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Haiti Start-Up mission design cold chain mango-avocado

Technical and financial evaluation for a logistics service for the control of the cold chain in the export of fresh products between Haiti and the United States

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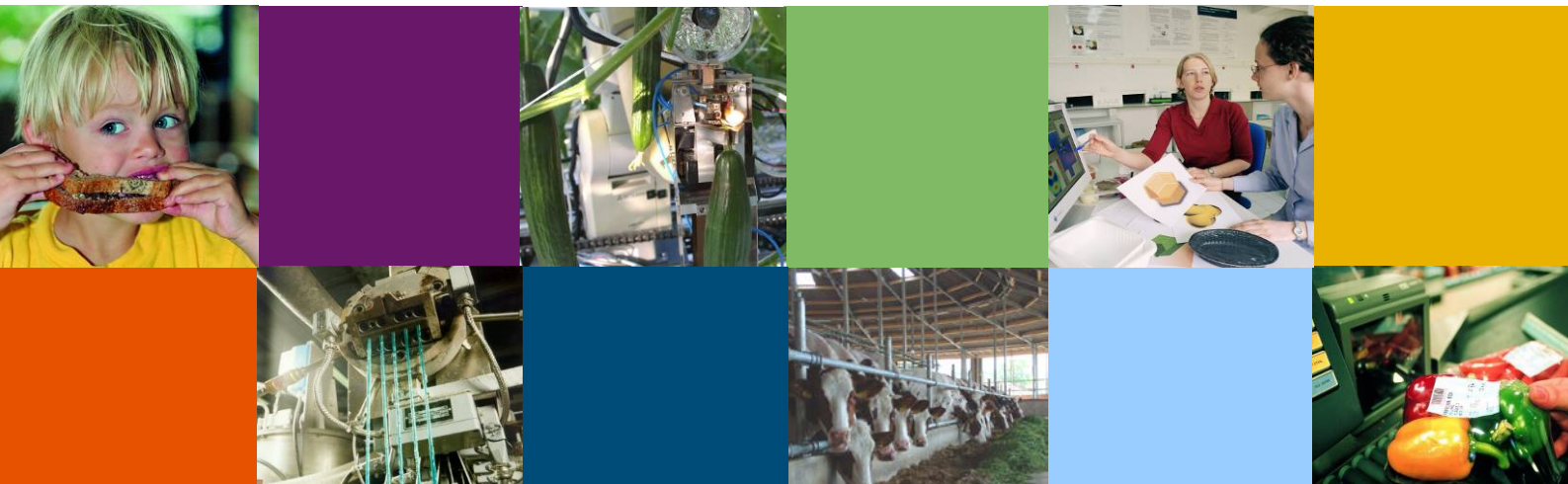
Report 1795



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Abstract

This report shares the findings of the first start-up mission to Haiti, exploring all relevant elements pertaining to the design of the mango and avocado cold chain for fruit export to the USA, with the possibility to extend logistics services to other fruits like pineapple. Findings of the mission will be used to produce a report on the technical design of the cold chain from tree harvest till arrival in Miami. The mission was exposed to the current realities and experiences of fruit production and export in Haiti and will factor these into the design of the proposal. Basic data and information on the two value chains are presented in chapter 2. During the mission a number of ideas and suggestions to improve the value chain have been discussed and explored, including logistical, economic and social elements. These are presented in the chapters 3 and 4 of the report.

Content

1 Introduction

This report provides the results of the start-up mission to design a cold chain for mango and avocado in Haiti. The cultivation and sales of mangos and avocados is a major contributor to the income of the poorest people of Haiti. However, studies show a lack of competitiveness caused by a poor performance of the supply chain logistics and inefficiency due to lack of (micro)orchards. In particular post-harvest losses and quality decay throughout the supply chain are problems to be tackled to increase the income of the farmers and other stakeholders in this supply chain. To resolve these issues expertise in packaging, facility design, logistic design, cost analysis and optimal product conditions is required.

The Haitian Ministry of Trade and Industry (MCI) through the Business Development and Investment Project (PDAI) undertakes activities to support regional development and sustainable economic growth in Haiti. This project uses a value chain approach to promote the development of the country by establishing functional links between micro, small and medium-sized enterprises (MSMEs), which generates benefits for all producers and end consumers. MCI intends to use the counterpart funds mechanism of the PDAI project to fund either partially or totally training rounds, technical assistance or common services that MSMEs currently need to allocate or increase value to products and, as a result, access markets or they can maximize their profits and thus increase their income.

Wageningen Food & Biobased Research (WFBR) has been contracted through the Project Coordination Unit (PCU) of the Ministry of Economy and Finance, within the framework of the implementation of the PDAI project financed by the World Bank Don HA-8650, to provide a logistic service for the control of the cold chain in the export of mango and avocado between Haiti and the United States. The main objective of the consultation is to lay the necessary foundations for a mastery of logistic services of the cold chain for the export of mangoes and avocados from the Artibonite and the Central Plateau to the United States (US).

The project has 2 phases:
1) Technical and financial assessment (1 year); with a. Technical and financial analysis (six months); b. Tender support (six months); and
2) Supervision of implementation (1 year).

This report provides the results of the Start-Up mission for phase 1. A with detailed elaboration and fine tuning of activities and time schedule, together with assigning responsibilities and contacts for the various topics. In Appendix 1 the ToR of the mission is presented. The objective of the Start-up mission is to start the technical design of the cold chain through site visits, meetings with relevant stakeholders and other observations.

In the next chapters the results are presented following the eight outputs planned in the ToR (Ch. 2), results are discussed in chapter 3 and the final chapter 4 gives conclusions and overview of follow-up.

Appendices are available on Terms of Reference of the mission, a list of key contacts, and the first outline of the potential mango block chain.

2 Results

Results are presented according to the 8 outputs mentioned in the ToR (see appendice 1):

1. Familiarization with the areas of production and the transport routes between the areas of production.

The areas targeted and their zones of influence under this initiative are located in the North-Northeast of Haiti; the Centre-Artibonite loop and the Southern Peninsula (see map below). The Cap – Ouanaminthe corridor in the North-Northeast and the corridor going from Lascahobas toward Port-de-Paix are a major area for mango, avocado and pineapple production among other crops where approximately 1,300,000 people are living, two thirds in the cities; 55% of them are youth. Both corridors are articulated around the Centre-Artibonite loop (see map below).

