Milk, Trade and Development in the Sahel

Socioeconomic and environmental impacts of European vegetable fat dairy blend imports in West Africa

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Final report

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Detailed summary

1. Since 2018, a consortium of West African civil society organizations and European NGOs has been advocating for the creation of a policy framework that would enable the sustainable and equitable development of local dairy value chains in West Africa. The goal is to ensure that agriculture and trade policies and corporate investment practices are consistent with UN Sustainable Development Goals and fair and responsible trade rules.

2. Indeed, for the past 20 years, trade policies implemented in West African countries have encouraged the importation of low-cost European milk powder. Over the last 10 years, milk powder imports have been gradually replaced by a new type of product: mixtures of skim milk and vegetable fat in powdered form that is often and improperly called fat-filled milk powder (FFMP). To better reflect their content, we refer to them as “vegetable fat dairy blends” (VFD blends). In 2019, these blends, which originate for the most part in Europe, accounted for more than two-thirds of West African dairy imports. These products have generated considerable controversy with regard to their labeling, nutritional quality and environmental and social impacts.

3. This study seeks to shed light on these controversies and to strengthen the positions of professional livestock farmer and pastoralist organizations. It does so by reviewing available knowledge concerning the comparative socioeconomic and environmental impacts of the different dairy raw materials used in the local dairy value chain. The comparison is made using a set of socioeconomic and environmental criteria which include income, employment, rural development, nutritional security, and the preservation of the environment. Until now, no comprehensive study existed that could provide a complete picture for such a comparative analysis.

4. The study provides a number of indicators based on previously published data. It also identifies the research work that still needs to be done to round out this knowledge and answer the questions raised by this unprecedented situation. This review also emphasizes that sustainable development strategies require trade-offs between several objectives and must therefore be guided by several indicators.

5. Imported powders appear to be particularly effective in providing industries with cheap raw material and enabling them to meet rapid growth in demand. These imports now account for 40% of the available milk in the region, and up to 90% in some coastal cities such as Dakar. These imports have enabled the emergence of a West African dairy processing sector that has created many urban jobs and has made it possible to market inexpensive processed dairy products. Average per capita consumption has been maintained at 20 kg/capita/year (> 50 kg/capita/year in Sahelian countries) despite rapid population growth and sustained urbanization. These powder imports also have helped secure European jobs in the production and processing sector under a strategy to capture export markets.

6. However, the economic and social objectives justifying the strong growth of these imports have overshadowed a number of other objectives that are essential to sustainable

development in Africa. In particular, the role of local livestock farming in creating employment in rural areas has been overlooked, despite the fact that millions of pastoral and agropastoral families produce milk in the region. It is estimated today that only 20,000 pastoralist families are involved in industrial milk collection in West Africa, whereas the potential is much greater. Moreover, the share of milk collected varies between only 1 and 7% of the total milk produced, depending on the country. Importing industries have thus neglected the dairy sector's role in creating outlets for local livestock farmers. Similarly, the use of standard grade imported raw materials has led to a decrease in the quality of dairy products consumed in West Africa.

7. Yet the region has a rich pastoral dairy culture based on numerous dairy products and know-how that appear to be grossly undervalued today. Available data on the environmental impact of pastoral and agropastoral livestock production furthermore show that these extensive and semi-extensive production systems are particularly suited for reducing the carbon impact of the dairy sector, preserving the biodiversity of ecosystems, and limiting deforestation. For example, the greenhouse gas (GHG) balance of Sahelian pastoral territories may be close to equilibrium due to the importance of natural pastures and soils in carbon sequestration. The local milk collection systems implemented by some 20 industries and 300 mini-dairies in the region show that this model could have a promising future, provided that livestock farms can change their feeding practices and that dairy companies can invest in collection systems.

8. In contrast, the available literature suggests that the environmental impacts of mixtures of skim milk and vegetable fat in powdered form are problematic, due in particular to the incorporation of non-certified palm oil, i.e., without environmental guarantees. These products also carry the risk of misleading consumers, as some labels do not meet Codex standards. It is estimated that 30% of the products consumed in the region do not meet Codex labeling standards. Today, the surging share of vegetable fat dairy blends in European exports to Africa raises the question of "responsible" exports, and calls for West African policies to reconsider modes of integration into international trade.

9. Based on this review, we suggest a number of recommendations for the actors involved in these sectors. First, this initial review should be supplemented by research and studies to fill gaps in the data. Second, nomenclature and labeling practices need to evolve. Third, European dairy companies should develop responsible export and investment strategies and approaches. Lastly, tax measures and incentives should be targeted to encourage local milk collection.

Summary of the impacts of the use of the different raw materials (see Table 11 p 54.)

Controversies	**Critical points**	**Vegetable fat dairy blends**	**Whole milk powder**	**Local milk**
What role in international trade?	1. Meet local consumer demand for milk and dairy products	+++	+++	-
	2. Supply cheap, regular and safe raw material to industry	++	+++	+
	3. Create market opportunities for herders and peri-urban farms	-	-	+++

	4. Create local jobs to reduce poverty, mass unemployment and economic migration	+	+	+++
What are the risks of misleading consumers?	5. Marks of quality that comply with Codex standards and avoid deceiving consumers	-	+	+++
	6. Raw material for the production of dairy products with a high cultural, environmental or heritage value	-	-	+++
What are the risks and benefits for the health of consumers?	7. Raw material to produce products of good nutritional quality	+	+	+
	8. Raw material enabling the production of products of good physicochemical, microbiological and organoleptic quality	-	+	++
What are the environmental issues related to the milk trade?	9. Production methods that respect biodiversity and contribute to the maintenance of ecosystems	-	+	++
	10. Production and marketing methods that limit the use of fossil fuels (non-renewable)	-	+	++
	11. Production methods that limit the emission of greenhouse gases (GHG) and contribute to their sequestration	-	-	++
	12. Production methods that save non-renewable water (groundwater) and cause little pollution	-	-	+

Legend: - : rather negative ; + : rather positive ; ++ : positive ; +++ : very positive

Introduction

For Sahelian countries, severely weakened by various socioeconomic crises and climate change, the sale of milk is a way to improve the living conditions of millions of pastoral and agropastoral families. However, access to commercial outlets for these livestock farmers is limited by growing competition from milk powder imports.

Since 2018, a consortium of West African civil society organizations has been advocating for the creation of a policy framework enabling the sustainable and equitable development of local dairy value chains in West Africa. United under the "My milk is local" campaign, these organizations are raising awareness among West African consumers about the importance of consuming local milk. At the same time, they are lobbying decision-makers at the national, regional and international levels to take concrete steps to strengthen the local dairy sector.

To support them in their efforts, another consortium, composed mainly of international NGOs, has been created as part of a campaign entitled "Let's not export our problems". This consortium works to provide support from Europe to the campaign carried out in West Africa, directing specific demands toward European policymakers and private sector actors, and seeking to raise the awareness of European civil society. The aim is to ensure that the European Union's agriculture and trade policies and corporate investment practices are compatible with both UN Sustainable Development Goals and fair and responsible trade rules.

Indeed, for the past 20 years, trade policies implemented in West African countries have encouraged the importation of low-cost European milk powder. The liberalization of West African dairy markets resulted from these countries' desire to promote regional economic areas (WAEMU and ECOWAS) open to the rest of the world. Increased competition also has been promoted through trade negotiations between West African countries and the European Union (EU), in particular to set up an Economic Partnership Agreement. Low-cost powder imports also have made it possible to meet the particularly rapid surge in demand in large West African cities. On the downside, the imports compete heavily with local milk, and are slowing the development of local collection systems.

Moreover, the composition of European powder imports has been profoundly transformed. Milk powder has been largely replaced by a new product which is not a dairy product in the strict sense of the word: blends of skimmed milk and vegetable fat in powdered form commonly and improperly called fat-filled milk powder (FFMP). To better reflect their content, we refer to them as “vegetable fat dairy blends” (VFD blends). These blends, consisting notably of palm oil, are about 30% cheaper than whole milk powder. The two opinion campaigns involved have denounced this situation because the use of these blends is distorting competition even more than milk powder. Three studies conducted through the "My milk is local" campaign in 2018 and 2019 (Duteurtre and Corniaux, 2019; Levard *et al.*, 2019; Larondelle, 2020) emphasized that vegetable fat dairy blend imports represented a major obstacle preventing the Sahel dairy sector from realizing its full potential. These studies also highlighted the risk of deceiving consumers due to labeling practices that do not conform

to international standards, as well as some questions about the impact of trade on consumer health and the environment.

