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Comparative Advantages of Pistachio

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Executive Summary

The scarcity of natural resources and the ongoing opening of Syrian economy to the world markets call for an urgent need to reallocate domestic resources and tradable inputs within the agricultural sector towards the objective of increased specialization based on comparative advantages.

'Comparative Advantage' refers to the most cost-effective compromise between economic efficiency and social benefit. Policy makers are then able to consider to what extent the production of certain agricultural products is possible using domestic resources efficiently, or if it is worthwhile to substitute local production with imports and to use those domestic resources for other agricultural commodities that have potential comparative advantages.

The pistachio crop is considered as one of the most important fruit trees, which have the potential for the generation of both social profit and hard currency. Pistachio produced in Syria is exported to Arab and European countries owing to its quality and preferred flavor. So, it is important to assess the potential comparative advantages of pistachios considering the current markets and the prospective ones (Middle East and EU) in order to enlarge the diversity of sources of foreign currency.

Accordingly, the Policy Analysis Matrix (PAM) is used to evaluate the effects of both government intervention and market distortion. PAM is calculated by means of data on revenues and costs, at both market and social prices, to allow for assessing profits and transfers and to derive the economic indicators of the PAM.

Regarding the current technology, the trend of the world price and the available data the following conclusions were reached in the study:

- Syria has comparative advantage in producing in-shell pistachios in the rain-fed system (DRC=0.55).
- Syria has comparative advantage in producing in-shell pistachios in the irrigated system (drip DRC=0.53, sprinkler DRC=0.59).
- Syria has a weak comparative advantage in producing shelled pistachios (DRC=0.97) due to the competition with the lowest price of Iranian pistachio.

There are many ways to improve the comparative advantage of Syrian pistachios, in the long term:

- It is very important to provide the farmers with new varieties that come into full production earlier, since the existent ones can take up to 15 years to do so. This will have a positive impact on reducing the costs before the full production stage is reached, it will boost the comparative advantage and improve competitiveness against the Iranian pistachios.
- Seek new varieties that:
  1) Have higher conversion rates and yields in rain-fed areas,
  2) Are more resistant to alternate bearing phenomenon,
  3) Are suitable for mechanized peeling, and
  4) Can be adopted as soon as possible.

- Introduce new technologies for peeling mechanically (This technology is used in other producing countries such as the USA), and support the processors to obtain this technology
- Concerning peeling pistachio, it is essential to introduce and look for new 'dry' peeling technologies (i.e. ones that do not use water) for green pistachio. 'Dry' processing protects the pistachio from fungus diseases (Aflatoxins) and therefore gives more potential opportunity to compete in the world market.
- Agricultural services should be improved; in parallel, the General Commission for Agricultural Scientific Research (GCASR) should continue improving local varieties and finding the good genetic roots that are resistant to *alternate bearing* phenomenon, and which can enter full production earlier. This will increase the yield and reduce the production unit cost.
- Exported quantities of pistachio are very modest, but Syria possesses strong comparative advantages for pistachio that should be further exploited through conducting marketing and farm administration programs according to international market demands. This will increase the potential to enter international markets, and brings good export revenue.

Chapter 1. Background and Introduction

The Syrian economy has been gradually going through extensive transformations during the last decade with increased exposure to international competition by joining the Great Arabic Free Trade Area, and signing of Free Trade Area Agreement with Turkey. However, another source of challenges is foreseeable with Syria's forthcoming Association Agreement with the EU, and the prospect of accession to the World Trade Organization (WTO). In this respect, trade agreements involving reciprocal trade concessions will force Syria to liberalize its markets and to move further ahead towards a more market oriented economic system. This scenario may will lead to appropriate reactions improve economic efficiency and so enhance international competitiveness, particularly in the agricultural sector. Policy makers need to make a comprehensive assessment of the potential impact of possible policy changes on the economic viability of Syrian produced commodities, so that they are able to increase their contribution to the economy.

The scarcity of natural resources and the ongoing opening of Syrian economy to the world markets call for an urgent need to reallocate domestic resources and tradable inputs within the agricultural sector, directed towards the objective of increased specialization based on comparative advantages studies.

The concept of comparative advantages dictates that if a country has lower production cost of a good than that of the rest of the world, it should produce this good with its own domestic recourses (labor, capital, land and water) to supply its population, and possibly to export. If this is not the case then it is more economically efficient to import this good and to reallocate domestic recourses to other goods that have comparative advantages. The aim of applying the concept of comparative advantages is to diversify domestic resources in efficient ways under free market conditions.

The pistachio crop is considered one of the most important fruit trees which have the potential for social profit and the generation of hard currency. Pistachio produced in Syria is exported to Arab and European countries. Syria imports shelled pistachio from Iran. Thereby, it is important to assess the potential comparative advantages of Syrian Pistachios.

1.1. Policy issues

The export of vegetables and fruits from Syria has been increasing over recent years, especially to other Arab countries. Syria is also committed to increasing exports to the European Union. Accordingly, it has removed all the taxes related to agricultural production and the tax on export profit[1].

Many policies which boost the Syrian export (including the pistachio processors and traders) have been implemented by the government such as:

- Legislative Decree no 48 on August 4, 1998. This marked Syria's signature of the Transit International Agreement (TIR). This reduces the tariff on the Syrian vehicles and the export cost.

[1]Decree no. 15 dated 3/7/ 2001.

- Legislative decree No 15 on July 3, 2001. This declared that all exported products are exempted from agricultural produce and income taxes.
- Decree No 1100 on July 15, 2003. This eliminated all the procedures that force the traders to finance imports from export earnings, and the exporters have the right to keep the foreign currency.
- Decree no. 672, May 18th 2002. This permitted the duty free import of vehicles that are no more than 5 years old[2].

The entire pistachio trade is in the hands of the private sector. Prices therefore are largely determined by market forces. There are government interventions in some areas of pistachio trade, such as a ban on the import of in-shell pistachios and custom duty on importing shelled pistachios (10% for the bags of 25 kg and more and 30% for the bags less than 25 kg); but no custom duty is applied on exporting pistachios.

The government continues to encourage pistachio production by selling seedling at incentive prices (low prices), alongside the private nurseries. The recent establishment of the Pistachio Bureau in the Hama Governorate (2006) should help to develop this product throughout by assisting improvements in quality, by providing assistance to the farmers, by collecting the data, by determining diseases and controlling them, and by holding the first Syrian pistachio fair in 2006.

1.2. The importance of pistachio

Syria is an important world pistachio producer. Pistachios are mostly planted in rain-fed areas in drought and sub drought regions. They have a high nutritional value; large share of them are consumed in green form; they are considered a 'luxury' good; it is also an essential ingredient in the dessert and ice cream industry, which Syria is renowned for. Moreover, they are considered as an excellent income source for many individuals from different parts of the Syrian society; this is helped by the fact that demand for it is increasing at local and world level. Therefore, pistachio is a promising crop for export.

Pistachios have been grown in Syria for centuries. There are some trees over 1000 years old in Ain-El-Thainah near Damascus. Traditionally, Aleppo, which is in the northern part of Syria, is the main pistachio growing region. Recently there has been a rapid expansion around Hama, Idleb and in the southern region near Sweida.

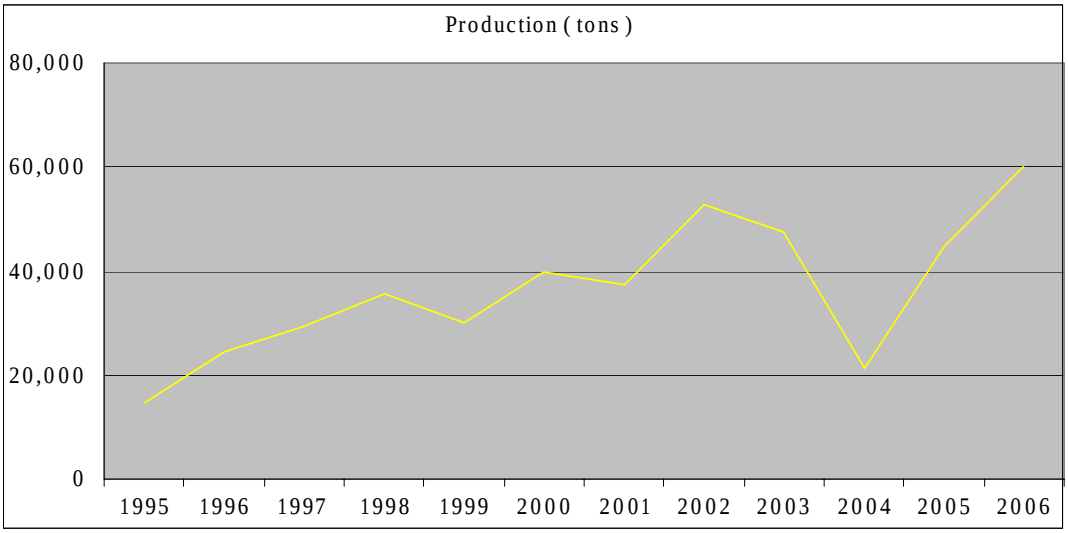
Besides the cultivated species, the *Pistacia Vera*, Syria is also home to five wild species of pistachio. The most widely distributed of these is the *Pistacia Atlantica,* which is resistant to pests and diseases which, together with its suitability on calcareous soils, makes it an important potential breeding resource for improving cultivated pistachios.

There are approximately 10 million pistachio trees in Syria that is still fairly immature, this accounts for 57 thousand hectares. Around 30% of all trees are still immature and haven't yet entered the productive period. Syrian production is expected to be 60 thousand tons in 2006 (Figure 1.1)[3].

[2] Ministry of Economic and Foreign Trade

[3] Syrian European Business Centre (SEBC) Interview, Hassan Ibraheem, the Head of the Syrian Pistachios Bureau 06/08/2006

Figure 1.1. Evolution of syrian pistachio production, 1995-2006 (ton)



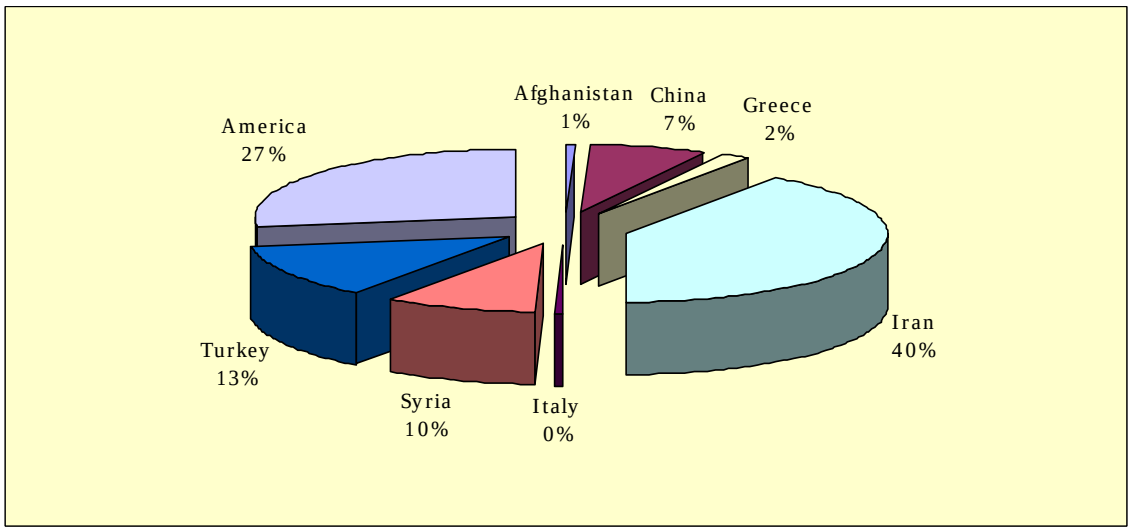
Source: Elaborated from NAPC Database

1.3. Global and Syrian pistachio outline

Production

In 2005 Syrian production was 45 thousand tons accounting for 10% of the world production. According to FAO database, Syria ranked fourth in the world in terms of pistachio production, preceded by Turkey with 60 thousand tons, which accounts for 13% of the global total. The first two producers were Iran (190 thousand tons and 40% of the global total) and the USA (128 thousand tons and 27% of the global total), see Figure 1.2.