The Southern Peninsula comprises Southeast, South, Grande-Anse and Nippes departments. The population along major production centers of mango, avocado and pineapple areas is around 1,200,000 people. Main cities around the production sites are Miragoane, Jacmel, Les Cayes and Jeremie connected to Port-au-Prince through RN2.

The region is formed by valleys and plains in the Northeast and a combination of mountains and plateau in Centre. North and lower part of Centre department benefit from more rainfall (>1600 to 2400 mm) while upper Centre, Northeast and Artibonite are dryer (900 to <1600 mm).
The whole Southern peninsula is dominated by mountains with a few plains in Nippes, Southeast and South. It receives the highest rainfall (<1,600 to 3,200 mm; some areas in Southeast: 800 mm).

Road conditions are poor outside the national roads (RN). RN1: Port-au-Prince to Cap-Haitian – 250 kilometers; RN2: Port-au-Prince to Les Cayes - 194 kilometers; RN3: Port-au-Prince to Hinche – 76 kilometers; RN4: Port-au-Prince to Jacmel - 121 kilometers and RN6: Cap-Haitian to Ouanaminthe -. Pavement of RN7, Les Cayes to Jeremie - 99 kilometers is almost completed. Beyond those roads, the municipal and communal networks (tertiary roads) are often in critical

conditions and many are not accessible during rainy season either due to flooding and/or muddy segments.

The regions around Mirebalais in Centre and Gros Morne in Artibonite have several collection points where mango and avocado are collected regularly for marketing. Northern region and South have less or no infrastructure for proper handling and processing of fruits. Refrigerated trucks are not used yet but crates are popular in mango production areas in Artibonite: Ennery and Gros Morne. It is of particular importance to ensure crates and transportation bins are robust but smooth inside, to withstand poor roads conditions and frequent rough handling.

2. Collection of any supplementary data needed from relevant stakeholders.

Data from the two SAE (Service d'Appui aux Entreprises – Enterprises Support Service) support teams on mango and avocado producers (area under production, yields) has been analysed prior to the mission and verified during the mission. They will be further updated and verified (especially check on production and seasonality data) by the SAE teams the coming months. SAE teams have also shared various other documents.

3. Familiarization with logistical/cargo service providers established in Haiti as well as the cargo facilities at the Toussaint Louverture Airport.

DHL Haiti (meeting with Christian Craan)

DHL Haiti transports all type of agricultural products, except meat and dates. Mangoes are transported as sealed and cooled containers to the airport. Filling the plane takes about 1 to 1,5 hours. They start to upload as soon as the plane lands. Max weight thousand pounds per pallet for air freight. In peak season 25-40 mango containers a week between mid-July to mid-August via boat. 8-9-10-11-12-13 is all called a "douzaine" and put in boxes. DHL does not have experience with transporting avocado.

All export is going to or through the USA and follows Food & Drugs (FD) requirements. USDA inspectors should be at venues if the cold chain starts at producer level. The easiest way would be 20"or 40" reefer containers at the venue. Main flow DHL Haiti is inbound; July-December is the peak season outbound. Exporting some perishable goods like vetiver, but mainly import.
On hot water treatment for mango flies: MCI has a project on traps for catching the flies. Putting the traps is not the problem, the issue is to put the produce stored away from the trees in clean conditions while waiting for transport. There are various other steps to be taken for better quality mango harvesting like education on technical requirements for harvesting, use of crates, and proper placing of the fruits in the crates. The logistic provider like for example Kuehn & Nagel will probably have to include training on these issues. Critical delay at plant: max 3 hours.

DHL offers two types of insurance. Payment per pound, or via insurance box for high value products (100% of value covered). Insurance provider is global. DHL gives preferred pricing for high volume clients. Pricing is online. Shipment price for semi-perishable material is available online. As Haiti is not able to produce high volume they have to go for niche markets where buyers are able to have high value. DHL does have refrigerated trucks as business standards, they are a basic requirement regardless of what you are delivering. DHL does not export with reefers.

Medhasa cargo facilities at the Toussaint Louverture Airport (meeting with Dimitri Malebranche)

Medhasa represents different air freight clients like Ameri-jet, Air Canada, DR company. Together with his dad they are the owners of Medhasa. They do not have cold storages presently but are building a small area where one container can be stored just in case a flight is delayed. But cold storage is not their main line of business. They plan with exporters to be ready for palletising, getting the permits and upload. Mon-Wed-Friday (3x a week) with Ameri-jet. It takes about 3 hours to receive and process mango transport. Medhasa has a customs officer as well as an inspector from MARNDR (Ministry of Agriculture, Natural Resources and Rural Development). Mangos arrive in container or truck load. They have regular experiences with USDA inspectors for mango transport as USDA seals the containers. Afterwards quarantined with supervision from MARNDR. In the mango main season they have 3 mango freights/per day. Some of the present mango families only ship by air the whole season. Medhasa works with various mango exporters (7 families), paying the USDA inspectors. Only the Francis variety is exported. Prices reduce with high number of container shipments. On the following site, freight rates can be checked: http://worldfreightrates.com/freight Indicative price at this moment for a 40' reefer from PaP to Miami is about US$ 1.500.

Medhasa has (limited) experiences with avocado export. For avocado there are less restrictions and the sector is less organised. They also have experiences with other food products, vegetables like pepper, live animals in bags with oxygen, frozen langouste, ...

Most transport is via US, but freight is also directly to Canada: twice a week during high season, once a week low season. Air Canada: shipment can be done on any cargo, more easy compared than US. Volume is available for out bound. "we can ship as much as we like". Air Canada is 3 hours and the longest trip. There is not an Air Cargo freight, so only with passenger flights. 20-50.000 pounds per day is possible. If the clients request it transport can be insured. Basis: about 1,50 USD for each 100 USD. But only transport is insured. Global insurance company is contracted. They can ship to any part of the US or elsewhere in the world, but all containers pass through Miami.

Tendency in the airfreight business: this depends on the economy. At some point Haiti was a major exporter for mango. That diminished with ocean transport. Now it starts again with

avocado, papaya, pepper, .. Various entrepreneurs start now in agriculture like one business with a new papaya variety. Older companies are phasing out (for instance from 10 mango exporters in the past there are now 7), but younger generations starts now with different fruits and vegetables. In general, air freight is approximately 3 x more expensive per ton than shipment by sea.

