MARTIN WEUSTHUIS

AFGHAN POMEGRANATES IN THE NETHERLANDS

Designing an international pomegranate supply chain

Larenstein
University of Applied Sciences
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An inquiry into the design of the pomegranate supply chain from Afghanistan to the Netherlands

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Supervisor: Dr. Robert Baars

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SUMMARY

This research is about the design of a pomegranate supply chain from Afghanistan to the Netherlands. Setting up a pomegranate supply chain could be an interesting business as western consumers show a great deal of interest in healthy food with high nutritional values. Pomegranate is already classified as a 'super fruit' with just the qualities consumers look for. Afghanistan might be an interesting supplier of pomegranates because indigenous cultivars hold these required qualities and are cultivated in conditions close to organic.

In order to determine the design of the pomegranate supply chain, this chain is looked at from 10 different viewpoints:

1. Processes in the chain
2. Actors in the chain
3. Flow of products and (product) information
4. Volume and value
5. Costs, margins and profits
6. Technology and knowledge
7. Services feeding into the chain
8. Relationships and linkages
9. Finance
10. Governance

The most important asset of Afghan pomegranate is its germplasm with market-sought attributes. Afghan germplasm has to be protected through establishing gene banks, protection and information programs and nurseries.

At this moment, cultivation and post harvest handling are rudimentary. Afghanistan missed 30 years of horticulture development. Due to the 30-year war, the recent drought and lack of treatment, orchards deliver some 25% of their maximum yield. Postharvest fruit losses run up to 40% because of existing harvesting, transport and packaging practices.

Afghanistan is a small pomegranate producer at global level. Only 2% of Afghan fruit cropland is used for pomegranate cultivation. Specialisation is lacking because for the greater part pomegranates are cultivated in small back yard orchards together with other fruit trees. Commercial orchards have mostly been abandoned in the course of war.

NGO's set up much needed extension programs on nurseries, irrigating, pruning, fertilizing and pest control, and on postharvest treatments like grading and sorting, packaging, storing and transport. Government extension institutions are severely understaffed. By a 2009 Memorandum of Understanding, the Netherlands have become the official lead donor in the field of agricultural education, training and extension.

Afghan government is absent. The Afghan economy is informal, unrecorded and untaxed by the state. In an informal economy with informal marketing structures, social marketing networks with patron-client relations set the rules. Farmers, local traders and wholesalers act in tight social and ethnical marketing networks giving no possibility to market their products outside these patron-client relations. Producers are sparsely connected to international markets. Few farmers are organized in horizontal producer's cooperations while farmer's marketing organizations do not exist.

The benefits of these vertical marketing networks are security; certainty of selling one's crop and being in a social network that acts as a safety net. The costs are hampering of contractual relations outside of these networks and of the establishment of transparent competitive markets. Chain arrangements between actors are geared to avoid risks. The result is an under developed product driven marketing system not aiming to deliver

product quality, but geared to heavy price competition. The chain is a truncated system without forward and backward linkages and push or pull factors to develop a value-adding subsector.

In Afghanistan, a formal banking sector is absent. A vibrant informal financial sector has developed using *hawala* services. Chain financing is common in Afghanistan. Many small-scale pomegranate farmers do not have the money to buy fertilizers and pay harvesters and packaging material. This is taken care of by local traders (often the local shopkeeper) who in turn often get pre financed by wholesalers and international dealers. Informal credit is embedded in Afghan society. Also outside the chain, informal credit is accessible for nearly all households in Afghanistan, with many households both giving and taking debts simultaneously.

Starting 2006, micro finance delivers credits aimed at setting up businesses and stimulating production in Afghanistan. Strict short-term financing conditions do not meet the agricultural season needs of a small-scale pomegranate farmer who needs fertilizers in spring and receives money in autumn. Because most credits are granted to non-agricultural activities in urban areas, micro finance will not be the financing source of agricultural supply chain development.

International fruit dealers will only be interested in establishing a pomegranate supply chain from Afghanistan when Afghan fruit quality is better than Iranian quality, prices are lower and a steady supply can be assured. At present, none of these conditions is met.

In the build-up to a possible future trade with Afghanistan a set of product specifications and technical contract demands has been recorded by the Dutch fruit industry for pomegranate import from Afghanistan. This research report lists the many actions that have to be taken in production and post harvest treatment to comply with these demands. One outstanding demand is the establishment of a cold chain. Within 7 hours after harvest, fruits have to be pre-cooled to 5°C and stored in a cold store, from where the cold chain is kept until arrival in Dutch retail shops. In Afghanistan, just a few cold stores do exist, built by NGO's in big cities throughout the country. When this cold chain demand is strictly kept, no supply chain will come about in the short term, just for that reason.

It is a challenge for wealthy Afghan families or other parties with land property and know how about Afghan conditions, to start big commercial orchards delivering the necessary product quantity and quality. An out growers scheme setting up farmer's marketing cooperatives and maybe an auction process nearby a cold store in provincial cities, is needed to develop transparent marketing systems and value adding chain conditions. Bringing about market oriented production, combined collection and quality control is part of these efforts. All of this is needed when linking up to the international pomegranate supply chain.

As a result, the supply chain will shorten. Activities of local traders and wholesalers adding no value will turn out to be redundant and many traders will be out of business, adapt to a new role in the chain, or perhaps deliver services to chain actors.

The report distinguishes four possible supply routes to the Netherlands. Routes via Pakistan and Iran across land and sea, or entirely across land with trucks or railway wagons.

At present setting up a profitable export supply chain giving a steady supply of high quality pomegranates to the Netherlands seems not feasible. Production volume is just not adequate, let alone the difficulties of collection, packaging and transport. For the same reason of inadequate supply, a pomegranate juice / concentrate processing plant with export potential is not profitable yet. This plant needs the produce of nearby big commercial orchards. Nevertheless because of substantial and increasing domestic juice

consumption (all imported), it is an interesting idea to start a small (concentrate) processing plant for domestic consumption.

Finally, governance is discussed through the position of the Afghan government as chain director. A facilitator of the Afghan marketing system is badly missed. This manager should have the position to collect, analyse and distribute market information to achieve transparency and competition in agricultural trade, bring together potential business partners, examine (export) trade opportunities and get in touch with foreign governments and business partners. Furthermore, this director should set quality standards for pre and post harvest handling and should have the power to enforce production and marketing rules. If the Afghan government doesn't play the lead role in establishing and enforcing formal rules in all of these actions, existing informal patron-client marketing networks and oligopolistic power structures dominating domestic marketing chains will remain and prohibit or at least slow down the process of opening Afghanistan's markets and joining international supply chains.

CHAPTER 1 INTRODUCTION

1.1. Pomegranate interest in the Netherlands

In the Netherlands in last decades, interest has grown in a more healthy way of living. Eating fresh fruit and vegetables is one way of giving meaning to a healthy diet.

Pomegranate is a fruit with proven and alleged health benefits. Pomegranates hold great quantities of vitamins, potassium and antioxidant polyphenols[1]. Moreover, research shows pomegranate being effective in reducing heart disease risk factors, risks of cancer and other maladies[2].

Commercially the expression super fruit has been invented for fruits with nutritional significance due to their nutrient richness, antioxidant value or anticipated health benefits. Scientifically the concept of super fruit is not validated. This did not prevent the food industry to recently promote pomegranate as a super fruit.

Therefore, at present pomegranate products attract a lot of attention. The European Union imported 27,000 tons of pomegranates in 2008 and expectations are this amount will rise in the next years[3]. Signs of interest in pomegranate products are clearly present[4].

1.2. Pomegranates in Afghanistan

Pomegranate is a fruit that for centuries has been an Afghan produce exported to countries in the region such as India, Pakistan, China and Iran. In these countries, pomegranates grown in Afghanistan are known for their quality and the beautiful red skin colour. In the seventies of last century, dried fruits and nuts from Kabul were exported to the EU. However, during wartime orchards were destroyed, supply lines cut off and production was reduced to supplying local markets. Countries like Spain and Turkey took over the EU market.

The Afghan central government has repeatedly stated that rebuilding agriculture, promoting horticulture for export and developing marketing chains from the farmer's field to the international market place are strategic priorities[5]. Afghans are proud of their fruit[6]. In 2008 in the Kurhaus in Scheveningen, the Afghanistan president Mr. Karzai told the audience of Dutch business persons: "Our fruit is the best in the world, but we don't know how to store, package and sell it. Dutch companies can help us introducing modern methods"[7]. November 2008 in Kabul in cooperation with USAID, the *ANAR*-project was proclaimed[8]. *Anar* is the Afghan word for pomegranate in several languages. The American government finances the *ANAR*-project with 12 million dollars with the purpose to create a successful Afghan export commodity.

1.3. Afghan pomegranates in the Netherlands

Institutional development partners like foreign countries and NGO's present in Afghanistan, not only try to develop agriculture in Afghanistan, but also attempt to set up domestic supply chains and export supply chains to Asiatic and North African region states and to the USA and the EU[9].

The Dutch government present in the province of Uruzgan also promotes the establishment of an agricultural society in this region, stating this is the way to get rid of poppy growing and terrorism. Furthermore, the Dutch government acknowledges that infrastructure and supply chains have to be built from scratch. For these purposes money, knowledge and capacity are reserved[10]. April 4 2009, the Afghan and Dutch governments presented by their mutual ministers of agriculture, signed a Memorandum of Understanding on cooperation[11]. The Netherlands have become the official lead donor in the field of agricultural education, training and extension.

This research is a contribution to these efforts by designing the supply chain to export pomegranate products from Afghanistan to the Netherlands.

1.4. Object and objective of this research

Dutch companies roam the world searching for high quality pomegranate fruit at the best price. Afghanistan can deliver this fruit with the beautiful characteristic red skin as a surplus value. The question is how to get this fruit in a cost-effective way to the Netherlands.

The object of this research project is the Afghanistan - Netherlands Pomegranate Supply Chain (PSC).

The objective of this research is to design the optimal pomegranate supply chain delivering pomegranate products from Afghanistan to the Netherlands.

1.5. Research issue of this research

What knowledge must be available to come up with answers to the objective of this research, an optimal functioning PSC from Afghanistan to the Netherlands? For that, the following questions need to be answered.

1.5.1. Central questions

Central question 1
Which elements and which processes of a functioning PSC deriving from relevant literature and experts experience, are essential to the Afghanistan – Netherlands PSC design?

Sub questions
1.1. Which elements and which processes of agricultural supply chains can be derived from literature?
1.2. Which elements and which processes can be derived from the knowledge of experts on Afghan international supply chains and (Afghan) PSC's?
1.3. Which elements and which processes can specifically be formulated on designing the Afghan international PSC after studying the subjects mentioned above?

Central question 2
What is the current performance of the existing Afghanistan – Netherlands PSC, assessed in view of the essential elements and processes?

Sub questions
2.1. How are the different chain processes organised and how are they functioning according to literature and experts?
2.2. To what extend the functioning of the chain can be assessed in view of the referred essential elements, and what are the opinions of experts on this?
2.3. What are the main problems in present day Afghanistan – Netherlands PSC's according to experts?

Central question 3
How should the existing Afghanistan - Netherlands PSC be redesigned in order to design an optimal PSC, delivering the wanted pomegranate products to the consumer?

Sub questions
3.1. At what points the functioning of the essential processes and elements lead to redesign of the chain?
3.2. What are the possibilities of redesign after discussion with chain actors?

3.3. How does the Afghanistan - Netherlands PSC look like according to the redesigned logistic concept, completed with specific Afghan design matters?

1.5.2. Definition of key concepts

In the research issue the following key concepts appear.

Process

A structured measured set of activities designed to produce a specified output for a particular customer or market. For the purpose of this research project, a process is defined as a distinctive part of the logistic concept of the supply chain.

Element

For the purpose of this research, an element is an aspect of the PSC that gives insight in the functioning of the chain from different angles, and after analysis offers possibilities for redesigning the chain.

Supply chain

A supply chain is a series of physical and decision-making activities connected by products and (product) information flows, which is aimed at producing value for the end consumer and at the same time is satisfying all other stakeholders in the chain.

Supply chain design

For the purpose of this research project, design of the supply chain means the logistic concept of the supply chain, describing all actions to be taken in all processes in the chain.

Supply chain redesign

For the purpose of this research project supply chain redesign is defined as redesign of the logistic concept of the PSC, based on the (mal) functioning of one or more actions or / and processes in the chain.

CHAPTER 2 THEORETICAL BACKGROUND

2.1. The theoretical model for pomegranate value chain analysis

Because this research project is about designing a PSC from Afghanistan to the Netherlands, this is a practical design oriented research with specific attention to subjects playing an important role in supply chains from developing countries. The basis for the model used for the appraisal of present day Afghan pomegranate value chains, lies in the concept used in the tool book 'Making value chains work better for the poor'[12], prepared by an international working group of specialists on value chains. This model is adjusted with themes borrowed from ´Donor approaches to supporting pro-poor value chains´[13], ´Value chain analysis for policy-makers and practitioners´[14], ´Report on value chains´[15], and the model is extended with an additional chapter elaborating on finance, using the USAID report 'Finance in value chain analysis'[16].

Finally, 10 elements were selected to study supply chains for an adequate description and analysis of present day value chains in developing countries. These elements are used in chapter 3 when describing and analyzing present day Afghan PSC's and in chapter 4 when designing the optimal PSC from Afghanistan to the Netherlands.

These elements are:

1. Processes in the chain
2. Actors in the chain
3. Flow of products and (product) information in the chain
4. Volume and value
5. Costs, margins and profits
6. Technology and knowledge
7. Services feeding into the chain
8. Relationships and linkages
9. Finance
10. Governance

These 10 elements are elaborated upon in the next paragraph and several research issues and questions concerning these elements are recorded there. Many of these issues originate from the tool book 'Making value chains work better for the poor'. This tool book offers a convenient survey of issues involved in the appraisal of a value chain from a developing country. These issues and questions are adjusted and completed for the purposes of this research.

2.2. Elements of the value chain analysis

1. Processes

In appendix 3 general information is given about the processes and the core activities of these processes in pomegranate cultivation. In appendix 4 general information is given about the processes and core activities in pomegranate processing.

Defining processes is about a good understanding of the functioning of the chain. For this at first, the chain has to be cut in separate parts, the processes. Then the processes are distinguished by defining the core activities as presented in table 2.1.

Table 2.1 Processes and core activities in present day Afghan PSC

1. Starting material
   1 seedlings
   2 fertilizers
   3 pesticides
2. Cultivation
   1 planting
   2 fertilizing
   3 irrigation
   4 pruning
3. Collection
   1 harvest
   2 grading
   3 packaging
   4 transport
4. Wholesale
   1 store
   2 marketing
   3 transport
5. Retail
   1 sorting & grading
   2 store
   3 sell
6. Export
   1 store
   2 sorting & grading
   3 paperwork
   4 transport
7. Import
   1 quality control
   2 store
   3 paperwork
   4 transport
8. Processing
   1 washing
   2 cutting
   3 pressing
   4 filtering
   5 packaging
   6 storing

2. Actors

This is about pointing out the actors involved in the above processes and how they can be categorized according to:

- legal status or ownership
- size or scale
- location

3. Flows of products and (product) information

This is about the stages the product follows from raw material to final product and the information and knowledge that surrounds and accompanies these production phases.

1. the flow of the product down the chain
2. the flow of information and knowledge up and down the chain
   - how is the information exchange within the chain organised, who informs who?
   - is there an actor in the chain that provides information and knowledge?
   - what information reaches which actor in the chain?
   - does every actor in the chain have the information needed to do the right thing?

4. Volume and value

This is about quantifying the volume and the value of the products throughout the chain.

1. what is the volume of the product in the different stages mentioned in item 3?
2. what is the value of the products in the different stages in item 3?
3. how does the value change in the different stages in item 3?

5. Costs, margins and profits

This is about the money an actor in the chain contributes (costs), the money this actor receives (margins) and the profits this actor makes. Measuring costs and margins enables to determine at what points in the chain the biggest contributions and the biggest incomes are made.

1. what are the fixed and variable costs of each actor?
2. what are the sales volumes and selling prices of each actor?
3. what are the margins and profits of each actor?

6. Technology and knowledge (t&k)

The assumption of studying technology and knowledge in chain activities is that demand driven product quality determines which technology should be used and which knowledge levels are required.

1. what is the current technology in use in the value chain per process / actor?
2. what is the efficiency and effectiveness of this technology?
3. does the t&k produce the required outcome?
4. who determines the used t&k?
5. who has access to t&k and who delivers t&k?
6. what are the costs and margins of used and new technology?

7. Services feeding into the chain

This is about the services and assistance actors within and outside the supply chain provide to help chain actors meeting the requirements of rules and regulations and quality standards.

1. which actors provide what services to which chain actors?
2. why do these actors provide these services to these actors?
3. how satisfied are the actors with these services?

8. Relationships and linkages

This is about the relations and linkages that exist between actors in the chain ranging from 1. spot market relations to 2. persistent network relations and 3. vertical integration. Linkages and enforcement mechanisms (governance) in a supply chain are each other's counterparts. The linking pin is trust. Organisations without linkages can do business if enforcement mechanisms exist to ensure compliance with a given set of rules.
In the absence of means of enforcement, only supply chains with linkages providing trust have rights to exist.

1. what linkages do exist?
2. what is the reason for linkages and the absence of linkages?
3. how important are linkages?
4. what is the level of formality?
5. what is the trust level?
6. how long do linkages exist?
7. what about the relative costs / benefits of the linkages?

9. Finance

This is about the financial structures within and between companies in the value chain. How is the financial relationship between actors in the chain organised, who has the money, who finances who, and what does that mean to power positions and dependencies in the chain?

1. how is the intra company finance organised?
   - is there book keeping and a (basic) cash flow analysis?
   - which cash flow factors determine profitability and how much risk do they represent?
2. how is the inter company finance organised?
   - is value chain finance the matter?
   - are there cultural and knowledge related factors?
3. how is the provision of finance services to companies in the chain organised?
   - who are the finance service providers?
   - which services do they provide (credits, savings, risk management)?
   - has every actor in the chain access to financial services?

10. Governance

This is about (government) rules and regulations governing (parts) of the chain. Governance is the system of organization, coordination and control that preserves and enhances the generation of value along the chain. Governance implies that interactions between actors are not at random, but are organized in a system that allows meeting specific requirements in terms of products, processes and logistics.

1. what formal rules and regulations do govern the supply chain?
   - from the government
   - from the EU

- from the cultivation organisation
- from the production company
- from the export company, etc

2. what enforcement rules and what sanctions and incentives do govern the supply chain?
3. who establishes the rules?
4. who monitors the rules?
5. what are the (dis) advantages of the rules for each category of actors in the supply chain?

2.3. Justification of methods

This research project is a qualitative, in depth study, conducted in a combined case study and desk research method.

Desk research was needed mostly during the first part (central question 1) of the research. This desk research was a literature study on modelling theory. At first, the chain redesign model of Van der Vorst[17] was used, to describe, analyse and redesign the Afghan PSC. However, this model is not suitable for these purposes when dealing with a supply chain from a developing country like Afghanistan.

The Van der Vorst model assumes a lot of facts and knowledge available about efficiency and effectiveness in the functioning of the chain. However, in Afghanistan there are hardly any known quantitative data such as lead-time, delivery time, fixed and variable costs, cost price, sales price and margins. The model is built around a comparison of the present and the future 'would be' situation, with an analysis leading to steps taken to improve processes and chain upgrading. At the moment there is not a functioning competitive Afghan – Netherlands PSC, so comparing is not possible.

Furthermore, the Van der Vorst model is built around recognizing uncertainties in the chain and looking for the sources of these uncertainties, aiming at eradicating these uncertainties by adjusting processes, restructuring organisations and remodelling the chain. The Afghanistan PSC is one big question mark with loads of uncertainties in the domestic supply chain. Moreover, the sources of these uncertainties are often hidden in political, social and ethnical circumstances and consequently very difficult to reveal. Lack of data is also a cause of ignorance of these sources. The only part that probably could be analysed and redesigned according to the Van der Vorst model, is the part after the sea container with pomegranates has been loaded onto the ship until the final product is lying on the supermarket shelf in the Netherlands. But this is something to worry about later. Analysis and redesign of the Afghan part of the supply chain should be done in the first place and are the major subjects of this report.

