by specific measures that include a list of the authorized substances, special conditions of use, purity standards etc. Commission Directive 2002/72 EC of 6 August 2002 gives special provisions for plastic materials intended to come into contact with the food or intended for the packaging of the food.
The annex V of the same directive establishes the "Declaration of Compliance", mandatory for every business operator which manufactures or imports the plastic materials or substances intended for the manufacturing of those materials.

Authorized food additives

The directive 89/107/EEC is the one establishing roles on the usage of food additives as ingredients during the manufacturing of food or as ingredient of the finished product (e.g. colorants, sweeteners, preservatives, emulsifiers, stabilizers, raising agents). It states that the only substances which may be used as food additives are the ones placed in the common lists approved by the EU and they have to be used under the conditions of use mentioned in these lists. This means that the Indian processing industry has to respect these limitations, regarding sugars and acidifiers and has to take into account the EU vertical directive on juices, mentioned below.

Specific provisions are applied to foodstuffs intended for particular nutritional uses (such as baby foods, dietary foods, gluten-free foods), as well as other specific requirements on composition, hygiene, labeling, additive lists, purity criteria and so on which can be found in the EU website.

Controls from authorities

(Regulation (EC) No 396/2005. Article 26.2) Competent authorities in member states will carry out regular controls on imported mango pulp to ensure the compliance with the EU general health rules. The controls may apply on the importers, inside of the EU, and/or in any other stage of the food chain (manufacturing, processing, storage, transport, distribution and trade).
In particular controls on pesticide residues will consist of sample analyzing and identification of the levels of pesticides. Further information may be found in the Health and Consumer Protection Directorate General (DG SANCO) website.

Some important guidance documents:
Guidance on the implementation of Traceability of the General Food Law http://ec.europa.eu/food/food/foodlaw/guidance/guidance_rev_7_en.pdf
Questions related to import requirements, rules in matter of food hygiene and official food controls:
http://ec.europa.eu/food/international/trade/interpretation_imports.pdf
Guidance document on the implementation of procedures based on the HACCP principles, and on the facilitation of the implementation of the HACCP principles in certain food businesses:
http://europa.eu.int/comm/food/food/biosafety/hygienelegislation/guidance_doc_haccp_en.pdf
Introduction to EC pesticide residues legislation:
http://ec.europa.eu/food/plant/protection/resources/intro_en.pdf

EU vertical directive for fruit juices and similar products

A vertical directive (Council Directive 2001/112/Ec of 20 December 2001) is present in the EU to organize the actors of the weaving factory of fruit juices and similar products and has to be taken into consideration in case of planning the chain coordination of mango pulp. It shall apply to all the actors of the chain including importers and wholesalers in the EU who trade mango pulp as ingredient of fruit juices. This directive recalls mainly some codex recommendations on the matter of labeling and gives some important definitions, in annex I, for the EU about "fruit juice from concentrate" and "fruit nectar" as presented:

"Fruit juice from concentrate: the product obtained by replacing in the concentrated fruit juice water extracted from that juice during concentration, and restoring the flavours, and, if appropriate, pulp and cells lost from the juice but recovered during the process of producing the fruit juice in question or of fruit juice of the same kind. The water added must display appropriate characteristics, particularly from the chemical, microbiological and organoleptic viewpoints, in such a way as to guarantee the essential qualities of the juice."

"Fruit nectar: the fermentable but unfermented product obtained by adding water and sugars and/or honey to Fruit juices or to concentrated fruit juices, to fruit puree or to a mixture of those products. The addition of sugars and/or honey is permitted up to 20 % of the total weight of the finished product."

In the same directive it is specified that the allowed quantities of sugar to be added in the juice, notwithstanding the ones established in the Codex Alimentarius, may not exceed 150 g per litre. Besides, the addition of lime or lemon juice (fresh or concentrated) may not exceed 3 g (expressed as anhydrous citric acid) per litre of juice. In this directive the use of carbon dioxide as ingredient is authorized.

In annex IV some special provisions state that in mango juice nectar a minimum percentage of 25% (% by volume of finished product) of mango pulp is required.

Labeling

This paragraph was intended as a summary of all the relevant information that a wholesaler intending to use mango pulp as ingredient for juices has to take into account. In the end of the chapter the references are presented to dig deeper into the labeling requirements for juices in case the trader desires to actively participate and cover the final stages of the supply chain and to present the product to the final consumer.

All the foods marketed in the EU have to comply with the internal labeling rules, aimed at ensuring the essential information and enabling informed choices to the consumers. Besides this, any additional information included by the manufacturer on a voluntary basis should be accurate and should not mislead the consumer.

Labels of any food traded in EU have to comply with the general rules laid down in the Council Directive 2000/13/EC of the European Parliament and of the Council of 20 March 2000. It is there established that *"..the list of ingredients"* in the label of the final product *"must show all ingredients (including additives) in descending order of weight as recorded at the time of their use in the manufacture and designated by their specific name.."* Moreover it is mandatory to declare: the name or the business name and address of the manufacturer, packager or importer established in the EU; the place of origin or provenance of the product; the lot marking on pre-packaged foodstuffs with the marking preceded by the letter "L". Such information has to appear on the package or on a label attached to the pre-packaged product, clearly legible and indelible, easy to understand and in the official language(s) of the member state where the product is marketed.

The Directive 2000/13/EC, that in the coming future will be replaced by the Proposal COM (2008) 40, states that the name under which the product is sold has to be clearly declared in at least the language of the EU member states where the product is marketed; that the physical condition of the mango pulp and the specific treatment it has undergone (concentration) must be included and that trademarks, brand name or other names may be used only in addition to the name of the product.

EU Labelling Law, List of applicable legislation:
http://exporthelp.europa.eu/update/requirements/ehir_eu09_01v001/eu/auxi/eu_lblfood_leg_general.pdf

Tariffs and taxes

The Harmonized System, or Harmonized Commodity Description and Coding System, is a nomenclature adopted by more than 200 countries which organizes the worldwide traded commodities in about 5.000 groups in a hierarchical path, for the classification of custom tariffs. The EU developed the 8-digit code Combined Nomenclature, based on the HS nomenclature, to classify products and to meet the requirements of its Common Customs Tariff.

With regards to mango pulp, here we report the Integrated Tariff of the European Communities (TARIC), which is based on the CN, and which identifies goods in a way that include all the trade policies and tariff measures applicable in the EU (including temporary suspension of duties, antidumping duties, etc.). The specific TARIC code for mango pulp is 2007101000 and the below reported tariffs and duties are set for a simulation date of July 2009 while considering the origin of the pulp from India.

Taking into consideration the regulation 2658/87 and the modification R 2204/99, the applicable duty is 24.00 % + 4.20 EUR / 100 kg of product. Because of the regulation R 0732/08 and article 6.3 of regulation (EC) No 732/2008 (OJ L 211), the Tariff Preference amounts to 20.40 % + 4.20 EUR / 100 kg (having in consideration that according to the Tariff Preference India belongs to the disadvantaged geographical group with code "SPGL", which means application of a discount or advantage in comparison to other countries). The shown costs are quite high and play a central role in the costs assessment, besides all the other costs shown in chapter 8.

The above calculations have been made from the following EU website. They are a projection of the duties in the legislations that are expected being in act in the future date, but they have not to be intended as a result officially published for the real future duties: http://ec.europa.eu/taxation_customs/dds/cgi-bin/tarchap?Lang=EN

Official documents relevant for the import-export

Along the supply chain and the logistic steps, the exporter and the importer of mango pulp will be required to show and apply for a certain amount of documents, on the request of the local authorities, of the EU and of the other trade operators. A list of the most important documents is presented here with a brief description of their meaning and value and the concerning specimens.

Customs Import Declaration (SAD)

As declared in the common import declaration of the Community Customs Code [Regulation (EEC) 2913/92], "*all goods imported into the European Union (EU) must be declared to the customs authorities of the respective Member State using the (SAD)"*, which is the common European import declaration form. Other relevant information about that can be found on this website:
http://www.prochile.cl/nexos/madrid_manzanas_anexo8.pdf

Other documents associated to the SAD

According to the nature of the imported goods, additional documents shall be declared and presented together with the SAD: the "Certificate of origin", normally used to apply a tariff preferential treatment; "Freight Document"; "Commercial Invoice"; "Customs Value Declaration" and Inspection Certificates ("Phytosanitary certificate" or others).

Certificate of Origin

This document, submitted by the exporter, certifies the origin of the imported goods. Specimen can be found at the following link:
http://madb.europa.eu/mkaccdb2/viewPageIFPubli.htm?datasetid=MAIF-IN09-01v001&filename=cf_orig.html&hscode=2007&path=/data/website/madb/egif/prod/MAIF-IN09-01v001/&imagepath=/egif/prod/MAIF-IN09-01v001/&page=&country=India&countryid=IN

Bill of Lading

The Bill of Lading (B/L) is a freight document (transport document), merely logistic, issued by the shipping company to the operating shipper. It serves as proof of receipt because it declares that the goods have been received on the ship and it obliges the operating shipper to deliver the goods till the consignee. "Clean Bill of Lading" means that the received goods are in an apparent good condition; "Unclean Bill of Lading" states that the goods on board were already damaged or in bad order: in this case the financing bank may not accept the consignor's documents.

Road Waybill (CMR)

The Road Waybill (transport document) contains the details of the international transportation of goods by road, based on the CMR Convention. A CMR is issued for each vehicle and it enables the transporter to have the goods at his disposal during the transportation.

Commercial Invoice

The Commercial Invoice is the document in which a record of the transaction between the exporter and the importer is drawn down: the exporter will charge the importer by issuing a commercial invoice once the goods are available. The commercial invoice has to be prepared by the exporter according to standard business practice and it will contain the basic information of the transaction. This document is the basis of commercial transactions and is a proof in the supply chain.
Specimen can be found at the following link:
http://madb.europa.eu/mkaccdb2/viewPageIFPubli.htm?datasetid=MAIF-IN09-01v001&filename=invoice.html&hscode=2008&path=/data/website/madb/egif/prod/MAIF-IN09-01v001/&imagepath=/egif/prod/MAIF-IN09-01v001/&page=&country=India&countryid=IN

Customs Value Declaration

In case the value of the imported goods exceeds € 10.000,- the Customs Value Declaration must be presented to the customs authorities in order to assess the value of the transaction, to determine the taxable value (Custom Value) and then to apply tariffs and duties. The taxable value is calculated as the value of the merchandise, including all the costs faced until the point of entry in the EU (commercial price plus transport plus insurance), and usually corresponds to the Transaction value (the price paid or payable for the imported goods).

Phytosanitary Certificate or Plant Passport

Taking into consideration the Directive 2000/29/EC, in case the trader wants to import fresh mangoes, the goods must be accompanied by a Phytosanitary Certificate, issued by the National Plant Protection Organization of India. For further information: http://ec.europa.eu/food/plant/organisms/imports/index_en.htm

Packing List

The packing list (P/L), documents of logistic competence, provides information on the imported items and the packaging details of the shipment (weight and bulk, handling issues etc.) and it is required as an inventory of the incoming cargo. Generally there is no need to be signed but in practice it happens that the two copies of the P/L are often signed. It has to be prepared by the exporter taking in consideration the standard business practice.
Specimen can be found at the following link:
http://madb.europa.eu/mkaccdb2/viewPageIFPubli.htm?datasetid=MAIF-IN09-01v001&filename=plist.html&hscode=2008&path=/data/website/madb/egif/prod/MAIF-IN09-01v001/&imagepath=/egif/prod/MAIF-IN09-01v001/&page=&country=India&countryid=IN

Identity of importer

This is a document used as identity card from the importer.
Specimen can be found at the following link:
http://madb.europa.eu/mkaccdb2/viewPageIFPubli.htm?datasetid=MAIF-IN09-01v001&filename=id_card.html&hscode=2008&path=/data/website/madb/egif/prod/MAIF-IN09-01v001/&imagepath=/egif/prod/MAIF-IN09-01v001/&page=&country=India&countryid=IN

Importer-Exporter Code

This is a document certifying that an importer submitted his profile to the authorities and consequently obtained the Importer/Exporter Code (IEC) number. The processing fee is 250 INR. In addition, the applicant must submit an IEC fee of 1.000 INR and a self-addressed envelope with a stamp of 30 INR with the application. The importer has to apply for the IEC and for the identity card at any regional office of the Directorate General of Foreign Trade (DGFT) of the EU, under the Ministry of Commerce and Industry.
Specimen can be found at the following link:
http://madb.europa.eu/mkaccdb2/viewPageIFPubli.htm?datasetid=MAIF-IN09-01v001&filename=ie_code.html&hscode=2008&path=/data/website/madb/egif/prod/MAIF-IN09-01v001/&imagepath=/egif/prod/MAIF-IN09-01v001/&page=&country=India&countryid=IN

Bill of Entry

This is a chain coordination document (in a prescribed form) filled out by the exporter and the importer which declares the value, the nature and the quantity of certain goods that are being shipped out.