To shed light on these controversies, and to strengthen the positions of professional livestock farmer and pastoralist organizations, this study takes stock of the available knowledge concerning the impact of European imports on the local dairy value chain. The aim is to take into account and discuss the economic, social, environmental, health and nutritional impacts of these imports. The study proposes a comparative analysis between local milk and imported milk powder (whole and blended). The comparison is made using a set of socioeconomic and environmental criteria which include income, employment, rural development, nutritional security, and the preservation of the environment. Until now, no comprehensive study had been conducted that could provide a complete picture for such a comparative analysis.

The study provides a number of indicators based on previously published data. It also identifies the research work that still needs to be done in order to round out this knowledge and answer the questions raised by this unprecedented situation.

The report is organized in three parts. The first describes the current situation of the dairy industry. The second focuses on impact indicators. The third concludes by proposing recommendations concerning public development strategies and private investments in different types of dairy sectors in Sahelian countries.

Part 1: Overview of the dairy sector in West Africa

The thrust of this first part is to understand **why blends of skim milk and vegetable fat (referred to henceforth as vegetable fat dairy blends) are problematic in the current context of the dairy market in West Africa.**

After reviewing the three main factors structuring the dairy sector in West Africa (population growth, poverty, Sahelian climate), we describe the main dynamics underway:

- moderate increase in local milk collection,
- industrialization and investments of large European dairy groups,
- increase in milk powder imports and the replacement of whole milk by fat-filled blends.

These recent dynamics have led to a **remarkable rise in the popularity of vegetable fat dairy blend powders.** Despite the controversy surrounding them, **they now account for more than 25% of "dairy product" consumption in West Africa, and even more than 70% in most West African capital cities**.

1. The three factors structuring the West African dairy market

The West African dairy industry operates in an environment defined by three critical factors: population growth, the relative poverty of producers and consumers, and the seasonality of production.

From 1960 to 2017, the human population in the region increased by a factor of 4.3, spurring the creation of urban centers and triggering an unprecedented boom in the sale of animal products. It should be noted that during the same period, the number of cattle increased by a factor of 3.1, in part to meet the growing demand, but also due to internal investment dynamics within agricultural and pastoral systems. **Although the population growth guarantees outlets for dairy products, it also raises the problem of resource sharing further up the value chain**.

The second factor is the relative poverty of West African populations. The average GDP per capita is US$975 for the entire region excluding Nigeria. **The weak overall purchasing power requires sector professionals to provide consumers cheap products**, at least on the retail market. At the level of production, livestock farmers face chronic cash flow deficits. Yet to develop dairy production, a minimum of intensification and investment is required.

The third factor is the low rainfall that prevails throughout the Sudano-Sahelian region, and in particular in the Sahelian countries. The seasonality of rainfall leads most producers to adopt mobile livestock production systems**. As a result, production is generally seasonal and spatially dispersed.** Milk is available for collection above all during

the rainy season. To even out the milk production curve over the 12 months of the year, livestock farmers would have to establish a sedentary dairy group, use costly concentrated feed or agro-industrial by-products, store natural fodder, or cultivate irrigated fodder crops.

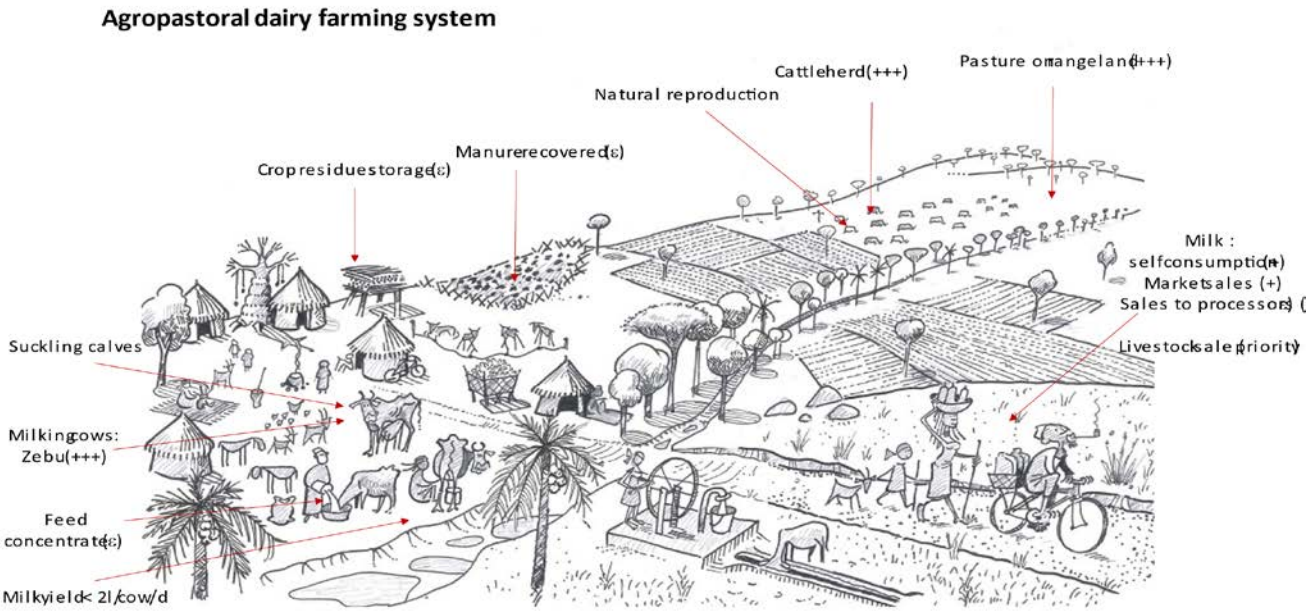
Despite this difficult context, milk collection has seen a certain amount of growth since the early 2000s. Dairy farms, collection centers, transporters and small processing industries have appeared around large cities and certain rural towns, creating outlets for local production and giving rise to genuine dairy basins (Corniaux *et al.*, 2014; Duteurtre, 2013).

2. Key dynamics at play

2.1. Moderate increase in local collections

- **Production dominated by pastoral and agropastoral systems which are not very intensive or productive**

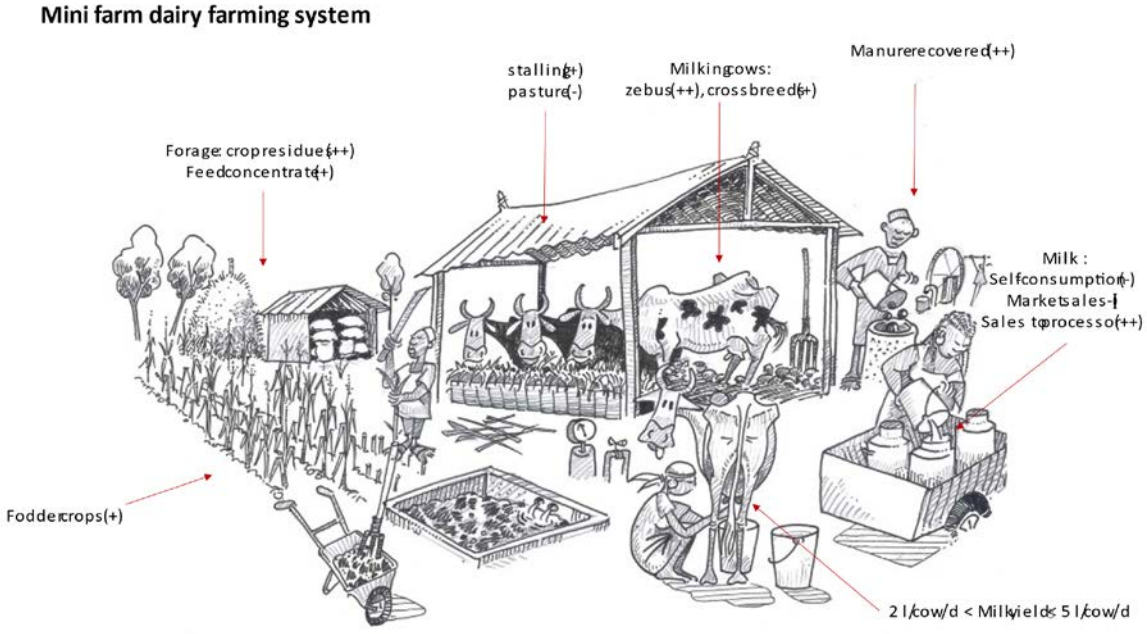
Extensive systems largely predominate, taking the form of pastoral and agropastoral farms located in arid, semi-arid and savanna areas. They account for over 80% of the milk produced (and 95% of red meat). These farms implement cow-calf production systems where milk has never been the main source of monetary income. Production is seasonal and fragmented, and milk productivity per cow is low. Local breeds are suited to pastoral mobility practices that allow the use of natural pastures. Increases in milk production per cow and per herd consequently are constrained by feed, genetic and reproduction factors. Self-consumption of milk is important (system with few market links). (Drawing 1)



(drawing Eric Vall, 2019)