4. Mango market and USDA export procedures

Mango Production for Export

Haiti is reported to produce 154 different varieties of mangos. Many of them are found nowhere else in the world. Mango production has been estimated up to 400,000 MT annually over an area of 40,000 hectares. A variety of mango called "Francis or Francisque", a product of cross-pollination and one of the few varieties capable of resisting hot-water treatment, a requisite condition for exportation into the United States, counts for 15% of total mango production. 75% of Francis mango production is consumed locally as fresh fruit.

Mango production is organized around two major harvest seasons, the small season: October – April and the major season: May-September (see table 1 below). Haiti has a major potential to export mangos to the US during the small season. Only Brazil, Ecuador and Peru are exporting mango to US during this window of seven months. Drip irrigation, grafting techniques and new orchards are options to support increase of production during the small season.

Table 1: Seasonality in the different mango producing areas

Mango production areas	oct	nov	dec	jan	feb	mar	apr	may	june	july	aug	sept
Ouest												
Léogane	■	■	■									
Cabaret				■	■	■						
Arcahaie				■	■	■						
Fonds des Blancs								■	■	■		
Croix-des-Bouquets												
La Plaine		■	■	■	■							
Central Plateau												
Saut d'Eau								■	■			
Mirebalais								■	■			
Artibonite												
Gros Morne									■	■	■	■
Saint-Michel de l'Attalaye												
Pont Sonde												
Sud-est												
Jacmel						■	■					
Cayes-Jacmel						■	■					
Marigot						■	■					
Sud												
Aquin & Saint-Louis du Sud							■	■	■			
Saint-Jean du Sud							■	■	■			
Camp-Perrin & Plaine des Cayes								■	■	■		

Source : Market Chain Enhancement Project (MarChE) and the Watershed Initiative for National Natural Environmental Services (WINNER) 2009

US Market prices (also for avocados and other fruits) are available on the following sites:
US retail prices:
avocados: http://www.hassavocadoboard.com/retail/volume-and-price-data
US wholesale prices all fruits:
https://www.freshfruitportal.com/precios-frutas/precios-usda/
https://www.marketnews.usda.gov/mnp/fv-nav-byCom?navClass=FRUITS&navType=byComm
General information on US fruit markets:
https://www.freshfruitportal.com/
http://www.mango.org/en/Professionals/Industry/Market-Information/Volume-Price

Current mango market in Haiti

The mango sector consisted of sixteen producers groups represented by FENAPCOM, Federation Nationale de Producteurs pour la Commercialisation de la Mangue, established in 2005. 40% of all production is considered mango rejects. However, postharvest losses can be as high as 60% due to fruit flies damage. COPAGM sold 10,000 dozens of mango Francis in 2009, only 10% of its capacity in a normal season due to fruit flies. Many producers are organized as cooperatives (see table 2).

Table 2: Overview grower cooperatives in selected departments

Cooperative	Department	Town
MOSOPA	Ouest	Cazale-Kamo-Fond Blanc
ASPVEFS	Sud	Camp-Perrin
COPACGM	Artibonite	Gros-Morne
KOPKOMFG	Artibonite	Gros Morne
SAPKO	Centre	Saut D'Eau
RAKKOM	Centre	Saut D'Eau
APD3	Artibonite	Petite-Riviere de l'Artibonite
APWOMOPA	Ouest	Arcahaie
PROCARECA	Ouest	Cabaret
RAPCOMOL	Ouest	Leogane
REPSIKA	Sud-est	Cayes-Jacmel
SPAVO	Sud-est	Oranger
UCOOPEDSA	Artibonite	St Michel de l'Attalaye

Source: MarChE, Market Chain Enhancement, 2009

The unit of measure used at farm gate for the Francis mango is the dozen. The standard weight of one unit of Francis mango approved for export is approximately 700 grams. Thus, one dozen

of Francis mangos weights approximately 8.4 kilograms or 18.48 pounds. Each cooperative could forecast to export half million cases or 6,000,000 mangos per year (less rejects), depending on the productivity of Francis mango trees. Each case holds on average a dozen mangos.
Only a small percentage of mangos is exported to US as organic (2% in 2009) because most organizations do not have the financial, technical, and organizational capabilities to obtain and renew this prized certification.

Suppliers

Suppliers (or "consolidators') are local or foreign entrepreneurs who finance sub-suppliers to reserve and/or buy mangos from smallholder farmers or grower cooperatives. Some of these suppliers receive their cash in advance from exporters. The suppliers usually pick up the mangos at the collection centers with the exporter's truck or a rental truck. Then they transport, wash and store the mangos in their own facilities. This group forms an important link which provides the information needed on the current Traceability Form used by ANEM, Association Nationale des Exportateurs de Mangues.

Mango and avocado Exporters

Avocados are currently almost exclusively supplied to the Dominican Republic (DR) or collected by DR traders and exported ad Dominican produce to overseas markets (mainly US). The number of exporting firms that dedicate to mango has declined from 13 to 8 (or perhaps only seven) over the years due to increased APHIS fees, high transportation and energy costs, and low yield during several harvest seasons. All of these factors have caused major financial stress to the industry. The Haitian mango usually earns close to a 50 % premium over its major competitor, the Ataulfo, from Chiapas, Mexico.
Eight mango processing facilities are operated by the Association of Mango Exporters (ANEM - Association Nationale des Exportateurs de Mangues). Seven are located in Port-au-Prince and one in Pont Sonde, near the city of Saint-Marc in Artibonite Department (about 46 miles, 74 km North of Port-au-Prince - 19° 9' 0" North, 72° 37' 0" West). Together these exporters handle roughly 2 million carton boxes (4.5 kg each) per year (see table 3).

Table 3: Haitian mango exporters and their market share

BUSINESS	YEAR 2011	YEAR 2012	YEAR 2013
LA FINCA	9.6	9.7	11.95
Agropak	12.8	14.87	12.09
GERMAIN PAUL EXPORT	9.85	11.99	13.07
TROPICAL TRADING	12.79	17.58	13.8
CARI FASH	9.6	8.19	9.13
GOLDEN CROWN	9.58	17.04	15.36
RALPH PERRY EXPORT	7.55	9.97	11.5
F L	9.4	10.6	13.1
MB PLANT	7.88		
JMB	10.94		
TOTAL	99.99	99.94	100

Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural (MARNDR), Direction de la Protection des Végétaux

Responsibilities of MARNDR with regard to fruit handling include the following:

- Develop and maintain a list of mango growers that are authorized to export mangos to the United States. These growers/areas should be organized into "production units" as determined by MARNDR and ANEM. MARNDR should issue each unit a unique "Registered Production Unit Code" for traceability and sampling/inspection purposes;
- Verify that areas whose production has been registered by MARNDR undergo plant health control measures in order to maintain low fruit fly population levels and sanitary field practices;
- Develop and maintain a list of authorized packinghouses/hot water treatment facilities that are approved to handle and treat mangos for export to the US. These plants should be issued a "Registered Packinghouse/Treatment Facility Code" for traceability purposes; and
- Submit a master list of all Registered Production Units and Registered Packing houses/Treatment Facilities, and their respective traceability codes, to APHIS thirty (30) days before the export season begins. This list should be organized by regions.

