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A value chain analysis for sustainable development of olive oil agro-industry: The case of Algeria

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Abstract: This study analyzes the performance of the olive oil value chain in Algeria and identifies the bottlenecks that must be overcome to achieve sustainable development. Surveys were carried out and interviews conducted during a five-year period. Value chain approach was used as a tool to analyze the entire chain. The results showed that despite the value chain was found to be profitable for all chain actors, significant shortcomings and bottlenecks continue to undermine the overall development of the value chain. Major bottlenecks to improve productivity and value added were the poor agricultural practice and institutional environment; issues related to natural, structural, technology and economic environment; lack of market transparency; market uncertainties; lack of quality control; absence of traceability monitoring system throughout the chain; lack of certification and labelling; almost total absences of organized structures exist around the product; and limited effectiveness of agricultural extension services with low involvement of farmers and millers in professional organization related to olive oil industry. However, Algeria's olive oil value chain has great potential for future development and currently, the country has an important advantage in terms of current development policies, the use of technology, and the extension of olive tree acreage. Nevertheless, the following upgrading strategies are recommended to enhance sustainability: improvement in product and process; changing in functional position; access to market; supply; cross distribution chain; and intra-chain linkage.

Keywords: Value chain analysis, olive oil, agro-industry, sustainability, Algeria.

Introduction

Algeria's olive sector development has witnessed significant growth during the last 15 years. The olive acreage has more than doubled, growing from 177,220 ha in 2001 to 383,443 ha in 2014 and accounts for 38 % of Algerian total orchards areas (MADR, 2015). The number of olive orchards has tripled from 17.3 millions in 2000 to 50.4

millions in 2014 (MADR, 2015). The production of olive oil has significantly increased, from 263,880 hl to 479,700 hl between 2001 and 2014, whereas olive production has more than doubled from 200,339 tons in 2001 to 482,860 tons in 2014 (MADR, 2015). These figures make Algeria one of the world's top ten main actors in the olive development sector, particularly in terms of acreage and production of olive oil and table olives (IOC, 2015a; IOC, 2015b; IOC, 2015c; IOC, 2016). This considerable growth was largely due to the development programs implemented by the Algerian authorities since the year 2000 (Mendil, 2009; Boudi *et al.*, 2013; Ait Mouloud 2013; MADR, 2015). However, despite the growth performance of Algeria's olive sector in terms of volume and area covered, the agro-industrial sector in general and the olive oil industry specifically faces challenges of stagnation of productivity (Hadjou *et al.*, 2013) since 2000 (from 12.91 q/ha in 2000 to 12.59 q/ha in 2014 (MADR, 2015)), slight increase in consumption (from 1.2 kg/capita/year in 1962 to 1.5 kg/capita/year in 2013 (IOC, 2015d)), low competitiveness with very low exportation volumes (180 tons between 2010 and 2014 (Ministry of Trade, 2015)), and strong climate variability (Sahli and Mekersi, 2005; Hadjou *et al.*, 2013). These challenges questioned the effectiveness of the implemented development programs and whether the olive oil sector's dynamic growth can be sustained in the future. Thus, given the above context, providing in-depth insight on the workings of and gaps in the olive oil value chain, through understanding the constraints on increasing productivity and value added along the chain, is crucial (Webber, 2007; Webber and Labaste, 2009).

There have been a few research studies carried out on olive oil in Algeria mostly related to the biological science perspective. There is, however, less research being conducted in the area of value chain analysis and its use in olive oil strategy development. Therefore, the objective of this study is to analyze the performance of the olive oil value chain in Algeria and identify the bottlenecks that would need to be overcome to achieve sustainable development. Eventually our work will lead to recommendations on how a sustainable value chain can be developed to ensure sustainable and economically viable production of olive oil sector.

Methodology

Concept and method of value chain analysis

The value chain concept is defined as the full range of activities required to bring a product or service from conception, through the different phases of production, delivery to final consumers, and final disposal after use (Porter, 1985; Kaplinsky and Morris, 2001). The concept encompasses organization, coordination, equity, power relationships, linkages and governance between organizations and actors (Helmsing and Vellema, 2011).

Value chain analysis is a powerful analytical tool (Schmitz, 2005), as it provides important information for decision making in value chain development and support (UNIDO, 2009a). It allows an analyst to identify bottlenecks and opportunities to pinpoint and make sector-specific recommendations to policy-makers (Stamm and Drachenfels, 2011). Furthermore, it investigates the role that value chains can play in achieving specific policy objectives, such as poverty alleviation, sustained growth and inequality reduction (Bellu, 2013).

A variety of approaches exist for conducting a value chain analysis. In agricultural/ agro-industrial sector however, according to the Institute of Development Studies, University of Sussex (IDS), approach of value chain analysis (Kaplinsky and Morris, 2001), four aspects should be considered: 1) Mapping systematically the actors participating in the production, distribution, marketing, and sales of a particular product; 2) Identifying the distribution of benefits among actors in the chain through the analysis of margins and profits within the chain, and therefore, determining who benefits from participation in the chain and actors who could benefit from increased support or organization; 3) Exploring areas of upgrading within the chain through assessing the profitability of actors within the chain and identifying chain constraints, drivers and incentives for upgrading; and 4) Assessing the role of governance in the value-chain through identifying the nature of relationships and coordination mechanisms that exist among chain actors.

For this research study, the four aspects of value chain analysis described above have been utilized and adapted to analyze the entire chain. The method allows one to identify where the issues are and one to identify what opportunities are available for sustainable development of the olive oil agro-industry sector.