Figure 1.2. Pistachio production in the world, 2005 (%)



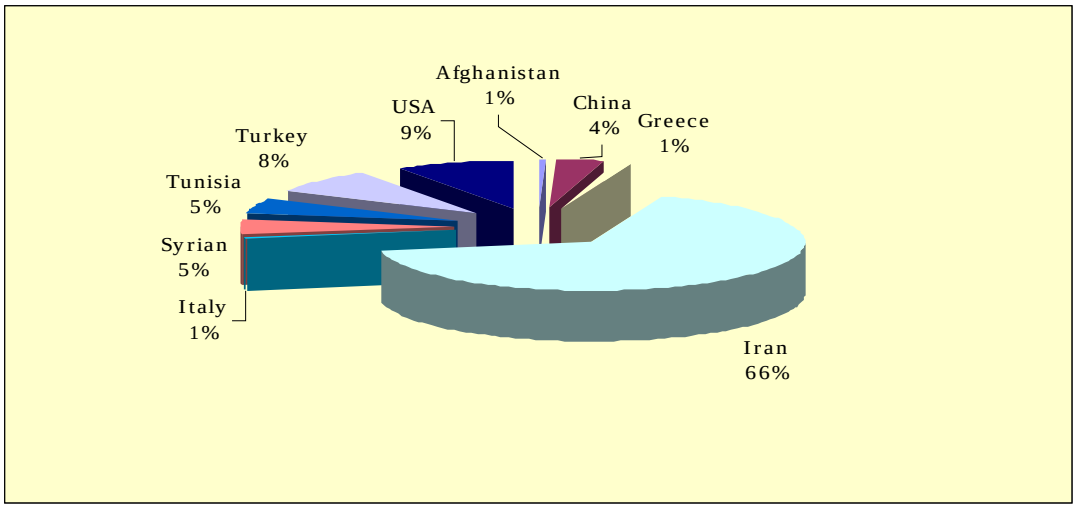
Source: Elaborated from FAO Statistical Database

The pistachio crop in Syria suffered from a severe frost in 2004 which caused a significant reduction in production to just 21 thousand tons. This phenomenon increased the prices affecting negatively the consumed and exported quantities.

Area

According to FAO Statistical Database, in 2005, Syria ranked fifth amongst the pistachio productive areas. Syria's 22 thousand ha account for 5% of the world productive area of pistachio. Syria is preceded by Tunisia which has a slightly higher area (23 thousand ha), Turkey, USA and Iran. Iran has the largest area (300 thousand ha) accounting for 66% of the global area devoted to pistachio (Figure 1.3).

Figure 1.3. Global pistachio productive area, 2005 (%)

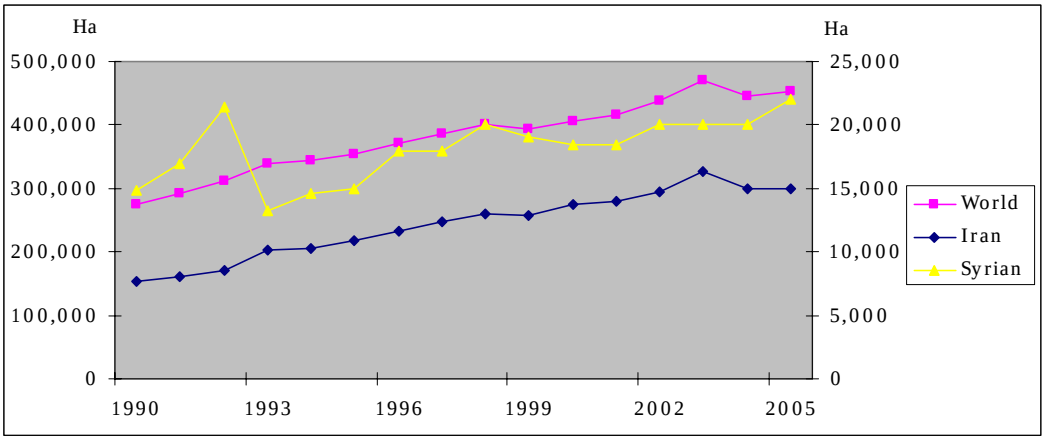


Source: Elaborated from FAO Statistical Database

As seen in Figures 1.2 and 1.3, the USA share of the world area and production amounts to 9% and 27% respectively, whereas Iran share is 66% and 40% respectively. This indicates a great difference in the productivity of the area unit due to different grown varieties, different agricultural services and different environmental adaptations.

During the period 1990 to 2005 the productive pistachio areas increased globally from 275 thousand ha to 452 thousand ha. This increase was mainly due to increases witnessed in Iran which is considered as the world's most influential pistachio producing country. In Syria the pistachio area improved over the same period from 15 to 22 thousand ha. (Figure 1.4)

Figure 1.4. Pistachio productive area, 1990-2005 (ha)



Source: Elaborated from FAO Statistical Database

Import and export

Table 1.1 shows the highest importing and exporting countries of pistachio in the world in 2004 (over one thousand tons). Syria imports shelled pistachios to use them in the dessert, pastry and ice cream industries. Globally China is the primary importer with 50 thousand tons, followed by the UAE with 38 thousand tons, and Spain with 33 thousand tons. In 2004 Syria ranked eleventh among the exporting countries of pistachio, this figure is low (just 1000 tons) owing to the frost experienced in this year. Iran ranks first with significantly larger share of the export market than its competitors with 139 thousand tons. The nearest competitor is the USA with 36 thousand tons.

Syria exports green pistachios during the production season; visiting tourists from Arab countries informally export annually significant quantities of pistachios out of Syria. Also, Syria exports in-shell pistachio and imports shelled pistachios. Syrian exports of shelled pistachios are negligible, just 32 tons and 115 tons in 2004 and 2005 respectively (Tables 1.2 and 1.3).

Syrian traders and processors prefer Syrian pistachios to imported ones and therefore are prepared to pay higher prices to get them. Accordingly, Syria's rising production has mostly been absorbed by domestic consumption. While the export and import quantities are affected by the alternate production phenomenon (Figure 1.5).

Table 1.1 Pistachio exporting and importing Countries (above 1000 tons), 2004

Countries	Import		Export	
	Quantity (ton)	%	Quantity (ton)	%
Iran			138,723	60.7
USA			35,692	15.6
China	49,568	18.8	14,013	6.1
UAE	38,471	14.6		
Spain	33,463	12.7	1,989	0.9
Germany	21,722	8.3	14,986	6.6
France	14,731	5.6		
Italy	13,643	5.2		
Luxemburg	11,418	4.3	6,961	3.1
Russia	8,912	3.4		
Lebanon	7,695	2.9		
Mexico	7,001	2.7		
Netherlands	6,669	2.5	7,039	3.1
UK	6,511	2.5		
Belgium	5,399	2.1	3,767	1.6
India	4,972	1.9		
Slovakia	3,996	1.5	2,984	1.3
Israel	3,925	1.5		
Canada	3,756	1.4		
Greece	3,466	1.3		
Pakistan	3,241	1.2		
Japan	2,347	0.9		
Syria	2,154	0.8	1,096	0.5
Saudi Arabia	1,736	0.7		
Czech Republic	1,681	0.6		
Jordan	1,552	0.6		
Poland	1,505	0.6		
Australia	1,232	0.5		
Hungary	1,277	0.5		
Armenia	1,000	0.4		
Afghanistan			1,202	0.5

Source: Elaborated from FAO Statistical Database

Table 1.2 In-shell exported pistachio quantities, 2005

Countries	Quantity (kg)	%
United Arabic	35.9	23.0
Saudi-Arabia	34.9	22.4
Jordan	32.5	20.9
Bahrain	17.8	11.4
Kuwait	15.7	10.1
Qatar	6.9	4.4
Sweden	3.0	2.0
Venezuela	2.4	1.5
Lebanon	2.4	1.5
UK	1.6	1.0
Syrian Free Zone	1.0	0.6
Oman	0.9	0.6
Hungary	0.5	0.3
Ghana	0.3	0.2
Denmark	0.1	0.1

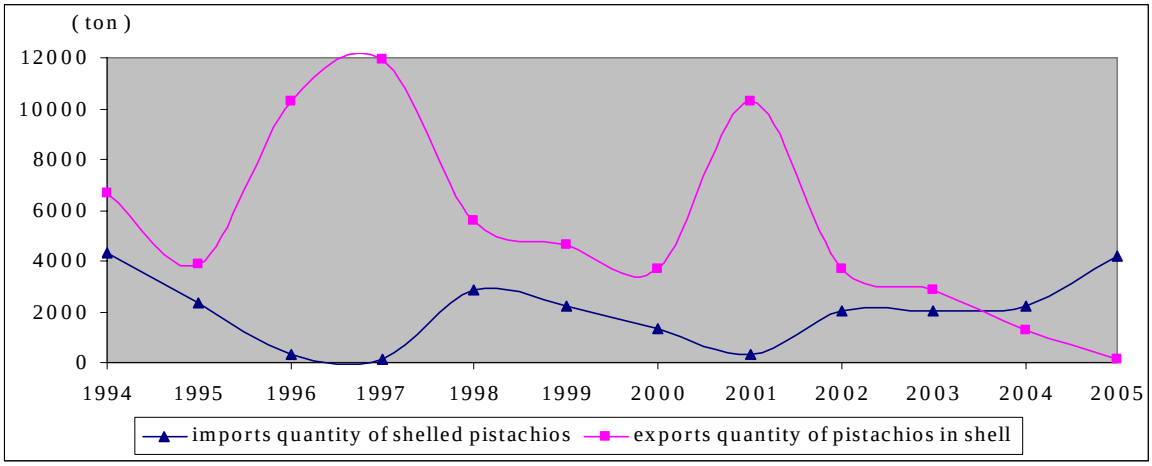
Source: Elaborated from NAPC Database

Table 1.3 Quantities of imported shelled pistachios, 2005

Countries	Quantity (ton)	%
Iran	3,707	88.3
Uzbekistan	238	5.7
Iraq	187	4.5
Afghanistan	42	1.0
USA	21	0.5

Source: Elaborated from NAPC Database

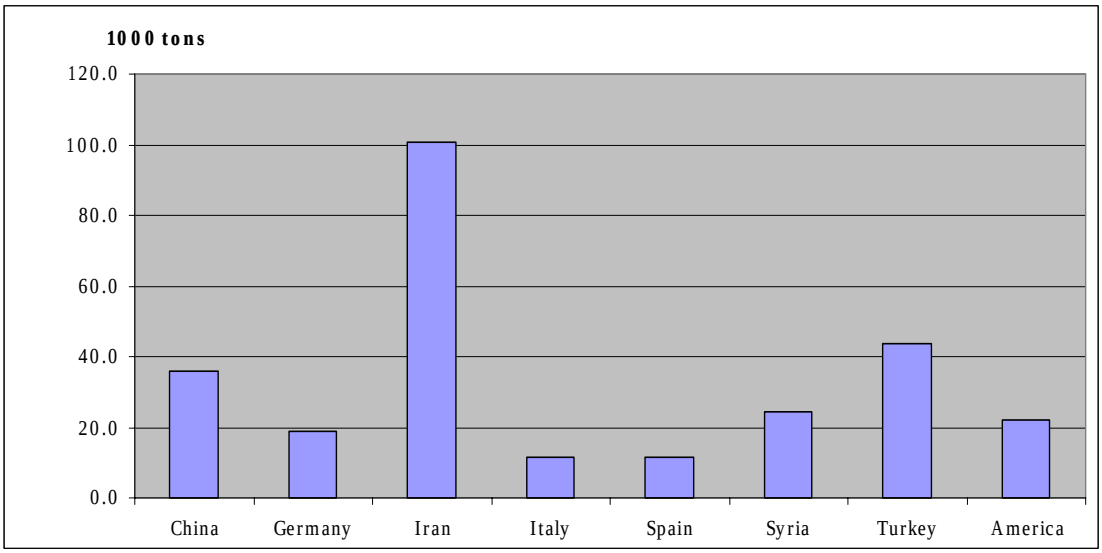
Figure 1.5 Evolution of exported and imported pistachio quantities, 1994-2005



Source: Elaborated from NAPC Database

According to the FAO Statistical Database, Syria ranked fourth in the world in terms of pistachio consumption, with 24,600 tons, preceded by Iran with 100,500 tons, Turkey 43,700 tons and China with 35,800 tons (Figure 1.6).