During this first modelling stage, Mr. Ehsan Turabaz, president of the Netherlands – Afghanistan Business Council, part of the Nederlands Centrum voor Handelsbevordering (NCH), member of the WEWA study group (Werkgroep Wederopbouw Afghanistan) of VNO-NCW, and honorary consul of Afghanistan in the Netherlands, was interviewed about supply chains from Afghanistan in general and about Afghan circumstances.
Secondly, an independent agricultural consultant with extensive experience in supply chains in developing countries in Eastern Europe, Africa and Central Asia was interviewed. He is specialized in value chain development and through his company CTRT (Consultancy and Training for Rural Transformation), he works for NGO's and partners such as EU and Dutch government institutions and the World Bank. Recent assignments concerning mapping out existing fruit supply chains and chain development formulation, were executed in Afghanistan.

During the second part of the study, a triangulation of sources and methods was needed to answer the central questions 2 and 3. Literature was studied and experts were interviewed on pomegranate supply chains from Afghanistan, Iran and Pakistan.

The director of CTRT contacted in the first modelling phase, was interviewed again. It was clear he could give a good view of fruit production, collection, marketing, transport, export and processing in Afghanistan. Later on, after studying literature, as a clearer image around the research subject emerged and information in detail was needed, several other specialists were interviewed.

At first, the director of Agro Eco, a Dutch agricultural consultancy organisation (recently merged with the Louis Bolk instituut) was contacted. He has knowledge of horticulture supply chains from developing countries, and he has done the groundwork for setting up fruit supply chains from Iraq and Iran to the Netherlands. At this moment, being associated to the WEWA, he is busy examining and setting up horticulture supply chains from Afghanistan (Uruzgan) to the Netherlands.
The director of Dutch company GSE BV (Growing Sales Exchange), with local experience in growing and handling saffron and other horticulture crops in Afghanistan was interviewed about local production, handling and transport circumstances and possibilities.
The directors of Yaran BV, a Dutch company importing fruits from Iran and employing local agents, were interviewed about pomegranate producing and processing conditions in Iran.
The director of Frischsaft FRISCHE Produktions GmbH, a German based fruit processing company, was interviewed about pomegranate marketing and processing conditions.
The director of Total Fruit BV, a Dutch fruit importing company promoting the import of pomegranates from Afghanistan, was interviewed about pre and post harvest conditions the Dutch fruit industry attaches to the import of Afghan pomegranates.
The director of Add Export Import Consultancy BV, with experience in global transport of agricultural products, also involved in the Total Fruit promoting activities, was interviewed about the promotion activities and the transport from Afghanistan.
The director of Netherlands based company YmeKuiper BV was interviewed about transport practices of agricultural produce from Uzbekistan and through Russia.
The director of Dutch consultancy firm Axuda Insurance BV, with expertise in insuring people, companies and activities in Afghanistan, was interviewed about transport insurances.
Finally, the Central Asian specialist of Dutch Company World Freight Logistics BV was interviewed about possibilities and costs of alternative transport routes to the Netherlands.

Looking at the framework of this research report, it seems clear that throughout the entire project theoretical and empirical study is mixed, at one time being supplementary, the other time testing and verifying.

CHAPTER 3 DESCRIBING THE POMEGRANATE VALUE CHAIN

This chapter will discuss central questions 2 and 3 as formulated in § 1.4.

3.1. Introduction

After a thirty-year war period, Afghanistan has lost its position on fresh and dried fruit export markets[18]. Because of their quality, especially dried fruits from Afghanistan were exported. Fruits such as grape, apricot, almond, watermelon, apple, apricot, mulberry, peach, pomegranate and nuts have always been important commodities for the rural economy. The war period set the country back in time by destroying farmland, orchards and infrastructure such as roads, transport, processing industry and marketing structures, and by introducing poppy cultivation.

At this moment, Afghanistan's most successful agricultural export product is opium. Poppy is a high yielding crop that produces in the year of sowing. For several reasons substitution is sought for poppy growing. According to the official Afghan agricultural policy, one good alternative is cultivating high yielding produce linked to worldwide markets through international value chains. The Afghan *Anar* with its shining red colour is mentioned as one of these high yielding commodities. Afghanistan wants to modernize and expand the country's pomegranate industry, which in wartime has depended on domestic sales and small scales exports to nearby countries.

Source: www.worldmapfinder.com

Figure 3.1 Map of Afghanistan and neighbouring countries

3.2. Processes

Starting material

According to FAO Afghanistan is home to 48 indigenous pomegranate cultivars[19]. These cultivars produce excellent fruits, big, with a red shining colour and a delicious sweet taste. Because of the war, not much care was taken of many pomegranate orchards until recently. The 3 years drought at the start of this century did not do much good either. In the battle against poppy NGO's and the Afghan government try to create as much value in pomegranate business as possible. This starts with revitalization of existing neglected orchards and by propagation in tree nurseries around the country. In addition, hundreds of thousands of fruit trees have been flown into Afghanistan. The question is which cultivars were flown in and what quality cultivars are used in propagation at this moment. Existing smaller orchards and small-scale farmers operate their own nurseries to deliver new saplings.

Cultivation

Many traditional pomegranate orchards consist of trees of different cultivars[20]. It is generally unknown which varieties are concerned. Pomegranate in Afghanistan does not get the treatment they should have to achieve an optimal yield[21]. For instance, irrigation is done excessively by flooding the orchards every 10 – 15 days. Pomegranate trees are rarely pruned and show excessive growth. Farmers do not clean flower remains of young pomegranate fruits as pest control, preventing the pomegranate moth to use these flower remains in the calyx. Money to buy fertilizers is usually not available; fertilizing is done by manuring and mulching. For the same reason most pomegranates are produced without pesticides. When chemicals are used knowledge about quantities and effective functioning is inadequate, which may result in too high residues levels. When the orchard floor is used for wheat intercropping, ploughing and harvesting damage the trees. However, this traditional farming is close to organic.

At the farm gate

At this moment, very few (big) commercial pomegranate orchards are (still) functioning in Afghanistan. A few are newly planted under the supervision of NGO´s, but do not bear fruit yet. The greater part of the orchards is small and in private ownership by farmers. These farmers often only take care of the cultivation process. This means planting, fertilizing, irrigating and pruning. In fact, in some cases the farmer needs nothing else to do than place his land at disposal and grow the pomegranates. Harvesting, packaging, storage, transport and marketing are done under the authority of the local trader and at his expense.

Traders employ labourers for only one or a few days to harvest everything. These labourers are not careful when picking or sorting the fruit. Everything is harvested including un-ripened fruit. Other labourers are employed to sort top-quality fruit. These labourers mix fruit of different quality grades. In each box first quality pomegranates are on top, second quality pomegranates on the bottom and third quality pomegranates are stacked 'hidden' in the middle[22].

From farm gate to rural market

Three ways of marketing are common. In many cases farmers contract crops to traders before harvest. The yield is estimated and the trader oversees the harvesting and packaging process. The main reason for this practice is the absence of marketing systems. Moreover, most farmers do not have a transportation option to carry their products to district and provincial level markets.

The other way is farmers selling their crop by the tree or by unit area at the farm gate to a packer / shipper at time of harvest[23]. Harvesting, packaging, shipping, storing and transport are taken care of by (local) traders. These traders are subject to transportation risks such as physical losses and bribes during transport across battered roads.

There is a third option. If farm location is closer to markets, the farmer will arrange for sale to or through the local shopkeeper, or he will harvest, package and bring his own products to market[24].

Many small farmers with just a few trees will do much of the harvesting and marketing at the local market themselves. When it comes to bigger orchards up to 5 yeribs (1 yerib is 0.2 hectare), handling and marketing will be left to traders.

From rural market to wholesale market
Local traders transport their commodities to regional and provincial markets and sell to wholesalers. These wholesalers usually have a store in the vicinity of the open fairs for horticulture products in a provincial town where they sell mostly to middlemen in regional markets and to retailers. Wholesalers buy, store and sell.

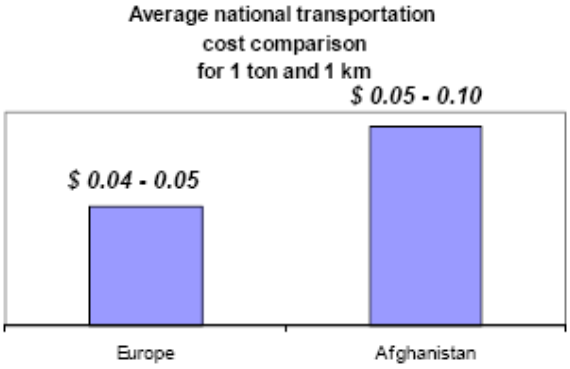
Retail
Retailers re-sort the carefully packaged pomegranates they bought at the wholesale market. They separate the poor quality fruits, which they probably cannot sell and repack the remaining fruit. Retailers usually visit wholesale markets themselves every day to purchase the limited quantity they need to keep losses at a minimum. Retailers buy, re-pack, store and sell.

Crossing the borders
At the moment, fresh pomegranates and all other fresh fruits, are exported mainly to and through Pakistan for consumption or re-export by railway to India and the seaport of Karachi. Afghanistan does not have a sizeable industrial legacy in fruit processing. And because of the fact that in Afghanistan virtually no pomegranate processing industry has survived the 30 years war period, processing happens outside Afghanistan in Pakistan. All fruit juices for instance are imported. A few initiatives like the cold stores built by USAID near Herat and Kandahar form the possible restart of industrial processing within the country.

Transport is the biggest problem. Horticulture produce are transported in open trucks across bad roads to the Pakistani border. If the final destination is outside Pakistan but not India, the product must be unloaded from the Afghan trucks and re-loaded into railway wagons sealed by Pakistani customs. The product is off-loaded in Karachi and held in the Afghan Transit Zone from where it (eventually) will be reloaded into ocean going containers and then exported by sea[25].

The biggest risk that Afghan fruit traders take during the whole production and export process is outside Afghanistan. Pakistan does not have large cold store facilities for re-export. It is while the commodities are in transit that a total loss of the consignment is a very real and even likely risk. If a truck is hijacked within Afghanistan, some compensation can be arranged with local commanders and other authorities. However, once the border is crossed a whole shipment can disappear, or a sealed rail wagon filled with fruits is left unattended for two weeks in Sibi junction in Baluchistan in 40°C heat[26]. Recently re-export through Pakistan with Pakistani owned cooled trucks seems possible without re-loading at the Afghanistan - Pakistan border[27]. Probably because of the fact this is about sealed and cooled containers.

One more problem with transportation in Afghanistan is high costs. While in Iran transport costs are very low because of extremely low fuel prices ($ 0.10/lt)[28], transportation in Afghanistan is very expensive. Fuel has to be imported and costs rise because of bad roads, bribes and roadblocks. Costs outrun the European level[29].



Source: Altai Consulting, 2004, Market sector assessment in horticulture - Presentation, Phase 1

Figure 3.2 Europe – Afghanistan transport cost comparison

When exporting to India, Pakistani trucks may collect the Afghan product in Afghanistan or at the Pakistani-Afghan border and then directly travel to the Indian border near Lahore and even to the final destination[30]. This greatly diminishes the risk of lengthy delays.

Because Afghanistan is a landlocked country and transport of Afghan horticultural produce encounters many domestic and transnational problems at the borders and seaports of Pakistan and Iran (bureaucracy, bribes), USAID in 2008 started a subsidized airlift to Dubai in an arrangement with French Carrefour supermarket[31]. From Dubai, the fruit was partly re-exported. This was a once only promotion act and the fruit was well received. But it is obvious that costs of air shipment are high and cannot compete with sea transport (except for arils). So at this point, the PSC is not enlarged with air shipment.

This is how present day Afghanistan PSC´s look like.

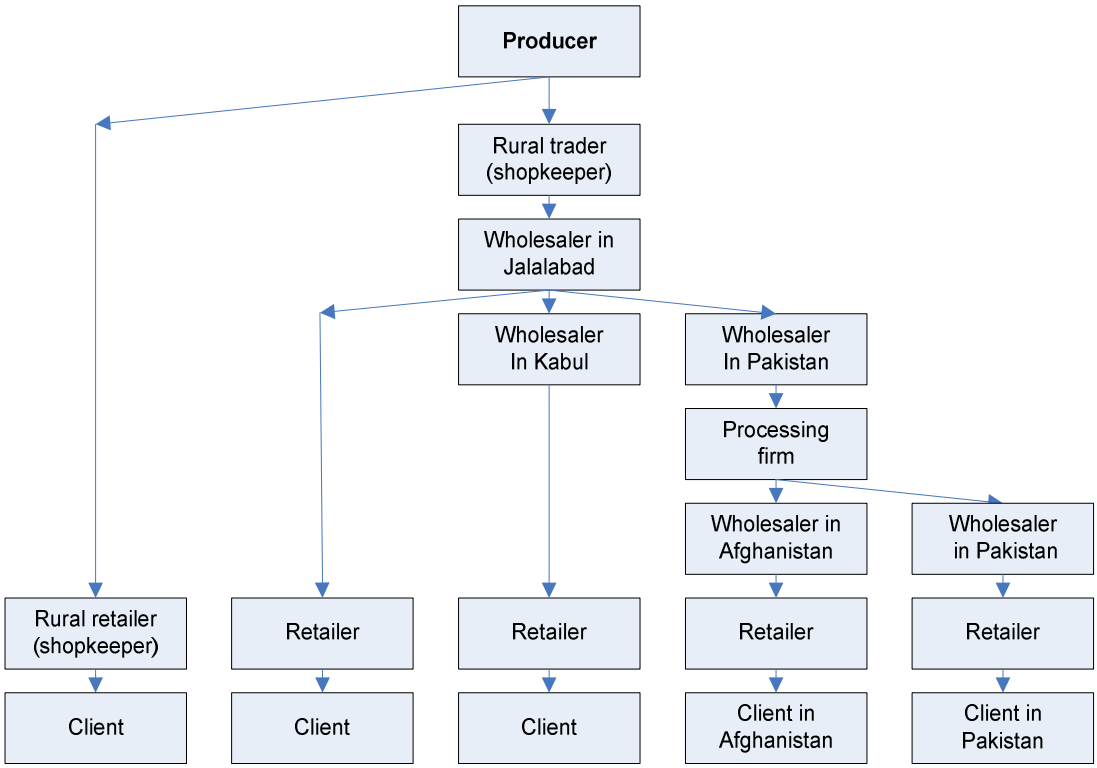


Figure 3.3 Present day Afghanistan pomegranate supply chains

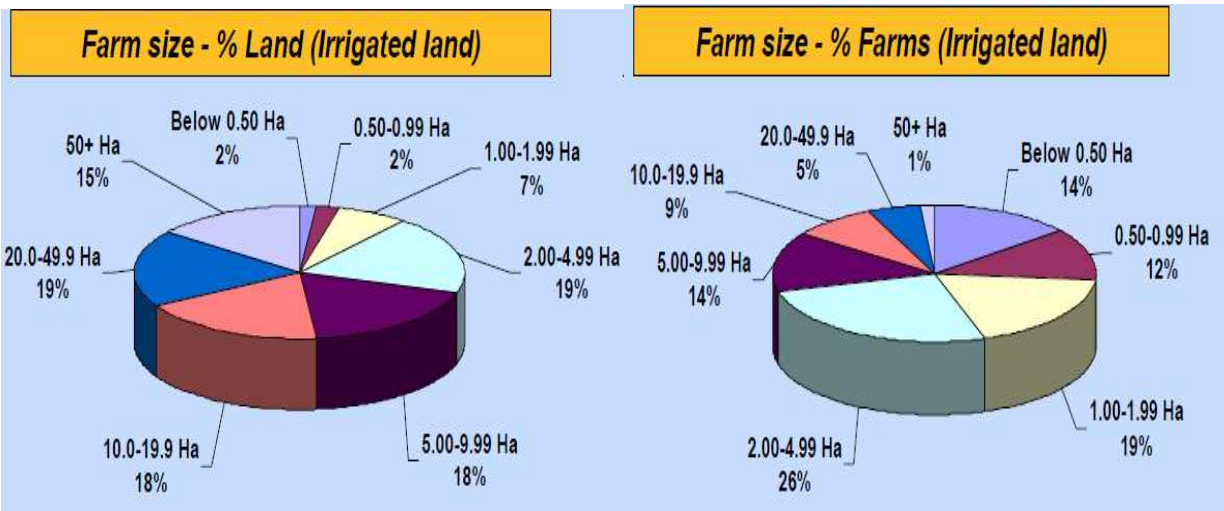
3.3. Actors

Farmers

It is estimated that from the 1 million Afghan farmers some 600,000 grow horticultural crops[32]. Many of these farmers hold small plots of land. In rural areas, there is no other way of making a living. Some of these farmers grow pomegranates. In rural areas in Afghanistan, literacy is scarce. Many farmers make barely enough money to stay alive.

Nearly 70% of all farms have less than 5 hectares and typically control 1.14 hectares of irrigated land and 0.5 hectares of rain-fed land. These farms are too small to achieve self-sufficiency[33].

As can be seen in the figure below, although Afghanistan is characterized by small land holding, there is a significant concentration of land in the larger farm-size groups. Six percent of the farms with area over 20 hectares of arable land, occupy 34% of the irrigated land and 50% of the rain fed land.



Source: Altai Consulting, 2004, Market sector assessment in horticulture - Presentation, Phase 2-3

Figure 3.4 Farm size in relation to irrigated land use

It is estimated that some 80% of the farmers own their land, whereas the remaining 20% are landless. Sharecropping gives them a livelihood obtaining a percentage of the harvest as a result of their labour. About landownership, not much can be said with any certainty. Landownership and land access rights in Afghanistan are very complex, especially now after the long period of war and political instability. At any given time, a single farmer may be owner, tenant, sharecropper and mortgager, or he may be in transition from one status to another with respect to one or more of his plots. Disputes and conflicts over landownership or usage are common in parts of the country[34].

Some 1,100 farmer cooperatives do exist aiming at collective input supply[35]. Marketing cooperatives that should care about product quality and chain logistics do not exist. Most farmers do not have the skills or awareness of how to establish such farmer's groups.

Pomegranate growers can be roughly divided into three groups[36]:

1. a majority of small-scale farmers with a few pomegranate trees
2. growers with a pomegranate orchard up to 5 yeribs (1 hectare)
3. commercial orchards owned by private land owners or the government (several hectares)

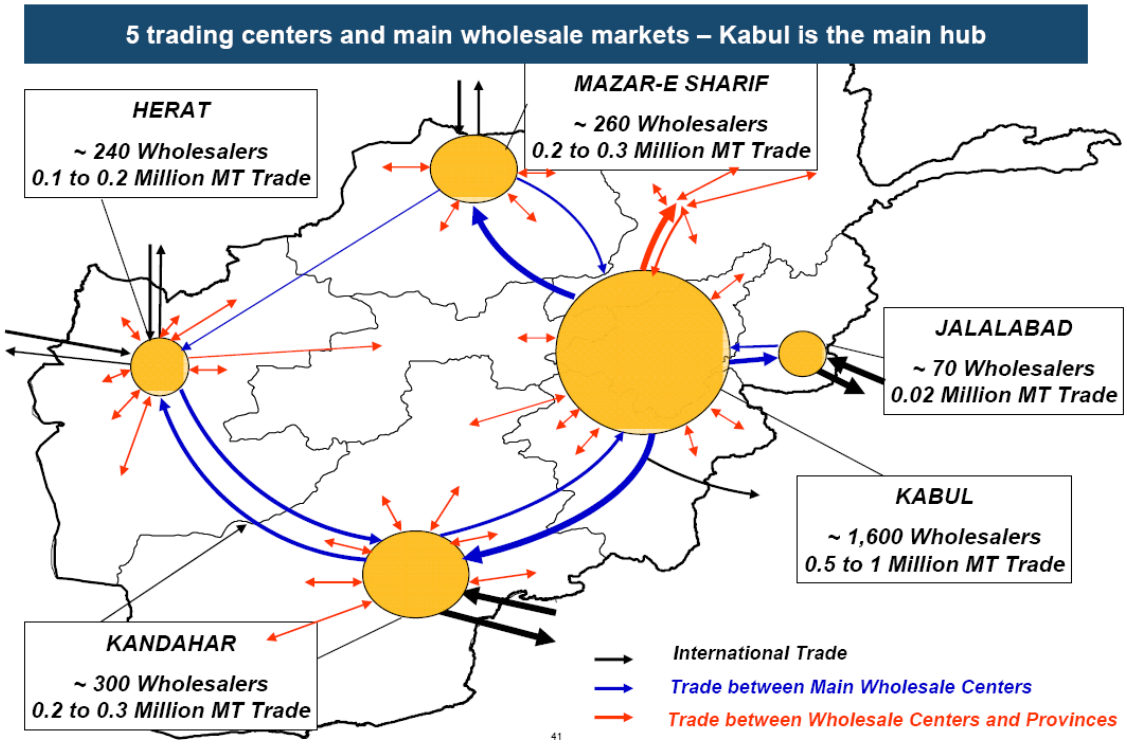
Traders / middlemen

There are several thousands of local traders liaising these farmers to the wholesalers in the country[37]. These traders meet the farmers at the farm gate to negotiate the price at harvest time. These traders can act on their own authority and risk selling the pomegranates at local and regional markets. For instance, this could be the local shopkeeper. This shopkeeper in rural areas far from the markets is usually the key figure with market connections and financial relationships with traders.