Drawing 1: Diagram of the agropastoral production system

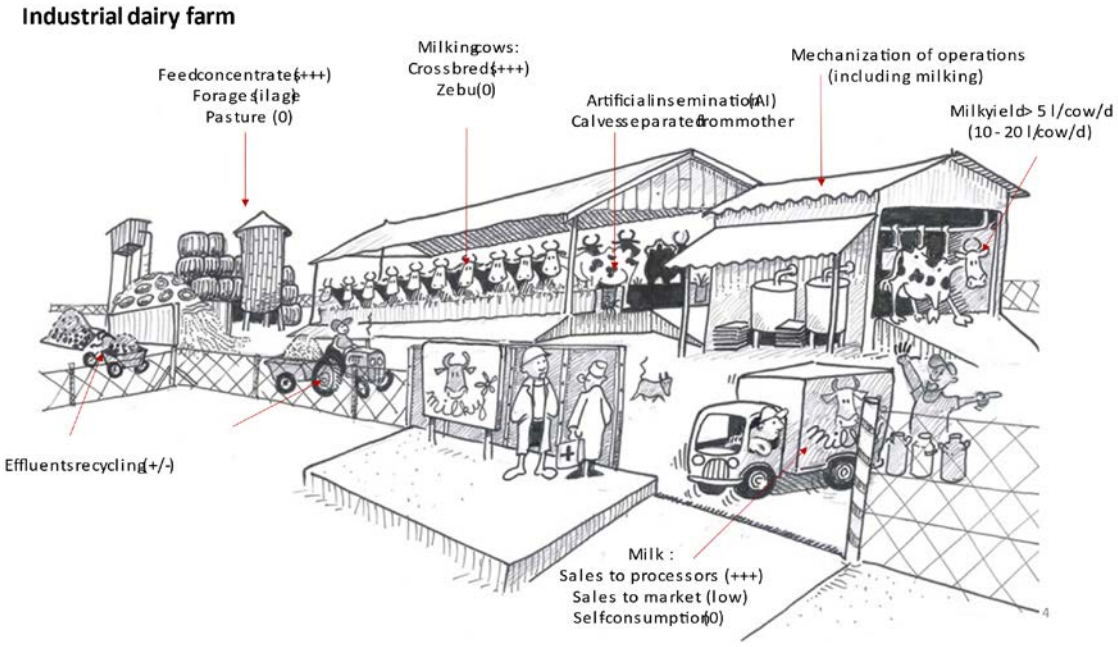
Semi-intensive systems are developing. "Mini-farms" are appearing around urban centers and dairies. They ensure year-round production with a sedentary dairy core (less than 10 cows, including a few crossbred cows) and feed supplements. Most of the production is intended for sale. Productivity per cow is higher, but remains average (Figure 2).



(drawing Eric Vall, 2019)

Drawing 2: Diagram of the small-scale intensive production system

There are still only a few dozen specialized dairy farms in all of West Africa. This is a relatively old dynamic, but one that has accelerated over the past twenty years. Around the capital cities, dairy farms are intensified units, oriented toward the production of fresh milk. This mode of production is costly and reserved for the few livestock farmers capable of investing (genetics, feed, buildings, milking parlor, etc.) (Figure 3).



(drawing Eric Vall, 2019)

Drawing 3: Diagram of the specialized semi-industrial dairy production system

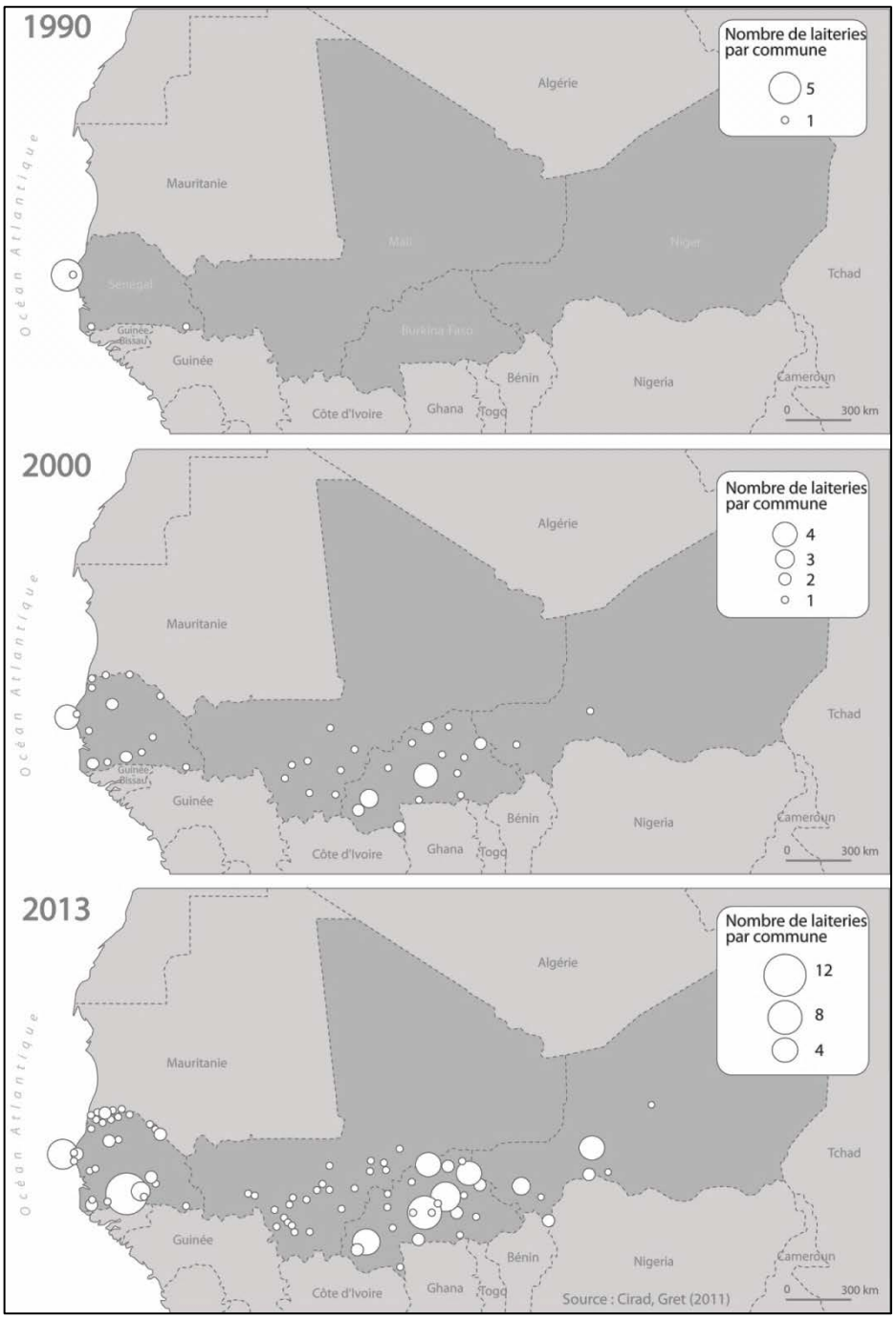
- **Development of rural and peri-urban collection basins**

Population growth is leading to both an increase in demand for milk and a densification of the population in rural areas. **Since the 2000s, regular milk collection networks have been set up. Rural and peri-urban collection basins have been established around small dairies. Their rapid growth is now well established in certain regions of West Africa** (Senegal, Mali, Burkina Faso, Niger). This demonstrates the strength and dynamics of the milk sector (Map 1).

Local production can only benefit from such a boom, despite competition and the possibility of being replaced by imported milk powder. Moreover, downstream from collection, it has given rise to the beginnings of a formal market organization and contributed to the creation, albeit limited, of new niches and dairy jobs, while upstream it has accompanied the intensification of practices.

However, it should be noted that these artisanal enterprises involve only a small number of regions and producers, often located in peri-urban or even urban areas. The national dairy potential is largely underexploited insofar as pastoral communities are excluded from collection due to their scattered locations and the high cost of milk, a highly perishable product in a tropical environment. Lastly, sedentary agropastoralists, who generally are not

among the poorest segment of the population due to the diversification of their activities and sources of income, are the ones who benefit most from the establishment of mini-dairies.



Map 1: Dynamics of the installation of mini-dairies (from Corniaux, 2014)

The rapid growth in the number of processing units has not been easy (Corniaux, 2014). Some face fierce competition in tight and saturated markets, such as in Kolda in Senegal, Niono and Koutiala in Mali or, to a lesser extent, Bobo-Dioulasso in Burkina Faso. Their

vulnerability reflects their inability to export their production to large urban markets and, above all, capital city markets. In other words, they are victims of their commercial isolation.