Specimen can be found at the following link:
http://madb.europa.eu/mkaccdb2/viewPageIFPubli.htm?datasetid=MAIF-IN09-01v001&filename=b_ent.html&hscode=2008&path=/data/website/madb/egif/prod/MAIF-IN09-01v001/&imagepath=/egif/prod/MAIF-IN09-01v001/&page=&country=India&countryid=IN

Miscellaneous

In case of interest, the Council Regulation (EEC) 2092/91 sets out the rules for organic production of agricultural products and indications referring to organic food products.
For more information about the import procedures:
http://exporthelp.europa.eu/thdapp/taxes/show2Files.jsp?dir=/requirements&reporterId1=EU&file1=ehir_eu09_01v001/eu/main/ovr_eu_010_0612.htm&reporterLabel1=EU&reporterId2=NL&file2=ehir_nl09_01v001/nl/main/ovr_nl_010_0612.htm&reporterLabel2=Netherlands&label=Overview+of+Import+Procedures&languageId=en&status=PROD#Introduction

3.2- Private regulations

Fair-trade regulations deal with a set of standards and requirements that must be met in order to get the produce certified under the moral of fair-trade. Beside these, there are three important generic quality assurance systems in the food sector. These are GLOBALGAP, HACCP and ISO.

Fair-trade

Before entering into the details of the fair-trade, it is wise to give a first description of what fair-trade is. First of all, the international organism which deals with the fair-trade issue is the Fair-trade Labeling Organization (FLO) which is an "*umbrella organization that links 20 labeling initiatives in 21 countries and producer networks representing fair-trade certified producer organizations in Latin America, Africa and Asia*" (FLO website).

According to FLO1 (2009) "*Fair-trade is a strategy for poverty alleviation and sustainable development*" dealing with assuring a higher, fair price to rural producers. "*A fair price for a product is one that covers the producer's cost of sustainable production.* (*On top of the production costs), FLO establishes a Fair-trade Premium which is invested in social, economic or environmental projects of improvement, decided upon democratically by producers within the organization or workers within the plantation*" (http://www.fairtrade.net/faq_links.html).

During these years, FLO has established a growing number of standards that must be met in order to receive the fair-trade certification. Under these circumstances, figure 3.1 below will shed some light on the issue.

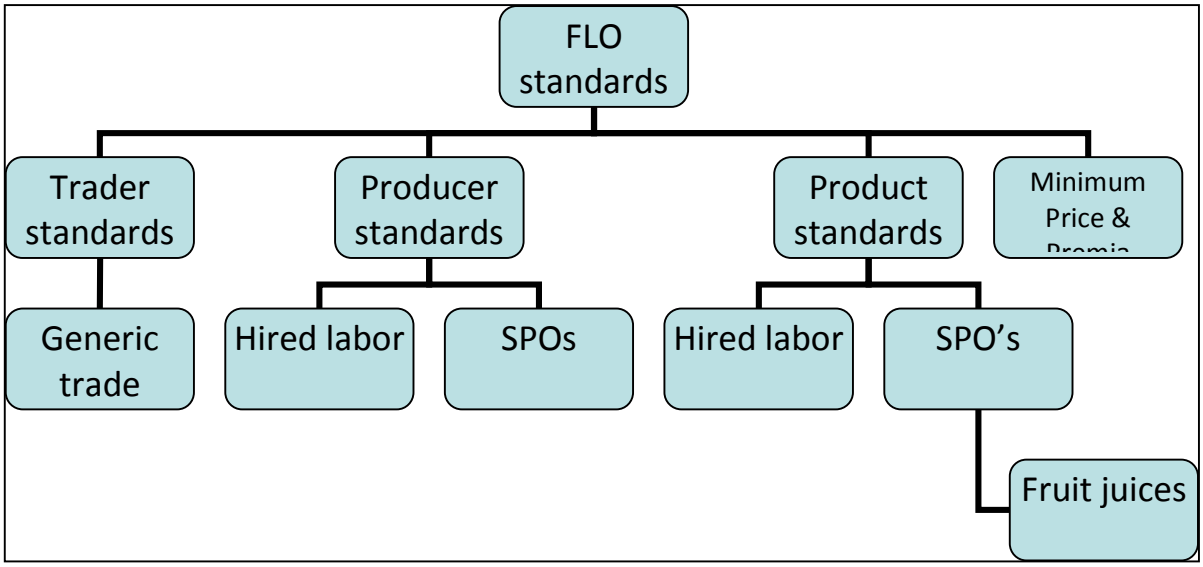

Figure 3.1

As can be sees, FLO has set several standards that must be met in order to receive the fair-trade certification. However, in this paper, only the most relevant will be analyzed and explained, i.e. those related to processed products (such as juices) and small producers' organization. For hired labor conditions, different standards should be applied.

Generic trade standards

Generic trade standards are valid regardless of how workers are structured and the traded product. They are based on document FLO1 (2009). These standards can be divided in terms of:

Certification: Every single operator involved in the value chain of the certified product must comply with the fair-trade standards, "*up to the point where the certified product is in its final packaging for the consumer*".

Traceability: Both buyer and seller of the product must be able to show where purchases have been made and where the produce is being sold ("one-up, one down" principle) in order to verify its fair-trade authenticity and protect operators and consumers. However, since fruit juices are among the category of products for which the principle of physical traceability is hardly achievable, new regulations are to be expected by FLO by the end of 2009. Documentation traceability (bills, invoices, etc.) is still to be applied to all products.

Contracts: Buyers and producers must sign a contract where volume, quality, price, payment terms and delivery conditions are clearly specified and mutually agreed on.

Sustaining trade: In order to create long-term relationships between buyer and producer and increase sustainable trade partnerships, it is recommended that buyers

provide farmers (when required) with information, training, risk sharing plans and other tools.

Pre-finance: In order to overcome the problems that small farmers face with formal credit markets, they can also request credit in advance to finance the harvest up to 60% of the total value of the contract itself. However, buyers are still allowed to charge an interest rate that is not higher than the buyer's cost of borrowing from a third party.

Pricing: Producers must receive from the buyer a "fair-trade minimum price" (established and updated by FLO) or the relevant market price where no fair-trade minimum price exists or the former is higher than the latter. On top of this, fair-trade payers must pay a "fair-trade premium" for the product.

Generic fair-trade standards for SPO's

After getting acquainted with the very general standards needed to receive the fair-trade certification, it is now possible to dig deeper into those producer standards which are especially designed for SPO's.
These standards are made up of requirements for which SPO's will be inspected. Given the scope of this paper, only the most significant minimum (ex-ante) requirements will be considered, whereas the progress requirements (which are associated with compliance over time, ex-post) will occasionally be mentioned. Information gathered in this section and more detailed information can be found in the document FLO2 (2009).

An accurate definition of small producers is necessary because they can only participate to fair-trade if they are part of a producer organization that is able to comply with fair-trade criteria in terms of different forms of development that will be clarified within the current section.

According to the above mentioned document, small producers must fit into these general definitions:

- *The producer's labor and that of their family members constitutes a significant proportion of the total agricultural labor undertaken on their farm.*
- *Most of the producer's working time is spent undertaking agricultural work on their own farm.*
- *Revenues from the producer's agricultural activities constitute the major part of their total income.*
- *The capital, assets and infrastructure required for agriculture are such that collective marketing is necessary in order to sell to the target market.*

Depending on the traded product, a further set of requirements for small farmers can be made; for fruit juices the following applies:

- *The number of permanent hired workers does not exceed a specific factor per hectare per crop, as defined by the certification body in its compliance criteria.*
- *Most of their working time is spent undertaking agricultural work on their own farm.*

- *Revenues from their agricultural activities constitute the major part of their total income.*
- *The production area under cultivation is below or at the level of the average range of farm size in the district or region.*

The "General Fair-trade Standard for SPO's" document is divided in various sections that are meant to underline how fair-trade triggers different forms of development and which requirements are needed to achieve them. Following this structure, we consider:

Social Development

1.1 Fair-trade must make a difference in terms of "*demonstrable empowerment and environmentally sustainable social and economic development of the SPO and its members*".

1.2 The majority of members must be small producers who do not constantly depend on hired workers, but run their farm mainly by using their own and their family labor. In order to meet this standard, they also have to produce more than 50% of the total produced volume.

1.3 The organization must comply with the cooperative principles of "*voluntary and open membership, democratic member control, member economic participation, autonomy and independence, education, training and information, cooperation among cooperatives and concern for the community*".

1.4 FLO expects the organization not to make any discrimination in terms of race, color, sex, language, political opinion, religion and so on among the members. They are chosen applying the same parameters and all stand the same participation and voting rights within the organization.

Socioeconomic Development

2.1 Fair-trade Premium "*is meant for investment in the social, economic and environmentally-sustainable development of the organization and its members and through them, their families, workers and the surrounding community. It is for the organization and its members to analyze and evaluate the possible options for spending the Fair-trade Premium. (Moreover), decisions on the use of the Fair-trade Premium are taken democratically by the members, following principles of transparency and participation*".

2.2 It is also expected that with the pass of the years, the organization becomes stronger and economically sustainable, also by adding value to the products they produce and taking higher control over the whole supply chain.

Environmental development

3.1 The organization is expected to make sure that the environmental impacts generated by its members' operations (planting, irrigating, harvesting, etc.) are properly planned, systematically implemented and monitored by a person within the

organization. This, in order to "*develop plans designed to mitigate those impacts*" on the whole eco-system. "*Initially, the plan will focus on the minimum requirements of the environmental standards. Over time the plan will also describe the actions that are needed to ensure compliance with the progress requirements*".

3.2 The use of agrochemicals is expected to be reduced to the maximum possible extent. They include all "*synthetics inputs directly or indirectly used in the production of agricultural products or in the maintenance of the processing equipment*". In particular, FLO prepared a list of prohibited materials. The organization will take care of the correct handling, usage, storage and registration of the exceptionally used and needed agrochemicals. The list can be found at: http://www.fairtrade.net/fileadmin/user_upload/content/FLO_Prohibited_Materials_List_Dec_2007_EN.pdf

3.3 Waste materials are properly handled and recycled according to their characteristics in order to improve environmental sustainability.

3.4 The organization is responsible to undertake practices and procedures aimed at reducing/preventing soil erosion and managing water resources. This must be done by raising awareness among the members and asking field specialists to make a continuous assessment and evaluation.

3.5 "*Producers are expected to prevent the use of fire in ways that adversely affect natural systems*".

3.6 Producers' organizations do not use genetically modified organisms neither during the production nor the processing stages.

Labor conditions

4.1 Within three years of certification, the organization will have developed an employment policy to be applied to all workers employed in the cooperative and those hired by individual members of the organization.

4.2 FLO pretends the organizations to comply with a certain number of minimum requirements dealing with the absence of discrimination (race, sex, religion, nationality, etc.) among its members, nor will tolerate psychological or physical mobbing, coercion or abuse.

4.3 FLO prohibits the use of forced labor (under all its many forms), bounded labor and child labor. Children younger than 15 cannot be contracted but just help their parents, as long as the farming activities they undertake do not hamper nor jeopardize their education.

4.4 Where there are a significant number of employed (hired) workers, the employer recognizes the freedom of association, collective bargaining and the "*right of all workers to join workers' organizations of their own choice and to collectively negotiate their working conditions*".

4.5 Where there are a significant number of employed (hired) workers, employers guarantee that salaries are equal or higher than regional averages or the official minimum wage for similar occupations. Moreover, maternity leave and social security conditions are to be guaranteed following the national regulations.

4.6 Where there are a significant number of employed (hired) workers, the organization must make sure that people undertaking potential hazardous work will be adequately trained and are not younger than 18 years, pregnant women or other fragile categories. "*All workers must have access to potable water and clean sanitary facilities*".

Fruit juices

According to FLO3 (2009), "*Fair-trade fruit juices are all types of fruit juices (except banana) for which fair-trade price exists*". No relevant requirements have to be applied.

Minimum Price and Premium

The last point regards the core characteristic of fair-trade which is in fact the minimum price and the premium that must be paid to producers (see the paragraph on Generic trade standards for definitions). In the FLO4 (2009) document, prices and premia for many fresh and processed products are reported. Regardless the above, apparently there is no specific information on mango pulp and juice from India and this is because there is no demand for Indian fair-trade mango pulp in Europe at the moment and therefore FLO is not interested in this kind of business (FLO, telephonic interview).

GLOBALGAP

Among the leading and most accepted European standards in terms of food quality and safety we find GLOBALGAP. This is a set of normative documents that see their roots in a long but continuous dialogue among several stakeholders involved in the whole agri-chain such as producers, cooperatives, agro-processing firms, retailers, supermarket chains, consumer associations, but also national governments and environmental organizations. This dialogue is based on the "people, planet and profit" concept and provides a protocol of ethical rules, recommendations, together with minor and major compliance criteria. The protocol GLOBALGAP provides is made up of general regulations, control points and compliance criteria and a checklist. These are cornerstones regarding good agricultural practices to which farmers have to stick when they want to show their commitment in the production process. This was made in order to facilitate the task of those farmers who want to join the modern value chains and produce fresh fruits and vegetables for supermarket chains and European export markets.

GLOBALGAP is a pre-farm-gate standard so that it only covers "*the process of the certified product from farm inputs like feed or seedlings and all the farming activities until the product leaves the farm*". For this reason, GLOBALGAP started a partnership with SGF in 2008, which will take care of the post farm-gate product processing. SGF

has set a list of private voluntary standards, checklists, requirements etc. SGF "*is responsible for checking the raw material markets as well as fruit processors, blending stations, traders, brokers, warehouses, cold stores and transport companies participating in the value chain system, in more than 56 countries throughout the world*" (SGF website).