It is more likely that traders act on behalf of a regional or national trader with connections in wholesale markets in Afghanistan. Or he can act on the authority of a foreign, often Pakistani, client. Thus, this trader has to visit many farmers to get his quotum. Most traders are linked to their suppliers and their clients in market relationships. Some are simply an agent of the wholesaler, others seem to be independent traders, but in fact they also have a strong patronage relationship with one or more wholesalers. Many farmers are also traders.

Wholesalers

The about 2500 wholesalers are found in the 5 main wholesale markets: Kabul, Kandahar, Mazar-e-Shariff, Jalalabad and Herat and in smaller wholesale markets in the 34 provinces[38].



Source: Altai Consulting, 2004, Market sector assessment in horticulture - Presentation, Phase 1

Figure 3.5 Main wholesale markets in Afghanistan and numbers of wholesalers

Wholesalers operate in an intricate social network, often with family members operating similar businesses in other (wholesale) markets in Afghanistan and Pakistan. Close communication among trading partners enables them to source a broad range of produce and keep a permanent flow of fruits and vegetables between markets. If higher demand has been identified in other wholesale markets at consequently higher prices, sometimes produce is transported.

The market of Jalalabad for instance is through lack of distance connected to the market of Kabul and of Peshawar in Pakistan. Usually though the produce remains in the region[39].

Transporters

Afghanistan is a landlocked country without a railway network. Other than two short lines across the northern borders with Uzbekistan and Turkmenistan, there are almost certainly no functioning railways in Afghanistan today[40]. This is a legacy from the days of the ´Great game´ when Britain and Russia tried to secure their military presence throughout the country by constructing railways. These days everything has to be transported on trucks across difficult and often badly maintained roads. Transport companies in Afghanistan can be well organized. Compared to other actors in the pomegranate value chain they are more professional. Several bigger companies deliver a good service with very few lost loads. Transports of these companies can be assured with western insurance companies. They also often work for foreigners, like for instance ISAF. There are some 55 cool-trucks in Afghanistan, but all of them are currently working for ISAF. Although prices are negotiated and fairly well established, the transport market in Afghanistan is a competitive environment. Transporters engage themselves in (fruit) marketing networks through pre-financing, making the chain even more complex.

International dealers

Nearly all fresh fruit leaves the country via Pakistan. Kabul-, Jalalabad- and Kandahar-international traders do have long-standing connections with Pakistani traders in Quetta and Peshawar, usually a family member or a close friend. In many cases, international fruit export business in Afghan fruit is done directly with Pakistani dealers. These international dealers maintain banking accounts in usually Pakistan.

3.4. Flow of products and (product)information

Flow of the product

The flow of the product when sold on the domestic market looks like this:

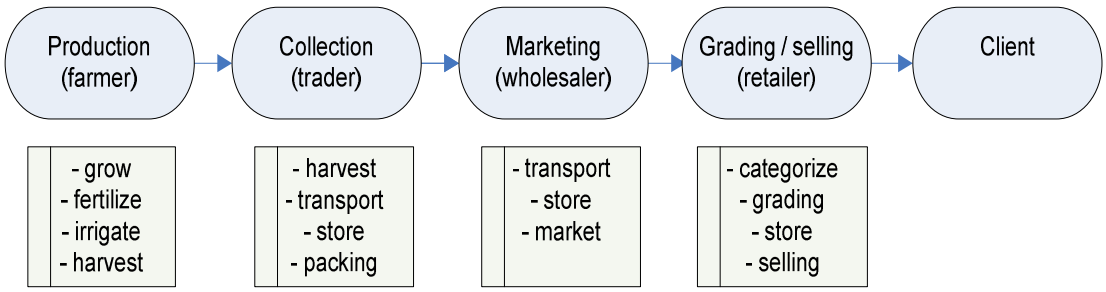


Figure 3.6 Domestic market product flow

Note: One specific element in the domestic PSC is that retailers at the end of the supply chain do the effective quality grading.

The flow of the product when sold for export looks like this:

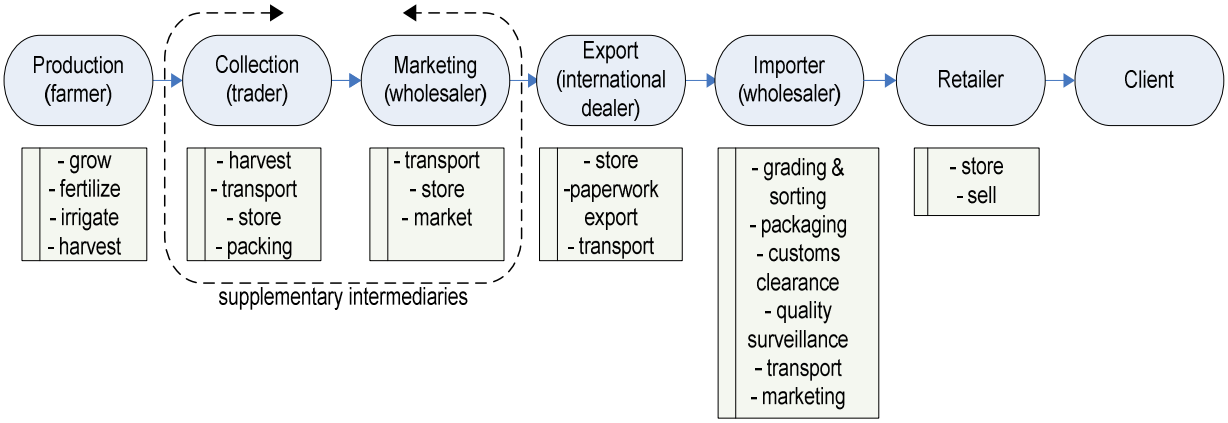


Figure 3.7 Export market product flow

Flow of (product) information

The consequence of fragmentation of Afghan society is scarce contact between producer and retailer. They do not know each other. The farmer in rural areas is poorly connected to markets and does only learn about prices through talking to neighbours and traders. However, the trader is not likely to give this information freely in a highly price competitive market. Wholesale markets, like for instance the open horticulture fair in Herat, are highly speculative and depend on daily available trade information such as numbers of buyers and sellers, trade agreements, etc. Rumours about 'who is in the market' can intraday double and halve prices. Especially the fact that at the end of the chain the retailer takes care of the sorting and grading, implies that the farmer is not directly confronted with information about quality matters of his produce.

With a government having little or no influence on market regulations and quality standards, the absence of producer associations and sparse contacts between producers and retailers, there is little market information exchange within the chain and there is no organisation to regulate this exchange.

From a marketing point of view the PSC, and that counts for the whole of fruits and nuts chains in Afghanistan, is a truncated system with neither forward nor backward linkages for value adding of any sort. There are no push or pull factors that initiate the development of the subsector, in the form of crop production technologies or profitable market opportunities that could increase product quality or the flow of produce. Market information reaches producers only sparsely, so the Afghan fruit market is supply driven.

3.5. Volume and value

Volume of arable land

The arable agricultural resource base in the whole of Afghanistan is approximately 7.5 million hectares, divided into rain fed and irrigated land[41]. The rain fed area is estimated at about 4 million hectares, but the area actually cultivated in any given year varies considerably depending on climatic factors.

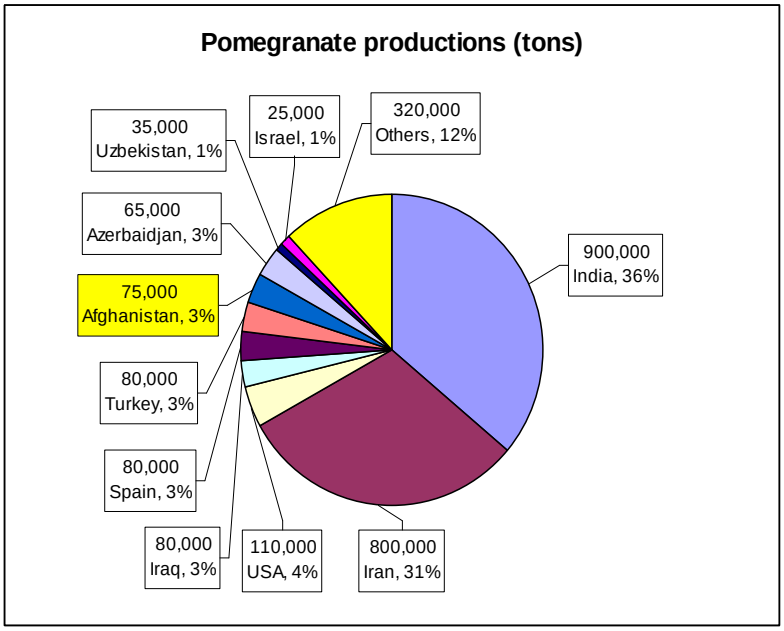
In the pre-war period, about 3.5 million hectares were cultivated of which 2.43 million hectares were irrigated. The extent of irrigated land recently under cultivation is estimated at about 1.5 to 1.7 hectares. The extent of rain fed land under cultivation fluctuates considerably depending on climatic conditions. In a good year, the extent may be 1.4 million hectares, in a drought year the area may be no more than 300,000 hectares.

On average 9.9% of the total arable land area (irrigated and rain fed) is used for cultivation of horticulture crops, of which 5.3% are dedicated to orchards and 4.6% to horticulture crops.

Volume of pomegranate production

In addition to India and Iran with the largest cultivation areas and the highest production, other countries growing pomegranates are Turkey, Pakistan, India, Armenia, Georgia, Tajikistan, Israel, Jordan, Egypt, Italy, Tunisia, Azerbaijan, Libya, Lebanon, Sudan, Myanmar, Bangladesh, Mauritania, Morocco, Cyprus, Spain, Greece, France, China, Japan and the USA.

The following graph shows estimated global production figures[42].

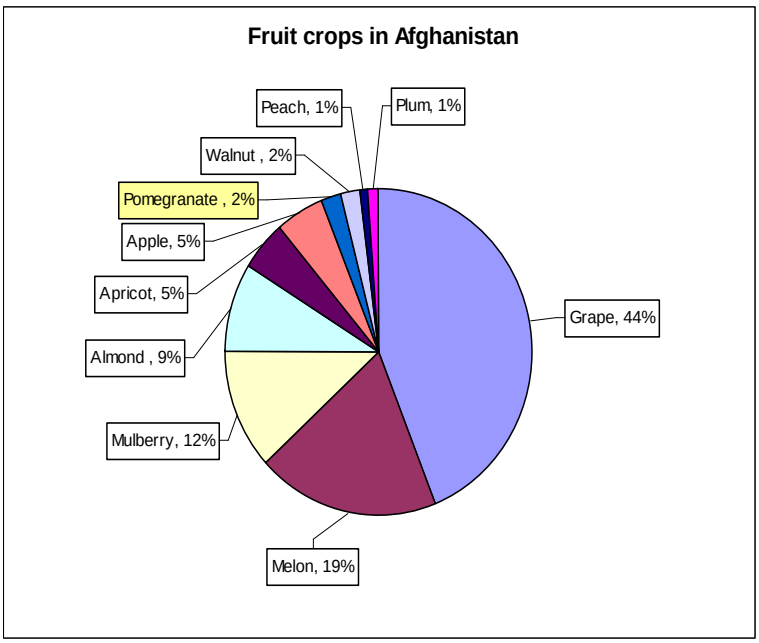


Source: FAS US – Spain and Iran Pomegranate Boards year 2007

Figure 3.8 Global pomegranate production figures

The 2004 Altai research phase 1[43], indicates that Afghanistan's volume share of world production is about 2%, down from about 10% in the seventies in last century.

Statistics about Afghan agricultural produce is part measured facts, part estimation. Mostly it is a matter of educated guesses. Until now pomegranate is not an important Afghan agricultural commodity in terms of cultivated area. In the year 2000 in an FAO study, the following comparative status of cultivated area per fruit species was noted[44].



Source: Altai Consulting, 2004, Market sector assessment in horticulture - Presentation, Phase 1

Figure 3.9 Afghan fruit cultivating area

A 2000 FAO-study reported 5,668 hectares of pomegranate orchard area[45]. This study reported an average yield of 9,730 kg/ha. Multiplied with those 5,668 hectares, total yield would be some 55,000 tons. In 2003, FAO reports a total pomegranate yield of 24,000 tons[46]. That is possible, considering that at the same time Altai Consulting reports an area decrease from 5,668 hectares in 1996 to some 3,000 hectares in 2003[47]. Production has risen since then.

The war and the drought in the first years of this century took their toll. Another reason is risk aversion of farmers. In a country with a food shortage and uncertain life expectances, farmer's efforts are geared towards staple food production to ensure food availability. Moreover, pomegranate trees were chopped down and substituted by poppy cultivation. Poppy prices exploded in those years because of the Taliban government banning poppy production.

Because of the fact few figures and statistics are kept in Afghanistan, and realizing that the 2003 FAO production measurements may be slightly out of date, production per hectare is not unambiguous. Given 6,000 hectares of pomegranate cultivation and 24,000 tons of production, the yield per hectare would be 4,000 kg. Given 3,000 hectares, the yield per hectare would be 8,000 kg. These calculations match the findings of USAID research done in Nangarhan province in the east of Afghanistan in 2006, where the study reports productivity levels between 15% and 25% of yield potential[48]. The reason is poor management; the orchards were not irrigated, pruned and fertilized for several years.

Pomegranate is produced throughout the country with the heart of the production in the south-west and the west region of the country, in the provinces of Kandahar, Helmand, Nimroz, Farah and Herat[49].

According to internet information,[50] an Afghan export organization stated that Afghan export of pomegranates reached a volume of 2,030 tons in November 2008 in the first two months of the season. According to that message, export in 2007 totaled 1,445 tons. Export was delivered to nearby states such as Singapore, Turkmenistan, India, Armenia and Iran, but also to Europe and the Middle East.

Source: www.globalsecurity.org/military/world/afghanistan/images/afg_ad1.gif

Figure 3.10 Provinces of Afghanistan

Value of pomegranate production

First of all it should be stated that the consequence of lack of economic scale, vulnerable producers, lack of market information, poor post-harvest practices, difficult transport, high trading risks, doing business in open fairs and eventually clients not willing (and not being able) to pay for quality, is low prices. And that is exactly the case in Afghanistan; the existing horticulture markets focus on price and not on quality. The large number of actors in horticulture chains from production to marketing also results in fierce competition on price, but does not promote quality.

Quality problems start with the fact that farmers are not overly concerned about quality because most crops are pre-sold. The marketing system militates against the development of a value added strategy that would require a partnership between farmers and traders. The grower only has an incentive to increase pomegranate quality if he knows that he will be rewarded for this improvement. In present day marketing conditions, he will not get this reward for market systems are geared to keeping prices low.

Moreover, quality is not stimulated because little specialization in pomegranate production is found among farmers. On small plots of land, orchards with for instance apricot, plum, citrus, guava and date trees are planted with intercropping of wheat. This is done for food security reasons.

Quality suffers further once harvesting begins. All fruits are harvested including the un-ripened ones and fruits of different quality grades are mixed. Quality further deteriorates because insufficient attention is paid to the manner in which fruits is packed and transported to market. A wide range of inappropriate packaging materials is used[51]. These range from sacks, woven baskets and plastic shopping bags to different sized wooden

crates. Additional quality deterioration comes from transport for many hours in open trucks driving bad roads at high temperatures and from the presence of contaminants in urban dust (open latrines and unsafe water) at wholesale markets[52]. At retail level, the packaged pomegranates have to be re-sorted. The retailer separates the different quality layers and finds himself unable to sell poor quality pomegranates.

The focus on price and not quality is also understandable from the viewpoint of risk. A farmer that had to suffer for so long, not being sure of tomorrow's meal, will not invest in a long-term asset as quality. As a consequence, not much value is added in the domestic value chain.

Of Afghan fresh pomegranate fruits, 20% to 30% are suitable for export[53]. In the 2008 INMA pomegranate export trial from Iraq, only 15% of the fruits were export quality. Until now, not much is done to promote quality, although this fruit is seen as a substitute for poppy. In the export chain, product value is created in processing outside Afghanistan. Fruits for juice need not be top quality. Starting with a more efficient collecting process executed by agents of Afghan/Pakistan dealers, directly consulting farmers, if practical bypassing local traders and wholesalers, fruits are brought to the Afghan/Pakistan border, reloaded on Pakistani trucks and transported directly to processing plants. Here the fruits are processed into juice and concentrate. Canned pomegranate juice finds its way back into Afghanistan. Meanwhile prices have tripled. Afghans assert that in the absence of cold storages in Afghanistan, in harvest time fresh fruit is exported to Pakistan, kept there in cold storage for a few months and then is imported again when prices have risen outside harvest season[54].

3.6. Costs, margins and profits

Fixed and variable costs

Distinction in costs for all actors in the chain turned out to be an impossible task. Only weighted production costs could be retrieved. Included in the production costs are:

- labour and farm power (irrigating, manuring, pruning);
- agricultural inputs (manure, pesticides);
- harvesting (picking, sorting and packing);
- marketing (boxes, transport to local market, (un)loading);
- fixed costs (farm tools, land rent and the like)

These production costs amount to $ 0.13/kg (price 2004) [55].

Separate cost figures for growers, traders and retailers are not in stock.

Sales volumes and prices

Sales volumes

Afghan statistics and research figures do not give insight in sales volumes and most certainly not in volumes per actor.

Sales prices

Research figures do give insight in sales prices. There is a big difference between prices paid for local market quality fresh pomegranate and prices for premium export quality suitable for the EU- and USA-market.

Afghan farm gate price of local market fresh quality pomegranate is about $ 0.25 per kg. Retail price is about $ 0.50/kg. Farm gate price for premium export quality is about $ 0.50/kg[56]. The price of fruits used in the processing industry in Pakistan and Iran is about $ 0.10 per kg. (prices 2009). Prices have risen by 20% the last few years[57].

In Iraq in 2008 USAID had to pay $ 1.20/kg - $ 1.30/kg market price for premium export quality for a pomegranate export trial to Dubai[58]. Prices included selection and grading,

carton, packaging, storage, stuffing of containers, etc. And these were prices paid in the best month October, increasing to $ 1.50/kg in late November due to quick product deterioration caused by adverse weather conditions and absence of cold storage.

Below the prices paid in Dubai for premium quality pomegranates coming from Iraq during the months September, October and November 2008[59]. Dubai with its seaport and international airport is the main trading hub for the North African and West and Central Asian world for exporting agricultural produce. At the premises of Dubai seaport, a large area for storage and handling of agricultural commodities is accommodated. There is also a 10 tons/hr pomegranate processing plant available.