Conversely, the success of small dairy industries collecting milk in pastoral areas (Tiviski Dairy in Mauritania, Laiterie du Berger in Senegal) highlights the potential of milk collection in pastoral and agropastoral areas. In particular, the convincing example of Tiviski Dairy, which has been collecting over 15,000 liters per day from hundreds of livestock herders in the Senegal River Delta since the 1990s, shows that despite highly fragmented production, the pastoralist model is not doomed to remain outside of market channels. This industrial collection model has the undeniable advantage of avoiding the pitfall of market saturation in medium-sized towns and the geographic limitation of a collection network.

In the end, the emergence of rural and peri-urban dairy basins is a dynamic that remains limited in scope. The share of milk collected by dairies remains low, as shown in Burkina Faso, Mauritania and Senegal (Table 1). In these three countries, the share of milk collected is estimated at 3.1%, 5.8% and 7.8% of milk processed, respectively. This share is slowly increasing. **The low percentage of milk collected in rural and peri-urban areas indicates that there is significant room for improvement in the use of "local milk".**

Table 1: Estimated share of cow milk collected by dairies in Nigeria, Burkina Faso, Mauritania and Senegal (2017).

Country	Total cow milk production (millions of l/year)	Collection by dairies (millions of l/year)	Share of milk collected in total production
Nigeria	607	6	1.0%
Burkina Faso	129	4	3.1%
Mauritania	365	21	5.8%
Senegal	180	14	7.8%

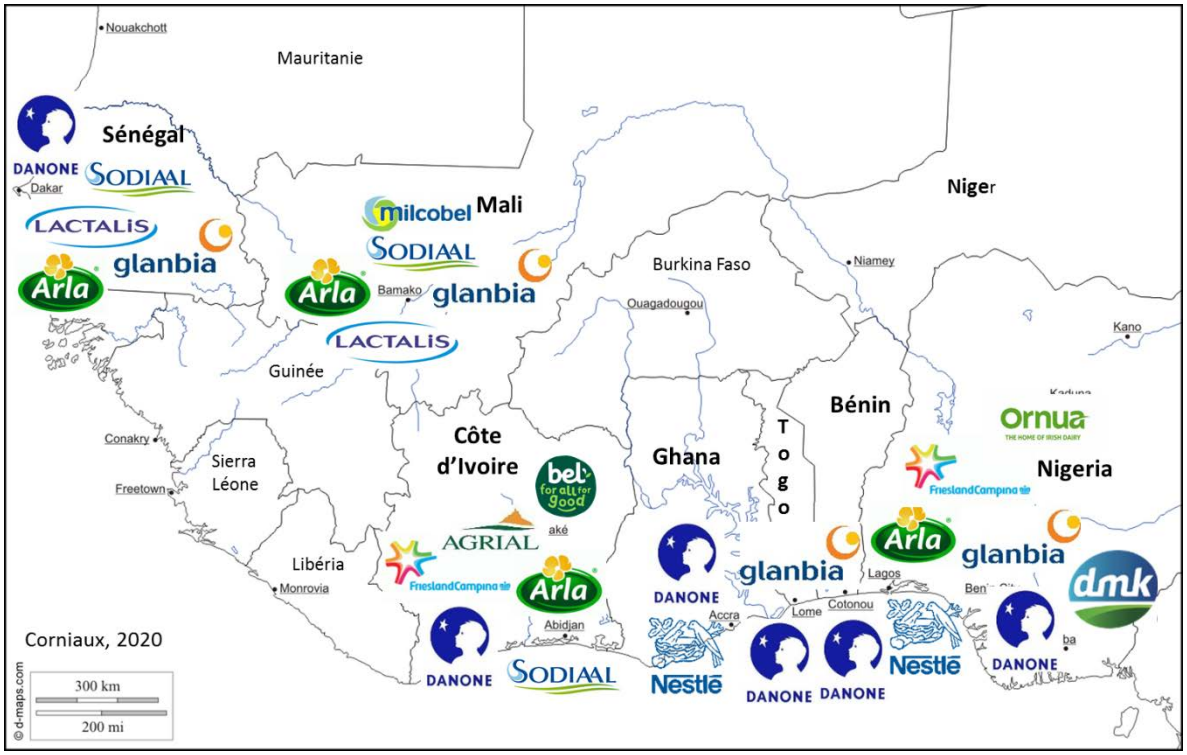
From Corniaux and Duteurtre, 2018

2.2. Investments by major European dairy groups

After numerous failed dairy plant projects in the 1970s to 1990s (Duteurtre, 2013), **dairies underwent a new phase of expansion in the 2000s**. They first relied on a raw material that was cheap and convenient to store and process: powdered milk. Today, **out of a hundred or so manufacturers in West Africa, about 80% use milk powder exclusively**. Half of them specialize in repackaging, from bulk to aluminum bags of 20 g to 500 g. Based in capital cities, i.e., close to consumption centers, and initially working on a limited number of products, these factories have gradually diversified. In addition to repackaging milk powder, they now

manufacture a wide range of products, including yogurt drinks (in bags), pasteurized or UHT milk, yogurt in jars, cottage cheese and milk-based drinks. Some companies also produce fruit juices.

In this dairy industry landscape, local milk plays a relatively minor role. Diaries all use powdered milk, with the notable exception of the Fada N'Gourma Dairy (Burkina Faso) and dairies in Mauritania. **However, the role of local milk has been increasing since the end of the 2000s**.



Map 2: Positioning of European dairy multinationals
in West Africa

The major development in recent years has been the establishment of European multinational dairy companies in West Africa (Corniaux, 2015; Corniaux, 2018) (Map 2). The presence of European dairy groups in West Africa has a long history. Nestlé invested there in the late 1950s. Lactalis and FrieslandCampina (or their precursors) have business relationships dating back several decades. However, the increased presence of large groups is a recent phenomenon dating from the 2010s. The first factor is undoubtedly the surge in population growth in major West African capitals. Today, Dakar, Abidjan, Accra, Bamako and especially Lagos each have more than two million inhabitants. **The size of the market is no longer an obstacle to industrial investment**, even if it is necessary to sell micro-dosettes - as Nestlé always has done - to reach the poorest people. **However, the foremost accelerating factor is the end of milk quotas in Europe**. Milk quotas, which previously governed the European market, were lifted in April 2015. As expected, production has increased significantly in

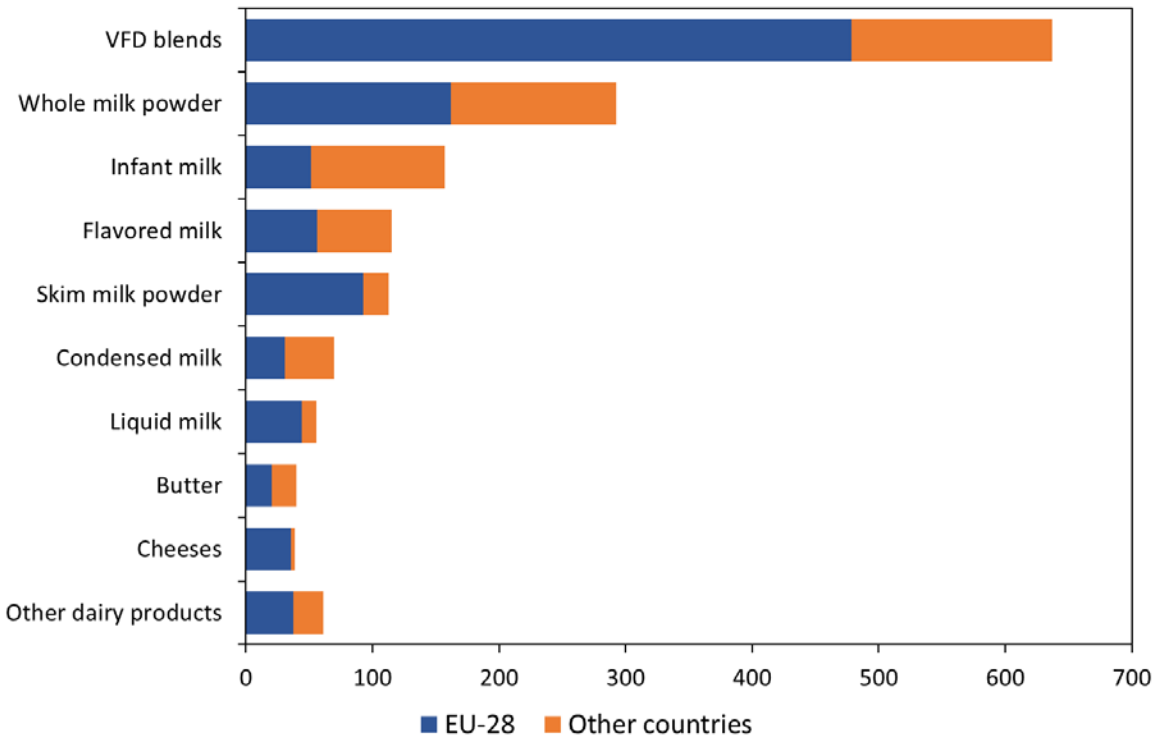
northern European countries and Ireland. Arla (Dk), FrieslandCampina (Nl) and Glanbia (Ir) have seen dramatic increases in collection of 20-30%. Drying towers have been built. In a context of a stagnating European market, an embargo on the Russian market and the restructuring of Chinese milk production (the world's largest importer), European firms accelerated their exploration of promising new markets. The priority for these northern European firms was undoubtedly to dispose of surplus milk powder and gain market share in West Africa. **They have relied on existing industrial infrastructure to develop their activities**. With the notable exception of Nestlé, all European dairy firms are associated with private companies established in West African countries. They thus benefit from administrative facilities, market knowledge and distribution channels. Several types of partnerships are possible, ranging from exclusive contracts to franchises, licenses and joint ventures, and even takeovers.