The GLOBALGAP system includes a set of guidelines for agricultural practices aiming at assurance of minimum standards for production and storage. For instance, Table 3.1 shows the typical GLOBALGAP requirements for fruits and vegetables:

Table 3.1: GLOBALGAP requirements for fruits and vegetables
Source: www.eurep.org

Requirements	How to check
Traceability of products up to the farm	A documented system is required
Record keeping of farm activities	To be stored for two years
Record keeping of varieties and rootstocks	Quality certificates of seeds, nursery stock health certificates
Record keeping of site history and site management	Site characteristics, crop rotation
Soil and substrate management	Soil mapping, soil erosion management
Record keeping (fertilizer and pesticides usage)	Types, quantities, applications
Record keeping of irrigation activities	Quality and supply of water, rainfall documents
Record keeping of harvesting activities	Documented hygiene protocol, records on operations
Waste and pollution management	Types, quantities, recycling plan
Attention to worker health, safety and welfare	First aid boxes, training records
Attention to environmental issues	Dealing with wild life, biodiversity
Internal audit	One internal audit against GLOBALGAP standard every year

HACCP

HACCP is a systematic approach for the identification, evaluation and control of those steps in food manufacturing critical to product safety (Trienekens & Zuurbier, 2007). HACCP involves seven principles:

1. Hazard analysis (biological, chemical or physical conditions which may pose an unacceptable health risk to the consumer);
2. Identification of Critical Control Points (steps at which control can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable levels);
3. Establishment of preventive measures with critical limits (operational boundaries of the critical control points which control the food safety hazard(s)) for each control point;
4. Establishment of procedures to monitor the critical control points;
5. Establishment of corrective actions to be taken when monitoring shows that a critical limit has not been met;
6. Establishment of procedures to verify that the system is working properly;
7. Establishment of effective recordkeeping to document the HACCP system.

These HACCP principles are the basis for most of the food quality and safety assurance systems such as Codex Alimentarius, EU and US food legislation, and most private standards.

ISO

ISO is a non governmental agency, encompassing public and private standard organizations coming from 159 countries. Nowadays, many companies have been working hard to meet the strict requirements dictated by ISO standards. ISO standards are international standards in order to achieve uniformity and to prevent technical barriers to trade throughout the world.

These certifications are in fact regarded as a common ground for discussion between producers and consumers all over the world. The most popular certification regarding quality management systems is labeled as ISO 9001; those who are interested in meeting these voluntary requirements can download them from the ISO website after paying 118 Swiss Francs (± € 78,-). After implementation, however, "*ISO itself does not carry out conformity assessment. This is a matter for suppliers and clients in the private sector, and of regulatory bodies when ISO standards have been incorporated into public legislation. In addition, there exist many testing laboratories and certification bodies which offer independent conformity assessment services*" (ISO website) the certification bodies are also called "registrars".

Of course, this assessment entails the largest part of the overall cost and this may depend on how much time is needed to upgrade the quality management system, how long it takes to develop a quality management system, how many people are involved, and how much the registrar charges.

Conclusions

As far as the first part of this chapter is regarded, we could see that many aspects must be borne in mind in terms of official documents to fill in, but also quality and safety laws and regulations.

The fair-trade topic is based on several standards to be applied to the different actors involved in the business. Those who want to join the fair-trade initiative must meet these standards and their requirements. They are divided in trader standards, producer standards, product standards and minimum price standards. As far as the mango pulp business is concerned, this is very unlikely to be implemented because the fair-trade umbrella organization (FLO) is currently not interested in importing processed mango pulp from India due to a lack of demand. Europe prefers Latin America countries (such as Brazil and Peru) for importing mango and mango pulp, and this seems to be true for both conventional and fair-trade markets.

As far quality and safety are concerned, three major private standards (GLOBALGAP, HACCP and ISO) will contribute to make the product easier to sell in the European market although complying with them may incur high costs, not only in terms of certifications and assessments, but also in terms of time for implementation. The issue of quality and safety will extensively been treated in chapter 6, whereas the next chapter explains how mango chain coordination is organized. This is important to know in order to evaluate which steps are missing to bridge India and Europe.

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Chapter 4 - Chain Coordination

Introduction

This chapter concerns the Indian-European mango supply chain coordination. As introduction, a short theoretical review of the supply chain structure, including actors and the coordination mechanisms is given, followed by contract theory and contract farming. Thereafter a short overview on the importance of trust is provided. The next element is the identification of the current supply chain, which identifies the main players in the INEU mango supply chain. Going along with the identification also the key players are highlighted, according to power and proportion of the final price. The importer price is taken as final price in the INEU supply chain. The chapter gives as well advices on how the efficiency of supply chains can be increased. Analysis of the current contracts in the INEU supply chain is the last part before conclusions are given.

Research questions

What is the organization among the actors in the INEU mango supply chain?

- What is the current supply chain structure?
- Who are the key players?
- What are the coordination mechanisms in the chain and which relationships exist between the actors?

Chain Structure

The linkage of supply chains to major urban and export markets changes the relationship between processing enterprises and farmers (Catelo & Costales). Supply Chain is a "*sequence of (decision making and execution) processes and (material, information and money) flows that aim to meet final customer requirements, that take place within and between different stages along a continuum, from production to final consumption*". Coordination of product flows as well as coordination of risks through the supply chain is highly required (Vorst, Silva & Trienekens, 2007).
The actors of the supply chain are at first producers and their suppliers. The logistic flows of products require the transporters, warehouses, retailers, and consumers as players in the chain (Vorst, Silva & Trienekens, 2007).
The relationship between the different actors is influenced by the actors' power. Power is defined as the ability, of individuals or organizations, to influence, induce or persuade others into following certain courses of action. A course of action includes also price regulation (John, Scholes & Whitting, 2008). Furthermore, power can be divided in market power and bargaining power. The latter is the ability to bargain a larger piece of the cake and the former is the dominance in end-customer markets (Iyer & Villas-Boas, 2003).

From the power relationship three main chain structures derive (Becx, Broek, Hofwegen, 2005):

1) Ownership over all vertical chain parts, including upstream integration up to breeding and downstream until the retail inlet.
2) Dominant chain members can coordinate the chain. Dominant members are retailers or seed companies. Power concentration to one organization.
3) Coordination is more or less equally shared by the chain members. Every chain member has the same power.

The coordination of chains is divided in horizontal and vertical coordination; the latter is the most important for the INEU mango supply chain. Following major literature on the topic, three major coordination mechanisms are recognized: market, hierarchy and hybrids. In the vertical coordination three types are derived: coordination through markets, where the price is the dominant factor. The second mechanism is the hierarchy, including ownership and contracts. Ownership involves command structure. The last mechanism of coordination is network. The basis of networks is trust (van Tilburg, 2008).

When the current chain is not sufficient for the chain-members lower down the supply chain different opportunities exists. Advices in setting up an efficient supply chain (Vorst, Beulens 2001 :8):

1) Change or reduce the number of parties involved
2) Change the location of facilities
3) Eliminate non-value-adding activities

Competitive advantage of supply chains can be reached through reducing customer lead time and optimizing organizational structure (Vorst & Beulens, 2001). Activities to reduce customer lead time are:

1) Implement ICT systems for information exchange and decision processes
2) Reduction of waiting times
3) Create logistical processes
4) Improve reliability of production quality and quantity
5) Increasing flexibility
6) Simplify structures, products, processes and systems

Activities to optimize organizational structure (Vorst & Beulens, 2001):

1) Joint definition of chain objectives
2) Define clear performance indicators, which are reachable and set incentives

Contracts

Finally, within the category of hybrids, contracts and clubs play a major role. Contracts are instruments to coordinate, set incentives and allocate risks in supply chains (Bijman, 2008). The contract devolves control over different aspects in the supply chain (Hobbs, 1996). The content of contracts includes specification such as price, volume, quantity and time (Bijman, 2008).

According to Hobbs (1996) three major contracts exists:

1) Market specification contract: Agreement between buyer and seller to provide a market for the product (output). The seller has influence on the product and marketing activities.
2) Production-management contract: Characterized through more control by the buyer compared to the market specification contract. The buyer influences the production management by inspecting the production process and influencing the input use.
3) Resource providing contract: Allows the buyer to provide a market outlet for the product, supervise the production and supply key inputs.

The implementation of contracts is aimed at reducing the risk which is observable at all stages of the supply chain. Income fluctuation and quality risks are picked up in contracts through different agreements. Contract farming is necessary when the raw materials go to processing industry, when an international supply chain is set up and the goal is to supply supermarkets (Bijman, 2008).

Contracts in the INEU mango supply chain

The first contract in the Indian supply chain (described beneath) occurs between the pre-harvest contractor and the grower. The first payment is made at agreement of the contract and the second one after harvest (Kruijssen & Sudha 2008).
The reasons for entering the contract are diverse:
First, the biennial bearing of mango trees, which means that there is an irregular harvest over the years and thus irregular supply of the produce. Second, contracts minimize transaction costs in terms of contact, contract and control. Third, farmers lack access to credit (H.M. Lanting, personal communication).
The second contract arises on the processing stage. The raw material and the packing material are provided by the contracting party and the processor is responsible for the availability of labor and the processing. The contracting party can for example be an exporter (Kruijssen & Sudha 2008).

The chain coordinated via the processing cooperative (described beneath), is characterized by a specific contract between the farmers and the cooperative. The contract includes the resolution to supply fruits on the first priority basis to the cooperative. The pricing is based on the market and for fresh mangoes varies on a weekly basis. Money passes directly through the members' group bank accounts (Muthuvelayutham, 2009).
Contracts between exporters and importers are difficult to investigate: according to trade confidentiality. The standard contracts consist of the main parts like quantity, quality and price as well as the business conditions. The main coordination mechanism from India to Europe is the market and so contracts are based on market prices.

Box 4.1 - Contract farming

The chain coordinated by the cooperation implies contract farming. The topic of Contract Farming has been raising a growing interest in the last decades. Flicking through the relevant literature on contract farming it is possible to find several definitions that, of course, converge towards the same idea. Perhaps, we can regard the book from Eaton & Shepherd (2001) as a milestone in this topic, and the definition they give of contract farming is basically reported in all the major works:

"Contract farming can be defined as an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices. The arrangement also invariably involves the purchaser in providing a degree of production support through, for example, the supply of inputs and the provision of technical advice. The basis of such arrangements is a commitment on the part of the farmer to provide a specific commodity in quantities and at quality standards determined by the purchaser and a commitment on the part of the company to support the farmer's production and to purchase the commodity".

Trust

Trust is a supportive factor to increase the reliability of each participant and the result is an excellent contribution of all parties with their available capabilities (Byrne, 1993). Building trust is time consuming and needs positive personal experiences. In addition, some kinds of investment costs increase, because of setting up a positive relationship. Communication about the companies' abilities and the product is an essential factor to build trust, while in chapter 5 the mutual fact that trust is essential in communication is stated, thereby interconnecting trust and communication. The overall effect of trust in the supply chain is the decrease of transaction costs. Furthermore the transaction risk is reduced. Trust is connected to social capital, relational capital and relational marketing (Fritz, 2007).

Chain coordination in the INEU mango supply chain

The performed research figured out two different main set ups of supply chains in India. The first chain is coordinated mainly by the market (Figure 4.1) and the second chain is coordinated through hierarchy (Figure 4.2), as occurs with the case of the cooperative Aharam.

The market chain is characterized by the following actors: mango growers, pre-harvest contractors, wholesalers/commissioners, processors, retailers and exporters.

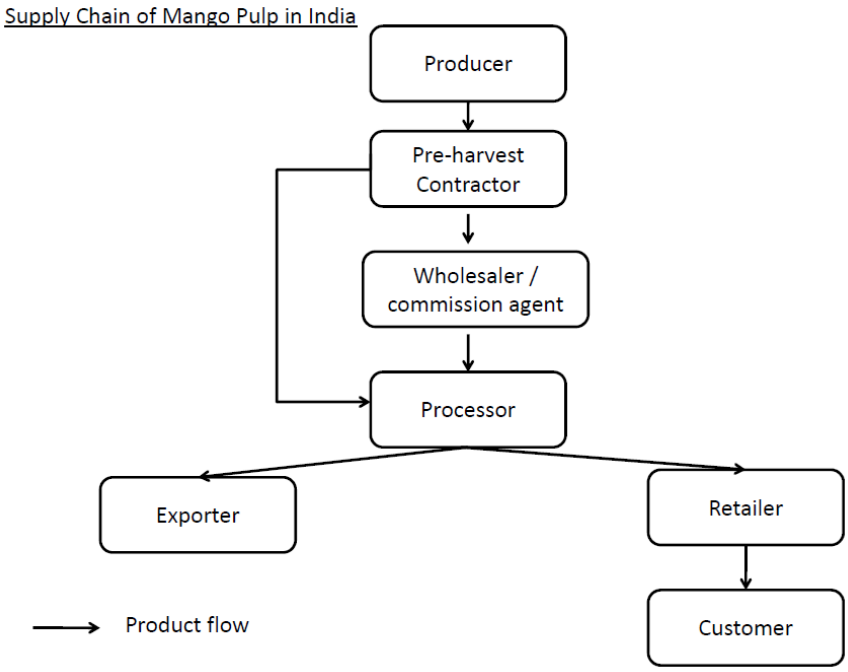

Figure 4.1: Supply chain of Mango pulp in India.
Source: H.M. Lanting (personal communication 2009) and Sudha & Kruijssen (2008)

The analysis focuses on small-scale growers of the mango variety Totapuri in the region Tamil Nadu. Compared to Totapuri, the variety Alphonso is mainly cultivated by large scale farmers (H.M. Lanting, personal communication) and therefore not included in our research. The pre-harvest contractor contacts the growers three to four months before the harvest season and sets up a contract, based on the flowering of the orchard. The contractor enters many contracts with smallholders to reach economy of scale. The pre-harvest contractors are dominant players in the market chain (Kruijssen & Sudha, 2008). The pre-harvest contractor sells the fresh mangoes to the wholesaler/commissioner, or directly to the mango pulp processor. The wholesaler is mainly considered as auctioneer, which enables a daily pricing. The raw material is transported by farmers or pre-harvest contractors to the processing factory. The output after the pressing is mango pulp, which is canned or in some cases packed in aseptic packaging (H.M. Lanting, personal communication). Now two possibilities exist to sell the mango pulp: first it can be sold on the domestic market via retailers to the end-customers or second sold to foreign markets via export.