Case study

The study was carried out in 15 municipalities located in three subdivisions of Bejaia province – Tazmelt, Akbou and Seddouk. The province is located in the northern part of Algeria, at a distance of 180 km east of Algiers, the capital city. The selected study areas are located in sub-humid zone with geographical and climatic features vary in terms of altitude, temperature and rainfall between 280 m to 900 m, 3°C to 35°C and 300 mm to 900 mm respectively. Bejaia province is considered the heart of Algeria's olive oil production. Olive orchards in Bejaia represent about 13.5% of the country's total olive acreage and the olive oil production represents 20.8% (151,300 hl) of the country's total production.

Data collection and analysis

The research was heavily based on primary data that was collected through face-to-face interviews using several sets of open-ended and close-ended questionnaires from the major actors involved in the olive oil chain. Following the mixed method

approach, which employs both quantitative and qualitative analysis (Creswell, 2003), five types of questionnaires have been developed. Each addressed specific questions related to selected target groups. Respondents' groups of this survey were: input suppliers (questionnaire includes information on agricultural inputs, relationships with various actors of the value chain, and facing issues in the agro-industry); producers (questionnaire used includes qualitative and quantitative data about structure, functioning, performance, interaction between actors and within the olive oil value chain, relations with the institutions and development policies, and issues); millers (questionnaire includes data on structure, functioning, performance, relation with different actors of the value chain, and facing issues in the agro-industry); distribution (questionnaire includes information on strategies, supply sources, marketing channels, consumers, constraints, and added value); and lastly the institutions (questionnaire includes their role in the development of the value chain, intervention level in the chain, and facing issues).

The surveys were conducted over a 5-year period from 2007 to 2011. This was due to the several difficulties and barriers encountered during the survey including: large sample size; considerable variability of farmland in foothills and mountains; difficulties to find farmers during working days; difficulties in access remote areas; short production season; and finally the seasonal nature of production and variation

Table 1 - Value chain actors sample and sampling method

Actors	Sample size number, (%)	Total in the region (number)	Sampling method
Input suppliers	12 (85.71%)	14	Almost of the existing input suppliers in the three subdivisions have been selected.
Farms	233 (2.41%)	9655	Stratified random sampling based on municipality, altitude and farm size.
Processors	50 (21.74%)	230	Stratified random sampling based on three types: automatic, semi-automatic; and traditional.
Distribution	10	N distributors*	All the existing bottling units (four units) in the region. Six retailers include 2 out of 8 specialized
Institution	8 (80%)	10	MADR, INRA, ITAF, INPV, DSA of Bejaia, and three agricultural subdivisions (CAW) **

* Sellers on road/market are difficult to quantify because they are mostly mobile, occasional and informal. Additionally, it is worth mentioning that the olive oil distribution is generally carried out directly by the producers and millers.

** ITAF (Technical Institute for Fruit Trees and Vineyards); INPV (The National Plant Protection Institute); MADR (Ministry of agriculture and rural development); INRA (National Institute of Agricultural Research); DSA (Direction of agricultural utilities), CAW (Subdivision chamber of agriculture)

of yield from year to year forced us to consider several seasons in order to estimate the average yield of the olive and olive oil production. Thus, the use of a sufficiently long period of investigation was found critical in order to ensure a comprehensive and thorough analysis of the olive oil value chain.

The data collected from the survey was analyzed qualitatively and quantitatively. The qualitative analysis was done using mapping and SWOT analysis to provide an overview of the marketing channels, marketing structure and to evaluate the strengths, weaknesses, opportunities and threats involved in the value chain. The Quantitative data was analyzed using appropriate descriptive statistics and tabular techniques (e.g. various socioeconomic, structural, production and management characteristics cross-classified by farm subgroups) were used to derive meaningful findings and to summarize the information, including frequency, mean, percentages, costs, profits and margin analysis.

Results and Discussion

Description of the value chain of olive oil in Bejaia Region

Value chain map of olive oil in Bejaia region

The value chain map (figure 1) shows the flow of the product and how the key actors are linked to each other. Two types of players have been identified:

Those who are directly involved in the production and distribution of product, such as the producers, processors, distributors.

Those that perform functions of facilitation, assistance and support to the sector. These are the input suppliers, structures of states that provide financing for projects, technical support (research and extension), and control (trade and safety), socio-professional associations (association of growers, association of villages etc.)

Actors and their roles in olive oil value chain

Producers

Three main classes of farms have been distinguished in our case study (tables 2 and 3):

1. *A traditional and poorly maintained olive grove* composed of small and medium-sized farms located in landlocked lands with a very uneven and rugged topography, and in most cases inaccessible, very difficult to maintain. These farms are lacking of the minimum conditions of intensive cultivation including infrastructure. This group has low and uncertain yields which vary between 7.5 and 10 q/ha.
2. *Traditional and better maintained olive groves* composed of small, medium and large farms, situated in accessible areas. These farms do not have sufficient means of production. Plantations are conducted in extensive, technical itineraries and