Figure 1.6 World consumption of pistachio (over 1000 tons), 2004

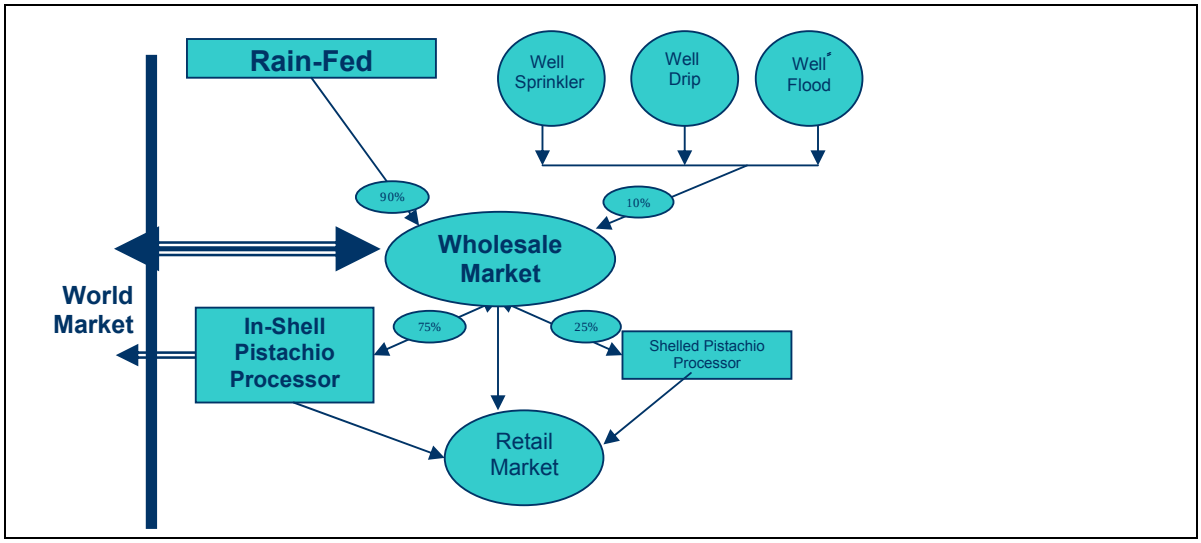


Source: Elaborated from FAO Statistical Database

Chapter 2. Description of the Commodity Chain

Figure 2.1 shows the basic commodity chain the basic commodity chain structure and the flow percentages between its stages.

Figure 2.1 Flow chart of the Syrian pistachio commodity chain



Source: Author

2.1. Description of the main commodity chain

Pistachio trees are planted in arid and drought areas. They are often planted alongside figs, olives or vines. Pistachios give high production when they are planted in regions with relatively cold winters and long, hot summers. This is because pistachios need comparatively cold winter temperatures in order to break bud dormancy. The tree is resistant to cold and wind but cannot tolerate excessive dampness and high humidity.

Above of 40% of the pistachio trees in Syria is still fairly young and have not reached the economic fruit-bearing stage. The average yield per tree increases with the age of the tree up to about 50 years old.

Pistachios need almost 10 years to start an early fruit period and 20 years to enter full production period. It is a crop subject to alternate bearing phenomena; in the bearing year the production is very good, and in the alternative year the production is limited. Despite their hardiness pistachios are sensitive to very extreme climate conditions, such as extreme drought and prolonged frost; examples of the effects of frost can be seen in Syria in 2004 which caused

the death of most bearing buds and significantly reduced production. The harvesting season extends from mid July to mid November.

The nurseries of the Ministry of Agriculture and Agrarian Reforms (MAAR) produce mostly three-year-old pistachio seedlings and distribute them at an incentive price to the orchardists. Some private nurseries produce nursery plants of pistachio on a commercial scale.

In Syria pistachios are planted on 57 thousand ha including 51 thousand ha rain-fed accounting for 7% of the rain-fed areas devoted to fruit trees in 2005. Pistachios are preceded by olives which accounted for the largest followed by almonds (Table 2.1).

Table 2.1 Areas of fruit production, 2005

Item	Irrigated		Rain-fed		Total	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Olives	49910	33.7	494743	68.8	544653	62.8
Grape	8564	5.8	45373	6.3	53937	6.2
Fig	439	0.3	9529	1.3	9968	1.1
Apricot	10725	7.2	2605	0.4	13330	1.5
Apple	15630	10.5	29584	4.1	45214	5.2
Pear	2284	1.5	1710	0.2	1710	0.2
Peach	1968	1.3	996	0.1	996	0.1
Green plum	1469	1.0	58	0.0	58	0.0
Pomegranate	3947	2.7	374	0.1	374	0.0
Cherry	3008	2.0	21765	3.0	24773	2.9
Almond	1717	1.2	59207	8.2	60924	7.0
Peal	5850	3.9	668	0.1	6518	0.8
Pistachios	6109	4.1	50787	7.1	56896	6.6
lemon	5285	3.6	84	0.0	5369	0.6
Quince	18373	12.4	4	0.0	18378	2.1
Other citrus	8052	5.4	73	0.0	8125	0.9
Other trees	4922	3.3	1745	0.2	16336	1.9
Total	**148254**	**100.0**	**719304**	**100.0**	**867557**	**100.0**

Source: Elaborated from NAPC Database

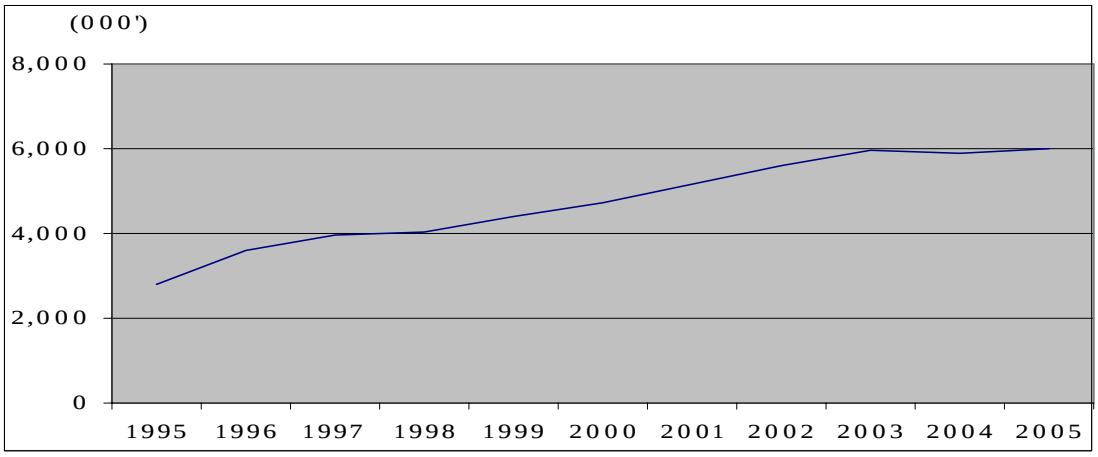
Despite the fact that the area dedicated to pistachio production has remained relatively constant over the last decade and the low production in 2004 caused by frost (Idleb survived this period with relatively little damage, accounting for 57% of the total production), Syrian production is increasing over time due to the fact that each year more immature trees enter into production. The number of productive trees has been about 60 thousand in recent years (Table 2.2 and Figure 2.2).

Table 2.2 Area, production, and number of trees of pistachio, 2005

Governorate	Irrigated				Rain-fed				Total			
	Area ha	N. Trees 000	N. P. Trees 000	Production ton	Area ha	N. Trees 000	N. P. Trees 000	Production ton	Area ha	N. Trees 000	N.P. Trees 000	Production ton
AL-Sweida	11	2.2	0.9	11	453	89.9	50.7	172	464	92.1	51.6	183
Dara	23.3	5.5	0.9	13	91.8	20.5	3	21	115.1	26	3.9	34
Damascus	7.1	1.3	0.8	7	3,110.9	742.8	2.8	9	3,118	744.1	3.6	16
Homs	50.8	19.7	10.6	70	274.3	75.6	17.2	51	325.1	95.3	27.8	121
Hama	5,001.3	740.1	665.7	6,628	14,721.5	2,351.5	2,007.5	9,917	19,722.8	3,091.6	2,673.2	16,545
Al-gab	10.8	2.4	2.1	54	44.7	8.3	5.4	82	55.5	10.7	7.5	136
Idleb	280.6	41.8	41.6	749	6,843.6	1,089.3	960.9	7,919	7,124.2	1,131.1	1,002.5	8,668
Tartous	0	0	0	0	0.8	0.4	0.1	0.8	0.8	0.4	0.1	0.8
Lattakia	0	0	0	0	1	0.5	0.5	4	1	0.5	0.5	4
Aleppo	92	20.7	5.8	47	25,155.9	4,148.9	2,210.2	18,799	25,247.9	4,169.6	2,216	18,846
AL-Raqqa	313.6	73.8	4	20	89.2	10.9	7.9	9	402.8	84.7	11.9	29
Deir-Ezzor	250	165.7	10.4	0	0	0	0	0	250	165.7	10.4	0
Al-Hassaka	69	33.1	4.9	59	0	0	0	0	69	33.1	4.9	59
Total	6,110	1,106	748	7658	50,787	8,539	5,266	36,984	56,896	9,645	6,014	44,642

Source: MAAR Database
N: Number

Figure 2.2 Evolution of number of productive pistachio trees in Syria, 1995-2005

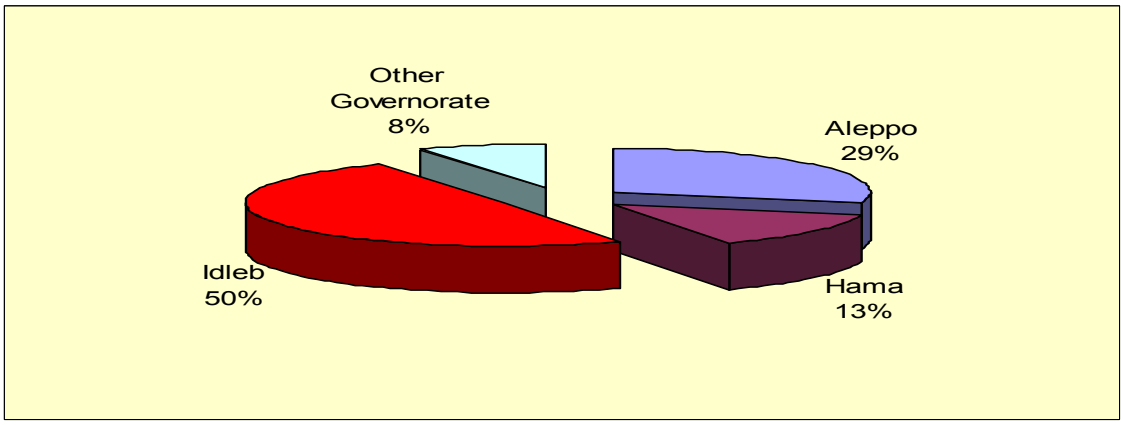


Source: Elaborated from NAPC Database

Pistachio trees are planted in rain-fed areas essentially in Aleppo, Hama and Idleb. Recently an expansion of irrigated pistachios is noticeable in Hama and Idleb (with the adoption of flood, drip, and sprinkle irrigation).

