

## Analysis of the dairy value chain in Central Tunisia: Challenges and opportunities for a better development

### L'analyse de la chaîne de valeurs des produits laitiers au Centre de la Tunisie: Challenges et opportunités pour un meilleur développement

M. ZLAOUI<sup>1\*</sup>, M.Z. DHRAIEF<sup>2</sup>, O. JEBALI<sup>3</sup>, M. BEN SALEM<sup>4</sup>

<sup>1,2,3,4</sup> National Agronomic Research Institute of Tunisia (INRAT), Rue Hedi Karray, 2049 Tunis, Tunisia.

\*Corresponding author: meriem.zlaoui@gmail.com

**Abstract** – Tunisian dairy value chain plays an important role in economic growth, enhancing food security, poverty reduction and rural development. The paper aims to diagnosis the dairy value chain in Central Tunisia (Sidi Bouzid governorate) in order to facilitate the development of stakeholder-driven strategies to improve the milk quality, added value, and milk cooling technologies.. Qualitative and quantitative interviews were addressed to 121 breeders, 30 milk collectors, 14 milk collecting centers and one milk plant. SWOT method was applied to determine the performance of the dairy value chain. Results show important opportunities related to the qualitative aspect and the value creation: introducing the dry ration which can improve the flock's productivity, encouraging breeders to group together in cooperatives to benefit from the multiple governmental advantages, cooling milk on the farm as a first step to guarantee a better microbiological quality of milk at production level, organizing the milk collectors by applying the specific rules of quality, revising the national quality standards towards higher levels, etc. However, a better coordination between the different stakeholders is necessary to carry out all the suggested interventions on the Tunisian dairy value chain.

**Keywords:** Value chain, dairy products, opportunities, marketing, central Tunisia

**Résumé** – La chaîne de valeur des produits laitiers tunisiens joue un rôle important dans la croissance économique en renforçant la sécurité alimentaire, la réduction de la pauvreté et le développement rural. Cet article vise à faire le diagnostic de la chaîne de valeur des produits laitiers au Centre de la Tunisie (gouvernorat de Sidi Bouzid) afin de faciliter le développement de stratégies pilotées par les parties prenantes pour améliorer la qualité du lait, la valeur ajoutée et les technologies de refroidissement du lait. Des entretiens qualitatifs et quantitatifs ont été adressés à 121 éleveurs, 30 collecteurs de lait, 14 centres de collecte de lait et une usine de transformation du lait. La méthode SWOT a été appliquée pour déterminer la performance de la chaîne de valeur des produits laitiers. Les résultats montrent d'importantes opportunités liées à l'aspect qualitatif et à la création de valeur: introduction de la ration sèche pouvant améliorer la productivité du troupeau, encourager les éleveurs à se regrouper en coopératives afin de bénéficier des multiples avantages gouvernementaux, le refroidissement du lait à la ferme constituant garantir une meilleure qualité microbiologique du lait au niveau de la production, organiser les collecteurs de lait en appliquant les règles de qualité spécifiques, réviser les normes de qualité nationales vers des niveaux plus élevés, etc. Cependant, une meilleure coordination entre les différentes parties prenantes est nécessaire pour mener à bien toutes les activités se rapportant à la chaîne de valeur des produits laitiers tunisiens.

**Mots clés :** chaîne de valeur, produits laitiers, opportunités, marketing, centre de la Tunisie



## 1. Introduction

The dairy sector occupies an important place in the Tunisian economy with a contribution of 11% of the total agricultural production; 25% of the total of animal production and 7% of the value of the food industry. This sector relies on 112 000 breeders; 424 000 females including 228 000 of pure bred females, a national network of 235 collecting centers and 10 milk production units (GIVLAIT, 2017).

The strategy of the development of the dairy sub sector in Tunisia aims primarily to improve the genetic potential of milking cows mainly through the imports of Holstein Friesian heifers, to optimize productivity for all the involved stakeholders in the production chain and enhancing competitiveness; to improve milk quality, to create a more efficient inter-profession, and the most essential is to liberalize the milk prices (i.e. to suppress all the subsidies granted by the Government to the different stakeholders of the sub-sector) (ICARDA, 2014).

Sidi Bouzid governorate, located in the Centre of Tunisia, is ranked number one nationwide in terms of collected milk with a contribution of 293,000 l/day (11 to 15% of the national volume). The dairy cattle population in this region is about 35,000 cows owned in the majority by small producers ( $\leq 6$  cows) with a daily production volume of 20 to 60 liters per farm (GIVLAIT, 2017). Unfortunately, the dairy sector in central Tunisia faces numerous issues, unreliable milk collection networks and missing on-farm cooling facilities leading to productivity losses through erratic milking regimes and to cash income losses due to milk rejection because of uncooled storage resulting in low quality, deprival from the cooling premium and even rejection of unsuitable milk at the collecting centers. Thus, there is a real need to improve production conditions at the small scale farm level to maintain milk quality (ICARDA, 2014).

The major objective of the study is to diagnosis the Sidi Bouzid dairy value chain in order to facilitate the development of stakeholder-driven strategies to improve the milk quality, and the added value. The specific objectives of this study include the diagnosis, selection and mapping of the relevant stakeholders in Sidi Bouzid dairy value chain which allows to identify the major constraints and opportunities and to suggest key intervention areas for stakeholder's development and policy action.