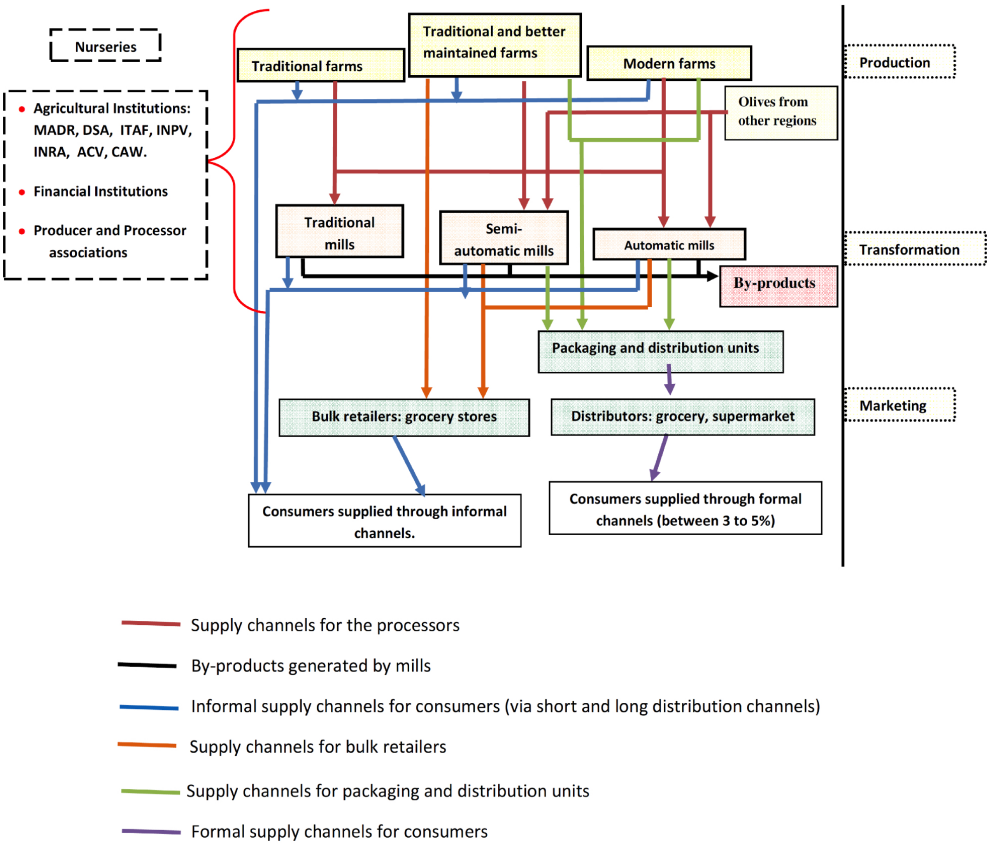

Figure 1 - Value chain map for olive oil in Algeria

production standards of virgin oil are not met, either by lack of access to resources and labor, or for the high cost of inputs. It has low and fluctuating yields (20 to 50q/ha on average) and the management of olive groves is less rigorous.

3. *Olive grove using modern techniques*, includes the farms that are the best managed in our sample. This group is composed of medium and large farms situated in the foothills and plain, they have good conditions of production and the intensification of production. Technical itineraries are followed; yields are high and stable, averaging 80q/ha.

Women's involvement in farm's production

The survey results indicate that women are responsible for the entire non-remunerative productive tasks and also some agricultural and non-agricultural productive tasks. Agricultural tasks include olive grove activities, which accounts for a predominant share of the volume of work performed, followed by gardening

Table 2 - Characteristics of olive farm types in Bejaia region

Class Features	Traditional Olive growing	Traditional and better maintained Olive grove	Modern olive growing
Number of farms	129	101	3
Zone's features	Rugged and landlocked	Accessible zone*	Plain zone
Average altitude	800m	600m	400m
Annual rainfall (average)	450mm	400mm	500mm
Land ownership	Private	Private; 4 EAC** and 1 pilot farm	2 private and 1 EAC
Average size	5ha	20 ha	100 ha
Farming system	Olive, fig, and cherry	Olive only	Olive, grain and vegetables

** Area that allows access of vehicles, particularly tractors for plowing and for transporting goods.*
*** EAC: Collective state farm*

Table 3 - Farm structure, production and management

Class Characteristics	Traditional Olive growing	Traditional and better maintained Olive grove	Modern olive growing
Average area used for olive grove	4ha	15ha	70ha
Olive species (% for each species)	77% chemlal, 20% Azeradj; 3% mixture of Bouchouk,	80% chemlal, 18% Azeradj; 2% mixture of Bouchouk,	95% Chemlal, 5% Azeradj
Tree density/Ha (average)	30 per ha	50 per ha	120 per ha
Age of olive tree	> 50 years (95%) > 100 years (5%)	<10 years (20%) 50<age<100 years (70%)	<10 years (50%) > 50 years (50%)
Irrigation	No irrigation	29% use irrigation for young trees	Drip for new olive groves
Mechanization	Non-mechanized.	Very little mechanized	Largely mechanized
Average Yield (q/ha)*	8.5q/ha	30.5q/ha	80q/ha.
Production's self consumption (average)	80 %	60 %	10 %
Off-farm Income	Liberal; government official; pension	Liberal; trade; pension	Trade; agro-food sector
% of association membership	4%	34%	66%

** q/ha =quintal per hectare (1 quintal=100kg)*

and small livestock. Non-agricultural tasks are mainly processing (red peppers, table olives, and figs) and in very low degree crafts. The study also revealed that the

surveyed women communities are living in precarious very difficult conditions, while they make an important contribution to the survival of their households.

Processors

Regarding the transformation process, the olives are stored for several days – and sometimes for several weeks – in recovery packing (jute sacks or plastic) and outdoors, until the farmer ends up picking all of its production. As a consequence, olives undergo serious alterations. As for oil yield, it varies generally between 15-20 liters/100Kg of olives for "Chemlal" the predominant variety, and 20-26 litres/100kg of olives for Azeradj variety.

Regarding the processing mills, the survey results revealed that despite the modernization of mills, the crushing capacity are used improperly, the average theoretical capacity of crushing mills exceeds 8 quintal/hour (8q/h) while the capacity used are only 5 q/h in average (i.e. equal to 61% of potential). Most mills are working less than 6 hours per day at the beginning of the harvest season, given the lack of olives deliveries and up to 16 hours during the peak harvest season. The oils obtained are usually stored in packaging recovery (jerry cans and plastic drums) but rarely in stainless steel tanks. The acidity, though a dominant criterion in the oil trade, is not really considered. Besides, the study also showed that the low productivity of traditional mills yielded to that 6 mills have closed their doors.