USDA/APHIS/IS

The United States Department of Agriculture (USDA)/ and Animal and Plant Health Inspection Service (APHIS) International Service (IS) agents inspect and certify all treatment plants prior to the export season of fresh mangos. A plant which fails inspection cannot receive a certificate or process fresh mangos for export.

Haiti is currently benefiting from a Pre-Clearance Program, monitored by an APHIS Officer-in Charge (OIC) or designee. This person is authorized to take necessary action to ensure acceptable pest risks found in mangos. This person is also assisted by employed Foreign Service Nationals (FSNs) who are trained and designated by APHIS IS to carry out specific duties under the regulations and procedures established by APHIS IS.

USDA inspectors are checking all installations implementing hot water treatment. As such, those inspectors are sent regularly outside of Port-au-Prince to Fruits et legumes http://www.fruitsetlegumes.ht/ located in Pont Sonde, Artibonite, Route Nationale #1.
A contract is signed between ANEM members, USDA and the Ministry of Agriculture.
Due to additional costs for transportation, lack of infrastructures for export and requirements from trucking companies to handle perishable products like mango, processing plants tend to concentrate in Port-au-Prince, away from collection centers.
The roles of USDA/APHIS/IS for inspecting fruit transport include the following:

- Jointly with MARNDR, sample and inspect each lot of fruit intended for export to the US. Pre-treatment Sampling, Inspection, and Record Keeping for each lot should be conducted according to the "Mango Sampling, Inspection, and Record Keeping Protocol" (appendix F Work Plan);
- Reject any lots found to be infested with fruit fly larvae, and refuse treatment and certification;
- Provide MARNDR with a copy of the results of the sampling/cutting record of each lot of fruit intended for export to the US;
- Verify that loads of crates, pallets and LD3 containers for exportation are strapped and that each crate is stamped with the official APHIS seal. The stamp indicates that the fruit has undergone quarantine treatment; and
- Verify that all conveyances have been cleaned prior to loading certified fruit.

It is essential for an exporter to US to collect the necessary information prior to ship its goods in order to avoid delays and even significant losses due to rejection by sanitary authorities: www.aphis.usda.gov/publications/plant_health/2012/f s_imp_food_ppq.pdf

General conditions for importation of fruit and vegetables into US are outlined in the database Fruits and Vegetables Import Requirements (FAVIR): www.aphis.usda.gov/favir/ It is an affordable and easy way to search by product and country before exporting a specific good. According to US laws, food products introduced to US territories are considered an interstate commerce and should meet US standards. FDA, Food and Drug Administration will not approve, certify, and authorize importers. Facilities in the foreign country where products are exported to US need to be registered at FDA and FDA needs to receive advance notice of upcoming products. FDA can retain a shipment if the production conditions are not compliant with American laws. All products offered at US entry points should meet the same standards required by FDA for food products manufactured in US.
https://www.fda.gov/ICECI/ComplianceManuals/Compli ancePolicyGuidanceManual/ucm119194.htm

Animal and Plant Health Inspection Service, APHIS1 and Foreign Agricultural Service (FAS) represent the interest of USDA at the US Embassy in Port-au-Prince. APHIS and Haitian authorities maintain technical working relationships with their Haitian counterparts in order to resolve Sanitary and Phytosanitary (SPS) issues whenever they arise. In addition, they maintain direct contact with industry trade groups, importers and exporters in order to assist and facilitate resolution of trade-related issues as they occur at Haitian ports of entry.

The importers need to review current US legislations. On the page https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsR egulatoryInformation/ImportsExports/default.htm they can check how to engage with a representative in the US, connect with a PCQI (Preventive Controls Qualified individual), prepare a food safety plan for the plant and/or the product to be exported, register its enterprise https://www.fda.gov/Food/GuidanceRegulation/FoodFacilityRegistrati on/default.htm and request an audit by a certified auditor. In addition, every importer to the US need to remain informed about the roll out of the final FDA FSMA rule (Food Safety Modernization Act) on Foreign Supplier Verification Programs (FSVP) for Importers of Food for Humans and Animals. The first compliance dates begun on May 30, 2017 and should be fully enforced by 2019 depending on specific products.

5. First sketch of how the cold chain logistical service can be organized.

During the mission it became clear that the focus of the assignment is shifting from mainly setting up logistics facilities towards design of a blockchain. It was also confirmed that there is no need it is not a requirement to build new building, but rather looking at present infrastructure that can be easily upgraded into pack houses, or cooperation with an exporter/ leasing existing pack house infrastructure are also possible to realise the project. A first sketch of a mango block chain structure has been made, which will be further refined the coming months and presented in the final report Phase 1 A. See Appendice 3 for the first draft. The Wageningen team will make outlines for the mango, avocado and pineapple cold chains from trees/field till arrival at Miami.

Blockchain is an emerging technological innovation, a method of documenting data via a digital ledger that records and verifies transactions, agreements and contracts. The technology allows immediate transfer of digital assets and reduces the need for intermediaries. With this decentralised approach, block chain helps stakeholders involved in a supply chain network or

[1] The Animal and Plant Health Inspection Service is a multifaceted Agency with a broad mission area that includes protecting and promoting U.S. agricultural health, regulating genetically engineered organisms, administering the Animal Welfare Act and carrying out wildlife damage management activities. These efforts support the overall mission of USDA, which is to protect and promote food, agriculture, natural resources and related issues.

contract farming scheme – from the farmer, the wholesaler, the financial service provider, to the supermarket – to trade more quickly and in a transparent manner.