The outline of the paper is as follows. In section 2, we introduce literature review on the value chain concept, followed in section 3 by the methodology. In section 4, we report the results and discussions. Section 5 concludes the paper with a discussion of the main findings.

## 2. Literature review on the value chain concept

According to Humphrey and Oetero (2000), the value chain concept is derived from two main analytical approaches. The first source is the business and industrial organization literature, exemplified by the work of Porter who defines a "value chain" as "the activities performed in competing in a particular industry" (1990), defined at the level of the individual firm. The second approach derives from the world systems literature on commodity chain where Gereffi (1994) defined "Global commodity chains" as they have three dimensions: (1) an input-output structure (i.e. a set of products and services linked together in the sequence of value-adding economic activities); (2) territoriality (i.e. spatial dispersion or concentration of production and distribution networks, comprised of enterprises of different sizes and types; and (3) a governance structure 'i.e. authority and power relationships that determine how financial, material, and human resources are allocated and flow within a chain'.

These value chain approaches have been utilized by development practitioners and researchers to analyze markets in developing countries and to examine the inter-relationships between diverse actors involved in all stages of the marketing channel (Kaplinsky, 1998; Giuliani and al., 2005; Bair and Peters, 2006; Pietrobelli and Saliola, 2008, Beneberu and al, 2012).

Typically the value chain describes the full range of value-adding activities required to bring a product or service through the different phases of production, including procurement of raw materials and other inputs, assembly, physical transformation, acquisition of required services such as transport or cooling, and ultimately response to consumer demand (Kaplinsky and Morris, 2002). As such, value chains include all of the vertically linked, interdependent processes that generate value for the consumer, as well as horizontal linkages to other value chains that provide intermediate goods and services.

### 3. Materials and Methods

#### 3.1. Study area

The baseline survey was carried out in the governorate of Sidi Bouzid located in Central Tunisia (Figure 1). It covers an area of 7405 km<sup>2</sup> and it is characterized by an arid climate with an annual rainfall between 200 and 300 mm. The Governorate of Sidi Bouzid is shared in 12 districts, 10 municipalities, 111 sub-districts and 12 rural councils.



Figure 1. Sidi Bouzid governorate, ODCO,2011

The most important milk producing areas within the district of Sidi Bouzid are located in the plain of Gammouda (sub-districts of West and East Sidi Bouzid) and the sub-districts of Regueb, Souk Jdid, Sidi Ali Ben Aoun and Regueb. Production systems are characterized by a high density of small-scale, landless dairy cattle producers and a relatively important network of milk collecting centers. Farmers are scattered in space leading to longer, less efficient circuits of milk collection. In addition, the milk producing sub-districts have a limited network of collecting centers.

The dairy sector in Sidi Bouzid is facing huge transformations these last years. The number of female units increased from 24000 in 2009 to 35000 units in 2014. The storage capacity has also increased from 261 tons in 2009 to 327 tons in 2014 (Table 1). The collected and processed milk quantities have also increased and the transport units went from 274 units in 2009 to 407 units in 2014.

Table 1. Evolution of dairy components in Sidi Bouzid 2010-2015

	2009	2010	2011	2012	2013	2014
Number of female units	24000	26000	28000	30000	32000	35000
Collecting centers	20	18	19	19	19	19
Storage capacity (Tons)	261	244	291	304	304	327
Collected quantities (Thousand tons)	76618	92924	99967	109989	117343	127436
Processed quantities (Thousand tons)	74953	90260	96248	108156	115388	124675
Capacity of transport units (Tons)	274	255	270	407	407	407
Dairy plant						1

Source: Dhraief and al, 2017

### **3.2. Data collection and source of data**

121 farmers were interviewed at the production level in the region of Sidi Bouzid. 14 surveys were administered to the collecting centers. The main considered criteria for the collecting centers' selection were the regions where it intervenes; the milk collecting zones and its legal type. Also 30 milk collectors were interviewed with face-to-face questionnaires. The field surveys were done at the same time with those of the collecting centers. The main idea is to select three to five milk collectors from each center randomly. The questionnaire was discussed with local partners and adjusted according to local conditions. Before launching the survey, the two questionnaires were tested in the target areas. Pre-testing the questionnaire provided an opportunity to make some modifications and to improve the field survey.

## **4. Results and Discussion**

### **4.1. The main stakeholders of the dairy value chain**

The core functions of the dairy value chain include: production (breeders), collectors, collecting centers and milk production units. All these functions are coordinated by regulatory actors.

#### **4.1.1. Production level**

Half of the breeders are considered to be small livestock farmers with a herd that does not exceed an average of 6 dairy cows. Besides, 89% of the herd is composed of cross-breed animals. The average age of the cow's production does not exceed 6 years in all the regions studied, so that the longevity of the livestock is considered to be low. This latter is influenced by feeding mainly on concentrates. Indeed, because the environment is arid, farmers try to fill the forage deficit by distributing large quantities of concentrates. In addition, the stables are in very bad conditions with the presence of cracks on the walls, piles of stones or cows dung. The condition of the stables is an important factor in the hygiene of the livestock. Unfortunately the stables in the area are poorly built and most of the time very old, they do not respect the space needed for each cow. These conditions negatively affect herd hygiene and promote the spread of diseases such as mastitis and the presence of ticks which affects the quality of the milk produced. According to the survey carried out in Sidi Bouzid, 93% of the breeders do not own grazing areas. These are mainly above-ground farms where livestock keepers do not have forage areas. The forage calendar allows a better understanding of the diet used by breeders. An intensive use of min-vitamin mixture concentrates is observed with an average of 11 tons per year, hay comes second with an average of 414 bales per year. Green forages are the least used. The average quantity is harvested over an area of 1.4 ha followed by sorghum and oats with 1.75 ha and 2.2 ha respectively. The absence of green fodder and forage areas is a limiting factor for dairy production in Sidi Bouzid region and a factor that also influences the quality of milk produced in terms of the richness of essential elements such as protein and fat.