In 2005 the rain-fed pistachios accounted for 90% of the total pistachio area in Syria of which 50% are in Aleppo, 29% Hama, 13% Idleb, and 8% in the other governorates (Figure 2.3). Moreover, pistachio trees are planted mostly in the third Climatic Zone.

Figure 2.3 Area distribution of rain-fed pistachio, 2005



Source: Elaborated from NAPC Database

Irrigated pistachios are concentrated in Hama, which accounts for 82% of the total irrigated pistachio area and 87% of its production. The soil of Hama is very suitable for pistachio, especially within the Morek Extension Unit.

2.2. Marketing and processing

There is no standard mechanized processing for Syrian pistachio; all processing (e.g. classification, shelling) is carried out by hand. The marketing of pistachios is entirely dealt with the private sector.

2.2.1. Marketing

Pistachios are marketed immediately after harvesting in two basic markets (Aleppo, Hama); traders (middle men) provide packaging and sell the product for a specific commission (2-3

SP/Kg). Every trader has his own clients (farmers). The trade of green pistachios occurs daily during the harvesting season. The pistachios are then sold to retailers and consumers. A big share of pistachio consumption is of green pistachios. Moreover a significant share of pistachio is exported in this green form to neighboring countries[4].

2.2.2 Processing

There are two kinds of pistachio processing; in-shell and shelled. In-shell pistachios are processed mechanically in small pistachio workshops. The capacity of the peeling machine in these shops is 2.5-3 tons per day. Pistachios are then dried by sunshine for two days on roofs. This will reduce in-shell pistachio moisture to be less than 10%. The in-shell pistachio processor then sells it to wholesale market. After that, it is distributed to local and foreign markets. The conversion rate from green to dried in-shell pistachios is 38-45% according to the date of harvesting) earlier harvesting has a low conversion rate and high prices, and vice versa) and its variety.

Shelled pistachios undergo the same processing operations as in-shell pistachio, but after the final processing step these pistachios are sent to family peeling workshops, where the pistachios are shelled manually for a specific commission of about 7-20 SP/Kg. The conversion rate of shelled pistachios from in-shell pistachios is about 40-48% according to date of harvesting (earlier harvesting results in a low conversion rate and high prices, and vice versa) and its variety. The price of pistachios changes in accordance with the time in which they are harvested, because the quality of pistachios deteriorates over time. To begin with pistachios have the desired white chip color, which can be used in dessert and ice cream industries and over time become yellow and brownish in color (these are less desirable for the industry).

2.3. Commodity chain of the representative systems

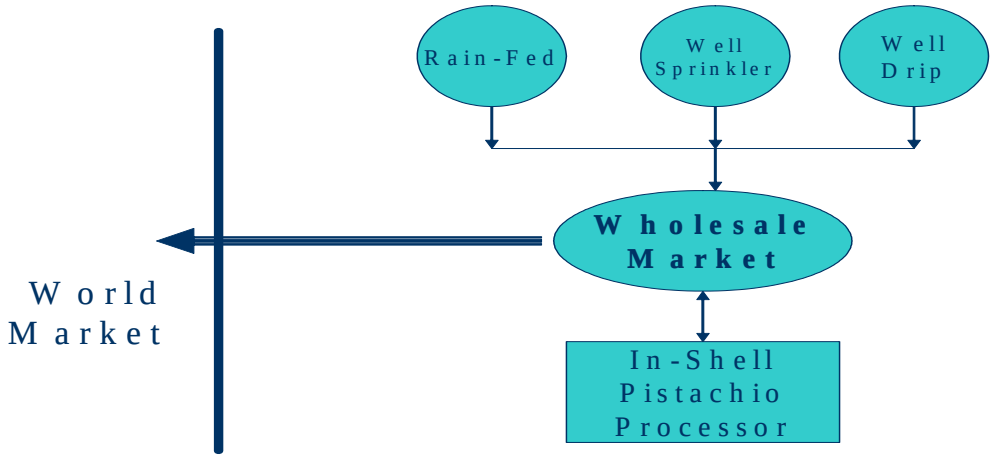
There are two kinds of final outputs; in-shell and shelled pistachios.

2.3.1. In-shell pistachios

According to the irrigation technique, the following systems are practiced (Figure 2.4):

- Rain-fed in-shell pistachio system
- Sprinkle irrigated in-shell pistachio system
- Drip irrigated in-shell pistachio system

Figure 2.4 Production systems of in-shell pistachios



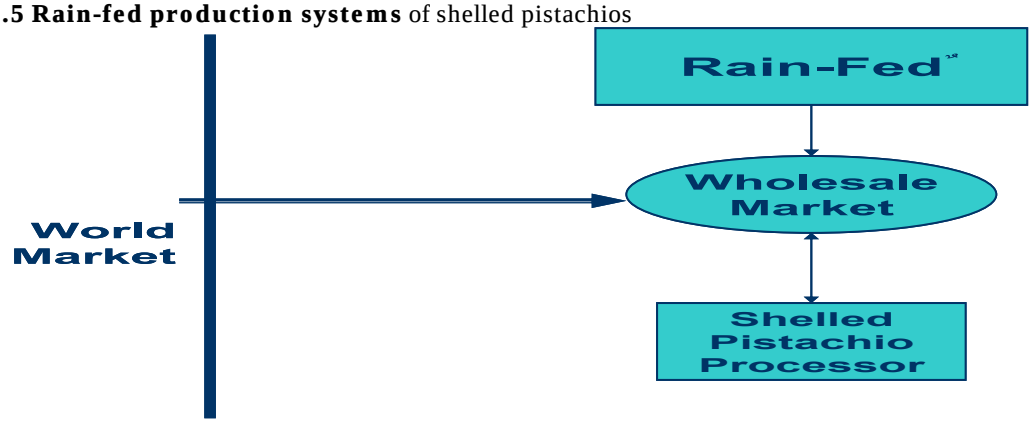
Source: Author

[4] There are no available data about the exported quantity of green pistachios.

2.3.2. Shelled pistachios

The representative studied system of shelled pistachios is rain-fed shelled pistachios because they have the major share (Figure 2.5).

Figure 2.5 Rain-fed production systems of shelled pistachios



Source: Author

Chapter 3. Commodity Chain Analysis

3.1. Data sources

The primary data is collected through various questionnaires with pistachio farmers in Aleppo (Albab, Azaz and Jabal Samaan), Hama (Soran, Taypet Alemam and Morek) and Idleb governorates (Chan Sheckon and Tamana). Each questionnaire includes data about the four growing stages (first year or establishment year, before production period, early production period and full production period).

The data for traders and processors was collected through interviews in Aleppo, Hama, and Damascus governorates.

Most secondary data at the national level is obtained from NAPC statistical database. Global data is obtained from the online sources and the FAO statistical database. Sector information is taken from relevant institutions.

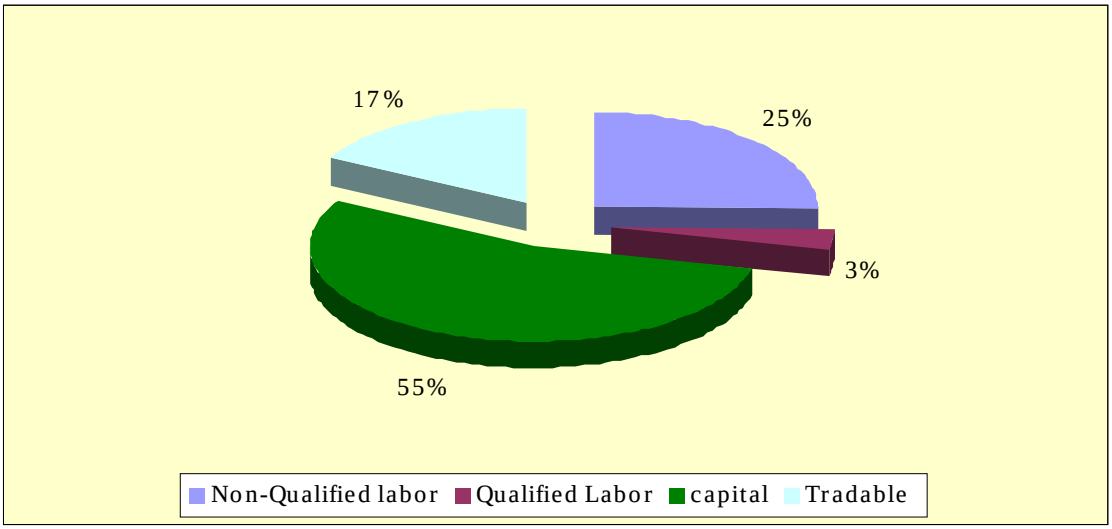
The data from the questionnaires (farmer, trader and processor) was entered onto a computer and calculated in order to obtain a representative unique budget for each combination of production system type, trader and processor type. These budgets include the fixed and intermediate costs and the profit. The tradable inputs are distinguished from the non-tradable inputs for each budget items, which is what characterizes the concept of comparative advantages.

3.2 Farming budget

As mentioned before there are farm types according to the production system, but rain-fed system will be illustrated in more detail. This is because it is the prevailing type of pistachio produced in Syria, and accounts for 90% of all pistachio area. The budget includes quantities, prices, and total cost per one hectare for each input and output.

In 2006, the cost of rain-fed pistachio was 108 thousand SP/ha. The revenue and profit were 155 and 47 thousand SP/ha, respectively. Figure 3.1 represents the various items of farm cost; the domestic resources account for 83%. The relationship between the share of domestic resources and the comparative advantage is inversely related. The tradable resources account for 15% of the total farm cost.

Figure 3.1 Farm cost of Rain-fed pistachio, 2006



Source: Author

3.2.1. Fixed inputs

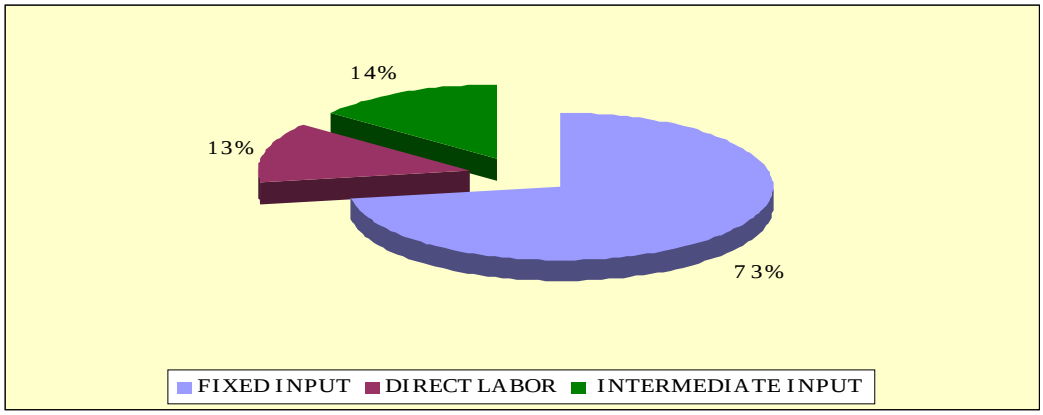
Fixed inputs are the inputs that are paid for but don't change according to production quantities. In a rain-fed pistachio production system, these costs include the expenses of the entire period before full production (first year, before production, and the early production period) minus the revenues during this period. The full production period is assumed to be 50 years long. The fixed cost in the irrigated systems includes, in addition to the aforementioned cost, the costs of the well and its equipment and of the irrigation net, which can be broken down as follows:

- The cost of digging the well is 300 thousand SP; lifespan: 50 years.
- Pump price is 250 thousand SP; lifespan: 15 years.
- Motor price is 100 thousand SP; lifespan: 15 years.
- Basin cost 50 thousand SP; lifespan: 50 years.
- Irrigation net price is 25 thousand SP; lifespan: 8 years.
- Fuel container cost is 25 thousand SP; used life: 25 years.