Table 3.1 2008 Dubai pomegranate wholesale prices

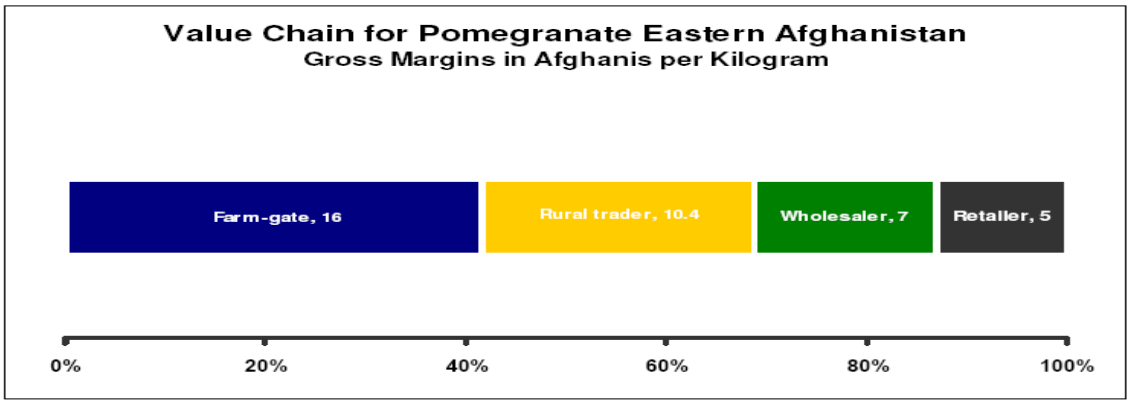
Pomegranate prices in Dubai September – November 2008
(US dollars)

Period	Top Price $/kg Dubai Wholesale	Mode Price' $/kg Dubai Wholesale
Dubai Wholesale Market		
Entire Season September 11 - November 25	$2.34	$1.74
Season September 11 – October 31	$2.51	$1.80
Early Season September 11 – September 30	$2.60	$1.80
First Half October 1 – 15	$2.57	$1.86
Second Half October 16 – 31	$2.29	$1.76
October 1 - 31	$2.42	$1.80
November 1 - 25	$2.17	$1.68
Peak Season December 15 – January 10	$3.18	$2.16

Source: INMA, Agribusiness Program, 2008, Pomegranate Export Trail

Margins and profits

Research conducted by USAID in 2006 delivered the following distribution of margins in the pomegranate value chain[60]. This is about the local market fresh quality pomegranate price. ($ 1.00 ≈ 50 Afghani).



Source: Perennial horticulture in eastern Afghanistan: subsector overview and implementation strategy, USAID, Alternative livelihoods project/east

Figure 3.11 Gross margins per actor in the fresh fruit Afghan PSC

These are margins achieved in East Afghanistan in the vicinity of two major markets, Kabul and Jalalabad, attended by clients with more purchasing power. Moreover, these two cities are close to the Pakistani border and from here, international dealers serve foreign customers, so margins and margin percentages might be different from elsewhere in the country. Effective margins also change according to the safety situation. In 2009, the safety situation is worse then in 2006. When the trader's (transport) risks increase, their margins go up, while farmer's margins drop and final prices will increase.

Non-organization of market information exchange gives way to the thought of oligopolistic power structures with power concentration at points in the chain where information is concentrated and with the picture of the farmer as a low margin victim. This concentration of power is likely to occur in circles of wholesalers and international dealers.

To some extent, this is a true picture often emerging in developing countries without an extended (market) infrastructure. On the other hand, many farmers are traders too and there is no conclusive information available that demonstrates the making of high margins by these wholesalers and international dealers[61]. Even when margins are high for international dealers, in present circumstances these margins can be seen as a reward for high risks they are running. It seems the profits these people make is not so much the result of high margins but rather of high turnovers.

Detailed cost prices of production, transport, etc are not on hand, so profits cannot be calculated.

3.7. Technology and knowledge (t&k)

Current technology

First, it should be stated that the current technology in all processes of the PSC, used in pomegranate growing but also in pomegranate handling, packaging, storage, transport and marketing, is rudimentary. There is little demand for expensive quality products. In rural areas, people can hardly buy the food they need to stay alive.

Efficiency / effectiveness of current technology

Current technology does not contribute to the efficiency of the present domestic value PSC.

Table 3.2 Use of current technology by Afghan farmers

In the production phase only:

a. 28% of the farmers practice pruning;
b. 21% control pests and diseases;
c. 11% use chemical fertilizers;
d. 11% use improved budded cultivars

Source: ICARDA, 2003, Needs assessment on horticulture in Afghanistan

High prices of agricultural inputs (e.g. farm equipments, fertilizers, pesticides, seeds, etc) represent a severe limitation to higher efficiency[62].

Postharvest technology is also poor.

a. poor grading and sorting;
b. absence of cold storage and transport facilities;
c. lack of adequate packing material;
d. lack of market information

Horticulture products at wholesale markets are sold in open fairs. These fairs are highly speculative depending on daily available trade information such as the number of buyers and sellers, trade agreements etc. If a large trader shows up wanting to purchase in bulk, for instance commissioned by a client in Pakistan, he has to act carefully by making many small deals over a longer period. In order to prevent distrust different agents usually execute these deals with different traders.

In addition, the absence of farmer's organizations, lack of government marketing actions and channels and the social fabric of patron-client relationships in the marketing channels also contribute to poor efficiency in PSC processes. Because of all this, the effectiveness of current technology in the domestic markets is also poor, significantly contributing to high levels of postharvest losses.

Efficiency in the international supply chain in the domestic part is better. Commission agents for Pakistan or Indian importers add efficiency to the chain by lowering costs for importers through bypassing domestic traders and wholesalers. However, as most fruit is exported to Pakistan or re-exported through Pakistan, transport is the dominant risk factor. All loading, unloading and re-loading activities are a time consuming and a costly affair, not only because of labour costs, but also because the transport happens in open trucks and train wagons without cooling, resulting in effective high levels of physical losses.

Does the t&k produce the required outcome?
At the moment, in the domestic PSC the outcome is perhaps what the Afghan people expect. Market efforts are about price and not quality. The people are used to the quality delivered and cannot settle for more not being able to pay more.

In the export PSC, the outcome for the processing industry in Pakistan is more or less sufficient. The problem of high losses in postharvest processes must be addressed. Because of the strong pomegranate rind, postharvest losses will probably be less than other fruits. The same counts for the outcome in the fresh pomegranate supply to India and other regional markets. Here also too much postharvest losses do occur, especially in lasting transport.

The outcome is surely not sufficient when it comes to fresh pomegranates intended for markets in other parts of the world. American and European clients demand high quality starting with the appearance of the fruit. The custom of packing different layers with inferior quality in the middle was a disappointing experience for an Afghan businessperson exporting apricots bought at the Kabul wholesale market to Dubai for re-export[63]. Dubai traders refused half of the load. USAID did the same later on with pomegranates, but this time the shipment was merely premium export quality and for that, it was well received.

Who determines the used t&k?
Actually the question is not who but what determines the used t&k. The used t&k is dictated by political, economical, financial and institutional circumstances. Within the domestic market there is little money and awareness to ameliorate present t&k. The only way to achieve this is exporting premium quality and therefore the quality has to rise, but there is no money and little consciousness to do that. So there you have the vicious circle that can only be broken by money, training and knowledge from outside.

Who has access to t&k and who delivers t&k?
Until recently in the whole PSC maybe just a few actors had access to t&k. That would be literate persons to be found in the circle of wholesalers and transporters. Before the wars, the Afghan Export Department of the Ministry of Commerce provided information to farmers and traders and established export quality criteria for horticulture products. Moreover, the Afghan agricultural bank and several cooperatives provided information to farmers[64].

After the Taliban regime was removed in 2001, foreign aid came into the country executed by many NGO´s and foreign governments. They are the primary source of t&k. In horticulture, actions were taken through the establishment of nurseries, giving classes to farmers and setting up farmers associations. In a 2003, ICARDA research[65] growers mentioned the following sources of technical information:

Table 3.3 Sources of technical information for Afghan farmers

Sources of technical information		
1.	government extension workers	6%
2.	NGO-agencies	6%
3.	close village neighbours	34%
4.	progressive farmers	35%
5.	none	19%

Source: ICARDA, 2003, Needs assessment on horticulture in Afghanistan

By 2009, the situation will have changed in favour of t&k delivered by NGO´s. Government services is still very weak. One of the aims of the spread of agricultural knowledge is teaching progressive farmers who in turn teach other farmers. By 2009, the Netherlands is the lead donor in the field of agricultural education, training and extension in Afghanistan, planning to stay the coming years. USAID built two cold stores, one near Herat and one near Kandahar[66]. Postharvest management is teached from here.

3.8. Services feeding into the chain

Technical:
In Afghanistan, many NGO's are present nowadays with thousands of employees. With no central guidance these NGO's follow their own agenda and their own preferences trying to uplift the people, while American NGO's play the first fiddle.

> For instance, IFHope claims to be the leading orchard development organization in Afghanistan having planted 10,000 acres and formed partnerships with 6,000 famers. IFHope as it says, in conjunction with UC Davis and Iowa University, also operates a tree nursery with over 2,000,000 saplings and an annual production of over 1,000,000 fruit, nut, forest and shade tree saplings, near Jalalabad. Each tree is grafted on local rootstock to maximize adaptability and potential for successful growth, a new technique to the farmers of Afghanistan. IFHope provided technical assistance for 5,000 farmers and conducted orchard management seminars for over 4,000 farmers. IFHope together with the Ministry of Agriculture (MAIL) is setting up a new project to provide field and classroom training to Afghan agriculture extension workers. In the future, the next step is to work with farmers to establish market linkages. IFHope works with growers associations and cooperatives to facilitate better access to markets and market information. IFHope plans to develop postproduction activities including basic sorting and packing, packaging, sizing and grading as well as developing value added products to increase the return to the farmer, all according to IFHope[67].

Foreign government institutions deliver the same services as NGO's and usually in cooperation with these NGO's.

Afghan government institutions deliver the same services as NGO's. Afghanistan has historically had an effective agricultural extension and training program, that effectively contributed to enhancing agricultural productivity and generating a surplus for export. Research stations covered a total of about 1,750 hectares and employed 1,020 staff members of which 40% were located in 7 main stations throughout the country. Technical staff accounted for 25% of the total staffing and most of them were B.Sc. graduates with some having a Master's degree[68].

Agricultural research in Afghanistan nowadays is organized at two levels[69]. At the central level, the Agriculture Research Institute of Afghanistan (ARIA) consists of ten units and three research stations located in Kabul (Darul Aman, Quargha and Badam Bagh) with a total of 150 employees. At provincial level, ARAI has 17 research farm stations. It has 100 staff members outside Kabul: of these, only 2 have MSc degrees; 58 have BSc. Biggest problems of the system are the lack of qualified staff and the inadequate funding: low salaries and no operational funds[70].

Export promotion is the task of the Export Promotion Agency of Afghanistan (EPAA) an executive arm of the Ministry of Commerce and Industries (MoCI) established in 2006. EPAA implements the export promotion policies of MoCI through:

- export promotion including training, exhibitions/fairs, promotion of the use of standards;
- individual advice to companies and advocacy;
- market research and collection and dissemination of export data;
- coordinating public and private initiatives to create a business-enabling environment for competitive exports, which contributes to job generation.

EPAA is streamlining export procedures to make export easier and it provides market data.

Though the Afghan government is involved in market research and coordination activities, its position is weak and no direction and control of marketing systems, price setting and export governance is to be expected[71].

Large international companies exporting agriculture (fertilizers e.g.) to Afghanistan provide assistance in virtually all aspects of farming, from laying out an orchard to manuring practice, usually in cooperation with an NGO.

Financial:
Financial services are discussed in § 3.10.

Why do these actors provide these services to these actors?
Aid from NGO's usually comes from a humanitarian perspective. The same counts for foreign governments although future business opportunities and geo-political and economic objectives are reasons too. The latter is also the case for international companies laying foundations for future potential markets. The soils of Afghanistan hold a richness of mineral resources. The country has extensive deposits of barite, chromite, coal, copper, gold, iron ore, lead, natural gas, petroleum, precious and semiprecious stones, salt, sulfur, talc, and zinc[72]. Thereby Afghanistan is the source of regional geo political conflicts and worldwide Islamic extremism. There are many reasons for many people, organizations, companies and governments to provide services in Afghanistan.

How satisfied are the actors with these services?
Afghan farmers are very much in need of information and assistance, they are inquisitive and they appreciate the offered assistance of NGO's, foreign government institutions and companies. On the other hand Afghan farmers are not very satisfied with their own government, claiming the government should do more to protect their industry from cheap imports[73]. Farmers state there is no government and the government does not care about agriculture business. Exporters complain they face an unfair competition from subsidised products from other countries (Lebanon, Egypt, Turkey and Iran) on international markets. In addition, they complain about the government 'red tape' and the bribes they have to pay to government officials[74].

3.9. Relationships and linkages

What linkages do exist and why?

Afghan society is home to a large variety of linguistic and ethnic groups.

Table 3.4 Afghan population divided into ethnic groups

The following ethnic groups dominate the social landscape:	
Pashtu's	38%
Tadzjiks	25%
Hazara	19%
Aimaks, Turkmen, Balochs	12%
Uzbeks	5%

Source: Needs assessment on horticulture in Afghanistan, ICARDA/USAID

The overwhelming majority is Muslim, mostly Sunni Muslim (84%) and part Shi´ih Muslim (15%)[75]. The people are related to many of the ethnic groups in Iran, Pakistan, Tajikistan and Uzbekistan, with cultural influences that go further away to various places as Kyrgyzstan, Mongolia, China and the Arabian Peninsula. Many centuries of human migration, political upheaval, invasions and conquests has led to a great deal of interethnic strife at social and political level, constituting one of Afghanistan's major problems.

The social and ethnically based fragmentation of Afghan society can also be seen in marketing networks. This hampers the establishment of contractual relations outside of social networks between producers for lager volumes of good quality products. Social networks and open fairs command the horticulture-marketing environment in Afghanistan. The rationales for traders and wholesalers to market horticulture products to one destination rather than another are largely determined by the presence of solidarity network members.

Farmers have linkages to certain traders who have exclusive relationships to certain wholesalers. These wholesalers hold international relationships with foreign clients to whom they might maintain family or social relationships.

Relationships between actors in the chain can be characterized as persistent network relations. The same traders visit the same farmers every year and they deliver to the same wholesalers. Vertical integration is not the case. The activities of the farmers, the traders and the wholesalers are separated without backward of forward linkages. Afghan markets fit the more traditional physical realm where traders meet to make face-to-face transactions. Actors cannot do business freely and well informed, they are more or less locked in social relationships with certain traders and indebtedness. As can be seen in many developing countries similar ties are a means of increasing the likelihood of economic cooperation by building trust and shared norms. The social capital generated between persons and firms is important for lowering risks and uncertainty at the local level.

At the horizontal level, cooperation is lacking. Some 1,100 cooperatives do exist, mainly focused on input supply. They are registered with the Cooperatives Department in MAIL. When they deposit their savings in a bank, they are entitled to government support to purchase equipment and other production inputs such as fertilizers and seeds, for their members. Marketing cooperatives are rare. A marketing cooperative where timing of operations and quality issues are crucial issues, a higher level of trust among members is necessary. These cooperatives are only found where NGO´s support and stimulate the farmers to work together[76].

<u>What is the level of formality?</u>
The Afghan economy is very informal, unrecorded and untaxed by the state. Rule enforcement by the government based on formal rules is absent, because there are no rules. Personal contact is critical for doing business. This is alike for small and large

players in all markets. Farmers and traders do not do bookkeeping for they are illiterate. Only international traders hold bank accounts in Afghanistan and in foreign countries and do their accounting.

What is the trust level?
Trust level between two chain actors doing business is low. Governance is neither through formal rules nor trust, but through social governance caused by dependence on social and ethnical bonds in vertical social networks. This is visible at the informal credits. Although repayment may be overdue, in the end some form of repayment is usually done.

How long do linkages exist?
Again because of their dependence on social and ethnical bonds linkages are strong and do remain many years, only to be changed through fundamental changes in political and socio-economical circumstances.

What about the relative costs / benefits of the linkages?
Personal trust relationships and networks have a negative effect on the competitiveness of markets and on the coming about of contractual relations for cost-effective large trade volumes. These networks are also vital to entering markets. New entrants without a 'social network capital' can be barred. Especially when credit ties are at stake, a pomegranate grower is dependent on the trader who gives him access to the market and delivers packaging material. These relations can lead to a situation that even when trust is abused, the farmer often will not rupture the longstanding relationship and will remain doing business with the same trader the following year.

The costs of these linkages are an underdeveloped product driven marketing system that does not respond to (international) demand. Further costs are high physical losses, low prices, small margins all through the chain, with producers and local traders being chain captives without a future perspective on a just reward for their work and thus without an eye for delivery of quality products. The benefits of these linkages are security; security of income and security of a social network that functions as a safety net.

3.10. Finance

The reason for discussing finance in a separate chapter is that finance, especially in Afghanistan with its system of Informal Funds Transfer (IFT), is a critical constraint to economic growth and to a well functioning value chain. So understanding financial structures is a key factor in value chain upgrading.

How is the intra company finance organized?
Normally there is no organisation of intra company finance. There is no bookkeeping, no cash flow analysis and no risk management based on figures, not by the farmer nor the traders and not by wholesalers. Not surprisingly knowing that over 90% of the population is illiterate and the war period caused an enormous brain drain. Those wholesalers who do have international business affairs normally keep bank accounts in Pakistan if paying has to be done by bank and these international dealers do their bookkeeping.

How is the inter company finance organised?
In the fresh pomegranate value chain, pre harvest contracts are the standard where it comes to orchards of a few yeribs and more. The informal credit system in rural areas brings along that often the trader/shopkeeper is a source of finance for the farmer through advance payments when he needs the money for buying fertilizers, packing material or harvesting labour. Even clients in for instance Japan order large quantities and pay in advance through international traders, who finance local traders, who finance growers[77].
Value chain financing in Afghanistan is usually done by means of the ´*hawala* system´.

How is the provision of finance services to companies in the chain organised?
In Afghanistan a real formal banking system is absent and a large vibrant informal financial market has developed. Money exchange dealers, the so-called *´hawaladars´*, provide a well-organized, convenient and cost-effective means of making domestic and international payments[78]. Actually, the Afghanistan population has relied for centuries on the informal sector to access financial services. [79]

> *The Hawala system*
> *Hawala* has its origins in classical Islamic law. Today the *hawala* arrangement is also widely used by migrant workers sending money to their family and friends back home. *Hawala* works by transferring money without actually moving it. In short, a customer approaches a *hawala* broker in one city and gives a sum of money to be transferred to a recipient in another foreign city. The *hawala* broker calls another (friendly) *hawala* broker in the recipient city, gives deposit instructions of the funds, and promises to settle the debt at a later date.
> *Hawala* transactions take place entirely on the honour system. The system is very reliable. It also means one mistake is being out of business. As the system does not depend on the legal enforceability of claims, it can operate even in the absence of a legal and juridical environment. The transfers are informal and not regulated by the government, which is a major advantage to customers with tax, currency control, immigration, or other legal concerns. Transactions are efficient and cost effective[80].

In rural areas, the *hawaladar* is often the shopkeeper in the village, but it can also be a farmer-trader or someone from an influential family. The first and foremost provision of finance services to famers and traders is informal credit. Informal credit was and is accessible to every actor in the chain[81]. Informal credit is almost exclusively used for either consumption smoothing or marriage with very little being deployed for investment in enterprises. The reasons for entering into informal credit relations are diverse, but investment in social networks for informal security in a country that has been devastated in a thirty-year war, is obvious. A second reason is maintaining or consolidating patron-client relations. Informal credit is also interesting because repayment practices are usually highly flexible and negotiable. This means among other things adaptability to the fluctuating farming season income.

So many pomegranate farmers do not have the money to buy fertilizers, pesticides, packing material or pay harvesting labour. This is financed and delivered by the local dealer through informal credit. Usually this dealer does not have the money himself, it is provided by traders and international dealers.

In international fruit trade the *hawala* system is used too when the client belongs to the family / social circles of the Afghan/Pakistan dealers. Only in international trade with customers taking no part in these circles, formal bank payment happens at the moment the fruit arrives and has been checked.

Micro finance
In 2003, the Afghan government set up the Microfinance Investment Support Facility for Afghanistan (MISFA)[82]. The Ministry of Finance is the sole shareholder. The board of directors consists of representatives of Afghan ministries and foreign scientific and financial institutions, including the director of a Dutch bank. The reasons for setting up MISFA were to move away from donor dependence and conflicting donor objectives and to get donor coordination right from the start. Initially MISFA's mission was to provide financial services to low income people. According to MISFA information, this is a success story.

Table 3.5 Afghanistan micro finance disbursement figures

Microfinance Afghanistan	
February 2009, sector growth, in US $	
Active clients	439,821
Percentage of women	62%
Gross loan portfolio	103 million
Loan outstanding per borrower	306
Cumulative repayment rate (%)	94.40%

Source: www.misfa.org.af

Late 2006 services extended to small and medium enterprises (SME). Loans range from $ 3,000 to $ 300,000. As of February 2009 MISFA/SME partners combined to disburse 641 loans with a collective value of $ 18.1 million in agricultural and non-agricultural production, service and trade sectors. Of these loans, 78% were disbursed in trade sectors and most loans were granted in Kabul and large provincial cities. So only a small portion of the money involved, ends up in agricultural production and that is why micro finance is not the source of finance for future development in Afghan horticulture production.