Besides, we have also noticed that nearly 65% of the sample studied possesses one or less than one can which mean that the milk is not properly stored at the farm level. On the other hand, only 53% of the sample do own a milking machine which is a determining factor in the quality of milk and have become an essential equipment for every breeder. Despite its importance, 47% still treat their cows manually, adversely affecting milk quality and lengthening milking time. Energy sources used by livestock producers are usually gas bottles purchased from the city center and sometimes brought back by collectors or nearby points of sale for the heating of the water.

Good practices are also decisive factors in the milk production; unfortunately these practices are almost missing with the breeders of Sidi Bouzid. In fact, almost 55% of the studied sample claimed that they reuse their cans without cleaning with hot water but with cold water and detergents (bleach and rinse). This is mainly due to the lack of materials used to heat water such as solar panels that are available only at the collection centers. Nearly 20% of herders use their cans not only to store their milk but also to transport it to the collection centers themselves.

Concerning milk rejection, more than 63% of the breeders have had their production rejected in previous years at least for one time. The rejection is generally due to the low storage capacity of the collection centers. The majority of breeders saw their milk rejected twice (94%) and only 7 to 9% once.

#### **4.1.2. Collectors**

The role of the collector is very important in the dairy value chain in Sidi Bouzid since it is the interface between breeders and the collection centers. The specificity of the region is that the majority

of the breeders are small with an average of 6 dairy cows. This makes them unable to deliver their own production directly to the collecting centers; the collectors intervene then as intermediaries to remedy this chronic problem. This activity does not require an important know-how but knowledge of the production areas and relationships with the breeders especially those who provide large quantities.

Almost 33% of the collectors have more than ten years experience, which gives them an advantage concerning the collection areas. It should be mentioned that collectors may represent the only way to access inputs and even food products for some farmers. Nearly 40% of the collectors have an experience of less than 5 years, these latter declare integrating this profession after the launch of the milk unit production in Sidi Bouzid since 2012.

There are three different types of collectors: collector-breeder, collector employed and collector-transporter. The collector-breeders represent the majority of our sample with 46.7%; they transport their own milk in addition to the milk of other breeders. They are motivated to carry out this activity for financial reasons (profitability) and for technical reasons (benefits linked to this activity such as the granting of inputs). Employed collectors represent 27% of the sample; they are classified into two categories: employees working for a collection center and employees working for an independent collector-transporter. These collectors are paid monthly, they have a fixed salary and they are held accountable to their employer for each period.

The last category is the collector-transporter, they represent 27% of the sample and are motivated mainly by a maximum amount of milk collected to guarantee a maximum profit (4.8 TND per 100 liters collected).

The services offered to breeders allow the collectors to create a dependency relationship with their suppliers which allow them to guarantee their regular milk supplies. Collectors offer concentrates of poor quality that are inadequate with the physiological needs of the dairy cow, Cash advances to breeders on collected milk (60%), technical and hygienic advice (46.7%) and also sector news (20%). Some collectors are offering more than monetary and technical support, but veterinary support: 20% are in charge of providing vaccines to the breeders, and 13.3% are buying medicines for their suppliers.

Concerning the payment, the majority of the collectors (76.7%) are paid per liter of milk delivered to the centers. This payment system favors the quantity to the detriment of the quality of the milk. The other collectors are paid with a fixed salary which averages 540 TND per month.

Almost 70% of the interviewed collectors refuse to establish a quality payment system. The collector is a trader who seeks financial gain in the first place and is not currently interested in a system that can reduce his profits or increase the rejection of the milk collected. This strategy makes the collection of the milk a step that negatively affects the quality of the milk in Sidi Bouzid region. It should be also noticed that collectors display opportunistic pricing behavior, exploiting information asymmetry between farmers and collecting centers to lower milk purchase prices, especially for farmers who are very far from the milk unit production.

The relationship between the collectors and the centers is apparently synergistic, but it suffers from many conflicts. These issues are the results of the frequent rejection of milk. In fact, nearly 62.7% of the collectors reported having milk rejected from the collecting centers but with different proportions. The milk unit production declares an annual quantity of rejection of around 7%.

Rejections are often due to frauds that can be done either by the breeder or by the collector. Adding water to the milk is the most used procedure and it is known by 93.3% of the collectors. Also, the addition of salt, flour or sugar are fraudulent practices that increase milk density. Some breeders are removing fat from their milk especially during the low lactation because they know that their milk will be accepted anyway and they could use the extra fat to process traditional butter.

In addition of the previous method and during low lactation, some breeders trend to add outdated milk to increase the collected quantity. Some of them may even use chemical agents such as formaldehyde to stop the chemical reaction and retain its quality for a longer time lapse.

For these numerous cheating methods, some anti-cheating measures were used by the collecting centers via the collectors to control the milk quality. The densimeter remains the most reliable and most used method by the collectors with a using rate of 90%. Other control procedure is carried out but always in conjunction with the densimeter, such as the pH meter in 6.7% of the cases. While 3.3% of the collectors are combining taste and milk density as an anti-cheating procedure.