Regarding oil by-products, our survey showed that quantity of liquid extract produced in the mills is disposed directly into sanitation system, so they end up quickly in Wadi flows (seasonal streams). Pomace are thrown after a period of storage on the Wadi beds and then burned. Although there were minimalist measures and tax charges imposed by agricultural services to reduce these effects, their impact was inefficient and also random.

Distribution and commercialisation

The domestic market absorbs most of the olive oil product. The olive oil distribution channel includes mainly the producers, the millers, the retailers, supermarkets, packaging and distribution companies and exporters. As for the exportation, the presence of Algeria on the world market is still very low (Only 180 tons were exported between 2010 and 2014 (Ministry of Trade, 2015)). The surveyed distribution units exported for the first time all of their production in the cropping year 2006 and 2007 in the U.S. market. Regarding the packaging of olive oil, only one supermarket and grocery are selling packaged products while the others sale it in bulk olive oil. Packaging is done in plastic bottles or glass originally planned for soft drinks or mineral water of 1 to 2 L or in jerry cans (2, 5 and 10L). Indeed, the packaging system is still in its infancy and the choice of oil in Algeria is still determined by tasting.

Consumers

The olive oil consumption is characterized by profound differences in consumption by family and by region. In Bejaia region, family consumption varies between 5 to 15 kg/person/year, depending on the family and years of production. In some families it reached more than 100 liters per year.

The actors of facilitation, support and assistance in the olive oil value chain

Professional organizations and associations

In Algeria, the organization level is low because of the actors' divergent interests. In recent years, there has been an emergence of new dynamic around the organization of the producers and processors for better quality of the product such as Tazarajt of Tazmelt municipality which cover an area of 1600 ha of olive grove with fifty producers and processors.

Agricultural suppliers

Suppliers intervene at different stages of the production activity of the olive grove. Generally, the players at this segment of the chain are relatively well-organized. The main products sold are varied according to fertilizers; herbicides; agrochemicals; plants; seeds; and farm equipment. Distribution of agricultural inputs is done at national level by wholesalers and state nursery, at local level it is through the dealers and private nursery. It should be mentioned that the relationship with the olive growers is new, and it is limited to large farmers because small farmers continue to think that the olive tree is hardy (often characterized by its resistance and ability to adapt to difficult natural conditions) and does not require special maintenance and multiplication can be done through the only practice of grafting of wild olive trees.

Funding

New funding products are allocated to individuals or to networks through operators such as the reduced-rate loans for the crop year (RFIG), reduced-rate loans for the agricultural investment (ATTAHADI)), credit of federations, the National Fund for the regulation of agricultural production (FNRPA) and Le Credit BONIFIE (reduced-rate loans), characterized by the flexibility of their granting procedures including the warranty that may be provided solely by the pledge of financed equipment. In addition to that, state support included landlocked areas by means of facilitating contact between the producer and the processor involving the forest department for plantations and opening access tracks, etc. On the other hand, Bank of Agriculture and Rural Development (BADR) currently finances small units across the largest number of investors in order to reduce risk and decide between several clients. Nevertheless, banks blame the farmers for their lack of commitment, and the guarantee funds blame farmers for their default in the payment of their loan obligation.

Institutions

In Algeria, the institutions representing the agricultural sector in general and the olive oil sector in particular are led by the Ministry of Agriculture, Directions of Agricultural Utilities (DSA), and municipal departments (agricultural subdivision). Agriculture technical research institutes such as INRA, ITAF and INPV, are also involved in the sector, mainly in providing the technical and development activities support. These institutions have developed a number of tools for the dissemination of technology and information (field observations, bulletins and participatory methods) that help to expand their field of expertise and activities (Sahli and Mekersi, 2005; ITAF, 2006; Mendil and Sebai, 2006; Mendil, 2009)

Through the National Plan for Agricultural Development (PNDA) (the government has provided substantial support to encourage investment in the sector. Since 2009, a policy of "Rural Renewal" has been implemented to organize the professions to increase the synergy between actors from different parts of the value chain (production, processing and marketing). Among other points of interest are certifying the products to accelerate the development of agro-food chains that have been highlighted in the political discourse. In 2010, a National Federation Development Of Olive Oil and National Inter-professional Committee of Olive oil industry were created, aiming for the development of the sector and achieving the objectives of the plan 2009/2014 such as increase production, increase the density of existing orchards, enhance wild olive trees, improved quality of products, reuse of by-products and environmental protection, and establishment of a new profitable market for quality.

Distribution channels and margins

Value addition is the difference in sales price and production costs (see the detail costs in appendices) at each stage of the value chain. The results of our study indicated that the cost of producing one kilogram of olive oil is essentially determined by the yield of olives which vary widely depending on crop management.

In our case study, the majority of actors involved in the oil value chain sell their products through traditional and informal market arrangements. The distribution channels consist of two main sources of supply:

a) *Producer-suppliers as the base of the value chain* – The distribution starts from the producer through the various actors in the distribution channel until the customer is reached.
b) *Processor-suppliers as the base of the value chain* – The processor acts as a main supplier of the olive oil because of the "payment in kind" mechanism. Under this mechanism, the producers pay the crushing-fee generally in-kind, for each quintal of crushed olive depending on the type of the mills. In the automatic and semi-automatic mills, the processor keeps two liters of olive oil, while for the traditional mills; the processor keeps three liters for each quintal of crushed olive.

As a consequence, at the end of the crop year, the processors end up with large quantities of oil greater than those of the producers; therefore, the upstream of the value chain in the second distribution system is dominated by the processors.