The second identified supply chain in India is the hierarchy coordination model. The cooperative Aharam is the coordination body in the case study.

Box 4.2 - The cooperative Aharam

Aharam Traditional Crop Producers Company Limited is a farmers' owned organization. The 600 producers are organized in 40 Self Help Groups at village level. The SHG's are in direct contact with the Federation of Mango Farmers, which are organized at regional level. The producer company Aharam acts as umbrella organization. The vision is to increase and sustain rural incomes by empowering the members through the coordination of Community Based Organisations and offering services which increase the opportunity to add value along the chain. (Aharam, 2009)

The fresh mangoes are transported by the farmers or carrier to the cooperative which fulfils the coordination function of the chain and bundles the fresh mango supply. The fresh mangoes are sold to other processing companies or directly processed in the own factory (Muthuvelayutham, 2009). The following chain actors are the same as above.

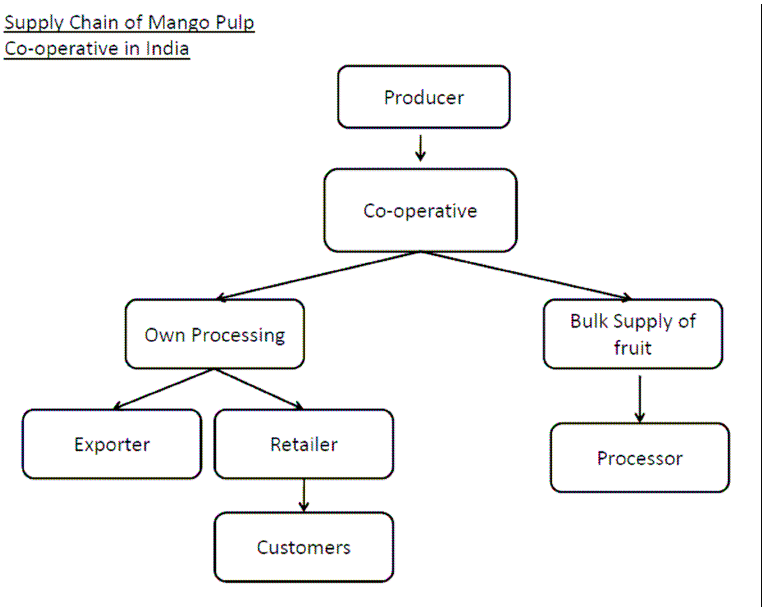

Figure 4.2: Supply chain of Mango pulp in India, cooperative based.
Source: N. Muthuvelayutham, 2009

The exporters are the gate to the world market and so also to Europe. The exporters' function is sourcing appropriated commodities for export and establishing worldwide contacts with importers.

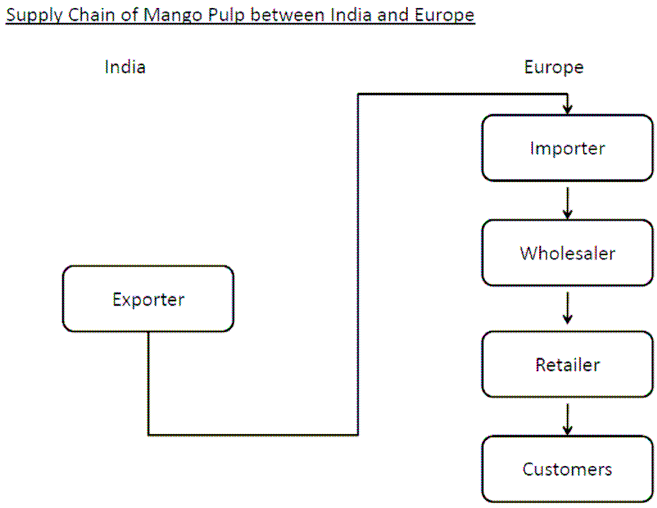

Figure 4.3
Based on literature

In Europe importers, wholesalers and retailers are the main actors. The actors have different functions in the chain. The importer is responsible for global sourcing and is the intermediate between exporters and wholesalers. The wholesaler uses the mango pulp as raw material for preparing mixed soft drinks, ice creams, juices, etc. The wholesaler distributes the packed product to the retailer's distribution centers. Here the products are commissioned and transported to the different stores (H.M. Lanting, personal communication).

The major Indian and overseas players in the food processing industry and especially mango processing are ITC Limited and Hindustan Unilever Limited (EMC, 2009). Hindustan Unilever Limited, subsidiary of Unilever, has a high market and bargaining power. It has its own division for Food and Beverage exports (HUL, 2009). ITC Limited is the market leader in agro-exports (ITC, 2009). Next to these there are hundreds of small scale exporters (Apeda, 2009).

The bargaining power increases through the chain. The grower has the lowest bargaining power and the retailer/customer has the highest bargaining power in the chain (Bunte, 2004). In this case the importer is the last chain actor for which the bargaining power is analyzed, because after forwarding the mango pulp is processed further. According to the mango pulp attributes, the importer is able to make global sourcing, which means buying on the world market and being free to buy the cheapest one. Table 4.1 shows that the importer has the highest proportion of the final price, whereas the grower gets only 2.32% of the final price. The bargaining power can be measured through the percentage price proportion at each stage of the final product. The farmer price is estimated with 3.00 Rs/kg, mango pulp price is 9.25 Rs/kg and the export price is 26.54 Rs/kg. The total price spread is 23.54 Rs/kg. The analysis of the allocation shows that the farmer gets 11.3 % of the final product. The pre-harvest contractor gets 8.4% and the wholesaler 5.56 % of the final product. The processor receives 9.5 % (Kruijssen & Sudha, 2008). The exporter receives 65.14% of the total price of € 26.64. This € 26.64 includes already the transportation

costs to Europe. When the same calculation is made with the known Mango pulp price in Europe, the proportions for the actors in India tend to be marginal.

Table 4.1: Proportion of the actors at the final price.
Source: Kruijssen & Sudha, 2008 and calculations

	Value (Rs/kg) fresh mango and mango pulp	Proportion at the final price in India %	Proportion at the final price in Europe in %
Farmer price	3.00	11.3	2.32
PHC selling price	5.25	8.4	1.74
Wholesaler selling price	6.73	5.56	1.14
Processor selling price	9.25	9.5	1.19
Exporter price	26.54	65.14	13.40
Importers selling price Europe	129		79,42

According to table 4.1 there are no processing and transportation costs included. The allocation can change if these costs are included.
The market-power in the end-customer market (Europe) is high for large global wholesalers like Nestle or Unilever. The market power in the end-customer market India is also allocated to some large companies like ITC. But in the Indian market many smaller actors play also an important role, because of the combination of local production and selling.

Conclusions

The main point in the chain analysis is that there are a limited number of chains focusing on the trade of mango pulp from India to Europe. The analysis of the chain structure indentified two possible chain coordination mechanisms in the Indian mango processing chain. The first one is coordinated through the market and contracts (and can thus be considered as a hybrid-led coordination), and the second chain through hierarchy. The key players were identified and the main player was shown to be the European importer. Market and bargaining power are also allocated to the importers and abroad retailers.

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Chapter 5 - Logistics

Introduction

As described in the chapter on market structure the market for processed mangoes involves global trade. This results in a need for transportation of the goods all over the world, from the producer to the consumer via processing and trade, in a cost efficient, reliable and practical way. Possible ways of handling mango pulp within the production and trade chain are described in this chapter. Because transportation efficiency is difficult to assess on a large scale this aspect is left out of consideration as it should be assessed for a specific chain, nevertheless some recommendations are given which can enhance efficiency.

Research questions:

What are the options for logistics activities in the INEU mango supply chain?

- Which are the transportation possibilities?
- What are the most efficient transportation possibilities?
- Which requirements of the products influence the worldwide logistic?

Communication

For a competitive logistic system effective communication and control systems are essential. In order to achieve the level of preferred supplier one needs to meet consumer requirements with regards to documentation, export-import management and movements of individual shipments. Because of the number of actors involved in handling the goods, each with their own system, tracking shipments in worldwide logistics poses a difficulty. [Coyle *et al.*, 2003] Verduijn & van de Loo [2003] confirm the fact that the consumer requirements can only be met when the actors in the supply chain collaborate. Sharing information is an integral part of the collaboration to avoid information asymmetry. Those integrated chains as a whole can compete with each other in addition to competition between single actors.
To achieve chain integration on the communication level, Verduijn & van de Loo [2003] refer to a number of new concepts with three major underlying mechanisms. The first mechanism is connectivity, creating possibilities for exchange of information between the systems of different organizations. Transparency is the second mechanism, in order to function well and respond to developments in the chain it is necessary to have background information on how previous or subsequent companies in the chain are organized. Finally planning is important in the chain and closely related to transparency. Planning is a determining factor for reliability and as such has large effects on the consumer. For the latter two mechanisms trust, as described in the chapter on chain coordination, is a very important issue.

Export transportation

The options for global transportation are diverse and commonly include multiple transportation steps over a large total distance. Within the global distribution network every transportation mode has an own niche. [Coyle *et al.*, 2003]

According to Coyle *et al.* [2003] options for worldwide transportation are:
-Ocean: The main mode of transportation on a worldwide scale. Advantages are the relative low costs and ability to transport a wide array of products. Disadvantages are long shipment times, limited accessibility and higher risk of damage.
-Air: Suited for highly valued products of low density and time sensitive goods (e.g. perishables). Main advantage of air freight is the significant reduction of transport times. Disadvantages are high transport rates and the need to repack goods as air freight usually does not use standardized packaging (containers).
-Motor: Very well suited for short distance distribution and the delivery of goods at site. Motor transport is therefore often used at the beginning and end of the chain and for intermodal transportation. Advantages are speed, safety and reliability. The costs are intermediate. For international transport *in bond* shipments are often used whereby the trailer is sealed after loading and unsealed only after reaching the country of destination.
-Rail: Transportation per rail is more cost efficient compared to motor transport, however limited accessible. Its main use is in land bridges, preventing ships from sailing around a continent, and thus saving time.

Depending on the specific package characteristics load efficiency can deviate. In the case of Tamil Nadu pulp is transported to one of the state's harbors, for example Chennai, Mangalore, Cochin or Tuticorn [Kent Flowers, Questionnaire], and subsequently taken to Colombo or Hong Kong were it is shifted on to a reefer [H.M. Lanting, personal communication, 2009]. In Europe the harbor of Rotterdam is a large receiver and trading hub for mango pulp as was shown in the first chapter.

In the framework of India's National Horticulture Mission an action plan for Tamil Nadu has been set up in which a number of agri export zones were allocated to different crops. For Mango Theni, Dindigul, Madurai, Virudhunagar, Tirunelveli and Kanyakumari have been designated as agri export zones. Cooling and processing facilities have been established here to facilitate and promote exportation of fresh and processed mangoes. Cold storage facilities are scarce, only one is allocated to fruits in Tamil Nadu and the states total cold storage capacity for all goods is 200.000 tons. [National Horticulture Mission, Action Plan for Tamil Nadu]

Efficiency

Some factors which have to be considered in determining the efficiency of the mango processing chain logistics are the sourcing of the raw material, biennial bearing of the trees, packaging methods and forwarding in the chain. Small scale processors operate locally, sourcing mangoes from nearby suppliers, thereby simultaneously lowering pre-processing transportation needs. However mango trees are known for their biannual bearing which means that once every two year supply might be short or in excess. The Totapuri variety bears relatively regular [market structure, varieties] which might be one of the reasons for its popularity in Tamil Nadu. Packing in round cans creates a lot of free space and thereby inefficiency, depending on the product and package weights improvements might be possible. Also palletizing the goods can yield higher transport efficiencies originating from shorter (un-)loading times. Finally forwarding and combined transports might result

in a detour from the shortest route and should be eliminated from the chain where that is feasible. Looking at efficiency enhancing factors in the complete production chain it is recommendable to investigate the possibility of reducing bulk by concentrating. This would result in gains on handling, packing, storage, transportation and distribution costs [Nanjundaswamy, 1997].