The costs mentioned above are for 20 ha. So the share of one hectare has to be calculated. The other agricultural machines are considered as rented and intermediate cost.

The fixed cost of rain-fed pistachio farm, which accounts for 96,365 SP/ha, represents the biggest share of total cost (73%), because it includes all farm cost before the full production period which is about 20 years (Figure 3.2).

Figure 3.2 Farm cost of rain-fed pistachio, 2006



Source: Author elaboration

3.2.2. *Direct Labour*

Labor is a local, non-tradable input. It is divided into permanent (qualified) labourers, who are registered in an insurance company, and temporary (non–qualified) labourers (daily and seasonal labourers). The labour cost was calculated by multiplying the number of work hours needed for the unit area with the cost of one work hour. It can be also calculated through the multiplication of the cost of one tree by the number of trees in one hectare.

Table 3.1 presents the direct labor cost of a rain-fed pistachio farm budget (notice that some farmers start to implement a supplemental irrigation when the tree entered the full production period), in 2006. The share of labor components in total labor and farm cost is also assessed; the cost of harvesting is the highest followed by pruning cost.

Table 3.1 Direct labor cost of rain-fed farm Budget, 2006

Items	SP/ha	Share of total farm cost (%)	Share of total labor cost (%)
Fertilizing labor	730	0.6	4.6
Controlling labor	1,327	1.1	8.4
Guarding labor	1,324	1.1	8.4
Harvesting labor	8,105	6.7	51.5
Pruning labor	4,262	3.5	27.1
Total labor cost	**15,748**	**13**	**100.0**

Source: Author elaboration

3.2.3. Intermediate inputs

Intermediate inputs are variable costs, which include the cost of agricultural operations and production requirements that are incurred during a full production year (agricultural materials, machines, fertilizing, controlling, harvesting and interest rates of capital)

Table 3.2 presents the intermediate input costs of a rain-fed pistachio farm budget, in 2006. The share of intermediate input components in its total and in farm cost is also estimated; the costs of chemicals and marketing are the highest cost.

Table 3.2 Intermediate costs of rain-fed farm budget, 2006

Items	SP/ha	Share of total farm Cost (%)	Share of total intermediate cost (%)
Manure	1,877	1.5	7.5
Nitrogen	1,528	1.3	6.1
Phosphate	1,011	0.8	4.0
Potash	858	0.7	3.4
Others (liquid)	884	0.7	3.5
Fertilizing machine	39	0.0	0.2
Total fertilizing cost	**6,197**	**5.2**	**24.7**
Pesticide	2,622	2.2	10.4
Pesticide oil	1,395	1.1	5.5
Fungicide	1,610	1.3	6.4
Herbicide	468	0.4	1.9
Chemical application	948	0.8	3.8
Total chemical cost	**7,043**	**5.8**	**28.0**
Ploughing	2,453	2.0	9.7
Marketing	4,528	3.7	18.0
Transportation	1,916	1.6	7.6
Water of irrigation	1,836	1.5	7.3
Interest rate	1,186	1.0	4.7
Total	**25,159**	**20.8**	**100.0**

Source: Author elaboration

3.3. Trader (middleman) budget

There are two basic wholesale markets for pistachios Aleppo and Hama (Morek) where the pistachios are displayed and sold. Table 3.3 presents the percentage composition of the trader cost (middleman); the seasonal labor accounts for the biggest share, 30% of the total cost, followed by building (17%) and the boxes and losses (12% each).

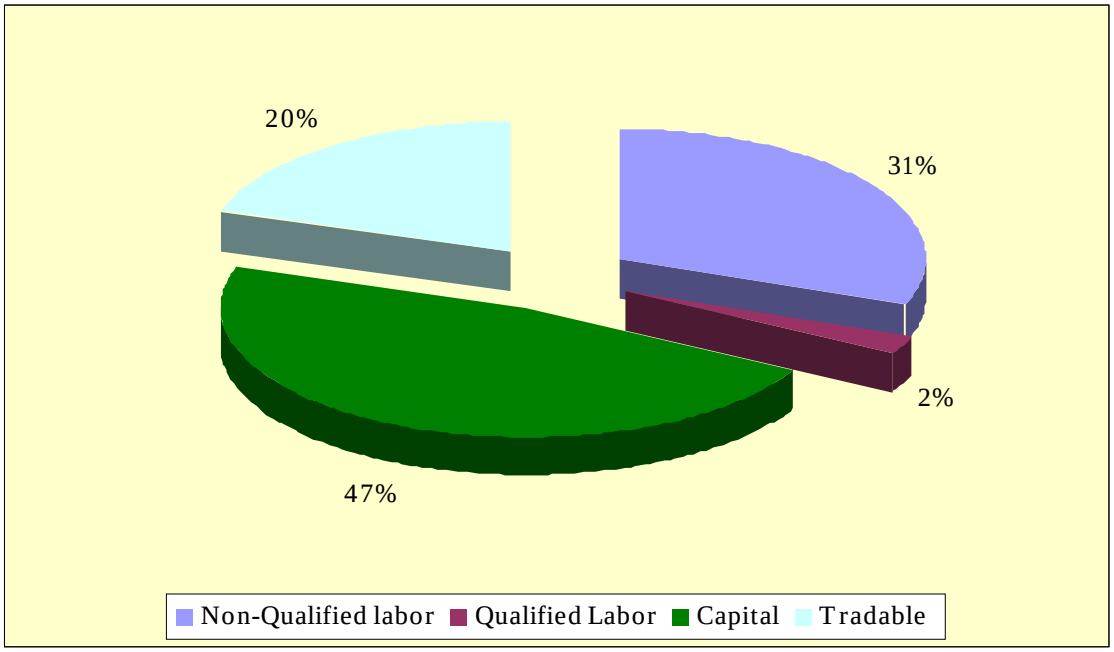
Table 3.3 The basic items in the middleman budget, 2006

Items	%
Building	17
Boxes	12
Seasonal labor	30
Fuel	5
Sugar and tea	6
Municipality	6
Interest rate	5
Losses	12

Source: Author elaboration

Domestic resources account for 80% (47% capital and 33% labor) and tradable inputs for 20%, of the total trader cost (Figure 3.3). The studied middleman traded 450 tons in 2006.

Figure 3.3 The middleman cost, 2006



Source: Author elaboration

3.4. The processor budget

3.4.1. In-shell pistachio processor budget

The in-shell pistachio processor buys the green pistachios; he/she then peels and dries them to get the in-shell pistachio, which is then sold to the wholesale market. Table 3.2 presents the share of the basic cost items of the in-shell pistachio processor; transportation cost accounts for 20% of the total cost followed by the labor cost (19%) and building cost (10%). The processed pistachio quantity was 26 tons in 2005. The conversion rate from green pistachios to in-shell pistachios is 42%, for this studied processor. The capital recovery period is assumed to be 7 days.

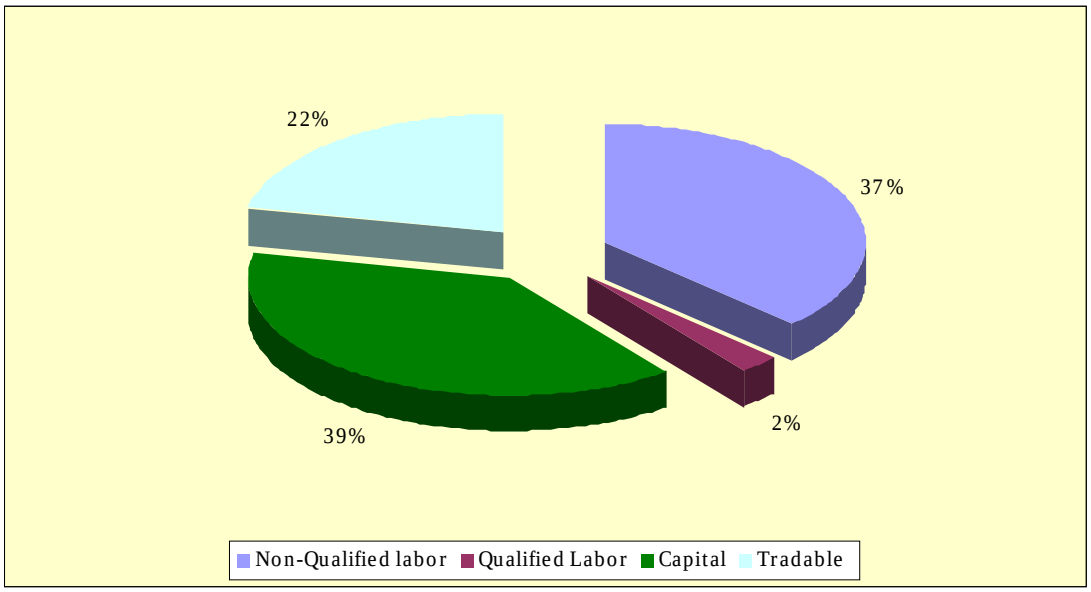
Table 3.4 Share of the basic cost items for in-shell pistachio processor, 2006

Items	%
Building	10
Direct labor	28
Transportation	20
Packaging	7
Land rent for drying	7
Interest rate	8

Source: Author elaboration

The domestic resources account for 78% (39% capital, 39% labor) and tradable inputs for 22% of the total cost (Figure 3.4).

Figure 3.4. In-shell pistachio processor cost, 2006

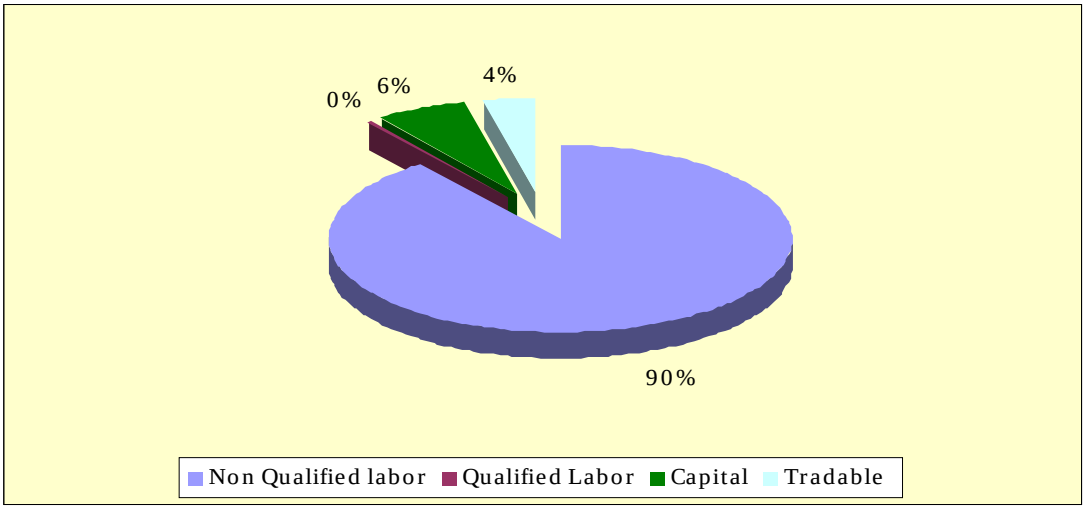


Source: Author elaboration

3.4.2 Shelled pistachio processor

The cost of peeling in-shell pistachio was 15 SP/Kg for the studied shelled pistachio processor, which accounts for 85% of the total cost. The capital recovery period is assumed to be 15 days. Domestic inputs account for 96% (90% labor and 6% capital) and tradable inputs for 4% of the total cost (Figure 3.5). The shelled pistachio processed quantity was 39 tons in 2005. The conversion rate from green pistachios to shelled pistachios is 19%, for the studied processor.