In agriculture there is currently limited knowledge and capacity for its adoption and use. Though block chain for agricultural value chains is still relatively new, the attraction of the technology is that it enables efficient and cost-effective business management, instant payments and helps stimulate innovative value chain partnerships. The advantage to all is that payments can be made electronically, with or without a bank, and transactions are tracked and validated. If a bank is not involved in making payments, then digital or crypto-currencies such as bitcoin, are also being used.

6. Agreement with MCI on initial findings and orientation for the next mission

At the debriefing a number of initial findings have been analysed and discussed. They are presented in the next Chapter 3. The last chapter 4 presents the orientation for the next steps.

7. Agreement on data to be collected prior to the second mission

The following agreements have been made:

- Information on certification requirements US market (Wageningen will check)
- WB information on financial management of proposed block chain (ToR has been shared 19/12/2017)
- SAE team provide data on mango-avocado-pine apple production in their respective departments

8. List of key contacts

A list of key contacts is added in an appendice 2.

3 Discussion

Based on the debriefing with MCI and WB the following elements can be confirmed:

No distortion of present market
The project targets producers in more remote areas and therefore we are not disturbing the current market, while at the same time reaching for more impact on vulnerable population.

Confirmation of importance to have harvester teams
The project will have service provider handling the first part of the chain with harvester teams handling the harvest from tree and transport to mobile truck. The service provider will select, organize, contract, train, monitor and pay harvester teams. The idea of training youngsters as professionals for harvest has strong potential. NGO can be associated for professionalization

Dry run idea
Preparation for tender procedures, tendering and contracting will take at least 6-8 months, meaning that service provider probably starts end 2018. Therefore: proposal to have a dry run of the block chain earlier (somewhere in the period April/May/June).

Sealing by inspectors USDA
USDA procedures of only sealing in PaP is blocking the idea to have packing facilities elsewhere. Regional packing station would create benefits like local economic growth and efficiencies in the chain. Ónly sealing in PaP adds considerable costs and risk in quality decay, which limits Haiti's competitiveness to a large extent. There are examples of regional packing facilities where sealing by USDA takes place (see example Fruits & legumes mentioned in Ch. 2). There is a need to explore if sealing indeed can be done in regional centres.

Block chain guiding the procedures
Block chain structure will be linked with an transparent communication and web-based tracking & tracing system. Standard operation procedures (SOP) are guiding in each step. This will sometimes mean rejection of some producers. Social issue to be aware of: if max capacity is reached other farmers are rejected. WB will select a consultancy/financial firm for handling financial part of the block chain. Auditing of the payment system will be done through block chain.

Outline Pack Station
The MCI should launch four simultaneous tenders for "fresh logistics services, from tree to final client" in four delimited areas in Artibonite, Center, Northeast and Nippes regions. The project would reimburse activities from harvesting to packaging to local transportation but NOT international transportation, up to a maximum amount. For Artibonite and Center, the maximum

amount will be $1.5 million each for mango, avocado or pineapple; for Northeast and Nippes, the maximum amount will be $500,000, for mango, avocado or pineapple.

Packing Centers are proposed for Gonaïves and Mirebalais, maybe adding two more (North-East and Southern peninsula). No need for a physical design of Packing Centre: report Phase 1A will describe the functionalities, flows of products, capacities, and type of operation with responsibilities. The service provider can hire and adapt existing facilities. Start in year I with air freight (3x/week); later reefers in Y 2-3-etc. Use as much as possible solar, use diesel generator only for back-up. The Packing Centers could become more efficient later with extended season to process other crops in low months to make the business running (add on).

Medium to long term perspective
We now start with the present situation (existing trees) with an inefficient production system. Market for mango Francis in the US is likely to be limited but available for start. There is a need for other varieties in the medium term. In the short-medium term farmers start with "micro-orchards" with professional production including new techniques and varieties as the markets demand. As production improves, market selects professional producers and service provider consolidates and expands, the new value chain system emerges.

4 Recommendations and follow up

The following **recommendations** have been shared with MCI and WB:

- Block chain design: one general for multi-purpose fruit Packing Centre, one for mango, and one for avocado. General design can be used for all four proposed venues, handling mango, avocado and pineapple (4 venues, 3 products).
- No need for a physical design of Packing Centre: report will describe the functionalities, flows of products, capacities, and type of operation with responsibilities. Service provider can hire and adapt existing facilities.
- Regional pack stations have preference over pack stations in PaP.
- Ideas for consortium structure service provider: Probably an international player like Hellmann is needed to lead the consortium. The consortium could be an international player together with local Haitian packing station operator and training agency like DOT fruits (DR) and Haitian NGO for capacity development (training of harvester teams).

Follow up for next steps:

Wageningen team:

- Have report phase 1A in good draft available by late January (reduce period phase 1A).
- Make a draft ToR for dry run also by end January.
- Find out which certification requirements are needed in US. Check that a group of farmers can apply as a group.

MCI/SAE teams will:

- Check data, especially production data of selected batch of mango (Artibonite) and avocado producers (Centre); share these data including average production and anticipated volume year I (2018). SAE Artibonite and Centre will also share the 4 key documents (strategy, industry, business,...).
- Other SAE teams (like North East, North, Nippes, ...) will add data for pineapple, mango and avocado.
- MCI (with help WB) will request USDA to allow sealing in regional centres.

WB:

- Will share documents/info on the block chain ideas (with SMS communication functionality). Maybe tracing on website is enough for farmers, not needing many SMS messages on each step. We also need to have information on financial flow structure and how this will be managed.

Focus and scheduling next support mission.

- Focus next mission: Assist in tender formulation and have a dry run.

- Period: April/May/June.
- Have draft ToR ready by end-January (Wageningen team).

References

In the first scoping study a list of references was included. New material also consulted:

- Nora Patricia Castañeda, Fernando Rodríguez, & Mark Lundy (2011) Assessment of Haitian Mango Value Chain. CRS-CIAT. A participatory assessment of mango chain actors in southern Haiti.
- LAREHDO, 2008. Filières Agricoles et Dynamique Transfrontalière. Zemès Bellande, Alex Damais, Gilles; Duret, Paul, 2005. Avocado: "A niche market dynamic articulated around the complementarity of two production systems across Haiti Dominican Republic border" Chapitre 4 –p.105.
- Jordan Bar Am, Michael Louis and Alika Phipps TechnoServe Haiti: Mango Market assessment 2011.
- Various SAE documents from Artibonite and Centre.