And there is more information. Microfinance relates to the call believing there is a strong demand for credit, justifying a program in micro credit provision in Afghanistan. Research shows that informal credit is accessible to everyone, even the poor and is highly unlikely to disappear, nor is it likely to exist independent of micro finance. In fact, the two systems are intertwined[83].

The primary role of formal micro credit is setting up businesses and stimulating production. But the relatively inflexible terms do not always meet the villager's needs and repayment possibilities in terms of the crop calendar. In reality, micro credit money is also used for consumption smoothing and marriage financing. If repayment is impossible, flexible informal credit facilities are used to overcome the gap. This puts some individuals into more debt and a more vulnerable position, while others enlarge their influential position.

If micro finance unintentionally leads to strengthening of patron-client relations pomegranate growers and traders are confirmed in their dependent positions. Market positions will not develop and the existing situation of farmers and traders taking no risks and putting no effort in quality increase, resulting in low fruit product quality and low prices, will pursue.

3.11. Governance

Rural policy making in Afghanistan
Rural policy making in Afghanistan is characterized by three visions[84].

The Ministry of Agriculture, Irrigation and Livestock (MAIL). MAIL emphasizes the collapse of agricultural production after the Russian invasion, the subsequent need to rebuild this production and the central role for the state and MAIL. MAIL holds the *productionist vision*.

The second vision is from the Ministry of Rural Rehabilitation and Development (MRRD). MRDD subscribes on the importance of good governance, private led development growth and a focus on poverty reduction. This is about investment in public goods (roads, schools and infrastructure) and pro poor investments to create chances for the poor and improve the rural poor's well being. This vision is shared by most NGO's. MRRD and many NGO's hold the *developmentalist vision*.

The third vision is the market driven vision, which emphasizes the role of the private sector in driving development and allows only a minimal role for the state. In this vision, there should be a focused support for international agribusiness and commercialisation leading to an increase of marketable value of agricultural commodities, following a market-driven value chain approach. This vision is supported primarily by USAID, being the *market driven vision*.

The attempt to merge these three visions into a common Agricultural and Rural Development Sector Strategy (ARDSS) has largely failed[85]. The Afghan policy making process was not able to overcome great competition between these visions and positions and to explore potential similarities. Individuals play a critical role in Afghan politics while holding on to their personal beliefs and interests. Moreover, Afghan politics is highly dependent on foreign aid. Across all donor programs, NGO's and other donors undermine national leadership of policy by off budget (outside the government) funding of programs or by selectively funding programs in specific provinces.

The final Afghanistan National Development Strategy (ANDS) document officially demonstrates a market-driven vision to agricultural development. The ANDS represents a selective distillation of the three differing views, undertaken by external consultants employed through the USAID funding of the ANDS secretariat. The first strategic objective is:

`*The ANDS strategic objective for agriculture and rural development strategy is to attract private sector investment to transform agriculture to a high-value commercial agricultural sector as a source of growth and expansive means of livelihood`*[86].

Developing the pomegranate sector to an international business as a high value substitute for poppy, providing first class fruits and linked to global supply chains, fits this vision and has led to this research.

Which formal rules and regulations do govern the PSC?

The Afghan government
Actors in the fruit chains say they do not have any government and the government does not care about their business. And if the government is present the regulation of markets is bureaucratic, confused, contains many inappropriate and overlapping functions shared by different ministries and hence is often merely used as a means of 'rent-seeking' by officials. Where regulation is really needed, such as in the sphere of basic standards and gathering public revenue, there is no capacity to enforce rules and regulations even when they existed[87].

In March 2003, the Afghan government signed a preferential trade agreement with India clearing custom taxes for agricultural commodities by 50 to 100 percent. Pomegranate imports were levied with a 30% Most Favoured Nations (MFN) duty rate. The margin of preference was settled at 50%, leaving a 15% duty rate[88].

The European Union
EU policy on imported fruit is that food quality and safety rules and regulations are similar for domestic and foreign products. That means that producing along EUREGAP (fresh fruit) and ISO 9002 (working methods) rules and processing along HACCP (when applicable) rules are required. Nevertheless, it is conceivable Afghanistan delivering fresh fruit to the EU not produced according to EUREGAP rules. Because Afghan cultivation methods are mostly without the use of fertilizers and pesticides (nearly organic), quality is good enough and fruits will pass the tests and will probably be admitted to the European market.

EU regulations prescribe a 0% import duty on all products coming from Afghanistan.

The cultivation organisation
At this moment in pomegranate growing, a cultivation organisation is a red haring. Some 1,100 farmers' cooperatives do exist aiming at collective input supply. But when it comes to requirements in terms of growing, processing, logistics and final product quality, no regulations exist. Marketing cooperatives that should care about just these features do not exist[89].

Which enforcement rules and what sanctions and incentives do govern the PSC?
Formal rules and sanctions for the domestic market do not exist. Enforcement rules result from the existing vertical social networks. Informal patron-client relations prescribe the rules. However, these rules are not about timing of production and delivery, food safety aspects and pomegranate fruit quality. At this moment, everything is about avoiding risks and a heavy price competition in the fresh fruit market. The farmer is dependent on the trader and the trader is dependent on the wholesaler. Moving outside these marketing networks means expel from the social environment and that means risking one's livelihood.

Who establishes and monitors the rules
In the absence of formal rules in Afghan society when it comes to business, social networks and patron-client relations establish and monitor the informal rules.

What are the (dis) advantages of the rules for each category of actors in the SC?
Farmers on the bottom of their chain marketing network are certain of their sales and the help of their social network. However, this certainty comes at a price. Local traders, knowing these farmers have little access to market information and are dependent on their pre financing, will easily try to cheat on them. These circumstances make the farmer vulnerable so they agree on a low price, keeping them on subsistence level.

Local traders also have to settle for secure but low margins. They run risks while transporting. Usually they work under the authority of a wholesaler. In order to reduce risks they tend to have close patron-client relations with farmers, wholesalers and international dealers, in order to retain at least a secure but small margin. Wholesalers working in the same social marketing system are confronted with similar advantages and disadvantages the local traders face.

International traders taking packaged pomegranates across the border are confronted with many the same problems as wholesalers are. Losses as a result of packaging and transport are an occupational hazard. Moreover they carry the risk of transport through Pakistan. But with virtually no formal rules in the (international) fresh fruit business they are in today, the picture emerges of an oligopolistic elite having close relations with foreign companies importing (fresh) fruit from Afghanistan, and at the same dominating the domestic market environment. This is a ubiquitous image found worldwide in countries in the absence of formal rules and regulations and an acting government.

Domestic retailers are entangled in the same vertical social networks and face the same problems as traders do, but their position at the end of the supply chain is not enviable. Many of the problems accumulating through the chain are realized at retail level.

CHAPTER 4 DESIGNING THE AFGHAN - NETHERLANDS PSC

This chapter will discuss central question 3 as formulated in § 1.4.

4.1. Introduction

The Afghan - Netherlands PSC does not exist yet. Afghan pomegranates did end up in the Netherlands, usually as part of a trial load, but there is no real commercial competitive PSC from Afghanistan to the Netherlands. Commercial parties in the Netherlands and in Afghanistan and Pakistan do take an interest, but quality standards of the Dutch public and food safety regulations of the EU are a hindrance.

In the build-up to a possible future trade with Afghanistan a set of product specifications and technical contract demands has been recorded by the Dutch fruit industry for pomegranate import from Afghanistan. These specifications are included in Appendix 1 and Appendix 2. Many of these demands are way out of reach in present day Afghan circumstances. Nevertheless, these specifications are used to demonstrate the challenges and efforts Afghanistan has to cope with when developing a pomegranate business for export purposes to the EU-market.

4.2. Processes

The international Afghanistan - Netherlands fresh PSC looks like this.

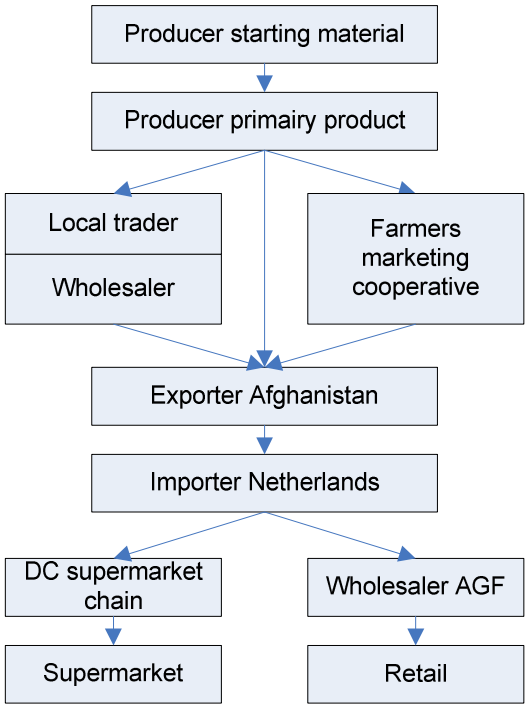


Figure 4.1 Image of the Afghanistan - Netherlands fresh pomegranate supply chain

Starting material

One of the most important assets of Afghan fruit is its germplasm. Indigenous pomegranate varieties are rich in market-sought attributes and therefore have the potential to compete with world-class producing countries. Nevertheless, there are neither plant variety protection plans nor genetic conservation programs in Afghanistan today. Genetic erosion has already been observed. Afghan germplasm will need to be protected to provide Afghanistan this relative advantage[90].

Recently hundreds of thousands of fruit saplings, and thousands of pomegranate seedlings, were brought into the country and the question is which cultivars these trees represent. Probably we are talking about modern high yielding cultivars. Pomegranate tree import is mostly coming from India. Import from Iran is likely too, in spite of Iran declaring a prohibitive order on exporting pomegranate trees. One might be doubtful on seedling quality coming into Afghanistan. Imprudent import and adoption of high yielding cultivars while not knowing exactly which germplasm they represent, may compromise Afghan fruit cultivation and threaten the local germplasm market advantage.

The following actions to preserve indigenous wild and cultivated germplasm should be taken:

1. establishing ex-situ gene banks and on farm conservation facilities
2. assessment and mapping of genetic diversity of fruit tree species
3. assessment of cultivars in regard to propagation capacity and cultivation use
4. setting up a national database for documentation and information sharing
5. establishment of germplasm protection programs to:
    a. rescue, safeguard and utilize Afghan's own genetic resources
    b. import and utilize some of the best modern cultivars from abroad
    c. reestablish modern breeding programs

Besides the establishment of gene banks and germplasm protection programs, nurseries must be established all over the country where growers can buy these tested, approved and registered cultivars. The setting up of gene banks, germplasm protection programs and nurseries is an important push factor in upgrading the PSC. To start a successful pomegranate business these saplings should be placed at (subsidized) disposal of small-scale farmers.

Cultivation

1. Knowing which cultivar is used for export when planting new orchards is important, for the choice of cultivar depends on the characteristics and the final use of the fruit. For instance, the Kandhari (also written as Kandahari) cultivar is favoured as table fruit for its shining red skin and sweet taste.

2. As a result of the war and the 3-year drought, many irrigation systems were destroyed and neglected. Instead, water tubes were drilled, water tables fell and saline water was used for irrigation. Mountain water supply in most regions seems to be sufficient again, but repair work on existing irrigation systems still has to be done. If no existing irrigation is available, construction of drip irrigation systems is the most adequate and cost effective alternative.

3. Pomegranate can withstand long periods of drought and then bear a load of fruit again, so rejuvenating old orchards is a good idea. Irrigation systems have to be restored, trees have to be pruned and orchards need fertilizing.

4. Flooding orchards on a regular basis as a means of irrigation has to be altered in a less excessive manner. Not only because it is not the best way of watering trees, but also because Afghanistan needs water management to decrease the amount of irrigation water needed by large orchards in the future and to be sure of the ongoing supply of safe, sweet, non contaminated water[91].

5. Planting trees of the same cultivar next to each other is favoured. Fertilizing, irrigating and pruning a larger surface at the same time lower production costs. Fruits of the same cultivar show a more equal ripening process, so it is easier to harvest more ripe fruits at the same time. Harvest costs will drop.

6. Pruning trees prevents excessive tree growth and favours fruit development and yield.

7. Cleaning flower remains in the crown should be done as pest control.

8. Fertilizing with Nitrogen and Zinc is a necessity when trying to produce maximum yields.

9. All farmers should be Global Gap certified according to the demands of the European market. Farmers should be informed about fruit cultivation and yields, fruit quality aspects concerning the European market and about the use of pesticides, preventing the emergence of intolerable residue levels.

10. In the international fruit (processing) business, high value fruit has to be produced at competitive prices. Growing practices on small plots of land by small individual Afghan growers cannot compete in this theatre. Just as elsewhere in the world in this situation, if Afghanistan is going the path of producing high value fruit for the international market, large areas of (fallow) land must be used to start big commercial orchards that can produce fruits of high quality at lower prices.

11. Alongside these big commercial orchards, small-scale farmers should get the position of out grower supported by out growers' projects, concerning the setting up of horizontal farmer cooperatives and the realization of market-oriented production, combined crop collection and quality control.

Collection

1. Considering pomegranate is a non-climacteric fruit, harvesting all fruits ripe and green at the same time, should be changed in several harvesting rounds picking only ripe fruits.

2. Fruits should be hand picked at the farm and brought to central packing stations from where trucks can be loaded. When it comes to fresh table fruit intended for the Dutch market, according to specifications these fruits should be pre-cooled to 5°C within 7 hours after harvest (Appendix 1), and then stored in a cold store. This presumes a pre cooling installation and a cold store in the vicinity of the orchards. These have to be built because usually they are not on hand. Building only seems favourable in the long term with lasting large-scale fruit production. As a provisional compromise, reefer containers (containers with a separate cooling unit) could be placed at central collecting spots, rounded up a day or a few days later.
When it comes to less quality fruits planned for processing in Pakistan or Afghanistan, a cold store is not a necessity. Because pomegranates do not decay fast, clean well-ventilated storages are a good alternative.

3. Size grading and packaging is done according to prescribed specifications. For export purposes, adequate packaging material is probably not on hand and should be brought into the country. Easy to stuff carton boxes strong enough to be stacked 10 high on pallets are preferable.

4. The price Dutch importers pay for fresh fruit is only for class 1 premium export quality pomegranates. Packaging in three layers with lower quality fruits in the middle is out of the question and will harm the Afghan brand. Second grade fruits not good enough for export should be separated and fed into the domestic fresh fruit chain, or be the starting point of a processing chain.

5. When buying fruit from Afghan farmers and traders, it is probably necessary to keep an eye on production and collection[92]. Specialized service companies with local know how act as intermediaries between EU-based fruit importing companies and local producers and dealers. The service company employs locals who maintain contacts with local producers and dealers. They make up contracts to deliver certain quantities according to pre arranged quality standards and take care of the contacts and the paperwork with the (export) authorities. An eye is kept on production, harvest and packaging to see if this is

handled according to specifications. They supply packaging material and take care of transport.

Local trade
With international traders seeking direct contact with farmers and local traders, activities of local traders in the international PSC become redundant and in time will vanish or change when delivery of larger quantities for export gets substantial. Bringing the fruits to collecting points, loading the fruits in a cold store, packaging the fruits in pre delivered cartons and transport in cooled trucks, means the local trader has less interference with the processes of harvesting, packaging and transport. Either he has to adapt to a position in that chain or he will be out of business.

Wholesale
In the international fruit supply chain it seems traditional wholesale activities have no added value. In the long run, the emergence of farmer cooperatives, central packing stations, cold stores and cooled transport in the international PSC, will make traditional wholesale activities superfluous. The alternative is to find a position as intermediary between farmer's cooperatives and international fruit dealers or deliver services to chain actors.

Export
1. Packaging of cartons on pallets and into containers according to prescribed specifications.

2. Certification of the load at the loading site in Afghanistan can be done by a certified organization. There is one based in Pakistan that already has done some certifications in Afghanistan[93].

3. When transporting through Afghanistan a local Afghan driver will ease passing roadblocks and borders.

4. A steady supply schedule in the crop period is a must for successful business. Large supermarket companies that sell 90% of all table fruit in the Netherlands, demand a steady supply before they do lasting business with a new provider.

Import
1. On arrival the pomegranates might be inspected by an independent quality surveyor contracted by Dutch FAD authorities or the Dutch importer.

2. On arrival the load can be inspected by Dutch customs.

3. After approval the reefer containers are cleared through customs and driven by trucks to the importer. The importer checks the load and after approval, he pays the supplier.

Wholesale / Retail
Either the importer sells to specialized wholesalers who deliver retailers, or he delivers to distribution centers of big supermarket chains from where the goods are trucked to the retail stores.

4.3. Actors

Farmers
At first, the farmer who wants to take part in the international PSC will have to improve the quality of his pomegranates. Later on, if he is still in business and he wants to produce high quality fruits, he will have to specialize and upgrade his production process. That implies an inevitable scaling up of his farm and his production activities. If big commercial

orchards appear, small-scale farmers will find a job there. Eventually the number of farmers delivering to the international PSC will drop.

Landowners
It is likely that Afghan private landowners will play an important part in export PSC's[94]. Big commercial orchards will probably be planted by these people with capital, powerful connections and know how. They have the money and can buy the knowledge to set up these orchards in Afghan circumstances. If and when later on international fruit companies are cultivating in big orchards, they will be king of the chain, because production, collection, export and import are in one hand.

Local traders / middlemen
When it comes to the export PSC, looking at the number of local traders, the prospect is that in the long run a greater part of them will be pushed aside and a smaller part will adjust to a new role as wholesale intermediary between farmers / farmers' cooperatives and (agents / dealers of) international companies. Surely their numbers will dwindle.

Wholesalers
Like the local traders, wholesalers are likely to be pushed aside or they adjust to a new role as intermediary between farmers' cooperatives and international fruit companies. These wholesalers become international dealers. As with local dealers in the international PSC, their numbers will dwindle.

Transporters
In international cooled transport, 20 ft or 40 ft reefer containers are used. These containers are sealed with a bolt lock on the loading site and not opened until arrival at the importer, with the exception of opening doors by custom officials or a quality surveyor. Standard reefer containers are not on hand in Afghanistan, they have to be brought in from Pakistan or Iran. Afghan transporters who want to participate in international fruit transporting business have to buy or rent/lease (cooled) trucks and / or international standard reefer containers, and they have to tune in with international fruit dealers and international fruit companies.

International dealers
At this moment, much of the international fruit business in Afghanistan is in the hands of Afghan/Pakistan dealers. With the exception of the export chain of big international fruit companies, if and when that is going to happen, these dealers are likely to keep their position. Dutch importers need locals to contact farmers, farmer organizations and local dealers. It is imaginable that these dealers' organizations get a surveyor task keeping an eye on production, harvesting, grading, packaging, storage and transport.

4.4 Flow of products and (product) information

The flow of the product
The flow of the product when sold to Dutch clients looks like this:

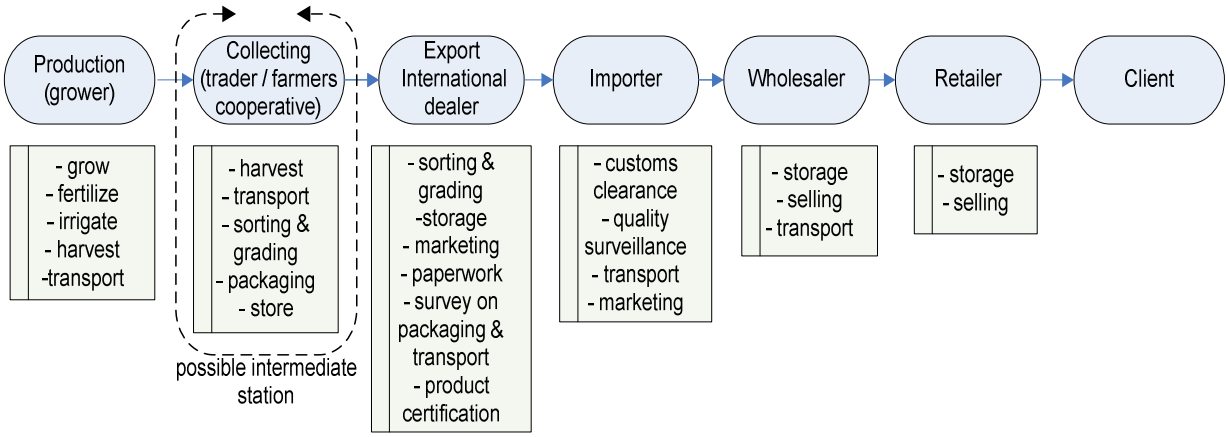


Figure 4.2 Afghanistan – Netherlands export market product flow

In the case of big commercial orchards owned by large Afghan landowners or by international fruit companies, the intermediate station of collecting by traders or farmers and farmers cooperatives does not exist. Produce is directly sold to export dealers.