Figure 3.5 Shelled pistachio processor cost, 2006



Source: Author

Chapter 4. Comparative Advantage of the Representative Systems

4.1. Methodology

The concept of domestic resources is considered to be the core idea of comparative advantage theorem. This concept specifies the available resources utilized in the national economy. Since these domestic resources are scarce, the optimal allocation of them is principal to achieve the greatest efficiency in utilization. The assessment of the comparative advantage of a certain system includes several concepts emerging from studying production costs and theory of international trade. The core concept is that any economic activity has a comparative advantage when it is profitable and able to compete with its alternatives coming from imports without benefiting from any form of subsidy transfers from other sectors of the economy.

Comparative advantage analysis is the framework by which it is possible to identify the economic and financial profitability for any activity through identifying the return of this activity in the absence of any market distortions. In other words, comparative advantage analysis means the calculation of the real (economic) costs using the reference world prices for tradable commodities and opportunity cost for non tradable commodities in order to define the probable profitability of any activity in the absence of any policy that causes the domestic prices to be diverge from the international ones.

The measurement of a comparative advantage of a certain production system is performed through an analytical framework called Policy Analysis Matrix (PAM), which is a tool to construct an aggregate budget for the representative systems, allowing the estimation of the impact of any Government intervention and/or market distortion through the calculation of the social prices (Frédéric Lançon, 2005). Therefore, a system is said to have a comparative advantage and an economic efficiency if it achieves a positive profit at the social prices.

Table 4.1 illustrates the structure of the PAM. Table 4-2 shows the PAM indicators, which are used both to assess the performance of the system and to compare between the various systems.

Table 4.1 The Policy Analysis Matrix

Item	Revenue	Tradable inputs	Domestic factors	Profit
Private prices	A	B	C	D
Social prices	E	F	G	H
Divergence	I	J	K	L

Source: Author elaboration

Table 4.2 Indicators of the PAM

Indicators	Formula	Meaning
1. Financial Profitability (FP)	[D = A - B - C]	Absolute value of the profit generated by the system at private price
2. Financial Cost-Benefit Ratio (FCB)	[(C+B) /A]	Indicator of the competitiveness of the system. If FCB<1, the system is competitive, if FCB>1 the system is not competitive, FP is negative
3. Social Profitability (SP)	[H = E - F - G]	Absolute value of the profit generated by the system at social price.
4. Domestic Resource Cost (DRC)	[G / (E - F)]	Indicator of the comparative advantage of the system. If DRC<1, the system has comparative advantage, meaning that we use less value of Domestic Factors (labor, capital...) than the added value generated (VA= E-F), if DRC>1 the system has no comparative advantage, SP is negative.
5. Social Cost-Benefit Ratio (SCB)	[(F + G) / E]	Another indicator for measuring the comparative advantage of the system. It takes into account the full cost of production (F + G) instead of the Domestic factors only. It is a more appropriate ratio to rank the relative position of different systems when they have different cost structures (i.e. tradable and non-tradable), because the DRC is biased in favour of the system that has a high share of tradable.
6. Transfers	[L = I - J - K]	Absolute value of the transfer between the economy and the system
7. Nominal Protection Coefficient (NPC)	[A / E]	Indicates the level of protection for the main output, if NPC> 1, the system benefits from a protection, if NPC<1 the system is taxed.
8. Effective Protection Coefficient (EPC)	[(A - B) / (E - F)]	Indicates the total level of protection taking into account the effect of the policy on the private value of the tradable output and tradable input.
9. Profitability Coefficient (PC)	[D / H]	Measures the impact of the policy on the profitability of the system. If PC>1, the system benefits from a net transfer from the economy, if PC<1, the economy benefits from a net transfer from the system.
10. Producers Subsidy Ratio (PSR)	[L / E]	Indicator of the impact of the policy/market distortion on the increase (+) or reduction (-) of the total revenue of the system at social price. i.e. magnitude of the divergence from the reference situation at social price to the current situation at market price
11. Equiv. Producer Subsidy (EPS)	[L / A]	Indicator of the impact of the policy/market distortion on the increase (+) or reduction (-) of the total revenue of the system at market price. Equivalent to the Producer Equivalent Subsidy (PSE) as defined by OECD for trade negotiations. If + it is producer subsidy, if – its consumer subsidy.

Source: Author elaboration

4.2. Macroeconomic environment

Since social prices are calculated with domestic currency while the tradable items are treated with the US dollar, the exchange rate of the domestic currency against the US dollar has a great impact. With reference to the mechanisms of setting up the exchange rate during the last year, there were no distortions noticed between the current exchange rate and the social exchange rate, so the unified exchange rate (51 SP per 1 US dollar) was adopted.

The estimation of social prices for the domestic resources requires a great expertise since these resources do not have reference prices such as world prices. For the capital market, the interest rate for deposits in the Commercial Bank of Syria (CBS) reached 7% per annum. This rate is used to calculate the opportunity cost for capital used in production at private prices. However, to calculate the opportunity costs for capital at social prices, the weighted interest rate (3%) that is calculated by the IMF for the Asian modern industrialized economies was applied.

For the labour market, we assume the presence of no distortions and that the current wages reflect the true opportunity costs of labour. Nevertheless, a distinction is made between qualified and permanent labour from one side and unqualified and temporary labour on the other side. This distinction is used to calculate the policy distortions on permanent labour[5].

The current trade policy has caused the distortions on the tradable inputs to decrease. This is due to the reduction of taxes on imported agricultural inputs. Consequently, the social prices of tradable inputs are calculated from the domestic prices by subtracting the import tariff and adding the Government subsidy. The implicit subsidy on oil price is also considered especially the price of diesel, which is at about 30% that of the world price.

The social value of water is calculated based on the profitability of one cubic meter used in best agricultural alternatives for land (Frédéric Lançon, 2005), which is 3 SP for one cubic meter of water.

4.3. Policy Analysis Matrix (PAM) of pistachio

The comparative advantage of pistachio commodity chains is studied according to the following production systems:

- Rain-fed in-shell pistachio, exported to Europe,
- Drip-irrigated in-shell pistachio, exported to Europe,
- Sprinkler-irrigated in-shell pistachio, exported to Europe,
- Rain-fed shelled pistachio.

The way of setting up the PAM of rain-fed in-shell pistachio system is analyzed in more detail. The same way is followed to set up the PAM of irrigated in-shell pistachio systems.

4.3.1. Parity price of in-shell pistachio

Social price of pistachio is calculated depending on the FAO database, where the average price at the Greek and Swedish borders during the years of exporting to these two countries (CIF) is $4149 per ton. Then the costs of insurance and freight are subtracted to reach the parity price at the Syrian borders (FOB). The latter is multiplied by the exchange rate (51 SP), given that there is no tax on agricultural exports (Table 4.3).

[5] This tax is composed of 3% as health insurance by the state, 14% is paid by the employer, and 7% is paid by the labour.

Table 4.3 The calculation of in-shell pistachio parity price

Item	Unit	Data source	Market price	Social price
CIF to FOB				
Parity price at Greek borders (CIF)	$	FAO database	4,149	4,149
Insurance cost	$	Data	41	41
Freight cost	$	Data	67	67
Parity price at Syrian borders (FOB)	$	Calculated	4,041	4,041
Exchange rate		Data	51	51
Parity price in SP (FOB)	SP	Calculated	206,084	206,084

Source: Author elaboration

4.3.2. The budget of in-shell pistachio commodity chain

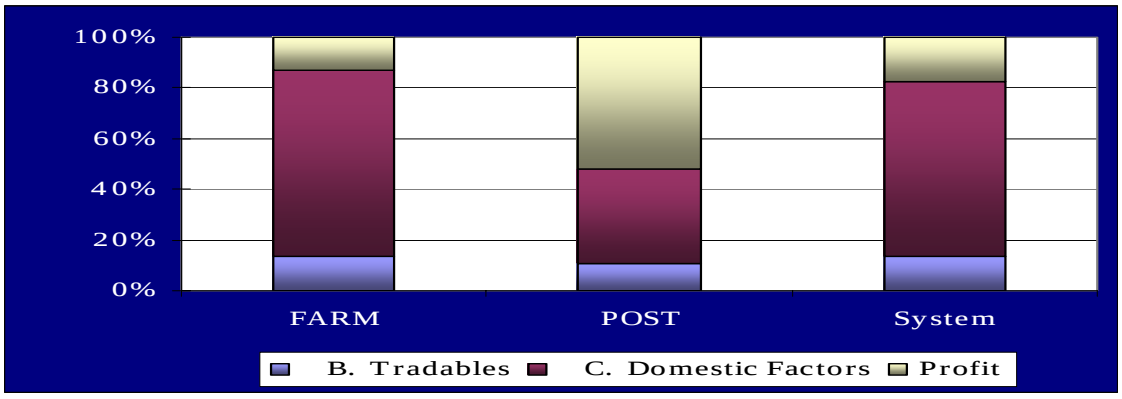
This budget represents a summary of the costs, revenue, and profit for each agent in the commodity chain and for the entire chain as well. It also converts all costs to the costs of one ton of the final product (Table 4.4 and Figure 4.1).

Table 4.4 The budget of in-shell pistachio commodity chain, 2006 (SP/ton)

Item	Farmer	Trader	Processor	Market	Post farm	System
Total revenue	234841	241365	252525	270000	270000	270000
Final output	234841	241365	252525	270000	270000	270000
Total costs	163513	237208	244068	264306	251693	180365
Commodity under processing		234841	241365	252525	234841	
Costs of tradable materials	27905	472	623	2622	3717	31622
Domestic costs	135608	1896	2081	9159	13135	148743
Temporary Labour	41152	727	1065	4441	6233	47386
Permanent Labour	5721	56	69	368	492	6214
Costs of capital	88734	1113	947	4349	6410	95144
Profit	71328	4156	8457	5694	18307	89635

Source: Author elaboration

Figure 4.1 The budget of shelled pistachio commodity chain



Source: Author elaboration

Table 4.5 gives an idea about the relative measures of the in-shell pistachio commodity chain in 2005. It is notable that farm's budget dominates the system's budget: most of the cost is concentrated at farm level (90% of tradable inputs, 93% of domestic factors and 89% of labor cost), and most of the system profit is also concentrated at farm level (66%). In general it can be

said that the profitability of the system is reasonable, for the profit accounts for 17% of revenue and 21% of total cost.

Table 4.5 Relative measures of the budget of in-shell pistachio, 2006 (%)

Item	Farmer	Trader	Processor	Market	Post farm	System
Cost/returns	87	98	97	98	93	83
Share of tradable materials	90	1	2	7	10	100
Share of domestic factors	93	1	1	5	7	100
Share of labour	89	1	2	8	11	100
Labour/domestic factors	31	41	54	53	51	32
Share of capital	95	1	1	3	5	100
Capital/domestic factors	69	59	46	47	49	68
Share of profit	66	9	18	12	39	100
Profit/returns	13	2	3	2	7	17
Profit/total cost	15	2	3	2	7	21

Source: Author elaboration

4.3.3. The PAM of rain-fed in-shell pistachio

Table 4.6 is the PAM of rain-fed exported in-shell pistachio at private and social prices.