2.3. Increase in imports and replacement of milk by vegetable fat dairy blends

- **Increase in vegetable fat dairy blend imports**

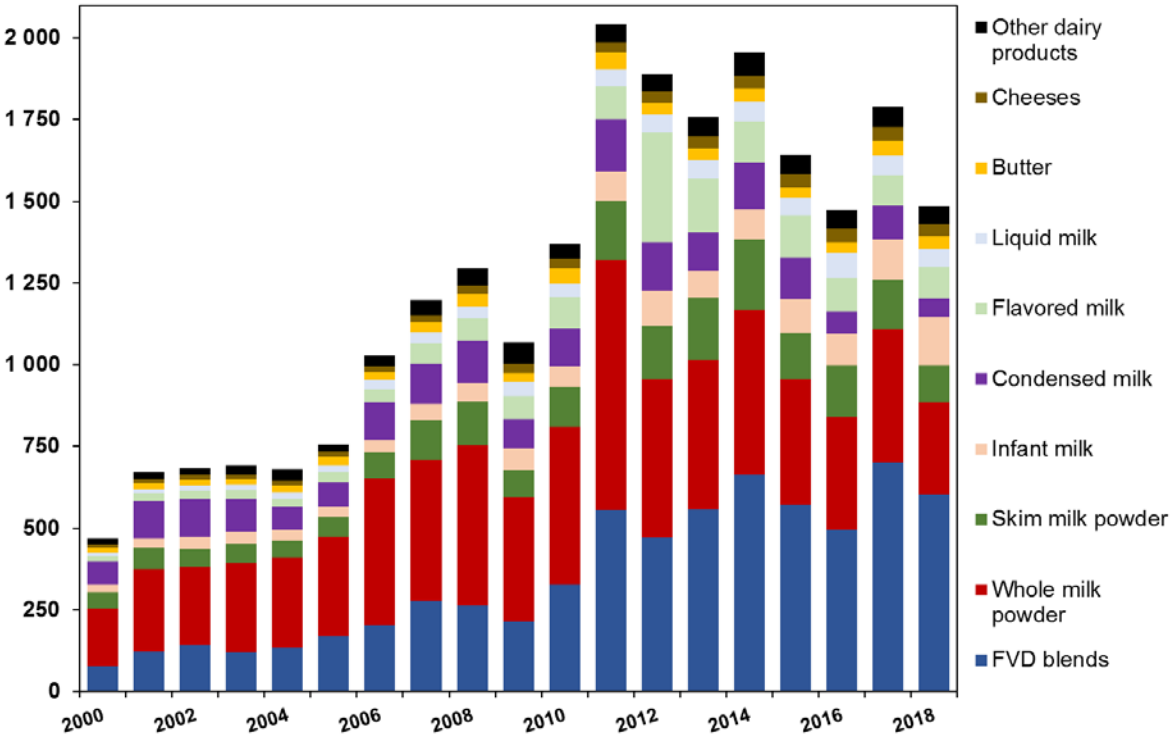
All West African countries have a milk deficit and import dairy products, mainly from the European Union (Figure 1, map 3).

Since 2015, the value of imports has oscillated between €1,500 and €1,800 million (Figure 2). With nearly 200 million inhabitants, i.e., half of the population of West Africa, **Nigeria is by far the largest importer** (Figure 3). **With a wealth of dairy industries, Senegal, Côte d'Ivoire, Mali, Ghana and Mauritania rank next**. Imports in these countries primarily cover the needs of urban consumers and the commercial share of milk consumed. **Imports have been increasing in all countries for decades and accelerated in the 2000s. They primarily have shifted toward imports of mainly milk powders, and more particularly of skimmed milk powder re-fattened with vegetable fats (generally palm oil). This cheap raw material is gradually replacing whole milk powder in value but also, and especially, in volume** (Figures 2 and 4).



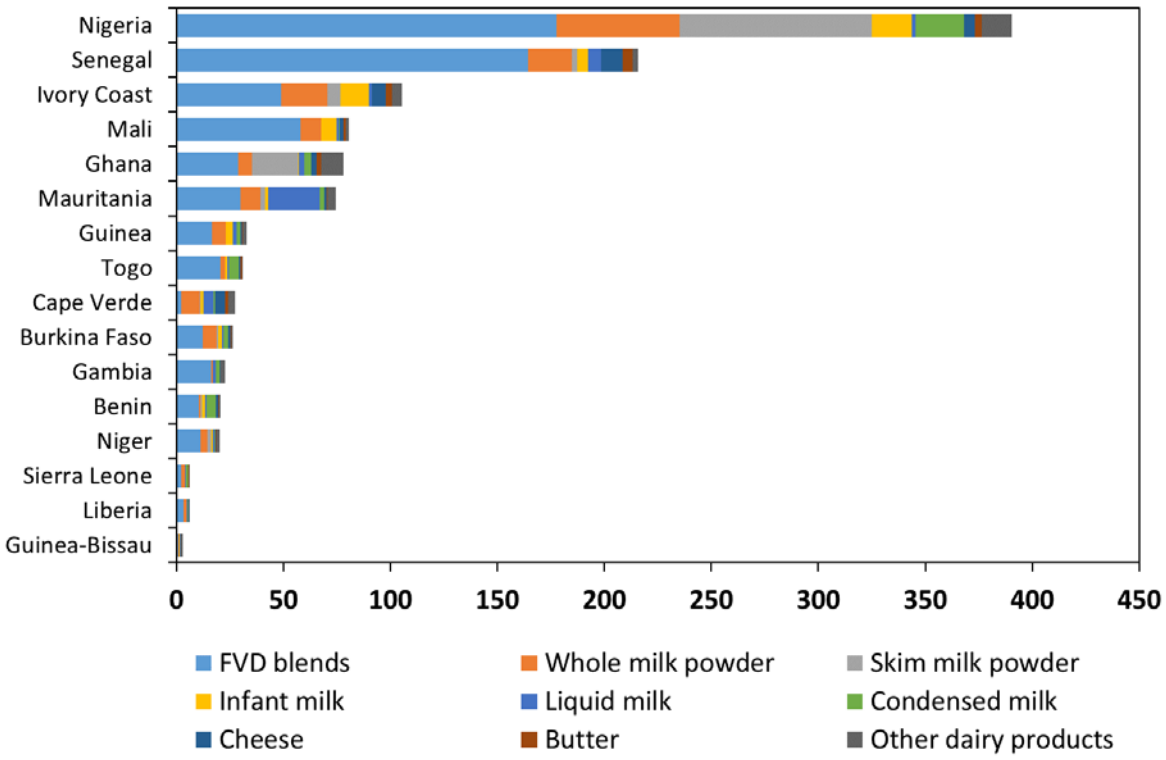
Sources: BACI / SMART-LERECO processing

Figure 1: The EU's share of dairy products and vegetable fat dairy blends imported into West Africa in 2018 (millions of euros).