At first, one thinks the only economical competitive way of transporting fresh fruit to Europe is by ship from Karachi in Pakistan or Bander Abbas in Iran to Rotterdam seaport. Nevertheless, there might be other options, right now or maybe in the future when certain conditions are met. Time can be of essence when trading fresh fruit. Delivery by trucks across land to the Netherlands, winning two weeks can be an important trade advantage.

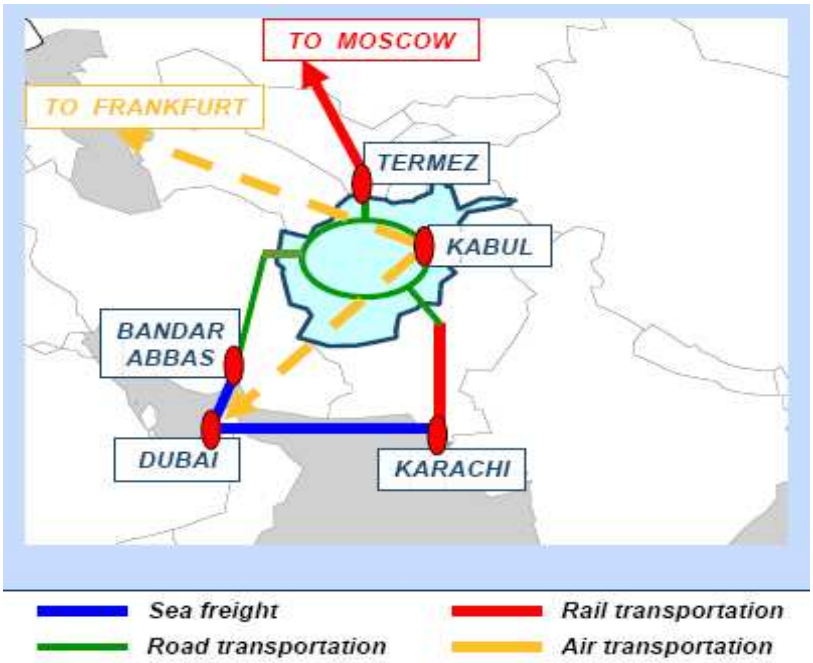
High quality pomegranate crop cultivated in western Afghanistan could be trucked from Herat and transported by cool trucks through Iran and Turkey to Rotterdam. High quality pomegranates grown in the northern part of the country could be trucked from Mazar-e-Shariff to Uzbekistan, transported further by railway from Termez in Uzbekistan through Russia to St Petersburg and then shipped to Rotterdam.

The Iran - Turkey trucking route over land is already in use by importers that transport fresh pomegranates and other fruits from central Iran to the Netherlands. Trucking routes in Iran need a few hundred kilometres extension. Iran already built a highway in Afghanistan leading from Herat to the Iranian border (A01) and beyond, connecting Herat to the Iranian highway system[95]. Transport across land is more expensive but in any given situation with favourable market conditions clients are willing to pay a higher price. It is uncertain however whether Iranian authorities will allow Afghan pomegranates to be imported and trucked through the country.

The railway route through Uzbekistan and Russia is already in use by importers who import dried fruit from Uzbekistan. This train route does not offer cooled or temperature-controlled transport to St Petersburg where the fruit is loaded onto a ship. As train transport takes two weeks to be executed in autumn and winter, at present this is a no go route. The railway track connects Riga in Latvia and St Petersburg in the Russian Federation to Termez in southern Uzbekistan near the border with Afghanistan. The soviets connected Termez to a transshipping point in Afghanistan on the south bank of the Amu Darya Uzbekistan - Afghanistan border river. This railroad is partly intact and is being used for fuel transport for ISAF troops, but needs some serious reconstruction. Passing the Uzbek border by truck from Mazar or Kunduz to Termez is currently no problem, and is done by a flood of trucks supplying ISAF troops in the northern parts of Afghanistan[96].

Iran is currently working on a railway track along this route. Pakistan is working on a railway track from the coast to the Afghanistan border at Spin Boldak on the way to Kandahar, and on a track from Peshawar to the Afghan border on the way to Kabul[97]. In

Pakistan there still is the Chaman Extension Railway built in 1891 to Chaman station on the Afghan frontier, just 108 km from Kandahar. This railway line was formerly used for trafficking Afghan fruit in ice-bunkered wagons to India.



Source: Altai Consulting, 2004, Market sector assessment in horticulture - Presentation, Phase 1

Figure 4.3 International transport routes from Afghanistan to the Netherlands

When it comes to juice concentrate time is of less importance. In this commodity, it is all about cold chain transportation costs. Juice concentrate is kept at temperatures below freezing point to minus 20°C. Carriage by sea to Rotterdam is the most cost efficient route.

Fresh arils are expensive to such an extent and moreover subject to decay in a few weeks, that air transportation is needed. They are flown in from Kabul airport or Dubai airport.

2. The flow of (product) information

Afghanistan setting up big commercial orchards and implementing export trade, will have the effects of an international PSC with push and pull factors influencing efficiency and efficacy of the chain. Production and product quality will grow to European standards. The chain shortens because non-value adding trade activities disappear. Demand driven information about fruit quality aspects will reach the bottom of the supply line. The most important consequence is the development of a supply driven chain into a demand driven chain.

Settling the price is no longer a matter of available speculative trade information on open horticulture markets. In the international PSC Afghan prices are linked to prices of pomegranate producing countries all over the world. Farmers and farmer organizations must be aware of current world prices to meet world competition. To enhance trade transparency and competition, an information system has to be built that not only collects, analyses and disseminates information on (world) prices and market opportunities, but also on news and information about production and postharvest handling aspects. Information can be spread through radio broadcasting.

To start a value chain with a fair margin for all actors and to have incentives for growers to improve quality and quantity, NGO's, government extension workers and government

institutions have to take part in preventing the emergence of oligopolistic power structures based on concentration of information in circles that have access to this information.

The establishment of regional extension and training centres is vital to teach and improve production practices and marketing and commercial practices in rural areas.

When setting up processing factories for export purposes a load of information has to be shared with clients and authorities. Information about quality control in production processing stages, residue levels and product temperature from the moment the product leaves the plant until arrival at the customer in the Netherlands. Pack sensor temperature recording chips should be placed in the load.

4.5 Volume and value

Volume

In a high-density professionally operated pomegranate orchard, one hectare can deliver a gross yield up to 30,000 kg. This is a yield under optimal circumstances. In a 2004 feasibility study for the Afghan pomegranate crop financed by UNDP the following yields for a newly planted orchard are assumed[98].

Table 4.1 Production figures per hectare of newly planted pomegranate orchard per year

YIELD	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7 and followings
Mt/Ha	0	0	2	4	8	15	22

(Mt is metric ton is 1000 kg)
Source: Altai Consulting, 2004, Market sector assessment in horticulture - Presentation, Phase 2-3

The international PSC will only be sustainable when an adequate steady supply is reached at harvest time. At this moment total pomegranate production in the whole of Afghanistan is estimated at about 75,000 tons. 25% of the crop (18,750 tons) is high value fresh table fruit quality fit for the Dutch and EU market. Much of this fruit is sold at a price of $ 0.50 on domestic markets in the cities to customers with more purchasing power. International dealers would offer this same price. Let us say 50% of the crop (37,500 tons), second quality fruits, is used as fresh table fruit in farmer households and sold at domestic local markets. This leaves another 25% (18,750 tons) for processing purposes.

18,750 tons of high quality fruit produced all over the country mostly in small non specialized orchards, of which the majority is sold at domestic markets at the same price international dealers offer, is an insufficient volume for sustainable export purposes and has to rise significantly. To achieve this volume big high yielding pomegranate orchards have to be started. Assuming 22 tons produce per hectare, 18,750 tons require 852 production hectares. This is a feasible quantity for one or two big commercial orchards.

Another 18,750 tons produced all over the country would be left for processing. One single factory for pomegranate concentrate with a processing capacity of 10 tons per hour operating 24/7, needs a supply of 25,000 tons (28,800 minus maintenance and repair hours) during harvest season (120 days from September to January). Ten tons of raw pomegranates are needed to produce 3.5 tons of pomegranate juice of 15°Brix and 1 ton of pomegranate concentrate of 65°Brix juice[99]. Therefore, 8,750 tons of juice and 2,500 tons of concentrate can be produced during harvest season[100]. To be competitive and because of high Afghan transportation costs, the plant should be built in the middle of pomegranate orchards area.

The conclusion is that at present pomegranate production volume shattered all over the country, is insufficient to start a processing factory with export potential. Nevertheless there is an increasing domestic fruit juice market and currently all fruit juices are imported. In 2004, ALTAI estimated the domestic market worth some $ 20 million with a yearly growth of 15%, importing 40,000 tons of juices from Iran, Pakistan, Uzbekistan and Turkey[101]. Processing is mostly done in Pakistan.

It is an interesting idea to start a small (concentrate) processing plant for domestic consumption in the vicinity of pomegranate orchards, or close to sites where new orchards will be planted. Filling lines and bottling stations situated in this plant or near customer concentrations could complete the business. The acquired experience could be the prelude to further reaching international business.

Value of pomegranate production

Afghan pomegranates are harvested around fall and early winter. This is harvest season for many other pomegranate-producing countries on the northern hemisphere as well. The biggest flows of produce will occur during that time[102].

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Albania												
Spain												
Israel												
Egypt												
USA												
South Africa												
Afghanistan												
Iran												
India												

Current months of greatest commercial production
Commercial production coming on line within 2 to 3 years

Source: Albanian export opportunities to Europe and the region, OTF group

Figure 4.4 Global pomegranate production calendar

On the southern hemisphere, South Africa is preparing to enter world markets within a few years and Australia is investigating whether conditions are right for involvement in the promising pomegranate business[103]. These cultivation areas have the advantage of counter season production, giving them the window of opportunity for spring sales in the EU, with Australia having the disadvantage of distance to this market.

Iran is Afghanistan's first and biggest competitor. When Afghanistan wants to deliver to the Dutch market, fruit importers are loud and clear: prices must be lower and quality must be higher than Iranian levels. And that is not an easy task knowing Iran has large-scale commercial orchards with first class high yielding cultivars and a developed pomegranate processing industry already connected to international supply chains. Moreover, Iran is known for its extremely low transportation costs.

With the start of pomegranate export, farmers might start to bother about fruit quality. However, working on quality is a long-term investment. The Afghan farmer must have confidence in future prospects on international markets, and he has to put his trust in fellow actors in the chain, before a value adding strategy will develop. The other way round, the Dutch importer must have confidence in the steady delivery of quality fruits over time. For these reasons, many different things have to be done.

To start with, for efficiency reasons and to minimize chain costs, fruit grading and sorting has to be done directly after harvest. Fruit has to be packaged in strong cartons, pre cooled to 5°C within 7 hours after harvest and stored in cold stores. Then trucks with reefer containers take the fruit to cold stores in the seaport area from where the containers are loaded onto the ship.

In doing so, the (trading) chain has shortened and (transportation) risks have decreased. Now, if the farmer gets a part of the trader's margin, then he might feel he is rewarded and fairly treated. A form of chain partnership might arise and the farmer has his incentive to worry about quality.

Storing the fruits through winter (6 months storage in a controlled atmosphere without noticeable product deterioration is possible) brings some (counter) season market possibilities. For further value increase, processing plants and/or filling stations can be built in Afghanistan. There seems to be a processing plant in Kabul. In Dubai a 10 tons/hr processing plant does exist, reportedly working with under capacity[104].

Increasing the value of Afghan pomegranate products to Iranian level to take part in sustainable export supply chains to the Netherlands is a matter of long duration and high investments.

4.6 Costs, margins and profits

Newly planted orchard

Costs:

A simple calculation per hectare gives the following installment costs:

Table 4.2 Installment costs per hectare of newly planted pomegranate orchard

- 1,000 trees ($ 3,00 per tree)	$ 3,000
- construction of drip irrigation	$ 3,000
- fertilizers/pesticides first year	$ 1,000
- labour costs preparing ground, roads etc	$ 2,000
Total installment costs	$ 9,000

Source: interviews with experts on Afghan pomegranate cultivation

Then 3 years follow before production starts. Trees have to be pruned, irrigated, and fertilized. Interviewed experts estimate yearly costs of $ 1,500/ha, making a total cost load of $ 13,500/ha before the first crop can be harvested[105].

This calculation is without costs of acquiring terrain (rent or buy). Land prices have risen lately and prices near cities and built-up areas are up to $ 50,000/ha. When acquiring land one has to have local connections, preferably powerful connections. A recent development is the emergence of water rights one has to pay to get water across neighbouring land.

This calculation is a commercial calculation. Small-scale farmers being part of a development program of an NGO usually get saplings, fertilizers and pesticides free.

Margins and profits

Examining margins and profits proves to be a very complicated business in a country with so many insecurities like Afghanistan has. Many surveys have been published with different and contradicting figures. In the time given for this study it is impossible to come up with adequate and reliable data.

Concentrate factory

Costs:

According to the 2008 INMA research[106] for Iraq installment costs (without terrain), for a 10 tons/hr processing plant with cold storage and generators, would be $ 4,115,000. Running costs would be $ 2,409,800 on a yearly basis (fixed costs $ 663,000; variable costs for 4 months operating $ 1,746,800).

Value chain of fresh pomegranates delivered to the Netherlands

Costs

Within the framework of the POM354 project[107], a Dutch international fruit dealer with local Pakistan / Afghan agents came up with a total cost price, based on delivery at the premises of the Dutch importer in the Netherlands, of $ 1.75/kg[108] consisting of the following elements. Farm gate price for 1 kg export quality fresh pomegranates is $ 0.50. Selection, cartons, packaging, storage, stuffing of containers etc, cost another $ 0.70, amounting to a raw material price of $ 1.20. Freight costs per kg from Kandahar in a reefer container through Pakistan via Karachi to Rotterdam add another $ 0.55. Border conflicts, roadblocks etc, remain at the transporter's risk. Transporting from Kandahar via Kabul and Islamabad and than south to Karachi is an occupational hazard.

Table 4.3 Cost price figures importing Afghan pomegranates to the Netherlands

- Afghan pomegranates class I, farmer price	$ 0.50
- Collecting, grading, packaging, pre-cooling, storage, etc	$ 0.70
- Freight costs Kandahar - Karachi – Rotterdam	$ 0.55
Total cost price Dutch importer	$ 1.75/kg (€ 1.30)

Source: Dutch international fruit trade organisation

Margins and profits

The margin of $ 0.70/kg for collecting, sorting, packaging and storage of the Afghan / Pakistan dealer, seems reasonable knowing that collecting, transport, sorting and grading, pre-cooling, cold storage and container stuffing are part of their activities and risks.

The retail price in the Netherlands for a red, sweet Kandhari pomegranate of 400 grams will be $ 2.05 (€ 1.50), making a price of $ 4.75/kg (€ 3.50) to $ 5.50/kg (€ 4.00). Considering the total import cost price of € 1.30/kg, it is clear that from a financial point of view this looks like an interesting market.

The transport route through Iran is examined too. At this moment, it is not clear whether Iranian authorities will allow a reefer container coming from Kandahar to cross the border and deliver a load of Afghan pomegranates in the seaport of Bander Abbas for re-export purposes. Maybe a cooled truck from Kandahar and re-loading at the border on an Iranian truck might be an alternative[109]. Transport costs however will probably be the same or perhaps less, because the distance is the same, Iranian transport costs are lower compared to Pakistan and the safety situation is better.

4.7 Technology and knowledge

For the international PSC current technology is insufficient in producing the required outcome. To be competitive on world stage Afghanistan must introduce new high technology in the chain processes. This will prove to be a lasting process.

In the production process, big commercial orchards are needed to reach adequate production levels for export and to introduce current production technology (agronomics). An adequate production level is also a requirement for the existence of processing plants, and with that, the need for the introduction of business economics and up to date processing technology (chemical, physical and logistics) is felt.

Besides these big orchards, existing farm production is helped with an out growers scheme for the existing small-scale farmers. As few of these farmers are specialised in pomegranate cultivation, an empowerment strategy including the establishment of tree nurseries, supply of fertilizers and perhaps pesticides, the setting up of farmer production and marketing associations and delivering technical and financial assistance, is needed.
In the marketing process, one problem is poor functioning of the present marketing system in servicing large orders. Ordering large quantities should lower transaction costs. In Afghanistan, the opposite happens.

Farmers united in marketing cooperations offering larger quantities through one representative are a solution. Loading these quantities presumes the presence of a storage facility, preferably a cold store. A further solution could also be a cold store and an auction process in a provincial town. The farmer would get the feeling he got a fair price.

A functioning cold store and processing plant presumes the technical and economical knowledge how to operate and manage a business in a competitive environment. Refugees returning from exile, that worked in the pomegranate business in Iran or acquired economical or technical expertise elsewhere in the world, will have the knowledge to lead the business. Otherwise, these people have to be educated.

4.8 Services feeding into the chain

NGO services and money from foreign countries will be needed for a long time from now. The country, most of the people and the infrastructure are ruined. Afghanistan belongs to the poorest countries on earth. Rebuilding infrastructure in a broad sense is the first thing to be done. Afghanistan has to import almost everything (products, services and know how) to get the country back on its feet again.

This applies to the pomegranate sector in Afghanistan too, ranging from quality pomegranate saplings to drip irrigation systems, postharvest handling techniques and passable roads. There is a shortage of everything.

Specifically for the agriculture export chain a domestic agricultural chemicals industry, a fertilizer industry and a packaging industry (plastics and cartons) should be set up.

Government services have to get better. Extension services should extend to the whole of the country. Regulation of uniform export rules and streamlining applications procedures should be done and certification regulations should be declared.

4.9 Relationships and linkages

If and when an Afghanistan - Netherlands PSC will come about, at first Dutch fruit importers will do business with existing Afghanistan / Pakistan international fruit dealers. These dealers have contacts with farmers and traders and they will take care of harvesting, sorting, packaging and transport, just as they do now and nothing much will change in the beginning. Existing marketing and social networks will do their job. Later on when trade gets substantial, things will change.

Afghanistan offers large areas of land to investors[110]. Wealthy landowners will be the first to grasp the opportunity to use their land or buy land to establish large commercial orchards. In this scenario, connections between international Dutch fruit dealers and growers will be more direct, probably with interference of just a wholesaler or international dealer, for these growers are capable of delivering large quantities at a time. In the future big international fruit companies may establish commercial orchards, resulting in vertical chain integration without any interference of Afghan traders and wholesalers.

Local farmers will work on these orchards, learn about modern production techniques and earn a living above subsistence level. As a result, their dependence on market information and crop pre financing by local traders will diminish.

Government extension institutions helped by NGO money and knowledge, will hopefully regain their positions as they had before wartime. Government institutions distributing production and marketing information, will hopefully get the position of chain facilitator and agricultural marketing director, being able to impose formal standards and regulations.

Out grower's schemes for small-scale farmers will have effect with empowerment programs. Farmers will realize that dealers up the chain hold a margin that could be theirs. To withstand the pressure of other actors in the chain, farmers will get the knowledge and feel the need to organize themselves in producer associations. For marketing reasons international dealers want them to get organized in marketing organisations. These marketing organisations will take over the processes of harvesting, grading, packaging and transport from traders.

Only when world market standards are met, profits are made and farmer organizations prove their right of existence, the fragmented marketing system will slowly unravel and patron-client relations will grow less tight. When farmers are paid a better income, dependency on informal credit and the need for a social safety network will diminish.

Simultaneously, due to international standard quantitative and qualitative demands, the level of formality in Afghan fruit marketing matters will increase. Dutch fruit dealers will secure matters of quality and quantity as far as possible in written contracts. Enforcement is through non-payment and loosing business to other producing countries.