#### **4.1.3. Collecting centers**

Half of the collecting centers are private and owned by individuals while 35.71% belong to the private agricultural services company (SAP) and 14.28% to the Mutual Agricultural Services Company (SMSA). The storage and packaging of milk in the collecting centers is very important to maintain the quality of the raw milk and to maintain optimal conditions for a sensitive and perishable product. The material is made of either stainless steel or aluminum which are two materials suitable for storing milk. Each studied collecting center has an average of 3 storage tanks with an average capacity of 23439 liters. Cans of 40 liters are very common for the transport of milk, 21.4% of the milk cans are made from stainless steel and the 78.6% remaining are made from Aluminum. The collecting centers benefited from the milk plant intervention as a bargaining power with the market for the supply of stainless steel cans to eliminate the use of plastic cans for their detrimental effect on milk quality. The average number of cisterns is 5 tanks per center with an average capacity of 782.5 liters. All the milk cisterns are made from stainless steel.

The storage capacity of the collected milk is a very important factor for the collecting centers. Many breeders have seen their milk rejected because of the saturation of the centers especially during the high lactation season. For this reason, the centers are always seeking to invest and increase their storage capacity as a form of adaptation to the productive potential of the region. The tank truck is also an essential tool for the collecting center. Each one has an average of 3 tank trucks with an average capacity of 34421 liters. They are placed at the disposal of the collectors to ensure the collection of milk from the breeders.

The collecting centers are equipped with solar panels used to heat the water needed to clean the cans, tanks and cisterns. The cleaning of the equipment of storage and transport of milk with hot water is very important to get rid of milk residues that can ferment and affect the quality of the milk collected. Twelve collecting centers out of 14 studied have installed solar panels to compress the costs of heating water. Concerning the cooling units, the studied centers have an average of 5 cooling units.

Dairy cow breeders in Sidi Bouzid region have benefit from the intervention of the collecting centers through feeding and the introduction of concentrate (71%) and hay (30%) which are considered essential for feeding the cattle. Nearly 43% of the interviewed centers provided artificial insemination services for herders. These services are considered essential since the natural breeding is still frequent and its consequences are detrimental to the genetic potential of the cows and their dairy genetic productivity. The collecting centers also supply milking machines and stainless steel or aluminum cans to the profits of the breeders. Milking machines help to reduce the milking time and the effort deployed by the breeder for this activity and help to preserve the milk at the level of the farm. This intervention also contributes to reduce the use of plastic cans for breeders, which adversely affects the quality of the milk collected. With the help of the milk production unit, the collecting centers train farmers to raise awareness of hygiene practices, livestock management, appropriate breeding techniques and good herd management in order to ensure good quality milk rich in fat and protein.

#### **4.1.4. Milk production unit**

Most of the collecting centers in Sidi Bouzid region collaborate with a single milk production unit. Nearly 54% of the centers choose to deliver a single dairy plant, 31% choose two plants and 15% prefer to cooperate with 3 milk production units. Our survey concerned one milk production unit: CLSB Délice (Centrale Laitière de Sidi Bouzid).

The main intervention with farmers can be summarized in training days concerning the importance of fat in milk and adequate feeding practices to increase its level; the milking hygiene; watering and balanced nutrition; training on milking machines and the distribution of gifts such as concentrates and milking machines at the end of each training day.

The milk plant has invested in local human resources in its strategy to improve the collection infrastructure to meet its needs with a solid network that ensures that the processing sites are close to the dairy basin of the center and southwest. Concerning the infrastructure, Délice committed to improve and upgrade the collecting centers in terms of collecting capacities and milk storage. The objectives are to maintain the collected milk in continuous refrigeration by making available to the centers tanks cooled with iced water; to provide cleaning and analysis products and cover 50% of these costs; to provide training courses for center managers on preliminary analyzes and cleaning techniques; to help collecting centers implement the best possible strategy to ensure better milk quality; to eliminate the use of plastic cans: now 95% of the collection circuit in the region use stainless steel cans.

In its strategy to improve the collection infrastructure, the milk plant facilitates the granting of credits to the centers in the form of an advance payments, the only condition is that the investment has to be productive. The region of Sidi Bouzid was very receptive to these investments, which made the collecting infrastructure evolve very quickly in the past few years. The collecting centers owners played a very important role in the dynamics of the sub-sector by their own continuous investments.

This policy of intervention with the collecting centers in Sidi Bouzid is a very effective tool in terms of competition strategy in the market since it is encouraging the collecting centers to deliver 100% of the milk to the CLSB and benefiting from its subsidies.

CLSB Délice has a strict and organized policy on monitoring the quality of milk collected. The milk quality control process is carried out by an internal audit in the form of a "checklist", also inspired by the national specifications. The audit contains information on the center, the audit of the center and the basic requirements in terms of milk collection, the staff of the centers, the hygiene, the storage and analysis conditions at the reception. It deals with several aspects, such as the supplier agreement, the reception and storage volume, the price component and the payment deadline.

The main constraint to the establishment of a quality payment system is the commercial nature of the collecting center. This latter receives incentives from the government on the volume collected, regardless to the quality (0.070 TND / liter as subsidy of cooling). Another problem that affects the quality of the milk collected is the lack of laws prohibiting the supply of milk from different sources.