Distribution channels with producer-suppliers as the base of the value chain

In total, nine marketing channels have been indentified and distributed by producers':

The distribution channel and margin for the best managed farms

The comparison of value added generated by different value chains characterised by the three distribution channels. Table 4 shows that the producer's share of the added value is higher than the other actors sharing 62.87 % of total added value per 1 liter of oil for the channel 1, 100 % of total added value per 1 liter of oil for the channel 2, and 85.3 % of total added value per 1 liter of oil for the channel 3. In channel 3, the producers have adopted a vertical development strategy which eliminates intermediaries in order to control the chain including production, processing, and bottling. As a consequence, production costs are higher and include a significant high packaging cost that represents more than 30% of the total costs.

As for the distribution, in channels 1 and 2, the olive oil products are distributed in the national territory, while in the third channel the producer declared that a part of his products are distributed at the regional level.

The distribution channel and margin for the traditional and better maintained olive grove

This group of producers encompasses a number of different area sizes and yields. Because of that, they adopted different distribution channels. As consequences, the value added differs among the different channels (table 5).

As shown in the different channels from table (5) below, the production cost of olive oil is estimated to be 195 DA/l and the direct sale to the consumer allows to the producer to have a profit margin of 210.5 DA/l (100%), however, these consumers are less loyal or occasional, and their purchasing is spread over a period of time.

For that, other farms that can meet the specifications for some distributors (bottling units) sell to them with significant amounts but with lower price (330 DA/l), which allows to have a margin of 105 DA/l which is 56.75% of total value added (see channel 7). But some farmers, to avoid market uncertainty, prefer to sell directly to millers at a much lower price (280 DA/l), which allows them to have between 48.5% and 72.97% of total value added for different channels (channels 5, 6 and 8). Regarding the distribution, the sale of olive oil products for these channels mainly takes place locally and regionally. Nevertheless, fewer than 5% of olive oil products are distributed to other provinces of the country.

Table 4 - The distribution channel and margin for the third class

	PRODUCER	BOTTLING UNITS	RETAILERS	TOTAL
Channel 1: Producer – Bottling units – Retailers – Consumer				
Costs DA/l *	164.5	380	450	
Sale price DA/l	300	430	480	
Net Margin DA/l	135.5	50	30	215.5
% of total margin	62.87	23.20	13.92	100
Channel 2: Producer – Consumer				
Costs DA/l	164.5			
Sale price DA/l	400			
Net Margin DA/l	235.5			235.5
% of total margin	100			100
Channel 3: Producer – Retailers –Consumer				
Costs DA/l	255		450	
Sale price DA/l	430		480	
Net Margin DA/l	175		30	205
% of total margin	85.3		14.7	100

** DA/l: Algeria Dinar per one liter. Algerian Dinar currency (see the appendix 1: Inflation rate and exchange rates in Algeria)*

The distribution channel and margin for the traditional and poorly maintained olive grove

These farms have a very fluctuating and generally low yield. Investments are very low or absent but production costs are high due to the low productivity of these farms. As consequence the margins are low but considered an additional and secure income for the family and the total margin goes to the producer (see channel 9 in table 6). With regard to the distribution, almost of the olive oil product is for self-consumption, and the remainder usually is sold to loyal customers such family or friends at the local and regional level. Three producers, however, were found to sell their products to other provinces.

Table 5 - The distribution channel and margin for the second class

	PRODUCER	MILLERS	BOTTLING UNITS	RETAILERS	TOTAL
Channel 4: Producer – Consumer					
Costs DA/l	195				
Sale price DA/l	400				
Net Margin DA/l	205				205
% of total margin	100				100
Channel 5: Producer – Retailers –Consumer					
Costs DA/l	195			350	
Sale price DA/l	330			400	
Net Margin DA/l	135			50	185
% of total margin	72.97			27.03	100
Channel 6: Producer – Millers – Consumer					
Costs DA/l	195	290			
Sale price DA/l	280	380			
Net Margin DA/l	85	90			175
% of total margin	48.5	51.5			100
Channel 7: Producer – Bottling units - Retailers – Consumer					
Costs DA/l	195		380	450	
Sale price DA/l	300		430	480	
Net Margin DA/l	105		50	30	175
% of total margin	56.75		27.02	16.21	100
Channel 8: Producer – Millers – Retailers – Consumer					
Costs DA/l	195	290		350	
Sale price DA/l	280	330		400	
Net Margin DA/l	85	40		50	175
% of total margin	49	23		28	100

Table 6 - The distribution channel and margin for the first class

Channel 9: Producer – Consumer		
Costs DA/l	280.6	
Sale price DA/l	400	
Net Margin DA/l	119.4	119.4
% of total margin	100	100

Distribution channels with processor-suppliers as the base of the value chain

In total, six marketing channels have been indentified and distributed by mills' type:

The distribution channel and margin for the modern mills

The crushing capacity of the modern mills is more important and the productivity is higher despite they are not used to their full capacity, which generates the lowest cost of 141.9 DA/l (table 7).

Table 7 - The distribution channel and margin for the modern mills

	Millers	Bottling units	Retailers	TOTAL
Channel 10: Modern mills – Consumer				
Costs DA/l	141.9			
Sale price DA/l	400			
Net Margin DA/l	258			258
% of total margin	100			100
Channel 11: Modern mills – Retailers – Consumer				
Costs DA/l	141.9		350	
Sale price DA/l	330		400	
Net Margin DA/l	188		50	238
% of total margin	79		21	100
Channel 12: Modern mills – Bottling units - Retailers – Consumer				
Costs DA/l	141.9	380	450	
Sale price DA/l	300	430	480	
Net Margin DA/l	158	50	30	238
% of total margin	66.4	21	12.6	100

The three identified channels showed that modern millers are responsible for more than 60% of the value followed by bottling units and retailers making them the most dominant actor in the chain. As for the distribution of the olive products, direct sales represent less than 20% of the total sales volume and sold at the regional level (channel 10), while in the other marketing channels, fewer than 50% of the olive oil product is sold at the regional level with the remainder going to other provinces.