Table 4.6 PAM of rain-fed in-shell pistachio, exported to Europe

Item	Revenue	Costs		Profit
		Tradable inputs	Domestic resources	
Market price	A 270,000	B 31,622	C 148,743	D 89,635
Social price	E 206,084	F 32,899	G 95,415	H 77,769
Divergence	I 63,916	J -1,277	K 53,328	L 11,866

Source: Author elaboration

This system has a comparative advantage because its social profitability (H) is positive. It also has a competitive advantage because the private profit (D) is positive. There is a divergence between private and social revenue of I. This is because the market prefers domestic pistachio to the imported one. The divergence between domestic resources at private and social prices (K) is positive. This is only due to the difference between the market interest rate (7%) and the social one (3%). Which means this commodity chain used the capital intensively. (J) is negative meaning that there are distortions in the domestic resources market. (L) is positive meaning that there are transfers from economy sectors to the pistachio sector.

4.3.4. PAM indicators of in-shell pistachio

Table 4.7 shows the PAM indicators of in-shell pistachios exported to Europe in 2006.

Table 4.7 PAM indicators of rain-fed in-shell pistachio, exported to Europe, 2006

Financial profitability (FP)	[D = A - B - C]	89,635
Financial cost-benefit ratio (FCB)	[(C + B)/ A]	0.668
Social profitability (SP)	[H = E - F - G]	77,769
Domestic resource cost (DRC)	[G / (E - F)]	0.551
Social cost-benefit ratio (SCB)	[(F + G) / E]	0.623
Transfers	[L = I + J + K]	11,866
Nominal protection coefficient (NPC) including by-product	[A / E]	1.310
Nominal protection coefficient (NPC) for final product	[A* / E*]	1.310
Effective protection coefficient (EPC)	[(A - B) / (E - F)]	1.376
Profitability coefficient (PC)	[D / H]	1.153
Producer subsidy ratio (PSR)	[L / E]	0.058
Equiv. Producer subsidy (EPS)	[L / A]	0.044

Source: Author elaboration

Financial profitability at market prices is positive and the domestic resources ratio at private prices is lower than 1, meaning that the system has a domestic competitive advantage.

- DRC is lower than one (0.55), and the social cost-benefit ratio is also lower than 1. This indicates that this system has a comparative advantage.
- The transfer from this system to the rest of economy is 11866 SP/ton.
- NPC is 1.31 indicating that this system is protected and the price of pistachio at domestic markets is 31% higher than its social price.
- EPC is 1.38, which is slightly higher NPC, indicating the presence of significant distortion in the domestic resources (capital interest rate).
- PSR and EPS are negative; the producer is protected by 6% of the social revenue and 4% of the private revenue. This arises from the distortion in the domestic resources market (capital interest rate).

4.3.5. Comparative advantages of in-shell irrigated pistachio

The analysis of in-shell irrigated pistachio systems shows that they have strong comparative advantages. The PAM indicators of irrigated in-shell pistachios exported to Europe in 2006 are shown in tables (4.8), and (4.9).

Table 4.8 PAM indicators of drip irrigated in-shell pistachio, exported to Europe, 2006

Financial profitability (FP)	[D = A - B - C]	104,439
Financial cost-benefit ratio (FCB)	[(C + B)/ A]	0.54
Social profitability (SP)	[H = E - F - G]	76,270
Domestic resource cost (DRC)	[G / (E - F)]	0.53
Social cost-benefit ratio (SCB)	[(F + G) / E]	0.63
Transfers	[L = I + J + K]	28,169
Nominal protection coefficient (NPC) including by-product	[A / E]	1.30
Nominal protection coefficient (NPC) for final product	[A* / E*]	1.30
Effective protection coefficient (EPC)	[(A - B) / (E - F)]	1.40
Profitability coefficient (PC)	[D / H]	1.37
Producer subsidy ratio (PSR)	[L / E]	0.14
Equiv. Producer subsidy (EPS)	[L / A]	0.11

Source: Author elaboration

Table 4.9 PAM indicators of sprinkler irrigated in-shell pistachio, exported to Europe, 2006

Financial profitability (FP)	[D = A - B - C]	91,133
Financial cost-benefit ratio (FCB)	[(C + B)/ A]	0.59
Social profitability (SP)	[H = E - F - G]	63,769
Domestic resource cost (DRC)	[G / (E - F)]	0.59
Social cost-benefit ratio (SCB)	[(F + G) / E]	0.69
Transfers	[L = I + J + K]	27,364
Nominal protection coefficient (NPC) including by-product	[A / E]	1.30
Nominal protection coefficient (NPC) for final product	[A* / E*]	1.30
Effective protection coefficient (EPC)	[(A - B) / (E - F)]	1.44
Profitability coefficient (PC)	[D / H]	1.43
Producer subsidy ratio (PSR)	[L / E]	0.13
Equiv. Producer subsidy (EPS)	[L / A]	0.10

Source: Author elaboration

4.3.6. Parity price of shelled pistachio

Social price of shelled pistachio is estimated based on the data collected from importers from Iran. The costs of freight and insurance are added to this price to attain the value of parity price at the Syrian borders (CIF). The value of tariff is not included in the social price. Finally, transport cost is added to obtain the parity price (Table 4.10).

Table 4.10 The calculation of in-shell pistachio parity price, 2006 (1 ton)

Item	Unit	Data source	Market price	Social price
FOB to CIF				
Parity price at Iranian borders	$	Data	6,700	6,700
Insurance and freight cost	$	Data	100	100
Parity price at Syrian borders	$	calculated	6,800	6,800
Exchange rate	SP/$	Data	51	51
Parity price in SP CIF	SP	calculated	346,800	346,800
Customary procedures	SP	Data	30,000	0
Post customs parity price	SP	Calculated	376,800	346,800
Transport cost to Syrian borders	SP	Data	10,000	10,000
Parity price at the factory gate	SP	Calculated	386,800	356,800

Source: Author elaboration

4.3.7. The PAM for exported rain-fed shelled pistachio

Table 4.11 is the PAM of exported rain-fed shelled pistachio at social and private prices.

Table 4.11 PAM of rain-fed shelled pistachio, exported to Europe

Item	Revenue	Costs		Profit
		Tradable inputs	Domestic resources	
Market price	A 500,000	B 64,616	C 351,043	D 84,341
Social price	E 356,800	F 67,432	G 237,548	H 51,820
Divergence	I 143,200	J -2,815	K 113,495	L 32,521

Source: Author elaboration

This system has a comparative advantage because the social profitability (H) is positive. It has a domestic competitive advantage as well since D is positive. There is a noticeable divergence between revenues at private and social prices (143,200 SP), which is because Syrian traders and processors prefer the Syrian pistachio to the imported one. This causes profit to be higher under private prices than it is at social prices. (J) is negative meaning that there are distortions in the domestic resources market. The considerable divergence in the domestic resources costs (113495 SP/ton) is mainly due to the high interest rate of capital at the market price compared to that at the social prices.

Table 4.12 shows the derived PAM indicators in 2006 for one ton of shelled pistachio.

Table 4.12 PAM indicators of rain-fed in-shell pistachio, exported to Europe

Financial profitability (FP)	[D = A - B - C]	84,341
Financial cost-benefit ratio (FCB)	[(C+ B) / A]	0.831
Social profitability (SP)	[H = E - F - G]	51,820
Domestic resources cost (DRC)	[G / (E - F)]	0.82
Social cost-benefit ratio (SCB)	[(F + G) / E]	0.85
Transfers (L)	[L = I + J + K]	32521
Nominal protection coefficient (NPC) including by-product	[A / E]	1.40
Nominal protection coefficient (NPC) for final product	[A* / E*]	1.40
Effective protection coefficient (EPC)	[(A - B) / (E - F)]	1.50
Profitability coefficient (PC)	[D / H]	1.628
Producer subsidy ratio (PSR)	[L / E]	0.091
Equiv. producer subsidy (EPS)	[L / A]	0.065

Source: Author elaboration

- Financial profitability at market prices is positive, and domestic resources costs ratio at the private price is lower than one, meaning that this system has a competitive advantage.
- The Domestic Resources Cost Ratio (DRC) and the social cost-benefit ratio are very close to one 0.82 and 085; respectively, meaning that this system has a very weak comparative advantage.
- There is a transfer of 32521 SP/ton from the economy to this system.
- NPC is 1.40 indicating that the system is protected and the market price of pistachio is 40% higher than its social price.
- EPC is 1.50 which is slightly higher than NPC, indicating the presence of distortions due to the domestic resources especially the interest rate of capital.
- PSR and EPS are positive, so the producer is supported by 9% from the social revenue and 7% from the private revenue.

4.4. Sensitivity analysis

Constructing the PAM depends on primary and secondary data, coupled with a number of assumptions about the values of parity prices of tradable items and at the aggregate level of the economy, such as:

- Exchange rate
- Interest rates
- Parity prices
- Yields
- Conversion rates
- Subsidy to permanent labour.

Therefore, it is necessary to assess the sensitivity of the PAM indicators to any change in the different elements of the budget at social and private prices. The values of the elements of the selected budget are attained inside an interval centered on the initial value that is entered to the system budget. An interval of +/- 20% of the initial value is adopted. The sensitivity analysis is implemented for imported rain-fed shelled pistachio system, and values of entries and indictors take the following ranges as depicted in Table 4.13 for one ton in 2006.

Table 4.13 PAM indicators of rain-fed in-shell pistachio, exported to Europe, 2005

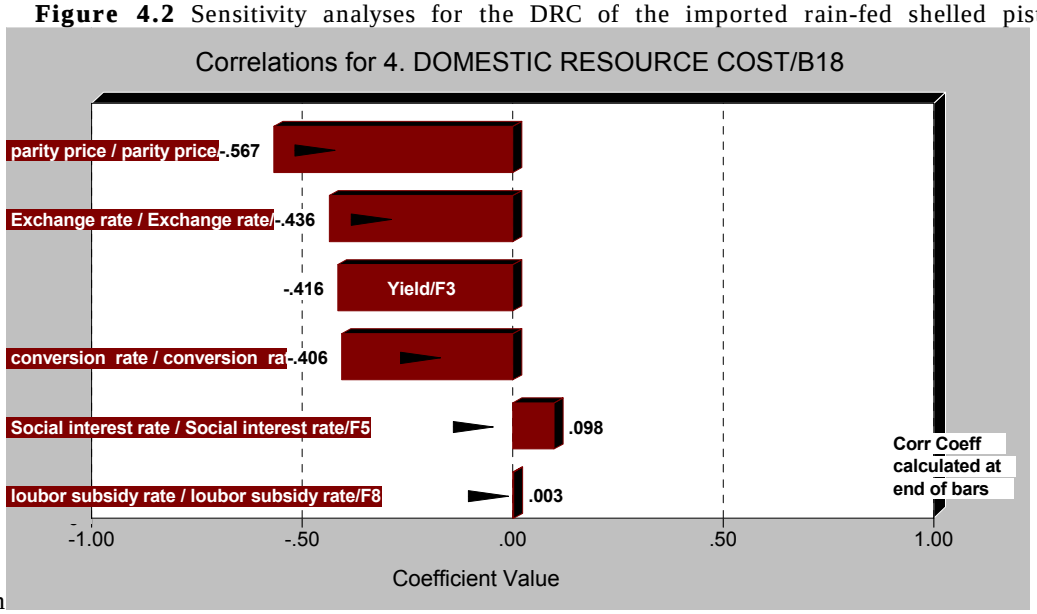
Name	Minimum	Mean	Maximum
Indicators			
Financial profitability	- 133,178.50	73,685.48	172,211.70
Financial cost-benefit ratio	0.67	0.86	1.23
Social profitability	- 138,210.00	4,426.67	110,591.50
Domestic resources cost (DRC)	0.69	1.01	1.56
Social cost-benefit ratio	0.74	1.00	1.40
Transfers	-29,845.88	69,258.82	187,732.20
Nominal protection coefficient (NPC) including by-product	1.30	1.66	2.12
Nominal protection coefficient (NPC) for final product	1.30	1.66	2.12
Effective protection coefficient (EPC)	1.36	1.85	2.46
Profitability coefficient	-24.65	28.53	2674.64
producer subsidy ratio (PSR)	-0.07	0.21	0.68
Equiv. producer subsidy (EPS)	-0.05	0.12	0.32
Entries			
Yield	1.32	1.60	1.88
Parity price	5,541.63	6,700.62	7,961.81
Social interest rate	0.02	0.03	0.04
Exchange rate	41.74	51.01	60.17
Conversion rate	0.15	0.19	0.22
Percentage of support to permanent labour	0.21	0.26	0.30

Source: Author elaboration

The sensitivity analysis (Figure 4.2) clarifies the presence of a strong inverse relationship between the DRC from one side and the social parity price, exchange rate, yield, and the conversion rate from the other side. However, the DRC is less sensitive to the social interest rate, but the relationship is proportional. For example, increasing the value of the current parity price by 1% is resulting in a reduction in the DRC by 0.567%, leading to an increase in the comparative advantage of this system.