CLSB Délice now asks for a review of the price policy because it is not adequate to the current situation of the dairy sector in Tunisia. A new price strategy must be used and revised periodically, since prices are not indexed to energy, quality and exchange rates for industrialists, which are important factors in determining price of the raw material. Délice also expressed the ineffectiveness of the current governmental policy because the subsidy of the industrialist (0.170 TND) is not sufficient and does not encourage the development of the processing sector but rather it exerts more pressure on the compensation fund of the government which suffers enormous losses since the reduction of the milk price in 2011. The milk subsidy must be phased out. The price without subsidy per liter of UHT milk will be 1.250 TND and will remain one of the cheapest in the world. The liberalization of the price will provide dynamism to the market and will make it possible to better orient the subsidy of the government towards other needs.

#### **4.1.5. Regulatory actors**

The dairy value chain is regulated by some public organisms; these include the inter-professional group of red meat and milk (GIVLAIT), the Regional Commissariat for Agricultural Development (CRDA) and the Office of Livestock and Pasture (OEP).

The GIVLait is a legal entity of public and economic interest, endowed with a legal personality and a financial autonomy under the supervision of the Ministry of Agriculture, Water Resources and Fisheries. The main tasks of the Inter-professional Group of Red Meat and Milk are the organization of the red meat and milk sectors in addition to the development of the relations between the professions through facilitating dialogue between the professionals on common concerns; the development and implementation of the contractual approach between professionals; the establishment of the organizational bases of the professions; arbitration between professions and promoting transparency in relationships; encouraging the emergence of inter-professional cooperation at the regional level and the promotion and development of small industries.

The CRDA is responsible, within the framework of the governorate, for the implementation of the agricultural policies adopted by the Government. To this end, it ensures the application of the legislative and regulatory provisions related to animal health as well as the defense and protection of animals and to participate in the protection of the environment; it undertakes agricultural extension and technical support and the granting of credit; it conducts agricultural and statistical surveys, allowing better monitoring of the sector and contributing to the development of national and regional agricultural strategies and it encourages farmers to create adequate structures contributing to the promotion of the sector.

The OEP is responsible for promoting and developing the livestock sector. It is currently the main operator in the livestock and food resources development sector and plays a role of adviser and technical reference for the public authorities. It provides the development of fodder and pasture resources: This is done through participation in the development of the production of forage seed; the development of agricultural techniques for the cultivation of fodder, for its harvesting, processing and

packaging; the creation, development and improvement of rangelands and finally the use of agricultural and agro-industrial by-products for livestock feed.

#### **4.2. Market access and channels**

The marketing of milk in Sidi Bouzid may have different distribution channels from production to consumption. The marketing circuit depends on the number of actors and the nature of the final product (See Figure2).

The main distribution channel is the organized channel where the milk passes from the farmer to the collectors and then to the collecting center which transmits it to the milk production unit. Once the milk has been processed, the dairy plant can sell it either to the wholesalers or directly to the retailers through its trucks or to the supermarkets. During the periods of high lactation and in case of markets' saturation, the milk can either be transported to the drying unit of Mornaguia or exported to Libya or Algeria through an export subsidy of 0.200 TND per liter. A second circuit where large breeders can deliver their milk directly to the collecting center without going through the collectors by their own trucks. In reality, these breeders are close to the collecting centers and they will be the ones earning a premium of 0.030 to 0.040 TND per liter normally dedicated to the collectors. Another circuit where traditional dairy manufacturing units buy milk legally from collecting centers or illegally from low-cost collectors during high lactation season. Milk can also be processed on-farm by breeders into traditional dairy products (Raieb, Goutta, local cheeses, etc.).

In Sidi Bouzid, most of the collecting centers sell milk to the Delice dairy plant (CLSB), but there are other collecting centers that prefer deliver the milk to other dairy plants that are less demanding in quality standards. Other centers prefer to deliver several customers in the same time. Despite the price fixing of milk at the production and consumption levels, in addition of government premiums, the added value differs from one circuit to another. Some actors such as collectors make speculation of prices to gain extra margins at the expense of breeders.

According to our survey, the cost of producing one liter of milk in Sidi Bouzid ranges between 0.746 TND in Ettouila region (Sidi Bouzid West) where farmers grow fodder crops and 0.846 TND for breeders who practice enclosed breeding. The margin of the breeder is in most cases negative despite the increase in milk price of 0.030 TND in April 2017. The margin of the collector is between 0.030 and 0.040 TND but this margin can be negotiated upwards through the delivery of cows' fodder (concentrate, hay, straw, etc...). They receive between 0.500 TND and 1 TND per transported bag. The total amounts of these services are deducted from the breeder monthly recipe given by the collecting center.

The margin of the collecting centers varies according to the payment of the milk production unit and the fat milk content delivered with a minimum of 0.014 TND per liter. Collecting centers receive a collection premium of 0.070 TND per liter. According to our estimation (conducted surveys), the minimum net margin of the collecting center averages 0.008 TND per liter for a daily collection of 20528 liters. The margin of the industrialist became 0.329 TND per liter of milk following the premium granted by the government in April 2017 of 0.030 TND. Milk production units benefit from two premiums: a storage premium of 0.050 TND and a consumption premium of 0.115 TND. The margin of the wholesaler is 0.007 TND per liter and it is 0.024 TND for the retailer.

The rise in raw material prices for farmers and industrialists prompted the government to intervene by giving each actor 0.030 TND to maintain their profit margin. Nevertheless, the government was forced to maintain the selling price of the milk fixed (1.120 TND) in order to preserve consumer purchasing power by supporting this increase by the general compensation fund. This intervention remains insufficient according to the farmers and the industrialists who wish to liberalize prices at the level of the sector.