So finally, if and when an export PSC to the Netherlands gets substantial and that will prove to be a long lasting process, this will loosen social and ethnical fragmentation of Afghan marketing structures. In the end the informal persistent network relations between actors in the chain will evolve to partly persistent network relations and partly spot market relations, for if crop is bad in Afghanistan, fruit will be purchased elsewhere on the world market.

4.10 Finance

Pomegranate farmers at present often contract their crop and are (partly) paid in advance. This is necessary for the farmers who live at subsistence level. Assuring a steady supply of high quality fruits from these orchards implies continuation of this chain financing in the beginning. It is not likely that Dutch fruit importers pre finance crops of individual farmers. Dutch importers do pay their Afghan/Pakistan connections partly in advance, the rest after the shipment arrives in Rotterdam, and the fruit has been checked and approved. Farmers still need this pre finance, so the Afghan/Pakistan international dealers will have to deliver this financial service.

Micro finance will not deliver the huge investments needed for horticulture development. High interest rates and inflexible repayment conditions not in line with the agricultural seasonal flow of money will prevent small-scale farmers to take micro credits. When Afghanistan / Pakistan international dealers want to involve farmers and local traders in their supply chain, they can pre finance the crop, but they can also deliver credits.

Private land owners and industrial fruit enterprises either do have the money to invest in commercial orchards, or lend the money through normal commercial credits at a commercial bank. In their business, micro credit does not play a role.

4.11 Governance

One distinctive element of the future PSC concerning governance of the chain is the facilitator, the manager of the PSC. This manager should have the position to collect, analyse and distribute market information to achieve transparency and competition in agricultural trade, bring together potential business partners, examine (export) trade opportunities and get in touch with foreign governments and business partners. Furthermore, this director should set quality standards for pre and postharvest handling and should have the power to enforce production and marketing rules.

This would be the task of Afghan government institutions, but will prove to be a long-term affair. An adequate fulfilment of this task implies restructuring the government and implementation of enforceable rules and regulations. Officially, the government's vision on developing agriculture is the market driven vision, assuming the invisible market hand is the fastest way of bringing progress and profit and a developed agriculture that can compete on world markets.

This is however a liberal view on economics that may be functioning in a developed country with a developed infrastructure. It is questionable whether a low literate, low technology country with poor infrastructure and an absent government is capable of leading its agriculture to this point. Afghanistan going this path needs intervention of foreign investors, large-scale production and a developed agricultural infrastructure.

Maybe this objective is just a little too ambitious. In the short and middle long term, this can only be done in a commercial agricultural economy alongside the existing reality of subsistence farming most farmers are engaged in.

At this moment, no formal rules do govern the domestic PSC. In the international PSC however formal food quality and food safety rules and commercial rules like delivery on demand and in time and according to previously agreed standards, prescribe stringent control of the production, transport and marketing process.

To achieve all of this and to keep things in own hands, the Afghan PSC needs a chain facilitator and that would be the government. If that does not happen, if Afghanistan itself is not establishing, monitoring and enforcing rules, governance will be in the hands of foreign powers and the existing oligarchic power structures in the country. This will prohibit or at least slow down the process of Afghanistan joining international supply chains.

Photo 4.1 Packaging of Kandahari pomegranates

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The first matter of experience was that an Afghanistan - Netherlands PSC does not exist yet. Some Afghan pomegranates may have reached the Netherlands, but that must have been part of a trial order.

The conclusion is that on the one hand, there is a promising Dutch market with interesting financial prospects for the Dutch fruit trade and on the other hand, there is Afghanistan not ready yet for admission in an international pomegranate supply chain. Supply quantity is insufficient and Afghan domestic logistics and infrastructure are inadequate to set up a PSC delivering a steady supply of high quality pomegranate products to the Netherlands. Big commercial pomegranate orchards need to be started and existing farmer practices need specialization and scaling up through farmer's production and marketing associations.

In answering central question 1 of this research, at first the 'Van der Vorst model' was used, but that model turned out to be not suitable in describing and analyzing a horticulture supply chain from a developing country. After discussing the research with agricultural chain experts and reading pro poor modeling literature, a model consisting of 10 elements or viewpoints for a value chain appraisal was designed. These 10 elements are a suitable instrument in analyzing existing horticulture supply chains and give all necessary viewpoints when designing an international PSC.

In answering central question 2 of this research; analyzing the present Afghan horticulture supply chains, it is obvious that Afghanistan missed 30 years of agricultural development because of the war period. The Afghan government is absent. The Afghan economy is informal, unrecorded and untaxed by the state. In an informal economy with informal marketing structures, social marketing networks with patron-client relations set the rules. Ethnical and social networks enforcing behaviour in persistent network relations dominate chain relations. Farmers, local traders and wholesalers act in tight social and ethnical marketing networks giving no possibility to market their products outside these patron-client relations. Chain arrangements between actors are geared to avoiding risks.

The consequence is poor functioning and non-transparent marketing processes. Producers are sparsely connected to international markets. Few farmers are organized in horizontal producer's cooperations while farmer's marketing organizations do not exist. The benefits of these vertical marketing networks are security; certainty of selling one's crop through the years and being in a social network that acts as a safety net. The result is an under developed product driven marketing system not aiming to deliver product quality, but geared to heavy price competition. The chain is a truncated system without forward and backward linkages and push or pull factors to develop a value-adding subsector.

In answering central question 3 of this research, many things in the domestic chain part have to be changed, starting with the protection of indigenous germplasm to provide Afghanistan the relative advantage of its first class pomegranate fruit. In cultivation, growing practices should be ameliorated and big commercial orchards, out grower's projects and farmer's marketing cooperatives have to be established to provide a steady supply of high quality fruit at competing prices. In collection; sorting and grading and packaging in cartons has to be implemented, for Dutch importers only pay for high quality fruits. Wrongly packaged fruit can harm the Afghan brand. Cold stores have to be built to be able to meet the demand of cooling down the fruits to 5° C within 7 hours after harvest.

NGO´s activities in pre and postharvest stages are necessary to bring current knowlegde and practices to a higher level. Trade activities in the domestic chain part will have to change drastically. Local trade and wholesale activities will prove to be redundant when delivering to international fruit dealers.

In international fruit supply chains, governance through formal rules and enforcement is inevitable. The Afghan government has to develop to the role of chain facilitator. If not, governance will be in the hands of foreign powers and domestic oligarchic power structures, prohibiting or at least slowing down the process of Afghanistan joining international pomegranate supply chains.

5.2. Recommendations

One conclusion of this research is that, if Afghanistan wants to set up a steady export PSC to the Netherlands, big specialized commercial pomegranate orchards and out grower's schemes have to be established to achieve the necessary production volume. The best spot to do this is, is where infrastructural facilities are at best and that is in the southwestern parts op the country. The warm arid climate is suitable for pomegranate growing. These regions are relatively peaceful; transport routes link up with motorways and seaports in Iran and are closest to the EU market. Furthermore, many war refugees fled to Iran and made a living in big commercial orchards. The knowledge they acquired is useful in operating these orchards.

Critical success factors for introducing the export PSC to the Netherlands are the existence of a cold chain and efficient chain logistics. To achieve this, central collection centers have to be established, cold stores have to be built throughout the country, auction facilities around collection centers and cold stores have to be created and reefer containers should become the main means of transport.

Afghan pomegranates varieties belong to the best in the world and are rich in market-sought attributes. This local germplasm market advantage should be protected through the establishment of gene banks and germplasm protection programs, especially now as many sapling from foreign origin are brought into the country. The 'Afghan brand' could make the difference on world markets and should therefore be handled with care.

Setting up a PSC to the Netherlands turns out to be a bridge too far at this moment. High fruit quality standards are a hindrance to export and many logistical matters in the domestic chain have to be ameliorated. To start with, it could be useful setting up a PSC to Dubai, supplying countries with less strict food quality and safety demands in central Asia and Arabia first, and learn from experience. For the same reasons the establishment of a juice / concentrate factory for domestic consumption should be considered. In addition, the economic viability of a local packaging industry for plastics and carton to support the export supply chain should be calculated.

The different supply routes from different parts of Afghanistan need further calculation.

APPENDIX 1 SPECIFICATION DRAFT AFGHANISTAN POMEGRANATES

Code	Product: Fresh pomegranates / Punica Granatum
Latest up-date 24-05-2009	
R10925 NFNC Afghanistan	**"KANDARHI and TAGAB " variety in 3,5 kg ,**
Specifications	Fruit is nearly round and hard, leathery shiny skin. The edible aril portion is transforming from deep pink to bright red, depending the time of the year. The ARIL is the surrounding of the individual seed and is juicy, crunchy. The whole pomegranate has a distinctive protruding flower end, cleaned inside with oil filtered air pressure of about 4 Bar. Outside skin polished and cleaned with soft cotton gloves.
Size Grading	Size graded with round bars system. - Optional few pallets per FCL,10 mm and up, 450 gr. and up, (7 cnt) Inside carton separation in diagonal crossing, 2 x 3 x 2. (about 10 %) I - About 20 %, 94-104 mm and 350-450 gr. (count 9 by 3,5 kg. crtn) II – about 35 % , 84 - 93 mm and 250-350 gr. (count 12 by 3,5 kg. crtn) III - About 35 %, 75 -84 mm and 200-275 gr. (count 15 by 3,5 kg. crtn)
Varieties red coloured pomegranate	KANDARHI AND TAGAB , red coloured , over all.
Origin	Afghanistan, States, a.o. Kandahar, Urozgan, Nangarhar,
Harvest	Product should be hand picked, immediately forced pre-cooled until 5 degrees C. within 7 hrs after harvesting in a typical pre-cooling system. No wooden boxes tolerated by harvesting (picking).
Packaging : size I to IV, about 3,5 kg cartons, Size L 40cm, Front 30 cm. Height, subject inner-layer and size Carton type half closed 220 cartons per pallet 20 pallets per 40 ft reefer 4.400 cartons per FCL.	In strong new coloured, waxed corrugated, moisture proof open cartons, with inside a black perforated plastic inner layer with separations for each pomegranate, to guarantee solid stuffing, with ventilations holes as well in the layer as under the pomegranates, in connection with the ventilation holes in the carton bottom. For the four counts, 9 - 12 - 15. Only count 7 will be with strong white crossing carton as separation. Carton strong enough to carry the whole pallet. The design and quality of the cartons in such a way that it can be stowed on the pallet as one solid block. Cartons with minimum 4 air circulation holes in the bottom, placed in such a way to stay open by putting on the special pallet design.
Palletising	Special pallet design needed for total air circulation in air forced reefer container, see separate, Block Pallet design of 17-2-2008 and R10867 Airflow pallet and carton of 5-2-2007, all in combination with special designed ventilation holes in the cartons and inner layers for these pallets. With 4 – moisture proof coated corner boards, vertical nailed (screwed) on the pallet and on the top connected on an horizontal square top cover layer. All bund together with vertical (about 3 straps by the under layers and the rest about every 30 cm, total about 8 straps) and horizontal straps. Only one pomegranate size (count) per pallet, mixed farmers are acceptable. Even when the quantities per size are not reaching 220 carton's / pallet. Pallets with less quantities can be stowed on top of each other with extra corner boards and straps as one solid unit. Per pallet 4 clear pallet numbered label. A4 size on all 4 sides, with thick printed letters and numbers, with the contents of that pallet in accordance with the specs on the Packing List Cartons to be stowed in such a way that product label is easy and clearly visible. By palletising one "Pallet Sheet ", in the middle and one on the top with ventilation holes and interlockers. To make the pallets solid.

Labelling	On one short side of the carton! Clearly printed on white paper: Produce: Pomegranates / Granatapfel " POM 354 " Variety: Kandarhi Origin: Afghanistan Size: 7 - 9 - 12 - 15 Cat / Class: I Weight: about 3,5 kgs. net weight Grower code: Packing code: Exported by: …….. Ltd. Kandahar, Afghanistan.
BRAND	Brand " POM TROYAL " on every pomegranate a sticker " POM354 "
Stowing into container 20 pallets 100 x 120 cm per FCL	All pallets stowed in the well-known " Vent Stowing Pattern " and in such a way that it fits good together to avoid collapsing. At the door side an air ventilation closing with plastic foil. 220 crtn's per pallet, total 4.400 crtn's See: " Stowage Regulations Pomegranates, up-date 26-7-2007 ".
Net weight	3,5 kg. Always a guaranteed minimum weight, tolerances only up-wards. .
Acidity	Citric acid, % in w/w , below 1,85%
Brix	12 - 15 °Brix.
Tannin	Below 0,25%
Pre-cooling	Within 7 hours after harvesting with forced air circulation until + 5 degrees , Celsius. Pre-cooling for the 3,5 kg. can be done in the final packaging.
Washed	no
Metal Detector	not applicable
Skin	Free from sunburn, cracks, cuts, decay. Max 5 % of the surface with THRIPS (outside skin damage caused by insects) or max 5 % BRUISING (outside skin damage caused by contact). Both max one (1) square cm.
Moisture	No external moisture including packaging.
Colour	Equal red to bright shiny red skin.
Maturity	Harvested ripe fruit, without signs of internal browning.
Flavour	Characteristic of fresh fruit, without any abnormal flavour or odour
Taste	Sweet taste
Cultivation	Only natural, no GMO allowed.
Traceability	With farmer codes on outer crtn through to the grower with IQMO system on the packing list.
Pesticides residue Control	Hopefully German Q.S. certified Afghanistan Laboratory numbered test reports, traceable per farmer lot via IQMO system made packing lists. At least the Afghanistan laboratories are ISO 17.025 certified. All in the tolerances of the EU. MRL. of 1-9-2008
GlobalGap certified Farmers	All farmers are certified, certification traceable via farmer code on the IQMO system made packing list.

APPENDIX 2 AGREEMENT AND TERMS OF CONTRACT PROPOSAL OF AFGHANISTAN POMEGRANATES

We hereby mail you our contract and cooperation proposal to supply Afghanistan POMEGRANATES for sale in Europe on the following terms & conditions:
This whole project will be the very first export of Afghanistan fresh Pomegranates by sea-container to Europe.

Seller:
Intermediate:
Buyer:

1. Produce & Variety	Fresh, clean polished pomegranates, Afghanistan Variety. Cat I. Brand "POM ROYAL "For supporting "POM354 "Afghanistan project.
2. Country of Origin	Afghanistan, State Kandahar and Urozgan
3. Specification	Fresh, clean polished fruit with reddish seeds inside. Sweet to taste, Disease free. Quality in accordance with the Pomegranate Specifications latest up-date. R10925 of 24-05-2009.
4. Shipment	By 40 ft. reefer, high top containers on 5 degrees C. Price sea-freight approx us $???, equal to about € ????
5. Packaging	Fruit to be packed about 3,5 kg net weight (about to be mentioned on carton) One size per pallet. Brand and design on costs of seller.
6. Loading	400 carton's per 40 FT. HC. reefer. pallets with 220 carton's. See stowage regulation Pomegranates of 26-7-2008
7. Shipping Program:	With weekly programs consulting by both parties, see separate Shipping Planning and Schedule model 30-12-2008. For successful business this schedule is a must . Crop period is from mid August up to end November.
8. Quantity	About ?? – ?? FCL..
9. Port of Discharge	Rotterdam.
10. Port of loading	????, sailing time to Rotterdam max ?? weeks.
11. Price	Advance € ??? / crtn. With a planned estimated final minimum FOB Afghanistan value of € ??? / crtn.
12. Payments:	Advance payment prompt by full swift after arrival in destination against acceptance of quality and full set of documents as stipulated here under. Final price payment one week after final sales against account sale.
13. Costs	Sea-Freight collect, based on shipping contract agreed by both parties.

	Buyer will sell on free consignment-charging 8 % commission.
14. Documents	1- Full set of B/L, or "WAY BILL, 3 originals, with Consignee and Notify , To be endorsed by consignee. 2- Full set of original Invoices, 3- Packing List pomegranates latest up-date 27-3-2008, 4- Certificate of Origin Form "A", 5- Phytosanitary Certificate, 6- Iso 17.025 certified Afghanistan Laboratory Pesticide Residue test document, in accordance with the EU MRL of 1-9-2008. Traceable per farmer code via packing list. 7- GlobalGap copy certification per farmer applicable to this contract. Traceable via the Packing list 8- IQMO , quality and traceability document.
15. Surveyor:	All shipments to be inspected on arrival by an independent Quality Surveyors ……, costs to be placed on the Account Sale.
16. Sales:	Stock and Sales position per week per FCL by Email to seller.

Extra points:
- Quality and Quantity is 100 % on responsibility of seller.
- All original Documents to be mailed by courier max one week after departure.
- Packing list to be mailed max 24 Hrs after loading in origin
- Account Sale, correspondence, payments, etc., always per contract number and container number.

Extra Dimension, hopefully the new "IQMO ", digital on line quality and traceability control can be installed.
With an internet password the buyer and all parties concerned can see all the technical details direct after loading the container in origin. (similar to the packing list).
see: www.iqmo.net

A Pack sense temperature recorder chip has be placed per farmer lot by arrival in the packing station in origin which can work about 60 days. Giving a total cool chain control from farmer through to the final destination.

APPENDIX 3 CULTIVATION OF POMEGRANATES

1. Origin of pomegranates

The pomegranate is native in the region from Iran to northern India. Since ancient times the pomegranate tree was cultivated and naturalized throughout the Mediterranean region of Asia, Africa and Europe. The pomegranate tree is a fruit bearing usually deciduous shrub or small tree between five and eight meters tall.

The most plausible explanation for the name pomegranate is its derivation from the Latin word *pomum* meaning apple and *granatus*, which means seeded. It is said that the genus name *Punica* is named after the people of the Phoenicians who were active in broadening its cultivation. Punica was also the Roman name for the city of Carthage founded by the Phoenicians, from where the best pomegranates came to Italy.

2. Taxonomy of pomegranates

The Latin name is *Punica granatum L*. The tree belongs to the family *Punicacceae*. This *Punicacceae* family only consists of one genus and two species: *Punica granatum L* and *Punica protopunica*. This last species is only endemic to the island of Socotra. It differs in having pink, not red, flowers and smaller, less sweet fruit. A dwarf variety does exist, known as *Punica granatum nana,* popularly used as Bonsai trees and as a patio plant.

Kingdom	**Plantae (plants)**
Phylum	Magnoliophyta (flowering plants)
Class	Magnoliopsida (dicotyledons)
Order	Myrtales (mezereums, primroses, myrtles,…)
Family	Punicaceae
Genus	Punica (pomegranate)
Species	Punica granatum (pomegranate)

3. Morphology of pomegranates

Growth Habits: The pomegranate is a neat, rounded shrub or small tree that can grow to 20 or 30 feet (6 to 9 meters), but more typically to 12 or 16 feet (4 to 5 meters) in height. The pomegranate is much branched, with stiff, angular and more or less spiny branches. The trunk is covered by a red-brown bark, which later becomes gray. There is a strong tendency to sucker from the base. Pomegranates are long-lived. There are specimens in Europe that are known to be over 200 years of age. The vigour of a pomegranate declines after about 15 years, however. The pomegranate may begin to bear in 1 year after planting out, but 2.5 to 3 years is more common. Production potential is reached at 7 years.

Foliage: The pomegranate has glossy, leathery leaves that are sometimes evergreen, sometimes deciduous, opposite or in whorls of 5 or 6, short stemmed, oblong-lanceolate and 0.4 to 4 inches (1-10 cm) long.

Flowers: The attractive scarlet, white or variegated flowers are over an inch across and have 5 to 8 crumpled petals and a red, fleshy, tubular calyx which persists on the fruit. The flowers may be solitary or grouped in twos and threes at the ends of the branches. The pomegranate is self-pollinated as well as cross-pollinated by insects. Cross-pollination increases the fruit set. Wind pollination is insignificant.

Fruit: The nearly round, 2 to 5 inches (5-12 cm) wide fruit is crowned at the base by the prominent calyx, the crown. Weight is between 200 and 500 grams. The tough, leathery skin or rind is typically yellow overlaid with light or deep pink or rich red. Its phenolic compounds determine the colour of the pomegranate. The interior is separated by membranous walls and white, spongy, bitter tissue into compartments packed with sacs filled with sweetly acid, juicy, red, pink or whitish pulp or aril. In each sac, there is one angular, soft or hard seed. Each fruit contains hundreds of seeds. High temperatures are essential during the fruiting period to get the best flavour. Under suitable conditions, the fruit should mature some 5 to 7 months after bloom.