The distribution channel and margin for semi-automatic mills

The distribution of olive oil for this group takes place locally and regionally. As for the distribution of the value added, the millers were found to be responsible for more than 76% of the value (table 8). The highest profit earned by the millers made them the dominant value chain actors. However, these mills are underutilized and with low productivity, which resulted in higher production costs of 167.7 DA/l. These types of oils are also preferred by the consumers due to the similar processes used by semi-automatic mills and the traditional mills.

Table 8 - The distribution channel and margin for the semi-automatic mills

	Millers	Bottling units	Retailers	TOTAL
Channel 13: Semi-automatic mills – Consumer				
Costs DA/l	167.7			
Sale price DA/l	400			
Net Margin DA/l	232.3			232.3
% of total margin	100			100
Channel 14: Semi-automatic mills - Retailers – Consumer				
Costs DA/l	167.7		350	
Sale price DA/l	330		400	
Net Margin DA/l	162.3		50	212.3
% of total margin	76.4		23.6	100

The distribution channel and margin for the traditional mills

The productivity of traditional oil mills is very low in average and generates a higher cost of 248.1 DA/l (table 9). This oil is sold at 450 DA/l, which is more expensive than the other two types of oil mill. These millers sell directly to the consumers because the quantities are low and their oil type is very popular among consumers who prefer this type of mills that produces strong flavor oil. Regarding the distribution, almost of the product is for self-consumption; the remainder is sold directly to the consumer at local and regional level; this includes to friends or relatives of other regions.

Table 9 - The distribution channel and margin for traditional mills

	Millers	Bottling units	Retailers	TOTAL
Channel 15: Traditional Mills – Consumer				
Costs DA/l	248.1			
Sale price DA/l	450			
Net Margin DA/l	201.9			201.9
% of total margin	100			100

Governance

Governance in a value chain refers to the structure of relationships and coordination mechanisms that exist among chain actors (UNIDO, 2009b). In our case study, coordination mechanisms were found to be based mainly on non market aspects of transactions, including the social rules, trust relationships, family relationships, reputation and networks. These rules are often integrated as part of informal commitments that approximate relational contracts.

The olive value chain was also found to be characterized by the absence of monopoly, some failures, but also by its lack of transparency for most operators. Strong uncertainties influence the economic relations between actors. Among the uncertainties were those of marketed volumes due to the instability of supply, those related to product quality, and finally those related to the price.

At farm level, small farmers faces many constraints due to isolation, lack of transportation, the extremely small size of farms and the lack of marketing networks size; which creates a certain horizontal competition between players of the same chain. As a result, disposal of products is distributed in informal way with no quality control, packaging, and storage or transport arrangements. At level of medium and large farms, marketing is more difficult; channels are less well established and lesser loyalties. Thus, they prefer to sell their production to mills directly after harvest or to bottling units, even if the price offered is significantly lower than that of the market. At the mills level, the disposal of olive oil was found easier in traditional mills and semi modern than in modern mills because consumers prefer this kind of oil, with a strong taste, even with higher prices. At the distribution level, the relationship between retailers and their supplier is based on informal and a quasi loyalty agreement. As results, it reduces market risks and transaction costs. Finally, at the institutional level, our survey found that supporting institutions did not play any significant role in the value chain. Indeed, none of the surveyed institutions monitors the traceability of the product, nor any quality control throughout the supply chain. Institutions generally intervene at farmer level and millers, nurseries, rarely upstream of the chain, but never at the marketing

segment level. The certification system in Algeria is not yet set to replace the relational contract. The customers prefer personal relationships and rustic packaging.

In addition, along with the aforementioned uncertainties and constraints in the value chain structure, a new mode of governance emerged. Specifically, some producers developed vertically integrating upstream and downstream of the chain, to market their own product in order to recover the whole profit margins, and especially to guarantee supply in quantity and quality. This is the case of large producers who make oral contracts with millers to crush their olives just on arrival, to avoid loss of quality of olives and oil. Furthermore, we see the appearance; though still marginal, network structures of small producers grouped around a large company. An example is a network organization of small producers grouped around caning and bottling company of olive oil and other local products in Seddouk and Akbou areas. It led farmers to adopt more strategies of a "follower" of leading firms to indirectly benefit from their presence and to guarantee certain profitability and income security.

SWOT Analysis

The SWOT analysis has revealed a numbers of strengths, weaknesses, opportunities and threats for the olive oil industry:

Strengths

a. Old, efficient and adapted local cultural heritage composed of about thirty varieties, most famously "Chemlal" (olive oil) and "Sigoise" (table olives).
b. Orchard in full extension, in traditional areas and new areas (Highlands and Saharan zones), and with a tendency toward a constant increase in the production.
c. Consumer preference to local product by its taste and color and new awareness with regard to the national product and traditional know-how to produce this specificity. The latter (specificity) can act as strong non-tariff protection (preference to local products with a specific taste) but also access to the most differentiated and developed markets.
d. Considerable potentiality of state support for the development of the olive oil sector.
e. Emergence of modern units with sanitary conditions and processing techniques able to safeguard the quality of the product.
f. Emergence of new operators with the means and desire to contribute to the reorganization of the olive oil sector to meet the requirements of the domestic market and export.
g. Possibilities of increase in the value added development of the national product in the future including through geographical indications.