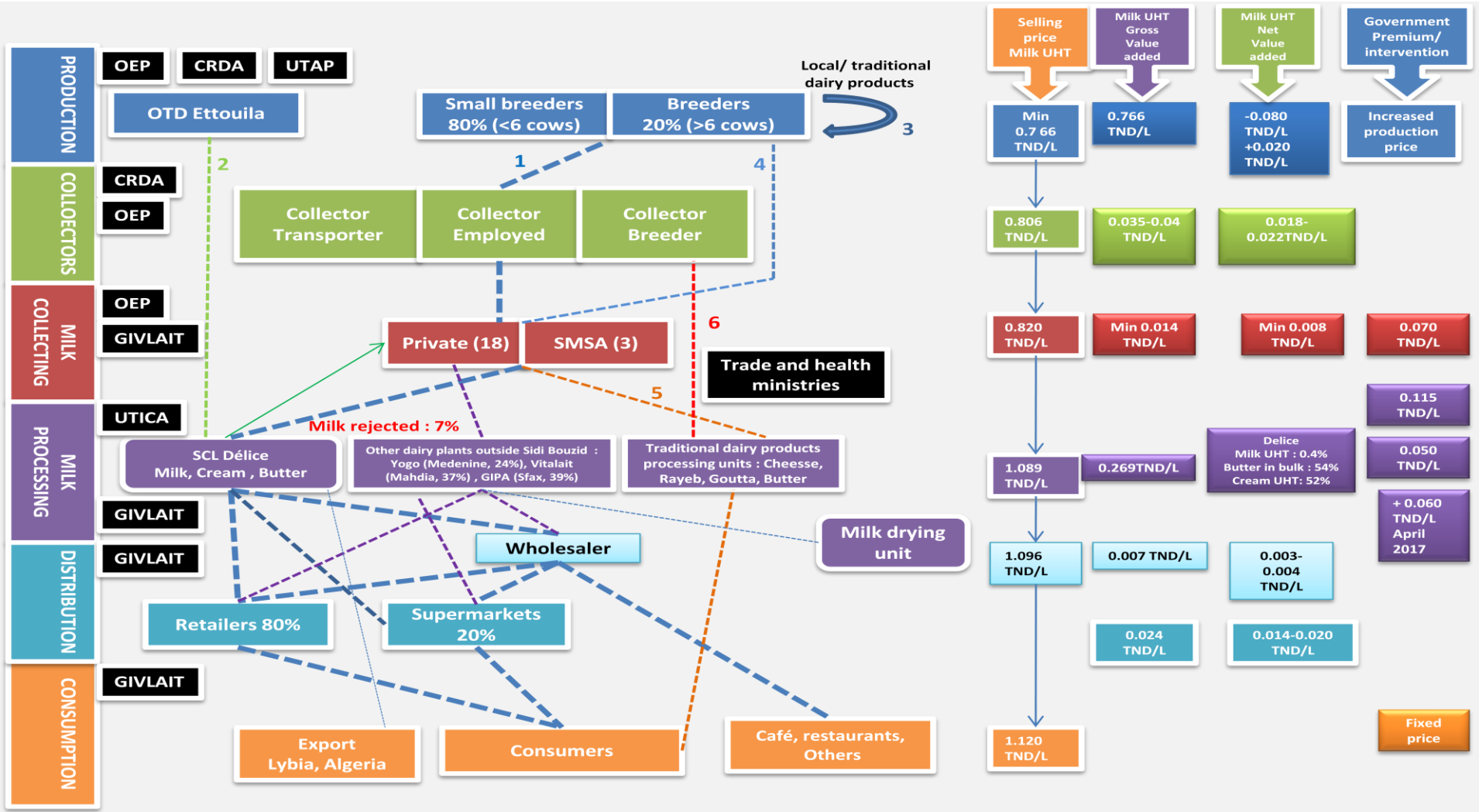


Figure 2. Mapping of the dairy value chain in Central Tunisia

### **4.3. SWOT analysis along the dairy value chain**

The SWOT analysis allows highlighting the main strengths, weaknesses, opportunities and threats along a value chain.

The weaknesses of the dairy value chain are numerous and relate mainly to the lack of hygiene (cleaning practices, stables in poor conditions), an unbalanced ration (concentrate-based ration and a forage deficit), the low bargaining power of breeders over the milk collectors and unfavorable weather conditions and the rising of production cost. The weak professional organization and the lack of support from governmental institutions (extension officers, inseminators, veterinary services, banks (BNA/BTS), etc...) are also seen as significant weaknesses. Another weakness is linked to the concentrated fodder market held essentially by the owners of the collecting centers and who are speculating about prices with the breeders. For example, some farmers are using a homemade concentrate formula to avoid the opportunism of Sidi Bouzid suppliers and to have the best possible concentrate quality, with a better price / performance ratio.

At the collectors' level, weaknesses are generally related to the informal relationship between them, the breeders, and the collecting centers. Fraud and opportunistic practices are recurrent in addition to the lack of a quality payment system and the means to detect frauds.

Concerning the collecting centers, the weaknesses are mainly linked to the milk collecting system which is based on quantitative and not on qualitative system. In addition, some collecting centers do not respect the hygienic requirements of the specifications and present failures in the equipments used. An informal relationship with milk suppliers affects directly the quality of milk in this region especially during low lactation (Only the quantity of milk collected imports whatever its origin or quality).