Packaging and storage life of mango pulp

After processing the mango pulp it is filled into cans, jars or bags of different materials. Depending on the production process the subsequent storage period ranges from 12 to 18 months. Tin cans and glass jars can be filled with pulp, at high temperature, sealed and cooled and so obtain 12 months shelf life at 15 degrees centigrade. When pasteurized, mango pulp filled in bags of polyethylene of 50-200 kg and swiftly frozen has a storage period of 18 months at minus 18 degrees centigrade. Aseptic production processes result in a storage life of 12 months at room temperature for the 'bag-in-box' system. [Naturland e.V., 2001] Exporting companies, e.g. Kart Exports, state a storage life validity of 24 months [R.T. Raja]. Standardization of the packages will help to reduce load times and safe costs. The use of pallets and containers with globally set dimensions, such as europallets and 20 or 40 foot containers, is an important aspect of transport efficiency. To assess the beneficiaries of using standardized packaging methods such as palletizing not only the costs of the material and loss of effective space should be considered, but also the savings at the consumer end of the chain. For example loading loose boxes in India might be attractive due to low labor costs compared to buying pallets, but unloading very unattractive in Europe caused by high labor costs and terminal rent rates.

For cost efficiency ocean freight is preferred as long range transportation mode for mango pulp over air freight. Maximum mass of a standard 20 foot container is 24 tons, after extraction of the container's tare mass a load capacity of 21,6 tons remains [Emase]. Mango pulp can e.g. be filled in round OTS cans of 3,1 kg, which are per six packed in a cardboard box. A 20 foot container can hold 1000 of these boxes and thus 18,6 tons of mango pulp in this way. Together with the weight of packaging material this makes up 21,6 tons. [R.T. Raja, Kart Exports; Kent Flowers Questionnaires]. For industrial use larger packaging volumes are more appropriate. For example polyethylene or polypropylene bags of 20 kg placed in boxes, or 200 kg placed in barrels [Nanjundaswamy, 1997].

Conclusions

For consumers the reliability of year-round-availability and equality in product characteristics are important aspects in their supplier choice and should be considered in the complete logistics chain.

To ensure a proper functioning of the logistic chain collaboration between the actors is needed and the need here for increases with higher levels of service towards the customer.

For global logistics the main modes of transportation are ocean and air freight. Because of the high density and low value of mango pulp, ocean freight is the most appropriate logistic solution. Intermodal transportation is dependent upon the local facilities combined with the quantities to transport. For mango pulp no additional

requirements have to be set for the transport. Due to the characteristics of the product it is easy to handle and ship. This is except for dealing with frozen pulp, were the cold chain possess limitations on the transportation possibilities.

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Chapter 6 – Quality

Introduction

For starting up and sustainable functioning of a mango pulp value chain from India to Europe it is compulsory to meet minimum quality and safety standards. Appropriate mango pulp quality must be attained to enter the European market. It is also required if sustained repeat purchases are to be made so that producing enterprises remain profitable and sustainable. This chapter addresses what quality comprises, in general and for mango pulp in particular, in different perspectives. Besides, aspects of quality are reviewed with particular focus on mango pulp. The second part deals with the reason why quality and safety standards are required in the current trade relationship. The next part focuses on the available quality standards and their relevance to mango pulp for the European market. The fourth part addresses the potential factors that affect the final mango pulp quality at each level of the chain and the possible remedies to maintain quality. The last part deals with key quality indicators for mango pulp. Finally, conclusions are given.

Research questions

What aspects of quality have to be taken into consideration for the INEU mango supply chain?

- What are the required conditions and treatments to keep the product conserved?
- Which quality aspects (chemical, sensorial, physical, color) and intrinsic aspects must be fulfilled to import them in the EU and characterize the product?
- Which private product certifications are relevant to state the quality?

Quality defined

Quality is a term difficult to define. It is different for people at different levels of the supply chain. Evans and Lindsay (1996) suggested that definition of quality depends on one's position in the chain. However, quality in general can be defined as "fitness for use" or, more specifically for foodstuffs like mango pulp, "fitness for consumption" (Peri, 2006). The international Organization of Standardization (ISO, 1998) has defined quality as "*achieving sustained customer satisfaction through meeting customer needs and expectations within organizational environment to continual improvement of efficiency and effectiveness*". Thus, quality can be viewed as "*the necessary requirements to satisfy or exceed the needs and expectations of the consumer*" (Luning *et al.*, 2002). To satisfy consumers, there are some aspects of food which should be considered. For instance, the essential aspects of total food quality include organoleptic and sensory attributes, safety, nutritional value, functional properties, service and stability, healthiness and psychological factors (Giusti *et al.*, 2008).

There are two attributes of quality. These are intrinsic and extrinsic attributes. These attributes may vary as per the outlook and memory of the consumer (Jongen, 2000). Intrinsic attributes are important components that enable the consumer to decide

what to purchase. These features of the product could be external or internal. External attributes include color, shape, size and freedom from defects whereas internal attributes include texture, sweetness, acidity, aroma, flavor, shelf life and nutritional value. Extrinsic attributes refer to systems of production and distribution. These attributes mainly influence the decision to purchase rather than the actual quality of a product. These factors include chemicals used during production and processing, types of packaging and their recyclability, and sustainability of production and distribution concerning energy utilization (Hewett, 2006).

If mango is to be delivered fresh to consumers, the mangoes must be fresh and healthy, clean; free from visible foreign substances, pests and injury caused by them, fungus, bruising and frost-damage, strange taste of smell; and must be mature and ripe (Naturland, 2001).

According to Naturland (2001), smell and taste of mango pulp need to be variety-specific and aromatic. It should also be free of foreign substances such as peels, stalks, and parts of seeds. Packaging is also pertinent to maintain quality. For instance, mango pulp could be packed into single or wholesale packages (bulk) either glass jars, tin cans or polyethylene or polypropylene bags. It should be filled aseptically into 'bag-in-boxes'. It is also important to consider the nutrient content of the pulp (Naturland, 2001).

Why quality and safety?

FAO/WHO (2009) indicated that there is sometimes confusion about the terms food quality and food safety. "*Quality includes negative and positive attributes that influence a product's value to the consumer*". Negative attributes include spoilage, contamination, discoloration, and off-odors whereas positive attributes embodies origin, color, flavor, texture and processing method of the food. Quality could be negotiated to a certain extent within the framework of the available standards. On the other hand, "*food safety refers to all chronic or acute hazards that might make food harmful to consumer's health*". It is not negotiable at all. This peculiarity has implications for public policy and the nature and content of the food control system (FAO/WHO, 2009).

Food quality and safety issues have been points of public discussion for more than a decade. This is because consumers are more and more aware and curious about the quality and safety of the food they buy. Consumers of the developed countries require foods which are consistently high in quality at competitive prices throughout the year (Trienekens & Zuurbier, 2007). Therefore, quality performance and delivery frequency influence the success in market competition at outlet level (van Tilburg *et al.*, 2007).

Due to food borne disease outbreaks and hazards related to chemical contaminants, the public is worried and calls for food safety and quality assurance (FAO/WHO, 2009). As a result, consumers expect protection from hazards occurring at the *farm-to-table* continuum. For this protection to be successful, all actors in the chain operate in an integrated way and all stages of this chain addressed by food control

systems (FAO/WHO, 2009). As far as mango pulp quality is considered, since mango pulp exported to Europe needs to be processed and packed under aseptic conditions, the risk of microbial contamination is lower. However, it is very important to consider contaminations associated to agro-chemical residues such as pesticides. This is where quality assurance works out well (Naturland, 2001).

Quality standards in relation to mango pulp from India

In the food sector, there are three important generic quality assurance systems. These are Good Agricultural Practices, Hazard Analysis and Critical Control Points and International Organization for Standardization. These were discussed in depth in chapter 3. The next paragraph focuses on HACCP in relation to mango pulp quality in India.

HACCP is a systematic approach to identify, evaluate and control steps in food processing that are vital to food safety (Trienekens & Zuurbier, 2007). For a mango pulp to be exported from India to the European market, it is a must to be HACCP certified. However, HACCP has not been followed in the pulp industry in India by the majority of small exporters. They generally agree that market access will undoubtedly be increased by HACCP, but they have several difficulties to adopt it (Mehta & George 2003).

Mehta & George (2003) forwarded the following problems for adopting HACCP mainly faced by small exporters in India. These include difficulty in record keeping at the smallholder orchard level due to heterogeneity and age of orchards which is between 3 and 100 years; seasonality of the industry which is only for 3 months and as a result it is difficult to have permanent staff; most of the industries are small and HACCP may not be feasible for them; higher costs of HACCP implementation mainly for old units since they will have to renovate facilities; no funds for HACCP activity from financial institutions; the target markets for mango pulp from India are Gulf countries which are mainly interested in price and not in HACCP. Besides this ISO certification also costs money. The cost of an ISO audit may range from € 2258 to 3767 while the surveillance audit is obliged every six months and costs € 150 per man-day (Mehta & George 2003).

Quality requirements are generally issued by the authorities or importers. Yet agreements may be reached between individual processors and importers upon different values, provided that they still confirm to regulations. For instance, the quality requirements addressed for a mango pulp traded under an organic label are summarized in table 6.1.

Table 6.1: Mango pulp quality requirements for the European market
Source: Naturland, 2001

Quality requirements	Values (minimum or maximum per kilo gram of mango pulp)
Smell and taste	Variety-specific, aromatic
Cleanliness	Free of foreign substances such as peel, stalks etc.
Relative density (20/20)	min 1.057
Brix degree	min 14.0 %
Ethanol	max 3.0 g/kg
Volatile acids, as acetic acid	max 0.4 g/kg
Lactic acid	max 0.5 g/kg
Hydroxymethylfurfural (HMF)	max 20 mg/kg
Heavy metals	
Arsenic (As)	max 0.1 mg/kg
Lead (Pb)	max 0.2 mg/kg
Copper (Cu)	max 5.0 mg/kg
Zinc (Zn)	max 5.0 mg/kg
Iron (Fe)	max 5.0 mg/kg
Tin (Sn)	max 1.0 mg/kg
Mercury (Hg)	max 0.01 mg/kg
Cadmium (Cd)	max 0.02 mg/kg
Residues	
Pesticide	Not measurable
Sulphur oxide	Not measurable
Bromide	Not measurable
Ethylene oxide	Not measurable
Mycotoxins	
Aflatoxin B1	max 2 Sg/kg
Total aflatoxins B1, B2, G1, G2	max 4 Sg/kg
Patulin	max 50 Sg/kg

In order to conform to the quality requirements and to prevent the mango pulp from contamination, all preparations must be carried out under clean, hygienic and acceptable conditions. According to Naturland (2001), the following aspects must be taken into account; clean equipment, rooms and working surfaces; health and cleanliness of personnel with clean and washable clothing; clean water which is free of contaminants and faecal materials; and the processed mango pulp must not be in contact with animals or animal wastes.

Furthermore, standard packaging is required to enter into a certain market. For instance mango pulp to be exported to Europe could be packed into single or wholesale packages (bulk) consisting of glass jars, tin cans or polyethylene or polypropylene bags, and also filled under aseptic conditions (Naturland, 2001).

Factors influencing quality in mango pulp chain

Properties of fresh and processed products, such as nutritional composition, sensory properties, and contents of natural toxins, anti-microbial agents and anti-oxidants, influence production, harvesting and handling conditions (Luning *et al.*, 2002). It is generally agreed that pulp quality is determined in the field. Hewett (2006) for instance indicated that "*postharvest technologies can only maintain quality, can not improve it"*. Quality can be possibly affected at all levels of the chain. Different chain actors should play their own role to maintain quality throughout the chain. The ultimate goal of all actors in the chain should be satisfaction of the consumer. Therefore, to deliver a desired pulp quality and ensure consumer satisfaction, cooperation of all members of the chain is needed as described in chapter 5. Each action taken in the whole chain, from orchard to consumer, has an impact on the final quality of the pulp. Table 6.2 shows the factors that influence mango pulp quality at each process step and how to control them.

Provided that the right variety of mango for pulping with satisfactory quality is obtained, careful processing is required to come up with premium quality mango pulp. For this, only fresh, ripe and non-mouldy fruit should be used to produce mango pulp. After harvesting, the fruits are sorted, carefully washed with clean water and peeled, and pulp is pressed out. Small skin parts, seed remains and fibers should be removed by sieving so that a homogenous product is formed which will have an improved storage life (Naturland, 2001).

Aeration of the pulp is prudent to avoid discoloration and to reduce the loss of vitamin C. In order to kill micro-organisms and to deactivate enzymes, the pulp is heated up to 95°C for 2 to 5 minutes. The mango pulp is then filled into cans while still hot. The cans are sealed while being steamed and the temperature is maintained for 5 minutes and then cooled rapidly. It is possible to store the pulp up to one year at temperatures of around 15°C. Another option would be cooling down the pulp after pasteurizing and filling into polyethylene bags placed in 50 to 200 kg barrels. It is then rapidly frozen and can be stored at -18°C for 18 months. Generally, a pulp filled under aseptic conditions can be stored at room temperature for about one year (Naturland, 2001).