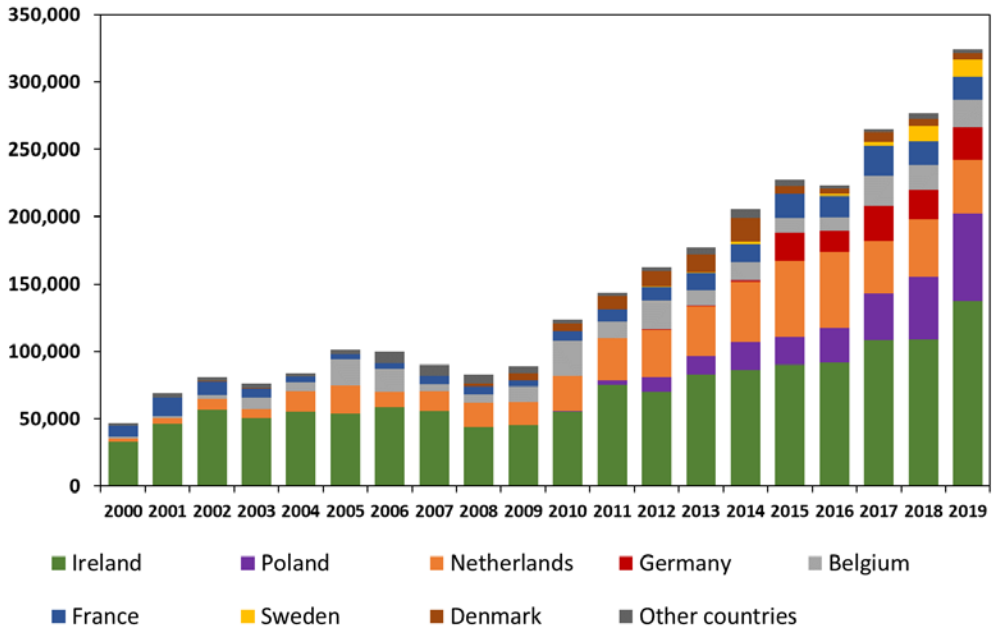
Sources: BACI/INRA SMART-LERECO processing

Figure 2: West Africa's imports of dairy products - changes between 2000 and 2018 by product type (million euros in current exchange rates).



Sources: COMEXT / SMART-LERECO processing

Figure 3: Imports of dairy products and substitutes to West African countries (million euros in 2019)



Sources: COMEXT / SMART-LERECO processing

Figure 4: EU Member States' exports of vegetable fat dairy blends to West Africa (tons, 2000-2019)

EU exports of vegetable fat dairy blends to West Africa have increased quite rapidly over the past decade. They **rose from an annual average of 81,000 tons between 2000 and 2009** to 173,000 tons between 2010 and 2015 **and reached 324,000 tons in 2019 (Figure 4).** They have outpaced imports of whole milk powder since 2012 (Figure 2).

The top five European countries exporting vegetable fat dairy blends are, in descending order, **Ireland** (42% of European volumes exported in 2019), **Poland** (20%), the **Netherlands** (12%), **Germany** (7%) **and France** (5%). Since the end of milk quotas in 2015, the increase in exports is mainly due to Ireland and Poland, two countries that at the same time have recorded a substantial increase in their domestic milk production.

- **Reasons for the increase of vegetable fat dairy blend imports to West Africa**

→ A growing West African market

The rise of skim milk powder and palm oil blends in West Africa is primarily due to the growth of a market for low-end food products. It is mechanically supported by population growth, which is around 2.5% per year (well above the world average of 1.1%). It is aimed at a population of approximately 400 million people whose purchasing power is generally low, at often less than two euros per day per inhabitant. In addition, West Africa meets barely half of its domestic milk needs (Corniaux, 2015), with domestic production that is not very accessible (in terms of volume and price) for urban consumption centers. These conditions therefore favor vegetable fat dairy blend imports, especially since import taxes are very low. The Common External Tariff (CET) of the Economic Community of West African States (ECOWAS) is set at 5% for milk powder and vegetable fat dairy blends (Tables 2 and 3).

Table 2: CET levels in the WAEMU and ECOWAS zones for dairy products

Nomenclature (HS6)		CET Category	CET level
040210	**Milk and cream powder with a fat content <1.5%.**		
	(available in pharmacies)	1	5%
	(packaging of more than 25 kg sold outside pharmacies)	1	5%
	(packages of less than 25 kg sold outside pharmacies)	2	10%
040221	**Milk and cream powder with a fat content >1.5% (**sold in pharmacies or in packages of over 25 kg)	1	5%
	(packages of more than 25 kg)	2	10%
040229	**Concentrated or powdered milk and cream with added sugar**		
	(available in pharmacies)	1	5%
	(packaging of more than 25 kg)	1	5%
	(packaging of less than 25 kg)	2	10%
040291	**Concentrated milk and cream without added sugar or other sweeteners**		
	(packages of more than 25 kg)	2	10%
	(packages of less than 25 kg)	3	20%
040510	**Butter**	3	20%
040520	**Dairy spreads with a milk fat content > 39%.**	3	20%
040590	**Other butter oils and industrial butterfats**	1	5%

Source: ECOWAS CET 2017 Sydam World Version revised wording (CI customs website http://www.douanes.ci/PDF/TEC_SH2017_20180420.pdf)

Table 3: CET levels in the UEMOA and ECOWAS zones for vegetable fat dairy blends

1901	**Malt extract; food preparations of flour, groats, meal, starch or malt extract, not containing cocoa or containing less than 40% by weight of cocoa calculated on a totally defatted basis, not elsewhere specified or included; food preparations of goods of headings 04.01 to 04.04, not containing cocoa or containing less than 5% by weight of cocoa calculated on a totally defatted basis, not elsewhere specified or included.**		
Of which:			
19011000	**Preparations for children's food, packaged for retail sale**	1	5%
19012000	Mixes and doughs for the preparation of bakery, pastry or cookie products	2	10%
19019010	**Milk-based preparations containing vegetable fats, in powder or granular form** (packages of more than 25 kg)	1	5%
19019020	**Milk-based preparations containing vegetable fats, in powder or granular form** (12.5 kg to 25 kg packages)	1	5%
19019030	**Malt extracts**	1	5%
19019040	**Powdered preparations containing malt extracts, for the manufacture of beverages (packages of more than 25 kg)**	2	10%
19019091	**Cassava-based food preparations** (including "Gari")	3	20%
19019099	**Other** (including milk-based preparations containing vegetable fats, in powder or granules, in packages of less than 12.5 kg)	3	20%

Source: UEMOA CET 2014 (website http://www.uemoa.int/sites/default/files/bibliotheque/brochure_tec_der_170117.pdf) and ECOWAS CET 2017 Version Sydam World revised wording (CI customs website http://www.douanes.ci/PDF/TEC_SH2017_20180420.pdf)

➔ European measures to encourage the development of supply

The West African market is therefore a godsend for dairy exporting countries, particularly for European countries that recently have increased their milk production following the end of the quota policy in 2015 (Chatellier, 2020). The gradual dismantling of public market intervention instruments also has encouraged industries to innovate in order to dispose of the milk powder stocks accumulated during the 2016-2017 dairy crisis.

➔ Evolution of world prices for food fats

The boom in vegetable fat dairy blends also is related to more general developments involving relative changes in international prices of different fats used by the food industry. In recent years, the price of butter (for European listings) has fluctuated sharply, rising from around €3,000 per ton in December 2015 to nearly €7,000 in September 2017, only to fall back to €3,500 in April 2020. The price peak was reached in a period when stocks in the main exporting countries (New Zealand and, to a lesser extent, the EU) were limited even as demand grew (Duteurtre and Corniaux, 2018). In response to this demand, manufacturers moved to the commercial valorization of butter and cream, resulting in an increase in the production of skim milk powder. Skim milk powder prices consequently dropped to record lows in 2017-2018, returning to their 2002-2004 level at less than €2,000 per ton. The price of

whole milk powder, on the other hand, rose in 2017 and 2018, fluctuating between €2,500 and €3,000 per ton, highlighting the revaluation of milk-fat content.

This rise in milk-fat prices, at least through early 2018, has contrasted with the steady decline since 2011 in vegetable oil prices. Palm oil, which is 15-20% cheaper than soybean oil, has followed this trend in particular. It was 12 times cheaper than butter in 2018 (in fat equivalent), and remained six times cheaper in 2020.

In this context, vegetable fat dairy blends have been about 30% cheaper than milk powders since 2018. This price differential plays a decisive role for many West African consumers.

➔ **Strategies of European dairy firms in West Africa**

As part of their strategy to conquer new markets, all European dairy firms have increased their exports of vegetable fat dairy blends to West Africa. While Glanbia (Ireland) has been a pioneer in this market since the 1990s, other multinationals have been involved since the late 2010s. This is the case of Arla (Denmark), Friesland-Campina (Netherlands), Nestlé (Switzerland) and DMK (Germany). In addition to European firms, several other exporters are present on this market.

3. Local availability of dairy products

In West Africa, the consumption of milk and dairy products in 2019 was estimated at 11 to 12 billion liters (in milk equivalent) (Figures 5 and 6). This estimate is questionable due to the lack of reliable statistical data. This is particularly the case for the production of fresh milk and, in particular, for fresh milk from small ruminants, which is likely overestimated. Nevertheless, beyond this figure, it should be noted that in West Africa today, cow milk and vegetable fat dairy blends account for one-third and over one-quarter of dairy product consumption, respectively (Figure 8). Given the growing importance of vegetable fat dairy blends, their potential impact on local milk collection must be considered.