Acknowledgements

The mission members are grateful to everybody who assisted in the preparation and the actual mission in Haiti. Our thanks go especially to the avocado and mango producers who shared their time and ideas. We are also grateful to the staff of MCI, especially the SAE teams in Artibonite and Centre and Mick Pantal from MCI, as well as Maria Kim, Jean Emmanuel Desmornes and Emiliano Duch from the World Bank.

All statements and arguments provided by this report only engages the mission members and in no way may the WB, MCI or any other partner involved in this study be hold accountable for the content of this study. The mission has tried to be as complete as possible. Any errors in the text are the responsibility of the mission team alone and not the responsibility of the people we have met in the course of our mission to Haiti.

Port-au-Prince/Wageningen
December 2017

Appendices

Appendice 1: Terms of Reference Start-Up mission
Appendice 2: List of key contacts
Appendice 3: First Sketch of Block Chain

Appendice 1: Terms of Reference Start-Up mission

Termes de Références/Termes of Reference
Mission en Haïti pour la conceptualisation de la chaine froide pour les produits frais

Project:
Technical and Financial Assessment of logistics for the control of the cold chain relating to the export of fresh products from Haiti to the United States. Contract PPM 3.1.6.
l'Evaluation Technique et Financière de la logistique pour la maitrise de la chaine du froid relatif à l'exportation de produits frais d'Haïti vers les Etats-Unis CONTRAT PPM 3.1.6

Main contact for supervision: Ministère de Commerce & Industrie (MCI)
Experts Wageningen FBR: Rene Oostewechel, Jan Brouwers, Yves-Laurent Régis

1. Introduction

The Ministry of Trade and Industry)MCI) through the Business Development and Investment Project (PDAI) is undertaking activities to support regional development and sustainable economic growth in Haiti. This project uses a value chain approach to promote the development of the country by establishing functional linkages between micro, small and medium-sized enterprises (MSMEs), which generates benefits for all producers and end consumers. The MCI intends to use the counterpart funds mechanism of the PDAI project to finance either partially or totally the training, technical assistance or common services that SMMEs currently need to allocate or increase the value of products and, as a result, access markets where they can maximise their profits and thus increase their income.

The cultivation and sale of mangoes and avocados is a generator of employment in the poorest areas of the country and contributes to nearly 40% of the income of this category of people. The value chain analysis was carried out by the MCI Business Support Services (SAE) of the MCI established in the regions. It is in this exercise that the SAEs operating in the Artibonite and the Central Plateau and which are working with producers in these areas have concluded that the mango and avocado industry needs to be improved so that Micro, Small and Medium Enterprises (MSMEs) become more competitive and generate more revenue. Mangoes and avocados are perishable products and as such may be damaged and become unfit for consumption due to undesirable variations in temperature, thus exposing producers to considerable losses. And, in order to achieve the reduction of these post-seasonal losses and, at the same time, to improve the quality of these fruits, the mango and avocado industry in Haiti requires suitable cold chain logistics that enables the control of the process of ripening fruit and to have access to more attractive markets, like the US.

MCI SAEs are currently working with a group of more than 100 mango producers in Artibonite and avocado producers in the Central Plateau that are willing to use cold chain logistics services to access better market opportunities in the US. For the time being, the annual production by target groups of farmers is estimated at 2.5 million kilograms of mangoes and avocados. However, beyond the 100 targeted producers, there is scope for greater demand for cold chain logistics services in Haiti. By 2015, the production of mangoes and avocados in the two areas mentioned above is estimated at 31 million kilograms and the country as a whole produces nearly 255 million kilograms of mangoes and avocados. However, net exports of mangoes are estimated at 15 million kilograms. The new cold chain logistics services represent a major opportunity for producers in this sector and others in their quest to access more promising markets.

The Haitian government has selected as consultant for the project Wageningen Food & Biobased Research (WFBR), see contract. WFBR already has concluded a scoping study that includes an analysis of the avocado and mango sector in Haiti (Annex 2: WFBR scoping report) and a study detailing the technical logistics facilities needed to upgrade the cold chain for fruits in Haiti (Annex 2: WFBR-WB report June 2017). These reports provide a basis for the present project, which will operationalise the cold chain design for two regions in Haiti.

2. Purpose of the project, objective of the Kick-Of mission and deliverables

The overall purpose of the project is to begin the technical design of the cold chain logistics services for the export of mangoes and avocados from the Artibonite and the Central Plateau to the United States. The first part of the project will be the description of services and technical specifications which will be used in the tender documents. The second part of the project is supervision of the firm which will win the tender for the supply of the cold chain service (see Contract p.35 App. IV ToR).

The objective of the mission is to start the technical design of the cold chain through site visits, meetings with relevant stakeholders (producers, MCI, logistics companies, etc.; see contract p.73 Appendix C TECHNICAL OFFER OF THE CONSULTANT).

The mission will produce a report containing the following elements/deliverables:

1. Familiarization with the areas of production (topography, landscape, local facilities, etc…) and the transport routes between the areas of production.
2. Collection of any supplementary data needed from relevant stakeholders (e.g. Producers, SAEs, others)
3. Familiarization with logistical/cargo service providers established in Haiti (e.g. DHL, Fedex, etc…) as well as the cargo facilities at the Toussaint Louverture Airport.
4. Meeting with USDA agent (if possible) to discuss export procedures, etc…
5. First sketch of how the cold chain logistical service can be organized.
6. Agreement with MCI on initial findings and orientation for the next mission
7. Agreement on data to be collected prior to the second mission

8. List of key contacts

3. Preparation

Before the mission takes place data will be collected to prepare the Kick-Off mission:

- Detailed description of needed data and 'acquisition plan' to collect these data (before, during and after the mission)
- Alignment with MCI regarding necessary data and method of data collection and data transfer
- Data transfer, translation, analysis and 'gap analysis' regarding missing data and insight

This will take place in the month before the kick-of mission.

4. Programme

Day 1 (Sunday Nov 26)

- Travel experts to Haiti, arrival and check in at hotel

Day 2 (Monday Nov 27)

- Morning: Visit Toussaint Louverture airport cargo and other facilities. Possibly meet with cargo operators.
- 2:30pm Pick up Emiliano Duch at airport.

Day 3 (Tuesday Nov 28)

- Drive to Mirebalais, Plateau Central
- Morning: Meet up with SAE Centre team. Visit avocado producers/production sites and other relevant sites.
- Afternoon: Drive to Montrouis (2 hrs from Mirebalais).
- Sleep at Decameron or another hotel in the area.