Weakness

a. Heritage increasingly undergoing a fragmentation of farms due to inheritance.
b. Predominance of old farming techniques particularly in traditional areas of olive trees.
c. Significant fluctuation of production based on rainfall conditions and problems of availability of water resources in some producing areas.
d. Poor maintenance, harvesting and processing of olives, reduce the level of product quality in which the low production farms reduced their income levels.
e. Very poor organization of the sector in relation to the profession and the support and control of development programs.
f. Lack of standardized market due to the predominance of the informal market.
g. Purchase price of Products are well above the international price compared with much lower quality levels.
h. Contingent benefiting from fiscal taxes granted by the European Union (EU) has never been used and also, limited experience of international markets due to the lack of coordination between public institutions and the profession for a common approach to markets.
i. Dispersion funding and state aid without significant results.
j. Disadvantageous configuration of the olive grove due to a mostly hilly landscape and an extensive orchard (50 to 100 trees/ha, grafted on the natural wild olive) in the case of traditional zones.
k. Little environmental concerns, where the by-products are released into the wild, which constitutes an ecological constrain and an economic loss as well.

Opportunities

a. Willingness and continuing efforts for the development of the sector.
b. A high growth of local and world markets for olive products.
c. Ability to identify specific products and rise of the immaterial quality dimension.
d. Development of supermarkets in favor of a standardized quality oils.
e. Possibility to revive the processing industry and recycling of industrial waste.
f. Prospective possibilities of exports of the olive oil following almost organic farming norms.
g. Enhancing by-products which may be of a great potential source of supply, such as for: additional oil (pomace oil) used for human consumption or in industry; cattle feed (leaves and twigs, pomace, water residue, unicellular proteins, etc.); energy (burning prunings, hulls pomace); particle board (hulls, chipboard): fertilizers (water residues, pomace); chemical products of many industrial applications (production of furfuraldehyde, phenols and polyphenols) for the pharmaceutical industry and cosmetics.

Threats

a. Collapse of prices and margins in the local market with the entry into production of other new areas.
b. Entrance on the national market for foreign products with the arrival of new producers.
c. Sales problems of the new productions due to the very slow evolution of consumer habits.
d. Worsening of financial difficulties of the operators due to exacerbated debts vis-à-vis the banking system which can greatly constrain the operation of the already fragile sector.
e. Impacts of environmental pollution.

Upgrading strategies

Improvements of olive oil value chain could be done on the following areas:

Improvement in product

a. Improve product presentation (packaging and labelling) by exploiting the collective recognition and restricted to actual indications (place of production, level of acidity).
b. Progressive implementation of the standard regulations of the International Olive Oil Council (IOC) which Algeria is a signatory to the marketing of olive oil, will have as an effect, eliminate questionable products and unfit for consumption.
c. Participation in exhibitions and fairs organized inside and outside the country to establish business contacts.

Improvement in process

a. Increased yields by reducing the phenomenon of alternate peering, improving cultivation techniques and operations of water management to reduce the effects of drought.
b. Due to the disadvantaged configuration of the olive grove, which is mostly a hilly landscape, developing structures that reduce the tree's fragility to snow by deploying ancestral pruning techniques would be very useful. When such techniques are applied, encountering trees that produced about 300 kg of olives or more is not uncommon. This method will ensure high density.
c. Encouraging the reproduction of the orchard by grafting the oleaster (wild olive tree) to increase the density of farms on the one hand, and ensure the effectiveness of the reproduction due to the natural adaptation of the grafted tree, on the other hand. From an economic viewpoint, it is mostly advantageous.
d. Pest control measures, in particular against Daccus (olive fly), should be applied

before and in the stage of picking olives. Indeed, picking olives at least when the overall maturity is 50% of green olives, 30% of olives and 20% at the intermediate stage does not leave much choice for the reproduction of this pest. The immediate transfer of production to the mill and hygiene measures at oil mills will contribute significantly to control of both quality and pests by reducing their chances of reproduction.

e. Improving productivity of traditional olive groves automatically will lead family farmers to care about their olive grove. This improvement will be made through the promotion of technical maintenance, harvesting and processing with assistance and the introduction of specialized service companies in the maintenance of olive groves.

Changing in functional position

a. Improvement of crop management techniques and respect for production standards can increase the quantity and improve the quality of the product.
b. Processing and recycling of by-products in the agricultural economy helps offset some of the costs of production and to increase the added value on one hand, and, significantly contribute to reduce the negative and harmful impact on environment on the other hand.
c. Development of supermarkets in favour of a standardized quality oils, will contribute to the enhancement of the product by securing an attractive "showcase" to the consumer.

Access to market

a. Promote the domestic consumption (households and communities) of olive oil in general, so that this sector can contribute to the reduction of imports for oil in case of oilseed oils.
b. Increase the sales on the domestic market by developing retail and investing new external growth markets (e.g. Africa and Asia).
c. The distinguishing criteria such as "organic" are instruments of development of products in these new markets. However this opportunity is difficult to envisage in the traditional farm where the organization is not easy to bring together, due to the smallness and environmental constrains of the olive grove.
d. Adjusting the local market by developing a specification for the marketing of olive oil in Algeria, including labelling and traceability standards, control and organization of information and consumer awareness.
e. Grasp the business opportunity from the European market by exploiting the quotas granted every year to Algeria in the framework of the Association Agreements, directed to the nostalgic market that represents a very important Algerian community.

Supply

Customer loyalty is dependent on the stability of production, the quality of stability and organization of producers around a "point of sale," which requires the development of contracts with potential farmers from the terms of delivery to oil mills and distributors.

Cross distribution chain

Switch to the production of a traditional oil by enhancing the quality of the intangible product, especially oils with geographical indications

Vertical chain (Intra-chain linkage)

Promote the creation of a common industrial sector through cooperation between groups, associations and individual operators, which have objective reasons to pool resources for intervention in order to reduce production costs. These groups may be formed for example around an industrial processing, a trader or a service delivery company or storage operator and/or conditioner.