Table 6.2: Factors influencing quality in the mango pulp chain.
Source: modified from Trienekens & Zuurbier, 2007

Process step (chain)	Factors influencing the final pulp quality	Remedy
Planting	Variety Seed source	Selection of variety or varieties suitable for puling Use of healthy and pure seed
Growing	Irrigation water Pesticide residues Injuries by frost, insects	Clean irrigation water Avoiding and/or limiting the use of pesticides Protection from frost, insects
Harvesting	Quality of the harvested fruit Harvesting method Handling during harvesting	Safe harvesting method Maintain safe hygienic conditions while picking Choice of clean fruits Protection of harvested fruits from sun, insects Proper harvest maturity
Transporting	Bruising and injuries of fruits and adulteration	Gentle loading/and unloading and hygienic conditions
Sorting	Foreign bodies Handling of the fruits	Elimination of foreign bodies (e.g. woods, leaves) Packaging quality
Processing	Contamination during processing	Aseptic and hygienic conditions Tests: physical, chemical, microbiological and sensory Type and amount of additives
Export	Improper packaging, carton damage	Safe and proper packaging materials and safe handling
Retail	Heating Damage on cartons	Proper in-store handling and conditions (packaging, temperature)

Key drivers for mango pulp quality

There are some quality indicators to be considered for assessing competitiveness of a supply chain. These are fitness for purpose, end product variability, level of certification and tracing and tracing systems (van Hofwegen *et al.*, 2005).

Fitness for purpose refers to the product being suitable for the particular purpose that the buyer wants it for (van Hofwegen *et al.*, 2005). It is the need to conform to accepted standards. In the case of mango pulp to be exported to Europe, it is compliance with the requirements of the European market. For Indian mango pulp producers it is more important to achieve the quality standards set as a requirement to sell mango pulp to European market than trying to achieve the highest achievable quality (Food Chain Centre, 2003). Therefore, it is mandatory to meet the GLOBALGAP requirements, described in chapter 3, to sell mango pulp on the European market (www.eurepgap.org).

Another crucial quality indicator is the variability of the end product. Variability of a product in the supply chain can lead to inefficiencies (van Hofwegen *et al.*, 2005). According to Naturland (2001), mango pulp users need wide supplies. However, they expect their favorite product available with always the same quality. For instance mango pulp exported to European markets must be consistently free of foreign substances such as peel, stalks and fiber and free of black dots. Characteristic flavor and color of the pulp should be maintained which is variety-specific. The total soluble solid required is 14^{o} Brix. These and other attributes should be consistently maintained (Naturland, 2001).

The level of certification obtained by the firm (e.g. ISO or HACCP) for instance is an indicator of quality (van Hofwegen *et al.*, 2005). Therefore, any company or individual who wants to import mango pulp from India to Europe must make sure that the level of certification and related issues for European standards is met (www.eurepgap.org). Garcia *et al.* (2003) indicated that knowledge of mango growers and workers in the pulp processing factory on production quality is crucial. They also indicated that the agreements to be set by the mango growers and cooperative and the contracts between processor and sellers are relevant factors influencing the quality of the end product. Safety and quality specifications should be set as part of exporter-customer contracts/agreements (Garcia *et al.*, 2003).

A highly developed and well functioning traceability system is considered as another imperative driver for quality tracking and improvement in the food chain (van Dorp, 2003). There must be uninterrupted data flow that contains information about mango quality that is passed in both directions (Hughes and Merton, 1996). The extent of traceability and the time needed for tracing back to the origin are important for the performance of the traceability system (van Hofwegen *et al.*, 2005). The extent of traceability is about the points were the trace stops. Mango pulp quality can in general be traced back to the processing factory were the pulp has been made. Due to intensive mixing of mangoes from different growers and different orchards during processing, these products cannot be traced back to individual orchard level. The time needed to trace in the mango pulp chain could be

variable based on access to information concerning tracking and tracing (van Hofwegen *et al.*, 2005).

Conclusions

Quality and safety are critical for successful competitiveness in the food supply chain. It is therefore important to critically consider food quality aspects when starting a mango pulp supply chain from India to Europe. Currently, the main target markets for Indian mango pulp are Asian and the Middle-East countries and they are only interested in prices not in quality certifications such as HACCP. As a result Indian mango pulp producers are less concerned about quality and HACCP certification. However, they must comply with the European quality standards to enter the European market. Currently, only a small amount of mango pulp is imported from India to Europe. One of the main reasons is compliance of quality. Therefore, it is difficult for small companies that base themselves on small-scale growers with heterogonous products to comply with EU quality requirements and start a trade in mango pulp from Tamil Nadu to Europe right away.

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Chapter 7 – Added value

Introduction

This chapter deals with the added value for mango produce in the supply chain. The focus is on how to increase the value of the mango product in different steps of the chain. The product and content that can be produced from the different stages of the chain are described briefly. It also highlights possible uses of byproducts from the mango fruits that might contribute to the farmers' income. The possible value addition in mango products for INEU supply chain under the fair-trade drive was planned to be assessed, however as described earlier no trade is going on under the fair-trade moral between India and Europe regarding mango (produce).

Research questions

What added value options fit into the INEU mango supply chain?

- What is the added value for the growers of processing the mangoes?
- What potential added value has fair-trade for mango growers in the INEU supply chain?

Value addition to a product is the addition of extra value to the product and consumers perceival of the value delivered to them. Considering the consumers point of view, value addition of the farm produce can be done at three possible levels. NAAS 2002 pointed out these three ways of processing as:

Level1: Post harvest or Primary processing: This includes the first stage of processing such as cleaning, grading and packing. This has a focus on the farm level with for example vegetables, potatoes and fruits.

Level 2: Secondary processing: This level focuses on the basic processing, packaging and branding, for example packed atta, suji etc.

Level 3: High end processing: This level of value addition is performed in further processed products and includes supply chain management, modern processing technology, processing of processed foods, branding and marketing. I includes products such as potato chips, break fast food, noodles and macaroni etc.

A food supply chain consists of the different steps of the process and procedures for adding value on the specific commodity through the chain. Walia (2008) defined the added value as the difference of the price of the final product and the product at the start with the direct and indirect inputs used to produce that particular product.

During the particular stage of production or through image and market, additional value can be created that increases the economic value and consumer appeal of the commodity. Value addition to agricultural produce requires better food safety issues, knowledge on consumers' preference and effective management (Walia 2008). Added value of the product in different stages of the production process increases the value of the product in a market supply chain. Value added to a particular commodity can be essential to make it marketable and demanded by the consumer. Value addition can be obtained by upgrading the quality of the product and

improving the production process. The adding of value can take place in different places within farm productive activities, particular farm or markets at local and national level (Kaplinsky & Morris, 2005).

Mehta & George (2003) reported two necessary conditions for the value added product to be suitable for export:

- Manufacturing and other infrastructure facilities
- Economies of scale for marketable surplus in chain

Food processing technologies are widely adopted but success and feasible business of enterprises face challenges on economics of scale. The raw materials for processing food need adequate quality and quantity with regular basis. During the production and manufacturing process raw material is used and creation of byproducts from the processing waste boosts the value addition in the chain. Food quality and safety regulation, use of additives and possible contaminants need to comply for the final product (Mehta & George 2003).

Added value can be reached on practically every stage in the supply chain. This chapter focuses on value adding activities on farm, processing and managing level of the supply chain. On the farm level, farmers need to be aware about the way handling of the fruits can influence market opportunities. In the processing level some more research and development work on the end product needs to be assessed (NAAS 2002). Mango processing units with byproduct processing units need to establish in the area where production is high. These help to use the valuable byproduct, such as oil from the kernel of the mango, with benefits for the producers. NAAS (2002) also reported the need to establish a linkage between processing units, farmers and cooperatives to produce raw materials of better quality. This can also help in adding value to the product by grading, cleaning, and processing and supports farmers by generating employment and income increase.

Diversity of Mango Products

Value addition to the product can be achieved through product differentiation; raw mangoes are processed into different product types. Mango can be used for processing in different ripeness stages. Figure 7.1 shows the possible utilization of mango to produce an array of mango products. Mango chutneys and pickles, brined mango slices, dried green mango slices and powder (Amchoor) and various other products such as candy, preserve, squash and jam can be prepared from unripe fruits. Fully ripened mangoes with well developed flavor, color and texture are preferred for fresh consumption and processed in larger quantities. The major commercial products of the ripe mango are slices in syrup, pulp, jam, squash, juice and nectar. The processed mango can also be used in mango cereal flakes, custards, powders, toffee, freeze dried products, wine and ice-creams (Hui, 2007).

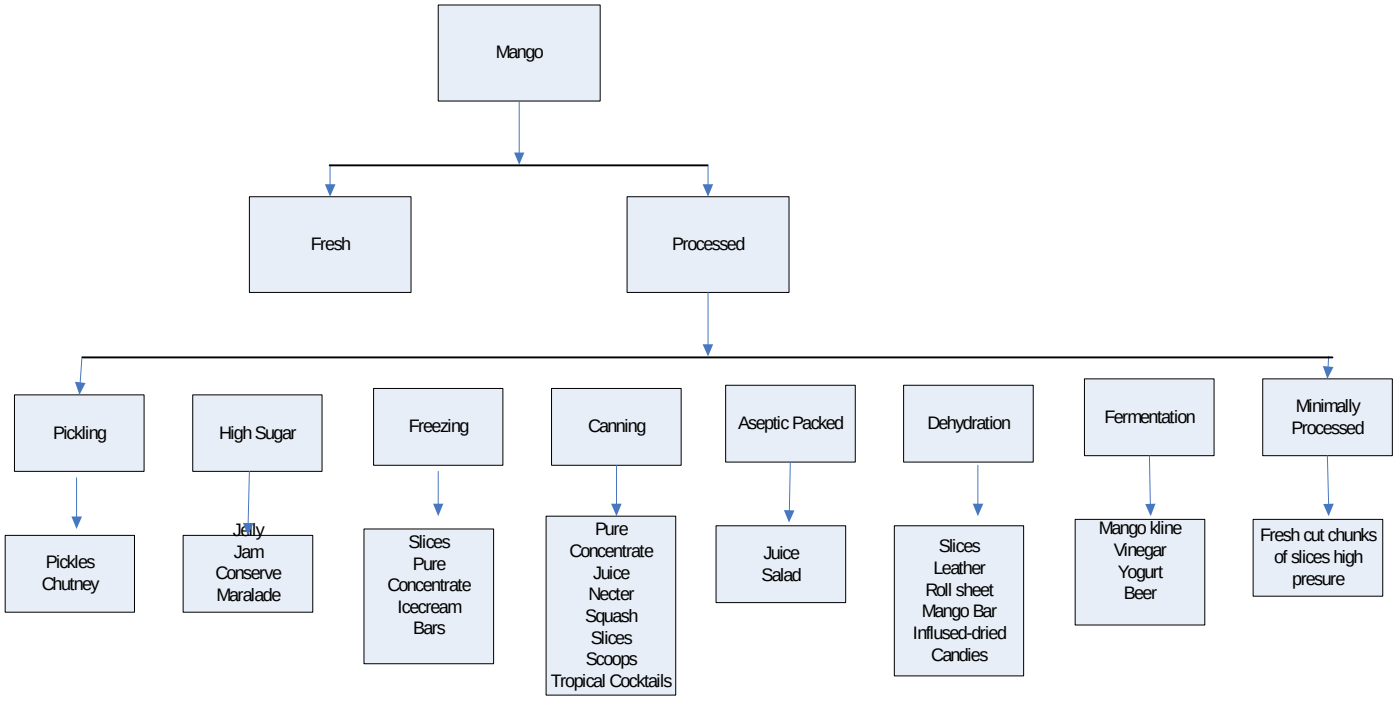

Figure 7.1: Possible mango products
Source: Hui, 2007

Unripe mangoes can be used to produce mango pickles and chutneys. Mango pickle is widely used in the local market in India as a spicy food. Pickle is prepared from high acid (5-6%) cured green mango slices, dried, mixed with spices, oil and salt and packed. Mango chutney exists in two types; sweet and hot chutneys. Fresh or cured mango slices are mixed with sugar and salt and subsequently cooked with spices and stored in bottles with vinegar or acetic acid (Nanjundaswamy, 1997).

At every stage of development mango fruits can be used for specific product preparation. At the unripe stage raw mango peeled slices are sun dried and powered to obtain the produce which is used as souring agent in curry preparation. Chutney and pickles from mango slices, peeled and unpeeled, are used for pickling. As a base material for pickles, chutney etc., raw mango slices are preserved and traded both domestically and on the export market. Homogenized mango pulp is preserved through heat processing, chemical preservation and to a limited extent, by freezing. With application of aseptic technology, the production of fruit-based drinks made from mango has shown an upsurge. Mango sheet leather is also prepared by dehydration of mango puree. Other commercial products such as mango jam, squashes etc. are also prepared. (Chadha & Pal, 1993)

Possible uses of mango processing byproducts

Syrup, purees and pulp are the major industrial products of mango processing. Depending on the variety of mango and the processed product, peels and stones consist about 35-60 of the total fruit weight. Peel is about 20-30 percent and stone is about 10-30 percent and these wastes are commonly used as animal feed. The waste

can be used as starting material for more valuable products such as alcohol, vinegar and pectin. Mango peel contains high amounts of extractable polyphenols (70g/kg) and soluble dietary fiber (281 g/kg) which indicates the good source of tropical fruit fiber (Larrauri *et al.*, 1996). The kernel is rich in starch and fat and can be used in oil production (http://www.delagrimarket.org/export.htm). For the alternative uses of waste material and their value addition, the seed of mango fruit can be used in fat production by solvent extraction of the kernel and has found suitability in making cocoa butter substitutes. Cocoa butter can be partially substituted by the acetone fractioned mango fat (Baliga & Shitole, 2006).