Day 4 (Wednesday Nov 29)

- Morning: Drive to Gros Morne, Artibonite.
- Afternoon: Meet up with SAE Artibonite team. Visit mango producers/production sites.
- Drive back to Gonaives (45 min) or Montrouis (1.5 hr).
- Sleep in Montrouis (TBC).

Day 5 (Thursday Nov 30)

- Morning: travel back to PaP.
- Drop Emiliano at airport at 2pm (flight: 3:36pm).
- Afternoon: prepare debriefing.

Day 6 (Friday Dec 1)

- Morning: Debriefing at WB: presenting findings, assess results, agree on priorities and presentation of TORs for next mission.
- Meeting with USDA (TBC).
- Agree on data collection and communication frequency.
- Preparation next mission.

Depart on a late flight on Friday or Saturday.

ToR Annex 1: relevant documentation

- WFBR report : Design of a Fresh Logistics Center and Fisheries Processing Facility in Haiti. Report No: ACS22611. Republic of Haiti, DTIS Implementation, June 2017.
- WFBR: Haiti Agro-logistical Design Report Scoping Mission 13-17 February 2017, report 1728.

ToR Annex 2: overview activities

(Contact document, Appendix 3 TECHNICAL OFFER OF THE CONSULTANT p.70)

Activities

The proposed activities start with a Kick off meeting:

1. *Kick off Project team meeting*: detailed elaboration and fine tuning of activities and time schedule, together with assigning responsibilities and contacts for the various topics.

Part 1a: technical and financial analysis

2. *Data collection*: data are needed about the current situation of the mango and avocado supply chain. Location, production (per month, showing seasonality), way of harvest, way of transport, packaging, activities taking place, supply chain structure, airport facilities and procedures, connectivity (distance, infrastructure and road quality), information flow, best practices export to USA, legal aspects, climate, information on quality aspects (local and in the USA). The first step is a desk research on documents, provided by the client, of previous studies on the Haiti agricultural supply chain. The collection of missing data is a joint effort of the client and Wageningen FBR, including interviews and field visits (including preparation for activity 6), specifically for the production regions of avocado and mango.
3. *Determining location of logistic service centres*: based on results of activity 2 the optimal amount and locations of the service centres are derived, especially using data on connectivity to production area and airport. Another important criterion in this process is the scale of operations (number of farmers connected) in comparison to the available investment budget of 1,2 million USD.

4. *Logistic design of supply chain*: describing all the activities, required facilities and involved stakeholders in the supply chains of mango and avocado from harvest to the border of the USA, including the order and responsibility.
5. *Functional design logistic service centres*: description of all functions of the logistic service centre (e.g. sorting, packaging, precooling, storage,…) including the set up parameters, like height, area per function, light, machine capacity, isolation, temperature, relative humidity, number and position of docks, investment costs.
6. *Operational and technical design of all processes*: detailed description of location, capacity, timing (e.g. buffering or not), packaging technology, equipment (including names of optional partners like Aweta, Greefa). Included will be the provision of technical specifications respecting phytosanitary standards for export to the United States. Considering traceability WFBR will consult the client what system to use best according GlobalGAP standards (f.e. GS1).
7. *Economic analysis*: using Activity Based Costing the operational cost of the supply chain are determined and compared to the estimated USA price. Scenarios on various volumes are analysed from an economic point of view including investment costs also, using high level ROI calculation.
8. *Team presentation*: findings are presented with client and discussed to optimize the input for the report.
9. *Report writing*: together with the client a report structure is created to support the tender phase. Wageningen Food & Biobased Research is writing the report on the findings of phase 1.

Part 1b: tender support

10. *Accompany the tender for the logistic service centres*: feedback on tender document written by the client and feedback on relevant parts of the documents of the tendering companies.

Part 2: supervision of the service provider

11. *Field visits*: every 3 months an expert is visiting the sights where the logistic service centres are built. The expert will check the development of the functional design, including small sampling if possible.
12. *Report writing*: document on progress in time and final result of the functional design with respect to matching the requirements described in activity 6.

Timeline
Kick off and Part 1a: 6 months
Part 1b: 6 months
Part 2: 1 year

Appendice 2: List of key contacts

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Appendice 3: First Sketch mango cold chain structure

Draft organisational sketch of the cold chain logistical service.

Below, each step in the cold chain will be discussed in a general model. This model will serve as a basis for several fruit crops and will be specified per product as the chain may differ somewhat per product.

The chain consists of physical handling of the product and SOP's for this regarding each step in the chain as well as administrative handling at each link in order to provide the correct data for a block chain traceability system that will enable checking all steps and costs build-up in the transparent chain from tree to the final sale of the fruit in the US.

Important to understand is the fact that the producer/farmer will remain owner of the fruit until the final point of sale in the US. The service provider will provide service including harvest, transport, all activities in the pack station, export- handling and shipping and take cate of the costs of these services. After sale of the final product, the service provider will be compensated for his expenses by the broker who will be deducting all costs plus a margin form the final sales price before paying the remainder (nett price) to the farmer. The bock-chain in which data of each step are computerised will ensure transparency of the cost structure, as well as food safety issues in the chain at batch level.

Step 1: Certification and registration

Physical handling	Responsible
Register all participating farmers, location, number of trees, estimated total yield, start/end date of harvest season and assign each grower with a unique code number (production Unit Code Number PUC)	SP- production manager
Registration of pack house facility and organisation with Haitian authorities and USDA inspection unit	SP- general manager
Train and certify ..... number of harvesters based on SOP harvesting	SOP, training and certification organised by SP, making use of DR expertise (Dotcom)
Primary production certification and/or trade certification (e.g. fair trade, organic) Organise an internal audit system for all participating farmers and design standard agreements with them in such a way that they can be certified as a group.	SP
Pack house certification HACCP Assure the construction of the pack station meets HACCP requirements. Design product flow chart and define all CP and CCP's plus mitigation actions.	SP
Data registration	Responsible

Farmer registration by PUC Tree location mapping Production and harvest planning Certificates and their registration numbers	
Information provision	Responsible

Step 2: Planning of the harvest

The planning will be as such that during 6 days per week, each day the same amount of fruit will be harvested and brought to the pack station. This makes management and planning easy and optimises capacity use.