Conclusion

The analysis revealed that the olive oil value chain was profitable for all value chain actors. The distribution of the value added in the olive oil chain between the various actors in the different stages of production was found heterogeneous. The mills and the best managed farms capture the largest share of the value added, while, the distributors represent the lowest share of the total value added.

However, the Algerian olive oil industry showed low competitiveness because of bottlenecks and constraints in the value chain. Several major bottlenecks to improve productivity and value added were found. They included the fragmentation of farms, lack of land title, and poor farm management practice. Climate variability and water scarcity, low productivity, low technological competence in mill's processing operations, and financial difficulties also played a role in creating constraints. In addition, insufficient subsidies that benefit only a small portion of producers and millers, lack of market transparency, market uncertainties, the dominance of informal behaviour activities, and supply issues are problematic. Further, heterogeneity of the primary product (olive), lack of quality control, absence of a traceable monitoring system throughout the chain, lack of certification and labelling, and an almost total absence of organized structures existing around the product also are of concern. The limited effectiveness of agricultural extension services with low involvement of farmers and millers in professional organization related to olive oil industry is an issue as well. All of this has resulted in a less competitive industry.

Algeria's olive oil value chain has great potential for future development. Nevertheless, the first necessity for the public authority and the value chain actors is to reorganize the marketing system, through the urgent development of the traceability system to meet the regulatory and market requirements locally and internationally. Currently the country has an important advantage in terms of current development policies, the use of technology, and the extension of olive tree acreage. Enhancing growth potential and industry development should needs consistent coordinated strategy between different partners including the actors of the value chain, institutions, research, extension, and the key partners.

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Appendices

Appendix 1 - Inflation Rate and Exchange rates in Algeria

Year	2007	2008	2009	2010	2011
Inflation (%)	3,5	4,5	5,7	5	4,5
Exchange rate (1 US$ to Algerian DA)	73.405	68.437	77.110	78.471	76.525

Appendix 2 - Farm production costs per hectare (DA) (by farm types)

Costs (DA)	Class 1	%	Class 2	%	Class 3	%
Tillage	6,000	3.4	5,000	5.6	1,200	3
Fertilization	5,600	3.1	650	0.7	0	0
Weed control	5,000	2.8	6,000	6.8	2,500	6.1
Pruning	10,000	5.6	9,000	10.2	2,500	6.1
Irrigation	15,000	8.4	1,000	1.2	0	0
Basin	4,000	2.2	2,500	2.8	0	0
Harvest nets	5,000	2.8	4,500	5	4,000	9.8
Crates	6,000	3.4	0	0	0	0
Transportation	15 000	8.4	5,500	6.2	3,000	7.4
Harvest	100,000	56	53,000	59.8	26,000	64
Wood harvesting	2,000	1.1	1,500	1.7	1,500	3.6
Security	5,000	2.8	0	0	0	0
Total (DA)	178,600	100%	88,650	100%	40,700	100

Appendix 3 - Production cost per liter of olive oil (DA) (by farm types)

	Class 1	Class 2	Class 3
Farm production costs (DA/ha)	178,600	88,650	40,700
Extract costs (DA)	32,000	12,500	3,500
Yield (ql/ha)	80	30.5	8.75
Yield (l/ql)	16	17	18
Oil production (l)	1,280	518.5	157.5
Total production costs / ha	210,600	101,150	44,200
Total production costs (DA/l)	164.5	195	280.6

Appendix 4 - Production cost per liter of olive oil (DA) for a case of producers of class 1 who do their own harvesting, processing and packaging

	Class 1
Farm production costs (DA/ha)	178,600
Yield (q/ha)	80
Extract costs (DA)	32,000
Total production costs (DA/ha)	210,600
Yield (l/q)	16
Oil production (l)	1,280
Production costs (DA/l)	164.5
Packaging (DA)	80
Other charges (DA)	10.5
Total (DA/l)	255

Appendix 5 - Processing cost structure by type of mills

Unit (Da/day)	Traditional		Semi-automatic		Automatic (modern)	
	DA/day	%	DA/day	%	DA/day	%
Labor force	2,400	53.7	7,700	38.2	4,800	21.1
Amortized costs	/	/	3,300	16.4	6,000	26.4
Rent	/	/	1,300	6.5	1,300	5.7
Consumables	1,366	30.7	5,357	26.6	7,714	34
Insurance and Tax	700	15.6	1,471.5	7.3	1,900	8.4
Transportation	/	/	1,000	5	1,000	4.4
Total	4,466	100	20,128.5	100	22,714	100

Appendix 6 - Production cost per liter of olive oil (DA) by type of mills

Type of mill.	Total expenses (DA/day)	Production (l/day)	Total production cost (DA/l)
Traditional	4,466	18	248.11
Semi-automatic	20,128.5	120	167.73
Automatic	22,714	160	141.96

Appendix 7 - Retailer (sale in bulk): Production cost per liter of olive oil (DA)

Costs	DA/l	%
Olive oil purchased	330	94.28
Labor	10	2.85
Other costs	10	2.85
Total	350	100

Appendix 8 - Olive oil bottling unit: Production costs of 1 liter of olive oil (DA)

Costs	DA/l	%
Olive oil purchased	300	78
Labor	10	2.5
Packaging materials	55	15.6
Tax	5	1.3
Transportation	5	1.3
Other costs	5	1.3
Total	380	100

Appendix 9 - Retailers (sale in standardized bottles with labeling): Production costs of 1 liter of olive oil (DA)

Costs	DA/l	%
Oil Bottle purchased	430	95.56
Labor	10	2.22
Other costs	10	2.22
Total	450	100