Value addition at farmers' level

At the farm level value addition can be obtained through postharvest handling, grading and packaging. These activities reduce the loss of the mango fruit and increase the quality of the product in the market. Grading the fruit is necessary for a better outlook and maintains the quality of the product. Mango can be graded by selecting superior quality, sorting by weight, size and removing fruits with defects (http://www.agmarknet.nic.in/fveggmrules04.htm#mangoes). Losses during the harvesting, handling, processing and marketing operations present opportunites to be decreased. It is thus essential to follow the preventing measures for the farmers, private traders, operators, processors and marketers (http://www.fao.org/sd/rtdirect/rtre0010.html).

Mango orchards may be spread over a wide area and damage during the transportation from the field to packing point or collection centre can occur. Baskets of bamboo, pigeon pea, mulberry and wooden boxes are used in India as packaging material for mango after harvest. Corrugated fiberboard boxes and polyethylene lining in the boxes were found beneficial for local level packaging (Negi, 1997).

Farmers need to be aware on the quality upgrade within the farm level by grading, packaging and post harvest handling which supports decrease of the waste and increase the shelf life and quality of the product (http://www.agmarknet.nic.in).

Ashan (2005) reported that good and appropriate post harvest operation, grading and packaging of the fruits increases the added value of the product and results in less losses during handling and transportation. Mechanical grading, sorting and sizing help to preserve the quality for fresh fruit as well as processed product with less waste. The mechanical grading of fruit is still promising in India, but not expanded as large scale commercial use. Unhygienic packaging materials, inadequate aeration, inappropriate handling and stacking lead to poor product quality. For local level processing a continuous type of raw mango peeler has been developed for the production of pickles, chutneys and amchoor (dried mango powder)(Ahsan, 2005).

Ghosh (2005) explained that during the fruit set and development phase 25-30 percent of unripe mangoes are lost in the orchard. These unripe mangoes can be used for processing into produce suck as pickles, chutneys and amchoor. Normally, mangoes are harvested manually. The Indian Institute of Horticulture Research in Bangalore has developed an integrated grader/peeler machine to facilitate the

farmers in peeling of mango. Gosh stated that low cost and eco-friendly technologies help to improve the product value during the local and distance chain. India develops zero energy cool chambers from locally available material which helps to maintain the quality of products and increases the shelf life thereby reducing waste of mango and other fruits during storage, handling and transportation. Mango harvesting tools and fruit peelers enhance efficiency in the farmers' field. Commercial uses of improved technologies have developed such as tent-type foldable solar dryers, packing boxes for transportation of fruits from the field to processing industries. This also contributes in production of value added products from the waste part of mango like pectin from peel, flour from mango fruit kernel and carbonated fruit beverages (Ghosh, 2005).

Post harvest handling of the fruits in a proper way increases the quality of fruits and processed products. Verma & Joshi (2000) suggested that post harvest technology, mechanical harvesting and proper linkage with the processing industries with hygienic handling of raw materials and proper sanitation of equipment lead to higher added value in the farmers' condition. The processing of fruits for export and for domestic markets requires quality attention as stated in the chapter on quality. Maturity indices standardization during the harvesting of the fruit needs to be taken into consideration for a better raw quality supply. Waste produced by processing industries has profitable usage, either through conventional technologies or through the adoption of biological processes (Verma & Joshi, 2000).

Added value in INEU supply chain

Supply chains of agricultural products underwent major changes over the last decades. Consumer driven markets empowered the development of the international trade in fruits and vegetables at a higher rate over the past years than trade in other agricultural commodities. The EU is importing almost one third of the fresh fruits and vegetables from southern hemisphere and about 0.5% of fresh fruits and 3.3% of fruits and vegetable juice from Asia (Huang, 2004).

Asian fair-trade fruits and other agro-produce have plenty opportunity in the European market. Sustainable and fair-trade products have opportunity for further exploitation and provide an added value based on the upper level of the food pyramid; consistent high quality, chain quality and ethical value. Partnership build up with the importing companies to innovate and create added value is challenging. Added value aspects like efficiency, pricing, flexibility, branding, marketing, diversity and year round availability are important and could play a major role in market competition (Timmermans 2007). At the present state it is not possible to consider the added value of fair-trade because FLO has not detected any market demand for Indian (processed) fair-trade mangoes.

If exported, high value mango products might provide access to new markets which have the opportunity to export with high profitability. Food manufacturers use most of these products as ingredient or raw material. Mango juice, pulp, puree and concentrate e.g. are used in dairy products, baby foods, bakery products etc. (Bradley & Castellanos, 2007).

The Government of India has launched the Essential Commodities Act 1995 and under section 3 of that act, The Fruit Products Order-1995 aims to regulate the sanitary and hygienic conditions for fruit and vegetable products. Uses and limits for the preservatives, additives and contaminants have also been specified for various products. "*The Fruit Product Order lays down the minimum requirements for:*

- *Sanitary and hygienic conditions of premises, surroundings and personnel*
- *Water to be used for processing*
- *Machinery and equipment*
- *Product standards*"

(http://mofpi.nic.in/annualreport/reports/dfp9900/chapter7.htm)

Food quality assurance to the consumer is one important part of marketing that differentiates value addition to the product. Agricultural produces with certification of traceability or quality level indicate the tools that secure value addition to the product and support a higher price in the market (Botonaki *et al*., 2006). A quality assurance system is vital for the added value of the product during and after processing in the market supply chain. India has initiated to work on the quality assurance system and has instituted HACCP as an important element in quality assurance. HACCP is really important as part of the quality requirement in the international trade and the Government of India ensures that products are safe and of good quality when HACCP certificated. Indian Government supports grants up to 50 percent of the implementation cost for total quality management and HACCP certification (Gupta, 2005).

Government of India developed policy in favor of farmers for added value of their products in their farm and at local level. Reduction in taxes on value added products and simplified credit facility for processing cooperatives are addressed by the policy. It also focuses on the mango pulp units ensuring under SPS condition in the village and clusters (NAAS 2002).

The Ministry of Food Processing and APEDA support the processing sector to upgrade the quality and obtain HACCP and ISO certification. Modern companies practice the food safety and good quality assurance but large numbers of small firms need to adopt HACCP and other quality assurance systems before entering the global export market. Indian Government focuses on quality upgrades and value addition through brand name registration, certification and HACCP. (Deininger & Sur, 2007).

Conclusions

Adding value to the product creates extra value to the final product and makes it demanded by consumers. Every ripening stage of mango used in processing into different product and the value added processed produce hereof have market opportunity in local as well as export markets. Value additions at the farm level ensure the shelf life of fresh fruits and quality of the processed product. Different alternative uses of the byproducts of mango processing can be implemented by processing into valuable products which at local level seems useful. Indian mango farmers need to adopt the scientific cultivation practices, proper post harvest

handling, grading and packaging which leads to value addition to the fruit and final product. Quality regulations, certifications such as HACCP and better marketing need to be implemented and comply with European standards for the INEU supply chain to become interesting.

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Chapter 8 – Costs

Introduction

This chapter contains the cost analysis for the INEU mango supply chain and is the practical part of running the business. The theoretical review gives a short overview of all costs, which arise in supply chains. Transportation costs, administrative costs and start up costs for a processing plant are concerned in this chapter. The focus of the costs analysis is the establishment of the startup costs of a processing factory in Tamil Nadu. Furthermore transportation costs from Tamil Nadu to Europe are identified. In addition costs are summarized arising through the certification of ISO and HACCP. Benefits of HACCP are identified. In the end conclusions are presented.

Research questions

What costs are involved in the INEU mango supply chain?

- What are the transportation costs from India to the Netherlands (Rotterdam)?
- How high are the start up costs for processing mangoes?
- What are the trade costs in the INEU supply chain?
- What are the administrative costs for receiving the fair-trade label?
- What costs are involved in the certification processes (GLOBALGAP, ISO, HACCP)?

Theoretical review

The competiveness of supply chains is influenced through transaction costs, and direct and indirect production costs. The information access along the chain influences the competitive advantage as well (Hobbs, 1996).
Transaction costs are caused through carrying out any exchange between firms and marketplace or a transfer of products between stages in a vertically chain (Hobbs, 1996). Transaction costs arise along the supply chain from grower to consumer.

Transaction costs are divided in two main categories:

1) Coordination costs
2) Motivation costs

Coordination costs summarize pre-contractual activities, like monitoring the environment, planning and bargaining. Motivation costs summarize post-contractual activities, like performance measurement (e.g. product quality), setting up incentives, and enforcing agreements, pay tribute to commitments, and achieve long term agreements (Milgrom & Roberts, 1992). Transaction costs must be reduced at each stage to reach a competitive supply chain in a changing environment (Catelo & Costales). Beyond these two main cost drivers other factors and activities raise costs. Factors are divided into directly related production costs, as costs of fertilizer, costs of seeds and plants, land price (purchase and rent prices) and costs of machinery (per hour). Indirectly related production costs are for example insurance costs (Barry, Ellinger, Hopkin & Baker, 2000; La Londe & Terrance, 1996).

Start up costs of processing factory

According to our research one company (Westfalia Separator Process GmbH) was identified which is manufacturing processing facilities for fruits and vegetables. The processing facility is a closed system. This attribute is the basis to reach HACCP and other regulations (Schmitt, 2009). H.M. Lanting (personal communication) stated that there is a huge demand for this kind of processing facilities. The following scheme shows the steps of processing mango.

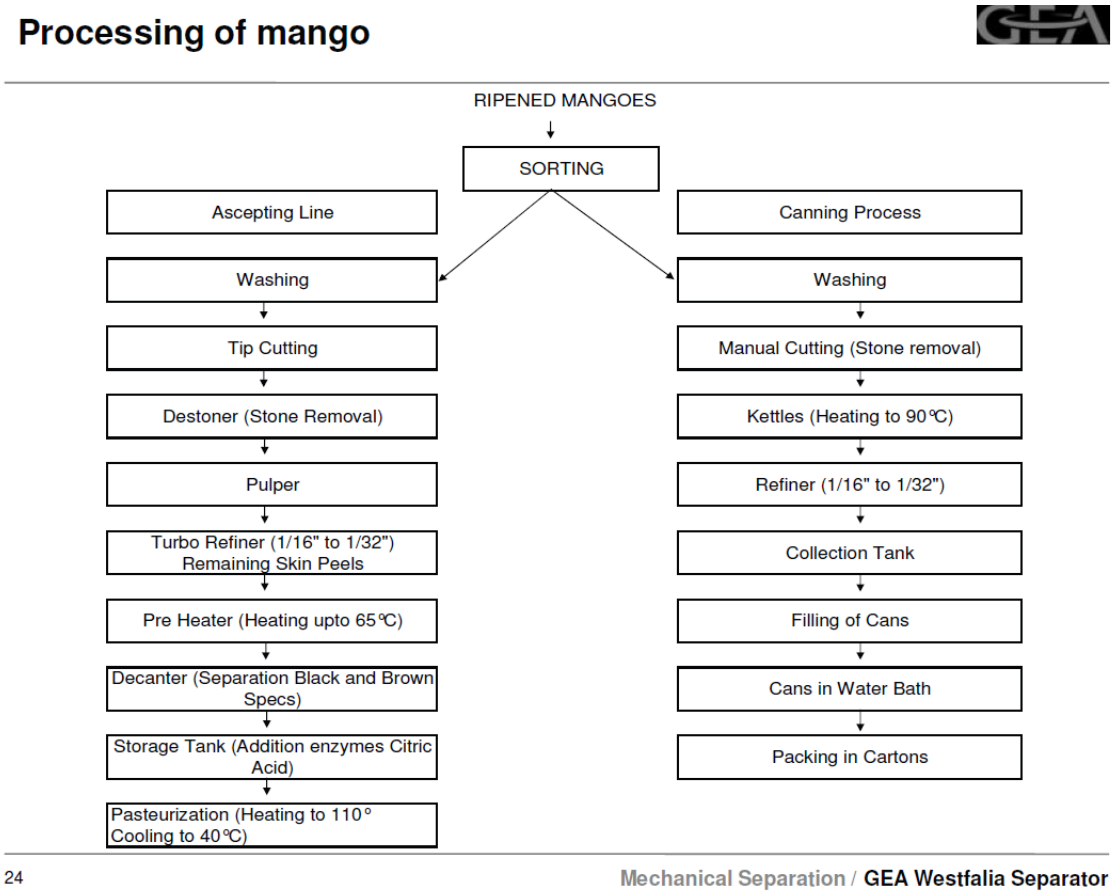

Figure 8.1
Source: GEA Westfalia Separator

The following paragraph lists components which are necessary to set up a processing factory. The estimated costs are given; no concrete costs are available, because of confidentiality.

The installation costs include the following components:

1) Conveyor belts
2) Two-stage Finisher
3) Tubular heat exchanger
4) Centrifuge
5) Pasteur of tube construction
6) Aseptic filling system (150 liter barrels)

The costs of all above components range between € 800.000 and 1.200.000. This is an estimate based on the known background information.

Further costs in the amount of 50% of the above mentioned components costs will arise for the following activities:

1) Building and land
2) Storage
3) Pool for cleaning the mangoes
4) Worktables
5) Pipes and fittings
6) Tanks, as buffer of production flows

The total investment costs range between € 1.200.000 and 1.800.000.