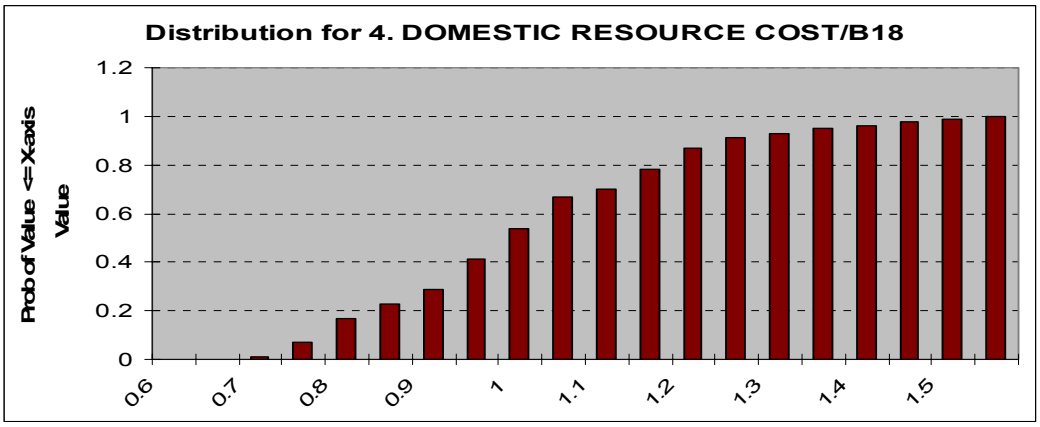
The gross value of the DRC through the sensitivity analysis is clarified in Figure 4.3 and Table 4.11, where the maximum value is 1.56 and the minimum value is 0.69, while the mean is 1.01. It is noticeable that 55% of the DRC distribution is less than one, meaning that if data change with an interval of +/- 20%, it is probably by 55% that this system has a comparative advantage. The probability values for yields, exchange rate, and social interest rate are clarified in Figure 4.4.

Figure 4.2 Sensitivity analyses for the DRC of the imported rain-fed shelled pistachio system



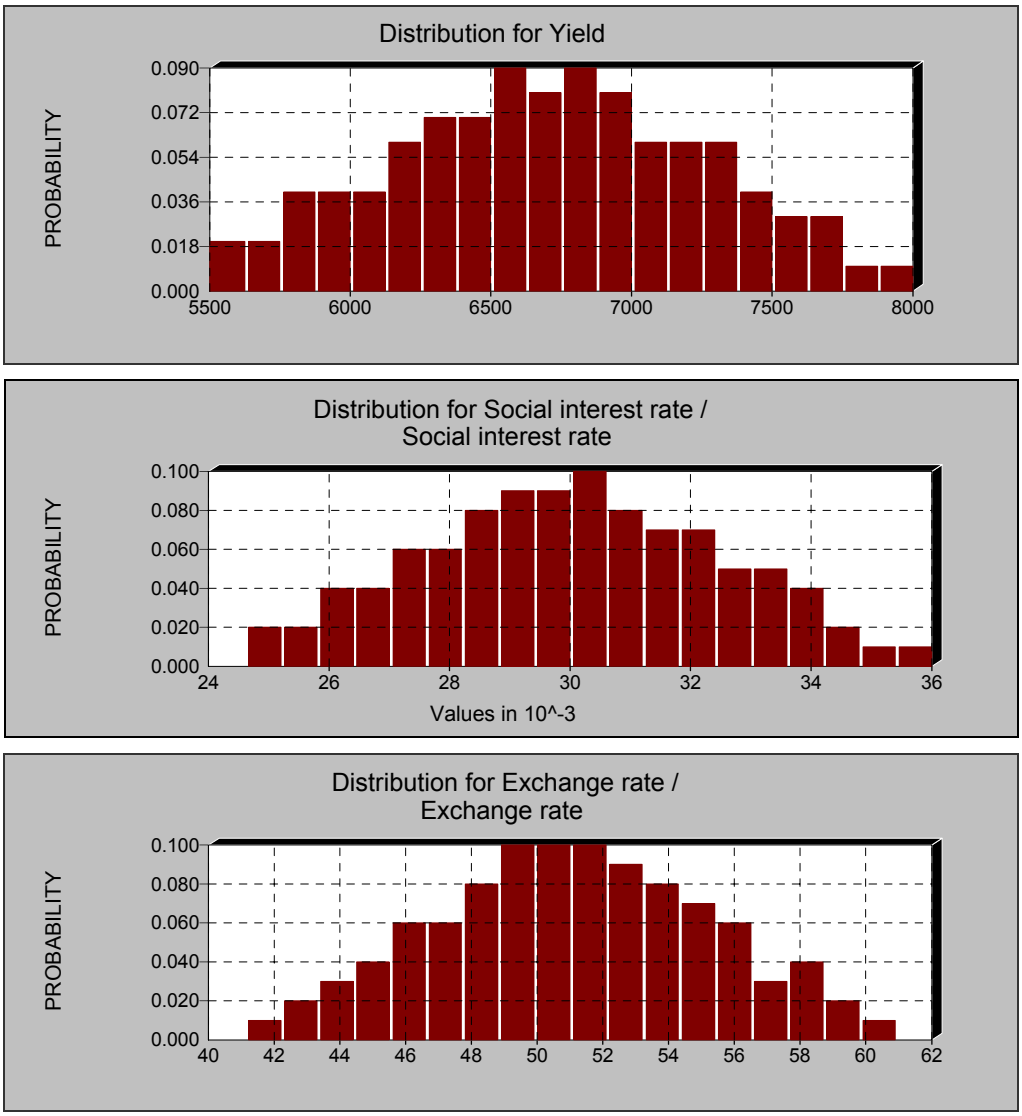
Source: Author elaboration

Figure 4.3 The probability values of the DRC for the imported rain-fed shelled pistachio



Source: Author elaboration

Figure 4.4 The distribution of the values of yields, exchange rate, and social interest rate for rain-fed shelled pistachio system



Source: Author elaboration

Chapter 5. Conclusions and Recommendations

Conclusions

Regarding the current technology, the trend of the world price and the available data the following conclusions were reached in the study:

- Syria has a strong comparative advantage in producing the exported rain-fed in-shell pistachio system(DRC=0.55)
- Syria has a strong comparative advantage in producing the exported irrigated in-shell pistachio (drip DRC=0.53 and sprinkler DRC=0.59).
- Syria has a weak comparative advantage in producing the rain-fed shelled pistachio (DRC=0.82), due to the strong competition with the Iranian pistachio. The domestically produced shelled pistachio is preferred by the domestic traders and processors who are willing to pay 15-20% more than they pay for the imported one.

Recommendations

There are many ways to improve the comparative advantage of Syrian pistachios, in the long term:

- Introduce new pistachio varieties that enter production stage earlier, since the current varieties require a very long time to enter the stage of full production (about 15 years). These early producing varieties will have a significant impact on reducing the costs in the pre-production stages; this will in turn strengthen the comparative advantage of Syrian pistachio and its competitiveness with the Iranian pistachio. In this regard, the pistachio research potential has to be boosted by providing government credits and investments, enhancing the research work at the scientific research center and university, coordinating with the global scientific research center. The General Commission for Agricultural Scientific Research (GCASR) has a substantial role in this direction especially by the cooperation with international institutions.
- Seek new varieties that have higher conversion rates and yields in rain-fed areas, are more resistant to the alternate bearing phenomenon, and are suitable for mechanized peeling. This will increase both outcome and income and reduce production cost.
- Agricultural services should be improved; beside, General Commission for Agricultural Scientific Research (GCASR) continues improving local varieties and finding the good genetic roots that are resistant to alternative bearing phenomenon and they can enter the full production period earlier. This will increase the yield and reduce the production unit cost.
- Introduce new technologies for peeling mechanically (this technology is used in other producing countries such as the USA) through providing credits, boosting private

investments and supporting the processors to obtain this technology. This process will improve the quality of pistachios and reduce the cost of post harvest operations.

- Regarding peeling the green cover, it is necessary to introduce a peeling technology that does not use water (dry peeling machines) and therefore exposes pistachio to less humidity compared with the current technology. This will help protect the pistachio from infection by fungi such as Aflatoxins , leading to an improvement in quality, outcome and international competitiveness.
- Farmers are advised to conduct agricultural activities at the proper time; also, they should attend field day seminars. Furthermore, the extension technical cadre should be improved through special trainings programs.
- Pistachios should be stored in good conditions (10 degrees, and 5-6% humidity) to avoid contamination from fungus diseases.
- It's noticeable that the exported quantities of pistachio are very modest. The comparative advantages of pistachio should be more effectively exploited by conducting marketing and farm administration programs according to international market demands. This will increase the potential to enter the international market and brings good export revenue.
- Adopt the convenient procedures to reduce the high cost at farm (chemical and marketing) and processor (peeling and labor) levels; this will foster the efficiency and competitiveness of Syrian pistachios.
- Cooperate with Arab and international institution and partners to enhance the productivity and profitability of pistachios.
- Develop marketing brands by regions to diversify the pistachio products, to enter the world market, and to enhance competitiveness and profitability.
- Establish a marketing information system concerned with pistachio especially agent based data to enhance flexibility, efficiency and international competitiveness.

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Annex

Table A.1. PAM of drip irrigated in-shell pistachio, exported to Europe

Item	Revenue	Costs		Profit
		Tradable inputs	Domestic resources	
Market price	A 267,475	B 41,042	C 147,294	D 79,139
Social price	E 206,084	F 44,416	G 98,485	H 63,183
Divergence	I 61,391	J (3,374)	K 48,809	L 15,956

Source: Author elaboration

Table A.2. PAM of sprinkler irrigated in-shell pistachio, exported to Europe

Item	Revenue	Costs		Profit
		Tradable inputs	Domestic resources	
Market price	A 267,475	B 48,843	C 156,320	D 62,312
Social price	E 206,084	F 54,492	G 102,731	H 48,861
Divergence	I 61,391	J (5,648)	K 53,589	L 13,450

Source: Author elaboration

Table A.3. PAM of flood irrigated in-shell pistachio, exported to Europe

Item	Revenue	Costs		Profit
		Tradable inputs	Domestic resources	
Market price	A 267,475	B 30,112	C 140,515	D 96,848
Social price	E 206,084	F 31,224	G 100,319	H 74,540
Divergence	I 61,391	J (1,113)	K 40,195	L 22,308

Source: Author elaboration