At the processing level, weaknesses are related to the lower quality of milk that arrives at the dairy plant and which causes considerable losses after canning it, the low added value of UHT drinking milk averages the 0.4%, and the difficulty of applying quality standards in the presence of a disorganized value chain, and finally the low demand for UHT milk during periods of high lactation and the narrowness of the export market. In this sense, in high lactation periods, the public authorities put pressure on the dairy plants to accept the milk delivered by the collecting centers when they reached the strategic UHT drinking milk stock.

The dairy value chain presents some forces at the different levels. At the production level, the value chain creates work and income for thousands of farmers. In addition, the rural area became specialized in dairy cattle breeding. In other words, breeders are ready to invest for improving their milk productivity. Concerning the milk collectors and despite the dominance of informal relations, they are covering the entire production area; they are young people graduated from universities and they provide beneficial services to breeders. The strengths of the collection level are essentially linked to the desire of the old centers to invest in the quality approach in collaboration with the Délice dairy plant (CLSB). In addition, the owners of collecting centers are usually businessmen who are willing to invest to modernize the collection infrastructure. Concerning the link of the transformation, the equipments used are very modern and the dairy plant has considerable bargaining power in relation to the collecting centers, especially with its support and control strategy (investments, training, audit, levy on collectors, sanctions etc...).

The threats of the dairy value chain in Sidi Bouzid are real and can jeopardize its development. At the production level, the dominance of soilless breeding system and the increase in input costs directly affect the profitability of dairy farmers, especially with the fixing of the production prices. In addition, the reluctance of banks to finance the sector is a threat that is hindering livestock producers to improve their conditions. In this sense, the lack of hygiene causes health risks and the appearance of communicable diseases such as Tuberculosis. Concerning the milk collectors, the dominance of informal actors (without a professional card) results in a multiplication of opportunistic behaviors and presents itself as a threat to the development of the milk value chain in Sidi Bouzid. Also, collectors do not pay attention to the hygiene of the collecting equipments (plastic cans) and make rounds of more than 2 hours which adversely affects the quality of the milk. The threats of the milk collecting link relate mainly to the dependence on the informal circuit, the increasingly high costs of storage and cooling equipment, and in relation to the payment of milk which is based mainly on quantity than quality. The threats of the transformation link are related to higher production costs, lower milk quality (low fat), opening to foreign competition and outdated quality standards.

Several opportunities exist at the different links of the dairy value chain in Sidi Bouzid. At the production level, the improvement of the breeders' technicality, the integration of the milk cooling technology and the adoption of mixed feeding are all opportunities to improve milk quality and the breeders' income. Also, the continued growth in demand of the national dairy market is a positive factor in increasing the productivity of dairy cows in Sidi Bouzid. At the collectors' level, the organization of this link is a very important opportunity for the milk value chain in Sidi Bouzid by the updating and the execution of the specifications charts. The Government should seize the opportunity to make young graduates and collectors-breeders work in this value chain in order to improve the provided services. At the level of collection, the modernization of collecting centers, the increase in their number (closer to the production areas) and the installation of the quality payment system are essential opportunities for improving the quality of milk. At the level of the transformation, opportunities are linked to the export markets' potential, the release from the government control, and the improvement of milk quality especially the fat content.

#### **4.4. Suggested interventions from main stakeholders**

The relevant stakeholders of the dairy value chain of the Sidi Bouzid governorate proposed some interventions to overcome the challenges encountered at four levels: the production, the milk collectors, the milk collecting centers and the milk processing units.

At the level of production, five main challenges are identified:

1. Lack of forage is a major constraint, especially for small farmers. A partnership between the OTD Ettouila, the big breeders and the OEP of Sidi Bouzid is possible to produce fodder for the small breeders with very small cropped areas;
2. Cow feeding is a major constraint for livestock farmers because of the high production costs of inputs, concentrate availability and supplier opportunism. The generalization of the dry-ration (commonly named the Spanish-ration) is a relevant solution to regulate the imbalance of the ration and offer the breeders a customized product. The product is now manufactured and tested on an experimental basis with a private company (Alpha Nutrition Animale);
3. The payment of milk is not made according to the quality and breeders who are producing good milk are punished by this payment system which does not encourage investment in milk quality. In this sense, a legislative text introducing a single system of payment by quality should be formulated in collaboration with GIVLAIT and OEP;
4. The low level of technology of the farmers is a handicap to improve milk productivity and quality. In this sense, several initiatives are formulated:
  - The F.B.S. Project or Délice Farmer Business School in agreement with the G.I.Z. consists in training farmers in technical and management terms so that they are able to carry out their own marketing and accounting.
  - The CRDA and the OEP are planning to develop a technical reference system and implement it in the form of training sessions on quality and supply aspects.
  - The CRDA and the OEP will set up a research and development program to enhance the milk quality by implementing an appropriate breeding system which will be viable and accessible to all breeders in the region.
  - Delice's "Hlib el-khir" project consists of selecting breeders with 4 dairy cows and injecting 4 more, in addition of the milk cooling technology and a training component in several areas such as food and hygiene.
  - The lack of means of the small-scale breeders is the main handicap for the production of a higher milk quality and the integration of the milk cooling technology. In this sense, the actors of the milk value chain in Sidi Bouzid are willing to help the breeders by encouraging small and medium-sized farmers to acquire cold on the farm (premium of 25 to 30% and exemption from V.A.T.), encouraging farmers to acquire green energy for cooling milk (solar panels) (INRAT-ICRADA-GIZ project) and finally commit small investments to support quality at the farm level (from small-scale refrigerated units to small-scale farms, isothermal milk cans, quality control kits, rehabilitation of barns, new milking equipment etc.).