Transportation costs from India to Europe

As stated in chapter 5, different transportation possibilities are available and different possible shipping routes between India and Europe are identified. The transportation costs analysis focuses on container shipment (20 and 40 foot) from railroad station Bangalore (Region Tamil Nadu) to the port of Rotterdam.

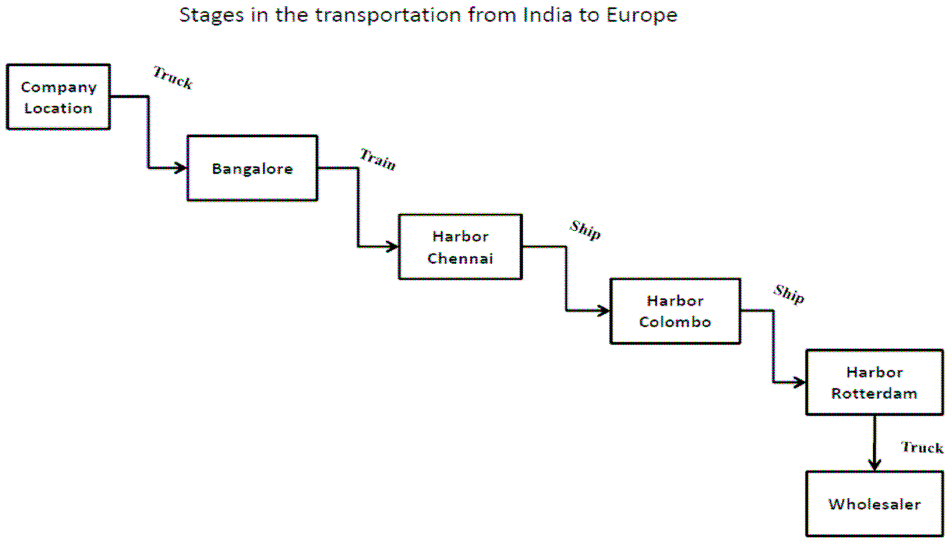

Figure 8.2
Source: Hischer, 2009

The following tables show transportation costs from Bangalore to Chennai and from Chennai to Rotterdam.

Table 8.1: Transportation vehicle railroad from Bangalore to Chennai

Container Format	Weight in tons (1000 kg)	Costs * INR	Costs € Exchange 7.04.2009 1 € = 66.398 INR
20' Box	12	18,000 – 20,000	217 – 301
	20	21,000 – 22,000	316 – 331
	22	23,000 – 24,000	346 – 361
	24	24,000 – 25,000	361 – 376
	27	25,000 – 26,000	376 – 391
	30	26,000 – 27,000	391 – 406
40' Box Highcube	9	28,500 – 29,000	429 – 436
	30	30,000	452

* include THC (Terminal Handling Costs) at harbor Chennai

Source: LIC Spedition and Container – Logistik GmbH, DHL and Kuehne&Nagel

Table 8.2: Sea freight from Chennai over Colombo to Rotterdam

Container Format	Costs in $ per Box	Costs in € per Box Exchange 7.04.2009 1 € = 1.3273 $
20' Box	950 – 1,000	715 – 753
40' Box	1,800 – 1,900	1,356 – 1,431
40' Highcube	1,900 – 2,000	1,431 – 1,506

Source: LIC Spedition and Container – Logistik GmbH, DHL and Kuehne&Nagel

Table 8.3: Surcharges

	Costs	Costs in €
Suez Canal Transit Surcharge	9 $ / TEU	6.78 € / TEU
Aden Gulf Surcharge	20 $ / TEU	15.06 € / TEU
THC Rotterdam	210 € / Container	210 € / Container
Release Fee	55 € / Blanding	55 € / Blanding

TEU: Twenty-foot Equivalent Unit

Source: LIC Spedition and Container – Logistik GmbH, DHL and Kuehne&Nagel

An example calculation has been made for one 20 foot container (20 tons) from Bangalore to Rotterdam. The total transportation costs are € 1.346,84 per container. Calculating the costs per shipping volume in kg, the storage capacity of one container is assumed to be 21.750 kg. So the costs per kg are € 0,062. In this calculation no insurance costs and taxes are included. Furthermore there will be some transportation costs from the company location in India to the railroad station in Bangalore. In Europe road transportation costs arise from the harbor to the location of the wholesaler. These costs are estimated to be € 1,35 per km (Logistik-inside, 2009).

Certification costs of fair-trade, GLOBALGAP, ISO and HACCP

The preceding chapters identified the necessity of ISO and HACCP implementation for processing facilities to trade with Europe. The cost analysis focuses on external costs. The implementation of ISO and HACCP raises internal as well as external costs. Internal costs are related to the activities which the company must perform to obtain the certificate, e.g. coordination and monitoring costs, for these activities personal is needed. All these activities cost labor hours (Milgrom & Roberts, 1992). The external costs arise through the certification organization. External costs are shown in the tables beneath. The costs depend on the chosen certification body. Three types of certification bodies are distinguished: TCL with JAS (Australia), SWISO/QSZ with SAS (Switzerland) and BSI/SAI Global with UKAS (UK) (IQMS 2009).

Table 8.4: Implementation costs of ISO and HACCP (without VAT)

	Cost in INR	Cost in € Exchange 7.04.2009 1 € = 66.398 INR
Consultancy and training charges	60,000	903.5
Certification Charges	50,000 – 90,000	753 – 1,355
Travel costs of 2 vists from Delhi till certification	40,000	602
Total costs	**150,000 – 190,000**	**2,259 – 2,861**

Source: International quality management solutions (See appendix)

Table 8.5: Annual charges for ISO and HACCP (without VAT)

	Cost in INR	Cost in € Exchange 7.04.2009 1 € = 66.398 INR
Annual Audit fee of Certification Body	20,000 – 35,000	301 – 527
Annual support consultancy fee	25,000	377

Source: International quality management solutions (See appendix)

The total costs of HACCP and ISO implementation would be around € 2.259 to 2.861. Annual charges for audits are round about € 777. Following the implementation benefits arise from the introduction of HACCP at company, customer and public body level (Romano *et al.,* 2004). The authors stated higher revenues, efficiency gains and cost avoidance for faulty products on firm level. Food-borne illnesses can be avoided on consumer level. The public body can save medical care and social security.

Conclusions

The start up costs for an aseptic processing facility range between € 1,2 and 1,8 million. Considering the short mango harvest period of 3 months and lifetime of 15 years, annual depreciation costs of around € 80,000 arise. To keep the unit costs as

small as possible a high degree of utility during the 3 month season should be reached. Decreasing the unit costs is possible, if the attributes of asset allow processing other fruits in the remaining months. For reduction of the variable costs like electricity solar cells can be installed. Transportation costs are calculated for the transport from India to Europe. Further research should be done on transportation costs to other favored markets to figure out the most efficient appreciated customer market. The implementation of HACCP and ISO is necessary to export to Europe, affecting the increase in the unit costs. If the sum of transportation costs and HACCP costs increase the unit costs so far that the Indian mango pulp is out of competition, other strategies should be taken into account.
As our research figured out that there is no interest of the Fair Trade Labeling organization to set up fair-trade regulations for mango pulp from India, the administrative costs for fair-trade labeling are not estimated. This can be done if demand arises for fair-trade mango pulp from India.

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Chapter 9 - General conclusions and recommendations

General conclusions

Characterizing for the Indian mango market at the supply side is the high level of fragmentation. India is a major producer of mango and within India the region of Tamil Nadu is on the main mango producing areas. The European Union imports relatively small amounts of mangoes and mango produce on the global level. As result of the performed research only a small number of mango pulp importers were found in Europe and the Netherlands in particular.

Considering regulations many aspects must be borne in mind in terms of official documents to fill in, as well as quality and safety laws and regulations to follow. A more extensive description hereof is provided in the third chapter of this report.

Quality and safety are important aspects in food supply chains with regards to competitiveness. Private standards (GLOBALGAP, HACCP and ISO) contribute to entering the European market and can be considered obligatory in practice. Compliance with these standards may raise high costs.
Small scale companies based on regional products face difficulties to comply with EU quality requirements and can not set up a mango pulp trade from Tamil Nadu to Europe without major efforts.

The performed chain structure analysis indentified two chain coordination mechanisms in the Indian mango processing chain. Coordination through the market and contracts (hybrid-led coordination) or through hierarchy occurs. The European importer has been identified as the main player with a high allocation of power.

Collaboration between the chain actors is needed to ensure a proper functioning of the logistic chain. Ocean freight is the most appropriate logistic solution resulting form the high density and relative low value of mango pulp. Due to the product characteristics mango pulp is easy to handle and ship and no specific requirements have to be set for transport.

The focus of Indian exports is predominantly on Asia and the Middle-East. The domestic market provides a very important outlet as well. Demands of European countries are fulfilled mostly with imports from Latin America and Africa. Both continents adopted a more commercial way of mango production than is common in India and can therefore compete very well. Suitability of domestic and regional markets is higher from the Indian perspective. These markets fit better with the current practices and have a high price orientation while quality requirements are relatively low (e.g. HACCP not required).

Mangoes used for processing in every ripening stage with different final products have market opportunity with added value in local as well as export markets. Indian mango farmers need to improve cultivation practices, proper post harvest handling, grading and packaging which can lead to value addition. Quality regulations,

certifications and marketing need to be increasingly adopted and compliance with European standards is required before the INEU supply chain becomes interesting.

Costs which one has to cope with when starting up a processing industry and export chain for mango pulp from India to Europe are substantial. In the regarding chapter (8) estimates are provided.

The topic of fair-trade has been based on particular standards applicable to the different chain actors which are elaborated in chapter 3 of this report; 'Regulations'. As the Fair-trade Labeling Organization has not identified demands for Indian fair-trade mango (produce) in Europe no regulations are presently existent.

Recommendations

We can finally provide two sets of practical recommendations taking into account the information presented in this report. The recommendations are especially regarded towards the studied case; the Indian-European mango pulp supply chain.

The first set of recommendations is directed to improve the livelihood of Indian mango farmers. To this extent, we realized that farmers should join a cooperative when possible, not only in order to receive a price which is higher than the market one, but also to reduce transaction costs caused by bargaining with the middleman.

The second set of recommendations regards increasing the market share, and this can be done by focusing on the domestic, Asian and Middle East markets, especially as far as (processed) mangoes are concerned. This is because the Indian market is already very large and the demands from the Middle East are higher than the European one while they do not require costly, high quality standards. Moreover, the European market is supplied by Latin American countries which are highly competitive due to their location closer to Europe and readily compliance with major quality regulations set in Europe.

According to the World Bank (2006), the region of Tamil Nadu has good opportunities to raise its competitiveness in the niche markets (EU, Japan and USA) "*as long as serious steps in terms of quality certifications (such as HACCP) are implemented by the actors involved in the processing industries".* From the information in this report we can conclusively support this statement. Facilitation can be reached by the joint intervention of governmental agencies and field associations.

Appendix I - Interview AgroFair

AgroFair (Importer of fair trade fruits)
Mr. Frank Gruijs (frank.gruijs@agrofair.nl), personal communication 30-3-2009 (telephone call by Bram Timmerman)

1. **Does AgroFair trade mango pulp?**

AgroFair imports mango pulp from Peru to help farmers sell second quality mangoes. Their core business is the trade of premium fair trade fresh fruits and the mango pulp is mend to create some extra income for the farmers with the mangoes sorted out for the fresh market. The demand is low and according to Mr. Gruijs mango pulp is a niche product.

2. **Is the mango pulp solely imported from Peru?**

At the moment AgroFair is working on import of mango pulp from Brazil on a facilitating basis. One of their regular suppliers form Brazil has produced and sold mango pulp. Both the producer and customer are not certified to import food products into the Netherlands and so AgroFair will provide their expertise to complete the chain.

3. **Are you aware of any specific product requirements on fair trade mango pulp set by FLO or related originations in addition to legal requirements?**

Mr. Gruijs was not aware of any specific requirements. After having checked it within the company he reported that no specific product requirements for fair trade mango pulp existed as far as he could find.

Appendix II – Interview Mongozo

Mongozo (Brewery)
Mr. Jan Fleurkens (0478-550968), personal communication 06-04-2009
(telephone call by Bram Timmerman)

Mongozo, located in Venlo, the Netherlands, produces fair trade beers with exotic fruit tastes; they introduced a mango flavored beer in 2008.

1) **Where is the mango-flavored beer produced?**

The beer is brewed in Belgium, and from there traded.

2) **How is the mango flavor of the beer obtained? With mango products or additives?**

By 100% pure mango concentrate which is fair trade.

3) **Where is the mango concentrate obtained from?**

The concentrate is not imported as such. Fair trade mango pulp is imported from Brasil, a German company converts the pulp to concentrate and then supplies it to the brewery in Belgium. For the banana-flavored beer the same process is followed.

4) **How much pulp/concentrate is imported?**

Annually at the moment 10-15 tons of concentrate are needed, the amount of pulp imported to produce this is approximately four times as high, so 40-60 tons. Growth in this volume is expected as the mango flavor is only recently introduced.

5) **Are you planning on performing the import in-house in the future?**

No, import and especially conversion of pulp to concentrate are not our core business and complicated, extensive processes which we want to leaf to our partners. Especially the involvement of fair trade makes the processing a delicate and precise task for which our German partner is equipped.