Cultivars

Varieties are often classified as sweet, sweet sour, sour, early, mid season and late, juicy, and table fruit, soft-seeded and hard-seeded or major and minor. The names originate frequently either from the place of cultivation or from the colour of the fruit.

Almost all pomegranate cultivars being grown throughout the world owe their origins to selection among wild seedling trees and/or volunteer seedlings of cultivated trees. Dissemination started first to the Mediterranean area and from there to the new world. These have been maintained by vegetative propagation and have acquired names in time. Research shows that all sorts of cultivars found in the world by all kinds of different names are in fact similar varieties. Until recently despite the large number of local varieties, not many of them were commercially utilised and propagated in nurseries.

Breeding programs started in the second half of the twentieth century and concerted efforts have only been achieved in the last three decades[111]. Many cultivars are listed and ex situ collections are already established in different countries, but interchange of plant material is still not frequent. There is a need for agronomic and genetic studies and for modern breeding objectives, systems and techniques. In view of the growing demand in the world for pomegranates, new methods must be developed for cultivar identification and genetic resources management.

In Central Asia there are several named cultivars. Types with relatively soft seeds are often classed as ‘seedless’. Among the best are 'Bedana' and 'Kandhari’ (or Kandahari). 'Bedana' is medium to large, with brownish or whitish rind, pulp pinkish-white, sweet, seeds soft. 'Kandhari' is large, deep red, with deep-pink or blood red, sub acid pulp and hard seeds. Others include '*Alandi*' ('Vadki'), *'Dholka'*–large,- *'Kabul*'–large, *'Muscat Red'*–small to medium, *'Paper Shell'*–round, medium to large, '*Poona*'–large, *'Spanish Ruby'*–round, small to medium or large; '*Vellodu'*–medium to large, *'Muscat White'*–large.

There are many more cultivars from all over the world. *Balegal, Cloud, Crab, Early wonderful, Fleshman, Francis, Granada, Green globe, Home, King, Phoenicia, Sweet, Utah sweet,* and *Wonderful* for instance, are all varieties originating in California and Florida, USA.

The question is which cultivar should the grower plant? Generally, the best cultivars can be recognized using the following characteristics:

- High yielding cultivars;
- Frost resistance; soft seeded cultivars are generally less frost-hardy than hard seeded types;
- Self compatible cultivars;
- Pink or red flowered types includes most of the common and all of the desirable and commercial varieties of pomegranates;
- Fruit maturing at the same time all over the tree. This allows a single picking and the fruits tend to split less;
- Good fruit quality: size and shape, rind and seed colour, juiciness, sugar content and acidity, taste;
- Large fruit, unless small fruited varieties are very early-maturing and therefore demanding a premium market price;
- Fruit resistant to fruit cracking;
- Fruit resistant to fruit borers: acid fruits are less damaged than sweet ones;
- Fruit keeping good post harvest quality with good storage- and transport-possibilities;
- Fruits having a high percentage of flesh to seed;
- Fruits with small seeds and with soft seeds;

In fact, the choice of a cultivar is a derivative from the final product. Is the pomegranate sold as fresh fruit or is the fruit meant for processing? Fruits with hard seed possess poor eating quality and fruits with an intense red colour can have higher juice content. So these fruits are utilized for processing. Soft seeded varieties are used as table fruit.

4. Cultivation of pomegranates[112]

Climate
Pomegranates prefer a semi-arid mild-temperate to subtropical climate and are naturally adapted to regions with cool winters and hot summers. The tree favours a semi-arid climate and is extremely drought tolerant. A humid climate adversely affects the formation of fruit. The tree can be severely injured by temperatures below 12° F (minus 11° C). Pomegranates produce best in full sunlight. Bark damage due to freezing or sunburn may be reduced by painting trunks white to minimize temperature fluctuation during cold nights and warm days, when the trunks are exposed to direct sunlight.

Soil
Pomegranate grows in most soils with the exception of saline soils. The pomegranate thrives on calcareous, alkaline soil and on deep, acidic loam and a wide range of soils between these extremes. In northern India, it is spontaneous on rock-strewn gravel.
While pomegranate tolerates mildly alkaline soils up to pH 7.5, they prefer slightly acid soils (pH 5.5 – 6.5). Heavy soils are acceptable if good drainage is provided.

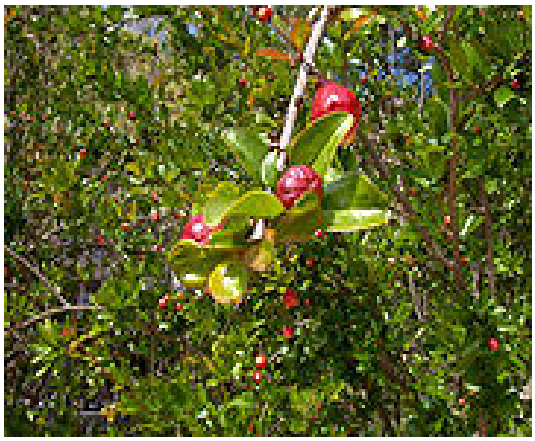
Culture
Pomegranate seeds germinate readily even when merely thrown onto the surface of loose soil and the seedlings spring up with vigour. However, to avoid seedling variation, selected cultivars are usually reproduced by means of hardwood cuttings 10 to 20 inches (25 to 50 cm) long. Trees are not grown commercially from seed germination because seedlings do not come true to variety. Such seedlings produce fruit of widely varying characteristics: large to small, juicy to woody, dark-red or purple to almost white, and from sweet to sour. The cuttings are set in beds with one or two buds above the soil for 1 year, and then transplanted to the field. Suckers from a parent plant can be taken up and transplanted.
Rooted cuttings or seedlings are set out in pre-fertilized pits 2 feet (60 cm) deep and wide and are spaced 13 to 19 feet (4 to 6 meter) apart, depending on the fertility of the soil.

Initially, the plants are cut back to 24 to 30 inches (60 to 75 cm) in height and after they branch out the lower branches are pruned to provide a clear main stem.

Orchard design

In a commercial orchard tree planting distance is from 2x2 meters to 6x6 meters and everything in between. Planting density depends on type and depth of soil and climacteric conditions. Planting density is the most important yield contributing factor, which can be manipulated to attain maximum production. Optimum spacing is important for the maximum utilization of the land. Research shows that, as plant density was increased yield per hectare also increased without affecting fruit quality. A density of 1000 plants per hectare gave 2 to 3 times higher yield and 2.44 times more profit as compared with normal plant population of 400 per hectare[113].
In California, high-density planting (3x3) with trees up to 3.5 meters height compared with mechanical harvesting delivers a yield of 35 tons per hectare[114].

Good light penetration between the rows depends on the distance between the trees and the height of the trees. Tree height should not exceed 3 to 3.5 meters. If trees grow higher fruit set will be mostly on top of the trees and harvest will be more expensive. In old orchards trees will have 5 to 12 trunks, in modern orchards 3 to 5. The trees are trained to grow as an open vase. In such a way that light penetrates the trees from the rows as well as from the inside of the trees. If planting is in very small distances fruit production is lowered, with fruit set at the top of the trees and bad colouring. For renewing old trunks new branches are left one per trunk. They can replace a trunk within 2 to 3 years of growth.



As in other fruit species there is a negative correlation between the number of fruits and their size. Therefore even distribution of the fruits on the branches is desired. Where a group of fruits develops the touching fruits are removed. If fruits touch each other the touching place has favourable conditions for developments of insects. In order to obtain fruits without damage to the skin and with good colour, small branches that might scratch the fruits are to be removed. By doing this the fruit is also more exposed to the sunlight. Trees planted too closely make picking difficult as they begin to crowd, and fruit colour develops more slowly when shaded in closely planted or hedgerow plantings. As trees get older and denser, fruit scarring may increase.

Full sunlight nearly all day is essential. Pomegranates develop well with high temperatures above 35°C. Trees that do not receive at least 6-8 hours of direct sunlight each day will produce long thin branches with few flowers and fruits. Areas of heavy summer rainfall are not appropriate for pomegranate cultivation as fruit will be soft and rot easily in storage.

Commercial orchards aim at harvesting 30 tons of high quality fruits per hectare each year. Big fruits obtain a higher price than small ones. A commercially attractive pomegranate weighs more than 400 grams. Therefore, the grower aims at fruits of 500

grams each. In an orchard with trees planted in 6x4 distance, one hectare will carry 400 trees. Therefore, the grower needs 150 fruits per tree at harvest to achieve these 30 tons. With trees planted in 3x3 distance 1,100 trees need 55 fruits of 500 grams to achieve this yield.

In orchards with organic methods weed control is only by mowing while a net covers the trees. This is effective but rather expensive management. The shading of the net may cause flower differentiation and reduce yields.

Irrigation
The pomegranate can withstand long periods of drought. Although not much fruit is produced under drought conditions, trees will survive for years; then, if properly irrigated, they grow vigorously and produce good crops. The plants are tolerant to moderately saline water and soil conditions. Trees will thrive and produce an abundance of fruit under high summer rainfall conditions but the fruit tends to be soft and has poor shipping and storage quality. For good fruit, production pomegranates must be irrigated.

To produce large crops of good-quality fruit, pomegranates require about the same amount of water and frequency of application as citrus. The amount of irrigation depends very much on the climate. Adequate soil moisture must be maintained throughout the growing season, particularly as harvest approaches in late summer and early fall, when it helps reduce the number of split fruit. A general guide is to start with 15 m3/ha per day in spring and raise the amount to 50 m3/ha per day in summer days close to harvesting. After harvest, very little irrigation is carried out[115]. Winter irrigation is avoided, as the heavy irrigation during harvest to improve fruit size, often is not depleted during the winter. Any further winter irrigation will only spur long, vegetative, non-fruiting spring growth.

Fertilizing
Pre plant fertilization can be done by working compost, animal manure and green manure into the soil to a depth of 1 meter. This should not be done directly to the tree-planting hole at the time of planting, but in advance of planting, so that rotting can occur and be completed prior to planting, otherwise root rot is likely. Organic sources of N should be applied during winter and/or spring to allow for timely decomposition and release of nutrients.

Pomegranate does not develop nutrient deficiencies easily. Though the level of N has more influence on the growth, yield and quality of the pomegranates than any other nutrient, adequate supplies of N are especially needed to optimize growth and development of newly planted trees. When available the trees should be given 50 to 100 grams applications of ammonium sulfate or other nitrogen fertilizer the first two springs. In the third year the amount is 50 kg/ha and in the fourth year and thereafter 100 kg/ha.[116] Fertilization however differs in every country and can be dictated by restrictions to reduce pollution from fertilizers, or because fertilizers are not available like in many cases in Afghanistan. Zinc is the other nutrient pomegranate needs and is applied by foliar sprays of zinc sulphate.

Pruning
Plants should be cut back when they are about 2 feet high. From this point, allow 4 or 5 shoots to develop, which should be evenly distributed around the stem to keep the plant well balanced. These should start about one foot from the ground, giving a short but well-defined trunk. Any shoots that appear above or below should be removed, as should any suckers. Since the fruits are born only at the tips of new growth, it is recommended that for the first 3 years the branches be judiciously shortened annually to encourage the maximum number of new shoots on all sides, prevent straggly development and achieve a strong well-framed plant. After the third year, only suckers and dead branches are to be

removed. In order to achieve the vase shape the trees should be pruned in winter. In winter pruning, the height of the trees should be brought back to the desired height.

Pollination
The pomegranate is both self-pollinated and cross-pollinated by insects. There is very little wind dispersal of pollen. Self-pollination of bagged flowers has resulted in 45% fruit set. Cross-pollination has increased yield to 68%. In hermaphrodite flowers, 6% to 20% of the pollen may be infertile; in male, 14% to 28%. The size and fertility of the pollen vary with cultivar and season.

Pests and Diseases
Pomegranates are relatively free of most pests and diseases. Minor problems are leaf and fruit spot caused by *Cercospora, Gloeosporium* and *Pestalotia* sp.; also foliar damage by whitefly, thrips, mealy bugs and scale insects; and defoliation by *Euproctis* spp. and *Archyophora dentula.* Termites may infest the trunk. Gophers seldom bother the roots, but deer will browse on the foliage.

The pomegranate butterfly, *Virachola Isocrates,* lays eggs on flower buds and the calyx of developing fruits. In a few days, the caterpillars enter the fruit by way of the calyx. These fruit borers may cause loss of an entire crop unless the flowers are sprayed 2 times 30 days apart. A stem borer sometimes makes holes right through the branches. Either Pleuroplaconema or Ceuthospora Phyllosticta may cause twig dieback*.* Discoloration of fruits and seeds results from infestation by *Aspergillus castaneus. Sphaceloma punicae* may sometimes disfigure the fruits*.* Dry rot from *Phomopsis* sp. or *Zythia versoniana* may destroy as much as 80% of the crop unless these organisms are controlled by appropriate spraying measures. Excessive rain during the ripening season may induce soft rot. A post-harvest rot caused by *Alternaria solani* was observed in India in 1974. It is particularly prevalent in cracked fruits. In 2008 a bacteria damaged great parts of the Indian and Iranian crop.

Harvest
Fruits ripen 6 to 7 months after flowering. Depending on the cultivar pomegranate is deemed ready for harvest when the soluble solids (SSC) reach 15% or higher. The fruits are ripe when they have developed a distinctive colour and make a metallic sound when tapped. Pomegranate is classified as non-climacteric fruit[117]. The fruits do not ripen off the tree and should be picked when fully ripe to ensure best flavour. The fruits must be picked when they tend to crack open, particularly when rained on. The fruits should not be pulled off but clipped close to the base, to leave no stem to cause damage in handling and shipping. In the Northern Hemisphere, the fruit is typically in season from September to January. In the southern Hemisphere, it is in season from March to May.

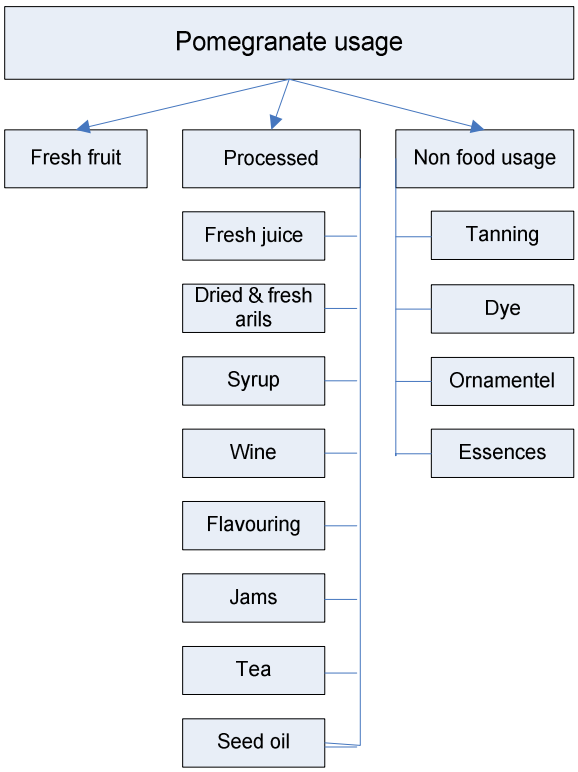
Storage
The limiting factors for prolonged storage of pomegranates are weight loss and shrinkage, decay and appearance of skin blemishes. Cold storage is needed. The optimum storage temperature varies by cultivar, production area and post harvest treatment. Research shows that for periods of storage less than 4 weeks after harvest, the fruit can be held naked in cold storage without any need for modified atmosphere. For longer periods up to 10 weeks after harvest, it is recommended to pack the fruit in moisture permeable film (better than perforated polyethylene films) to the extent that excess moisture is eliminated in the event that condensation forms within the bag. The pomegranate is equal to the apple in having a long storage life.

For long storage periods after harvest, fruits can best be packed in bulk bags of moisture permeable film in crates or bins[118]. Pomegranate fruit is best maintained at a temperature of 42° F (6° C) and can be kept for a period of 7 months within this temperature range at 90% relative humidity without shrinking or spoiling. The optimal controlled atmosphere storage conditions for pomegranates would be 3% O_2 and 6% CO_2[119]. After prolonged storage, internal breakdown is evidenced by faded, streaky pulp of flat flavour.

APPENDIX 4 PROCESSING OF POMEGRANATES

1. Food uses

Processing depends on the use that is made of the pomegranates. The fruits have many varied uses. Pomegranates are edible as fresh fruit, one can eat the processed arils and one can enjoy the extracted juice pure, or mixed in jams, jellies, juices, teas, beverages, and concentrated in syrups and liqueurs. In India the juice sacs, the arils, are dried in the sun for 10 to 15 days and then sold as a spice, named 'ardana'. Pomegranates have also pharmaceutical and medicinal uses. Research has demonstrated that polyphenol / flovonoid concentrates in pomegranate-fermented juice and cold pressed pomegranate is superior to that of red wine and approaching that of premium green tea.



Source: Pomegranates, Albanian export opportunities to Europe and the region[120]

Suggestions have risen to use the polyphenolic compounds of the rind, which have a very intense antioxidant activity, in dietetic formulations. Because of the shining (red) colour of some varieties, the fruit is used as decoration. In Israel pomegranate leftover from juice production being rich in fibre and antioxidants is used as cattle feed. The field of by-products is to be an interesting field once large scale industrial processing of pomegranates is reality.

2. Fresh fruit

Pomegranates are commonly eaten fresh, although the fleshy bitter pulp around each seed is a hindrance to fresh consumption. The pomegranate has a coriaceous rind. One has to score the fruit deeply several times vertically and break the sections apart. Then the clusters of juice sacs can be lifted out of the rind and eaten.

3. Arils

Eating a fresh pomegranate is a laborious business of cutting and peeling the fruit. Then, due to the high content of polyphenols and oxidative enzymes in the fruit rind, hands are stained brown and stains in clothing are difficult to remove. That is why the industry found a way to process the fruit with de-shelling machines, cutting the fruits in parts, removing

the juice sacs from the rind and processing the sweet and juicy pulp around the seeds, called the arils. The difficulty with these machines is that the arils should not be in contact with the rind. Tannic elements in the rind give the arils a bitter taste. In addition, the membranous walls with the white bitter tissue between the arils can be damaged while crushing the rind. An optimal solution has not been found yet. A recent development is a machine with belts at uneven speeds.

The arils normally undergo a minimal processing consisting of washing in chlorinated water and antioxidant solution to reduce the microbial count, pH modification and temperature control to reduce the perishability of the fruits. Finally, the arils are packaged in polymeric, (perforated) polyethylene or semi permeable film to develop a micro controlled atmosphere. Researches on pomegranates minimally processed show a browning produced by the oxidation of the phenolic compounds during storage. Therefore, packaging is crucial. Research on the films shows the importance of the packaging material, with a great influence on the respiratory intensity and the conditions for the action of many contaminating micro-organisms. Semi permeable film came out as best, allowing storage for 14 days at 4°C with good chemical, physical and microbiological quality[121]. Another research in 2004 with UV-C radiation on minimally processed arils showed no significant results on shelf life[122].

In 2008, a machine came on the market using sound wave technology producing a resonance that separates the arils from the peel and the white membrane and releases the natural preservatives from the skin. The arils are then packed using modified atmosphere packaging for longer shelf life. In the process no preservatives and sanitizers are used, only water at room temperature to wash the fruit[123].

4. Juice

Many of the same difficulties processing arils are met when producing pomegranate juice. The same de-shelling machines are used separating the rinds and the white membranes before the arils reach the squeezing system to extract the juice. Squeezing can be done using different techniques. The pressure should not be too high causing high temperatures and as a result juice quality deterioration. A membrane press seems to be today's best method as it reduces contamination with tannin and seed fragments. Then several filters like vacuum rotating filters and plate filters or ultra filtration are passed. After filtration, evaporators for treatment of clear or low viscosity juices are used for concentration.

Finally, the concentrated juice is sterilized and bottled. Studies show that the extraction and clarification process and the pH of the juice (added organic acids to decrease the pH) have marked effects on juice stability. For fresh juice results, storage should be done at 0°C. For preservation and use later, the best storage temperature is –20°C. Storage of frozen juice permits prolonging the juice life considerably, although it does not completely prevent pigment degradation and browning. Storage at -20°C without deterioration of the juice is possible for 6 months.

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Appendix 3 and 4

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