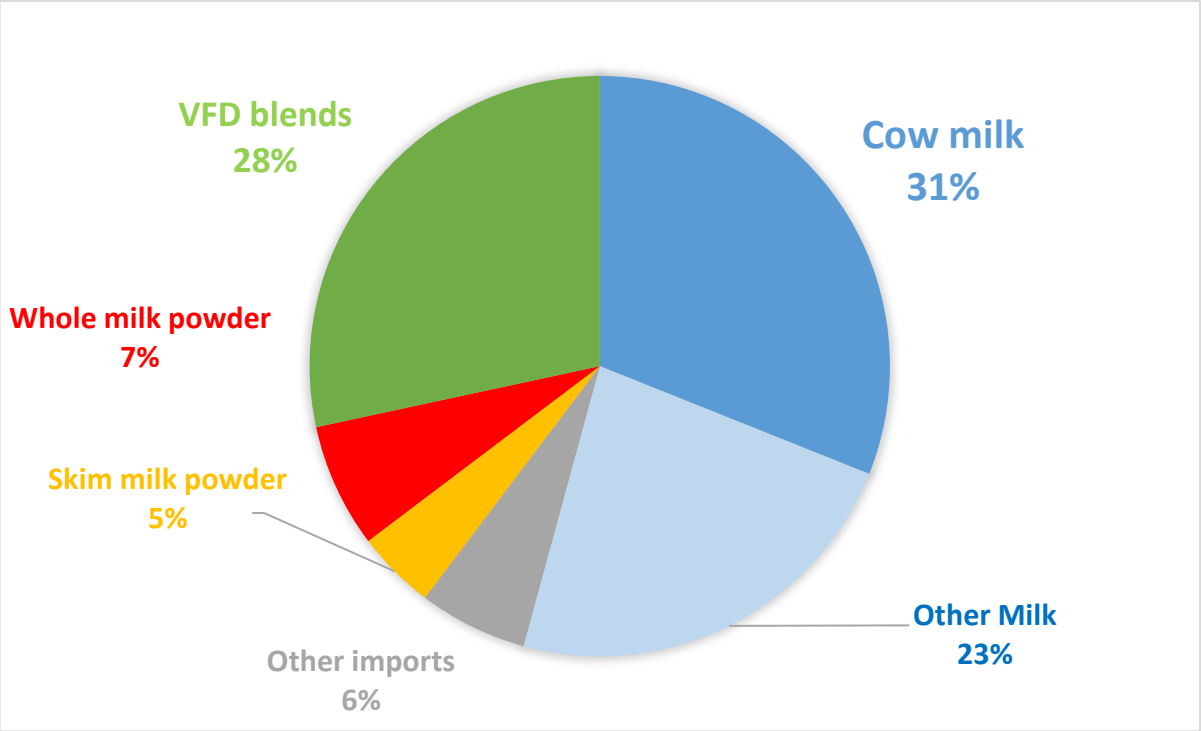


Figure 5: Estimated share of milk consumed in West Africa (ECOWAS + Mauritania) by origin (2018)

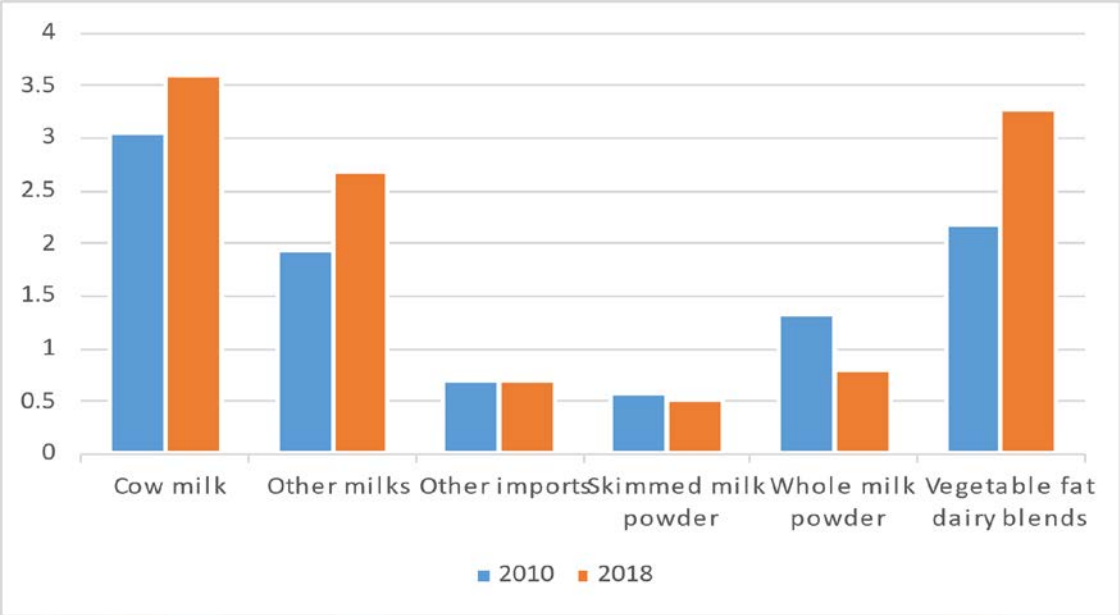
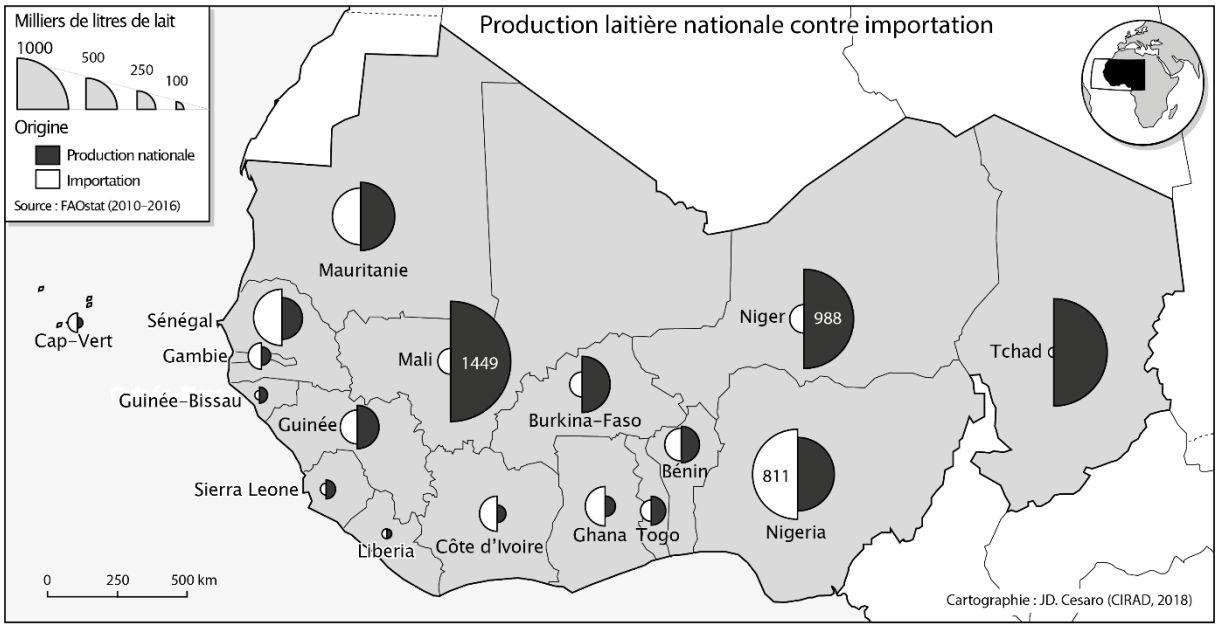


Figure 6: Evolution of the share of milk consumed in West Africa (ECOWAS + Mauritania) according to its origin (in billions of milk equivalent l)

Note on calculation method for figures 8 and 9:

- *Milk production: data from Faostat 2020,*
- *Imports: data from BACI and processed by INRAE Smart-Lereco (Chatellier, 2020)*

This share of vegetable fat dairy blends depends on the countries and on how they meet their national demand for dairy products (Map 3). Nevertheless, even in Sahelian countries where there is substantial milk production, vegetable fat dairy blends account for the major share of consumption in the capital cities, the main markets. Estimates range from 50% (Nouakchott) to 80% (Dakar) (Corniaux and Duteurtre, 2019).



From FAOSTAT 2018 and Corniaux 2019 study.