Physical handling	Responsible
Make a planning for the full season, based on number of trees and estimated yields, Adapt the planning in case necessary Fix an average number of fruits/weight to be harvested by a 3-person team per hour as a KPI	SP
Pre-harvest orchard survey, including fruit sampling, recording of pest, diseases, orchard management issues	SP- production manager
Data registration	Responsible
Harvest group (certified), its code number plus number of persons, date, harvest location Availability of empty crates, number and location to match requirements Batch numbers of orchards to be harvested	SP
Information provision	Responsible

Step 3: Harvest

A certified harvesting team will be send by the service provider (SP) to the orchard. They will bring a motorised transport means for the harvest (e.g. pick-up truck and crates). It is also important that the harvesting team is large enough to fill the truck within a period of time that equals the time needed to transport the fruit to the CC and come back.

Physical handling	Responsible
Arrival at orchard with motorised transport and empty crates. Harvesting in groups of three, one climbing the tree, clipping the fruit at 0,5 to 1,0 cm stalk and throwing it towards a catcher. Catcher puts the fruit upside down in a de-sapping rack. Third person puts de-sapping racks in place and after 30 minutes removes the fruit from the	Harvester team

racks and stacks in plastic crates (18 kg) padded with leaves and loaded to the truck put in the shade. Labelling each crate (batch number, variety, date of harvest)	
Data registration	Responsible
Date and time of arrival/start harvest Location (batch number) Date and time finish harvest Number of harvest teams and their code numbers	Harvest team(s)
Information provision	Responsible
Cost of the harvest	

Step 4: transport from orchard to Pack house

Physical handling	Responsible
Driving the motorised transport means (pick-up) from orchard to pack house Unloading the crates with fruit at the pack house Weighing, counting the number of crates supplied. Loading empty crates Returning to the orchard.	Harvest team
Data registration	Responsible
Location batch number Time leaving the orchard Time arrival at pack station Code number of the harvest team(s) Number of crates supplied Weight of crates supplies (nett) Number of empty crates loaded	Harvest team
Total number and weight supplied Cost of the transport	

Step 5: Receiving fruits at the pack house

Physical handling	Responsible
Recording fruit temperature. Recording weight and number of fruit Verification if plastic crates are suitably labelled Random inspection for maturity, size, bruises etc. in order to allow a lot to be processed or not	Quality supervisor
Data registration	Responsible
Batch number Fruit temperature Weight/number of crates	Quality supervisor

Time of delivery	
Information provision	Responsible
As above	

Step 6: Processing at the pack station

Physical handling	Responsible
Moving the fruits from pre-processing storage area to the processing area. Fruits will be put to an automatic washing system fitted with overhead sprayers and smooth rotating brushes. The water will be potable quality and 0.1% neutral soap will be added, this will take approximately 4 minutes and the water temperature is maintained at 27C°. Next, all fruit (mango) will be graded by weight/size prior to the hot water treatment. (for Francis, < 375 gram and 376-570 gram). Next step is a hot water treatment {**mango only**}. This is done in tanks with thermostatic control containing water maintained at 46,1C°. Duration [65 or 75 minutes] depending on the size. After the hot water treatment: when adding 10 minutes to the hot water treatment, the boxes with mangoes must be hydro cooled with water temperatures at 21 to 22 C°. This takes approximately 30 minutes (depending on size of the fruit) until the fruit flesh temperature is down to 27 to 29 C°. (measure!) After this, the fruits pass through a drying table until dry, then wiped with a soft cloth. Transferring to a sorting and grading belt/table. Sorting out over- and undersized fruits by trained workers. Also immature, damaged fruit. The fruits sorted out are put to plastic crates and kept separate (marked with their batch number). The good fruit is graded into different Classes. After grading, the fruit is packed in carton boxes of food grade. Usually 370x275x90 mm. The carton boxes are then labelled (USDA approved) The label includes Production Unit Code Number (PUC) (is farmer code),Pack house code Number (PHC) date of packing and batch number. Transport to forced cooling unit (for mango!) For other fruits the forced cooling takes place directly after arrival at the pack house. After	

reaching [12C], storing at ready products cold store waiting for shipment	
Data registration	Responsible
Quantity of rejected fruits per batch. Fruit temperature Hot water treatment registration	
Information provision	Responsible
Rejected fruit number (to be collected by the farmer or madam Sarah) Number of fruit to be shipped Costs (and margin) in the pack house	

Step 7: shipment to PaP

Shipments will be adapted to the flight schedules to Miami and target to arrive 2 hours in advance

Physical handling	Responsible
Loading of refrigerated truck (or reefer)	
Data registration	Responsible
Batch number(s) Date and time of shipment Temperature settings of the truck/reefer	
Information provision	Responsible
Product shipped to PaP Costs of the shipment	

Step 8: arrival at PaP airport (port)

Physical handling	Responsible
Unloading to cold store facility or remain in reefer	
Data registration	Responsible
Batch number(s) Date and time of arrival Fruit temperature	
Information provision	Responsible
As above Costs for airport handling	

Step 9: documents for export

Physical handling	Responsible
Export documents ..... USDA Approval	
Data registration	Responsible

Information provision	Responsible
Documents provided Costs of the export documents	

Step 10: air/sea transport to Miami

Physical handling	Responsible
Loading on the plane (or vessel) Transport to Miami	
Data registration	Responsible
Batch number(s) Date and time of loading	
Information provision	Responsible
Loaded!	

Step 11: trucking to depot in US

Physical handling	Responsible
Loading from plane (vessel) to truck Transport to depot	
Data registration	Responsible
Batch number(s) Date and time of loading Temperature setting of truck/reefer	
Information provision	Responsible
Costs of tucking to depot	

Step 12: Arrival at depot in US

Physical handling	Responsible
Receipt of the fruits Storing at cold store (12C)	
Data registration	Responsible
Batch number(s) Date and time of arrival Product temperature at arrival	
Information provision	Responsible
As above	

Step 13: Broker in US

Physical handling	Responsible
None	
Data registration	Responsible

Batch number Sales price Costs for depot Margin	
Information provision	Responsible
Produce sold Sales price, all costs and margins, final price for the famer.	

Step 14: US shipment to delivery address client

Physical handling	Responsible
Loading at depot Transport to final client Delivery at final destination before change of ownership	
Data registration	Responsible
Batch number Date and time of loading Product temperature	
Information provision	Responsible
Cost of transport	

Step 15: Delivery to address for change of ownership

Physical handling	Responsible
Delivery of the fruit	
Data registration	Responsible
Batch number Temperature of the fruit Date and time of delivery	
Information provision	Responsible
Cost of the delivery	