At the milk collectors' level, the main constraint is the lack of organization. In this sense, the General Directorate for Animal Production (DGPA), the CRDA, the GIVLAIT and the OEP must update the specifications of the milk collectors taking into account the social specificity of the region and the number of collecting centers covering the zone. Also, collectors must have their professional card and

apply the requirements in terms of respecting the conditions of milk transport. The ministries of Trade, Health and Interior through their regional structures must apply the specifications and carry out periodic checks on the collectors.

At the level of the collecting centers, two main challenges are identified:

1. The informal relationship between collecting centers and suppliers is the main constraint for improving milk quality. DGPA, CRDA, GIVLAIT and OEP must establish a contractual relationship between collecting centers and breeders but also between collectors and collecting centers.
2. The low quality of milk at the collecting centers is attributed mainly to the non-existence of a quality payment system. In this context, the DGPA and the OEP will have to index the storage premium granted by the authorities with the quality of the milk.

At the level of milk processing units, three main challenges are identified:

1. The main handicap for the development of the milk value chain is the continuous increase in the cost of milk production related to the continuous rise of material prices and the devaluation of the Tunisian money while the consumer price of UHT milk is fixed. The ministries of Agriculture and Trade in addition to the GIVLAIT are called upon to revise pricing and subsidy policies in order to give the stakeholders in the value chain a profit margin enabling them to follow a quality policy. In this context, GIVLAIT proposed a strategy to increase the consumption price of UHT milk by 0.260 TND until July 2019.
2. During periods of high lactation, the dairy plants are confronted to a continuous pressure from the collecting centers pushing the authorities to have a deal with the dairy plants: these ones will accept the milk surplus while the Government will pay for it in the form of a subsidy or purchase, such as the agreement between the Ministry of Education and dairy plants in 2016. DGPA, GIVLAIT and UTICA have taken measures to encourage the export of milk (premium of 0.200 TND per liter), the drying of milk and the improvement of the storage premium. However, these actions remain inadequate and a strategy of market adjustment is essential.
3. For the dairy plant, the existing quality standard is very old and it is imperative to revise it with the new market requirements. All stakeholders in the value chain are called upon to work together to raise the level of milk quality in this value chain.

## 5. Conclusion

The objective of this paper is to diagnosis the dairy value chain in the governorate of Sidi Bouzid in Central Tunisia. The Information obtained through the field surveys, focus group discussions, literature review and participatory approaches, allowed to identify the main stakeholders of this value chain.

The main results show that the major threats that may jeopardize its development are the increase in the production costs and the deterioration of the livestock producers' profit margins. Also, the collector's link is not organized and constitutes a significant risk for the development of this value chain especially on the qualitative side. The collectors are deteriorating the quality of milk with fraudulent practices and taking a share of the breeder's profit margin by exploiting their relationship of dependence with those who are far from the collecting centers. The threats of the milk value chain in Sidi Bouzid are also linked to the current regulations which do not encourage the investment on quality but to produce more milk with a minimum of quality because the whole chain is based on the quantity.

The analysis of the milk value chain in Sidi Bouzid shows also the important opportunities related to the qualitative aspect and the creation of added value. At the production level, the opportunity is to solve the problem of nutritional imbalance by introducing, for example, the dry ration (or Spanish ration) which can improve the cow's productivity. Encouraging breeders to group together in cooperatives to benefit from the various advantages of the Government is also an important opportunity for this value chain. Cooling milk on the farm level, which makes a consensus between the main stakeholders in the milk value chain, is a very important opportunity to move from the quantitative to the qualitative objective. Nevertheless, actions taken in this direction by the State (granting a cooling premium of 0.020 TND) or by the development projects remain insufficient. Today, there is no real public strategy to introduce cold on the farm in the milk value chain in Sidi Bouzid or elsewhere. The organization of the milk value chain and especially milk collectors through a specification chart and contracts is an important opportunity that will reduce frauds and parallel

circuits and it will improve the milk quality. At the moment, the dairy plant refuses to pay any milk cooling costs to the breeder before the organization of this value chain.

Margins of the different stakeholders should be improved by increasing the prices at the consumption level. Without sufficient profit margins, the improvement of milk quality is not possible. In its dairy milk preservation strategy, GIVLAIT proposes an increase in the price of milk at the level of the consumer of 0.260 TND/liter to reach 1.380 TND/ liter in July 2019. Also, a financing fund of the milk value chain will be created and it will be financed by the different stakeholders of the milk value chain at a national level.

The milk value chain in Sidi Bouzid shows a governance problem that remains strongly linked to the economic and social stakes of this value chain (Del Pretea et al, 2018; Mishra and Dey, 2018). The organization of the milk collectors, the revision of quality standards, the cost of implanting milk cooling technology, and the release of prices are all subjects of a conflict of interest between the stakeholders, in addition of the integration of the social aspects. In this sense, the social pressure of certain actors (milk collectors or collecting centers) pushes the public authorities to advantage the quantitative objective over the qualitative aspect.

To conclude, a better coordination between the different links in the milk value chain is essential to ensure the best possible milk quality without reducing the profit margins of the various stakeholders.

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