Map 3: Comparison of milk production and imports of dairy products in ECOWAS countries, Mauritania and Chad (in thousands of tons / year)

4. Vegetable fat dairy blends: controversial products

- **Definition of vegetable fat dairy blends**

This product appeared on the West African markets in the early 2000s under the names "fat-filled milk powder" and "milk powder enriched with vegetable fat". It is in fact a milk substitute that is obtained by mixing skimmed milk powder and vegetable fat. The powder is atomized by spray drying, which allows the product to be easily "reconstituted" in liquid form (Duteurtre and Corniaux, 2019). Various vegetable fats are used. Palm oil is today used most widely, but other oils such as coconut oil also are used. At the international level, these products are defined by the CXS 251-2006 standard developed by the Codex Alimentarius Commission. According to this standard, they are not dairy products in the strict sense. Codex recommends using the expression "mixture of skimmed milk and vegetable fat in powdered form" to qualify what is improperly called "fat-filled" in industry jargon. In line with these recommendations, we refer to these products as “vegetable fat dairy blends”. They are not to be confused with "plant-based milk" beverages or "creamers" sold on the market (Box 1).

Box 1: Diversity of dairy substitutes

Products commonly referred to as "**plant milks**" are **milk substitutes made from soy, coconut or almonds**, to name only the three most commonly used raw materials. They are not derived from the processing of mammal milk. The term "milk" does not comply with Codex standards, as it is a term reserved for dairy products. In Europe, the use of the term "milk" is tolerated for "almond milk" and "coconut milk". However, it is forbidden for "soy milk" which must be called "soy drink". Similarly, the terms "tofu butter," "tofu cheese," "vegetable cheese," or "**veggie-cheese**" are prohibited in the EU (Agri-info, 2017).

These milk substitutes are intended in particular for people allergic to cow milk (lactose intolerance, for example), but also for people who do not appreciate its taste. Today, they are presented as an alternative and chosen by consumers who want to limit or stop their consumption of animal products. Milk substitutes of vegetable origin are present in pasteurized drinks, fermented drinks, and cheese substitutes. Their dietary value is under debate, especially when intended for children and infants (see below). So-called "plant-based" milks are not very present on the West African market because of their high price (2 to 3 times more expensive than dairy products). Anti-milk rhetoric, for human health, animal welfare or environmental reasons, also is uncommon in West Africa (Figure 1).

Coffee creamers are liquid or granular substances of non-dairy origin intended to replace milk or cream as additives to coffee, tea, hot chocolate and other beverages. They are therefore substitutes for dairy products. They replace milk powder. They may contain vegetable oils. They are used as an additive to coffee or tea. Several brands are in circulation in West Africa. These coffee creamers are sold in micro-dosettes or in bags at very competitive prices. While their market presence remains limited, they could quickly conquer market share in comparison to milk powder. Their packaging and their name are designed to maintain the confusion with these milk powders.

Non-dairy spreads (margarines and blends of butter and margarine) are found widely in African markets and kitchens. They are sometimes (and improperly) referred to as "butter", including in advertisements promoting them.

- **History of the manufacture of vegetable fat dairy blends**

Vegetable fat dairy blends appeared in the dairy industry during the second half of the 20th century. They may be compared with other products in which dairy components are totally or partially replaced by non-dairy components, such as margarine, invented at the end of the 19th century, coffee creamers, imitation cream, etc. **The manufacture of these substitutes is based first on economics**: in many cases, the substitute ingredients are **commodities sold on the world market** at lower prices than the dairy ingredients of equivalent use. **However, this production also has a food rational**: these products are in particular intended for consumers who are allergic to or do not appreciate the taste of cow milk. For vegans and vegetarians, the consumption of plant-based milk substitutes (Box 1), which are more expensive than cow milk, is also a food-related issue.

In West Africa, vegetable fat dairy blends appeared on the market at the end of the 1980s, following an essentially economic rational. Originating in particular from the Irish cream whiskey industry, skimmed powder and "re-fattened" blends found an outlet in Nigeria, Senegal and Togo, then in neighboring countries. Until the early 2000s, vegetable fat dairy blends were sold as instant powders, plain or flavored (coffee, vanilla, strawberry, etc.). Brands such as Vitalait and Vivalait are relatively well known to consumers, who consider them to be a "second class" milk. In countries where purchasing power is low, this product has an important advantage: a low price. Concentrated milk and processed cheese made from re-fattened mixtures also appeared on the market. However, it was not until the end of the 2000s, particularly following the food crisis of 2008, that vegetable fat dairy blends became established in West Africa and increasingly used as a raw material by industries. It was also during this period that the technological barriers (bitter taste) that limited the use of palm oil in these blends were overcome at the industrial level.

- **A wide range of products on the West African market**

A wide range of mass-market "dairy products" based on vegetable fat dairy blends are now available (Figure 7). First, consumers buy milk powders in different formats (bulk, knotted sachets, micro-dosettes, 400 or 500 g sachets, 10 or 25 kg bags), plain or flavored. They also buy liquid milk, condensed milk and processed cheese. In the range of fresh products requiring a cold chain, consumers now have a wide choice of yogurts, ice creams and milk products (for example, yogurt-based dishes mixed with millet known as *dégué*).

Figure 7: Diversity of vegetable fat dairy blend-based "dairy products" on the West African market

It is interesting to note that these products are not marketed in Europe, or only to a very limited extent. When their manufacture is authorized, their sale requires that they be designated differently from dairy products, and meet community standards with regard to labeling. The long history of dairy product consumption may partly explain this situation. In France, the vigilance of industry professionals regarding these milk powder substitutes also has played a key role (Duteurtre and Corniaux, 2019).

- **A controversial product**

Vegetable fat dairy blends and their derivatives are heavily criticized by NGOs, political organizations, and some livestock organizations (SOS Faim, 2019; Commission Sociale et Environnementale de l'Assemblée Parlementaire Paritaire UE-ACP, 2020). This criticism has led to several advocacy campaigns in West Africa and Europe that have crystallized around **four subjects of controversy** (Corniaux *et al.*, 2020).

The first point of contention concerns the trade policies that have allowed the rapid growth of the imports of these substitutes. Indeed, the current rules governing international trade tilt competition in favor of these very low-priced imported products over local dairy farming. The insertion of the African dairy sector in international trade and the economic model underlying this trade are being questioned. On the European policy side, it is a matter of questioning the "coherence" of policies, i.e., identifying possible contradictions between trade policies, agricultural policies and development policies. These contradictions are illustrated by the ambivalent role played by European milk imports in the Sahel. On the African policy side, the aim is to examine the choices made by West African countries to dismantle tariffs in the context of the establishment of the ECOWAS single market, and their compatibility with local dairy sector development policies as envisaged, for example, by the ECOWAS "Local Milk" Regional Offensive.

The second area of controversy is the labeling and advertising practices of the industries that market these products. While these blends consist of about **30% palm oil**, the information on the packaging frequently confuses dairy products with substitute products. This is the case, for example, of products repackaged locally as "milk powder". This also is the case for "milk powder" sold in transparent bags without a label, and for processed products such as "yogurts" which do not mention the type of raw material used. Consumer confusion can also be caused by misleading advertisements that use dairy terms or images of pastoral life. This situation contrasts with European countries where these products are rarely sold.

The third concerns the health and nutritional risks of consuming vegetable fat dairy blends. While palm oil has proven industrial advantages, **its high content of saturated fatty acids** (45-55% palmitic acid) raises questions about its impact on health. Although at this stage there are no scientific studies that could render it possible to determine the implications of the consumption of these blends for human health, consumers and health services are demanding information on this topic.

Finally, the fourth area of controversy is ecological and environmental. The massive use of **palm oil** in the manufacture of many food products is a matter of concern for environmentalists. It is both a question of deforestation in the producing countries and of energy-intensive and polluting transport over long distances.

However, these controversies are based on very little published data. The objective of the present study is to review the current knowledge on the comparative impacts of vegetable fat dairy blends, powdered milk and local milk.

Part 2: Comparative impacts of imported powders and local milk

Controversies over the importation of vegetable fat dairy blends into Africa underscore the need for reliable data on the environmental, economic, and social impacts of this trade. However, little research has been conducted to date on these impacts. **The lack of information stems primarily from the fact that this trade has developed relatively recently, raising new research questions that have not yet been addressed. The lack of information also is due to the scarcity of databases and field surveys on dairy production, trade and consumption in Africa**.

To inform future policy debates and decisions about the regulation of economic exchanges between Europe and West Africa, this study reviewed the literature available to date (November 2020). A **total of 184 documents were analyzed**. These include scientific publications, expert reports, notes, and policy and advocacy documents. Among these documents, very few have focused on producing impact indicators for vegetable fat dairy blends. Nonetheless, the review enabled us to identify a number of assumptions about these indicators that allow a comparison of the impact of the use of different dairy raw materials. We propose estimates of these impacts and outline the research needed to better assess them.

1. Proposed indicator grid

We propose to compare the impacts of the use of different dairy raw materials on the dairy value chain, using the case of the manufacture of one kilogram of yogurt when necessary. Yogurt and other fermented milks are indeed the main dairy products consumed in the region, whether they are manufactured industrially or home-made from milk or milk powder. **We consider the three most commonly used raw materials in West African countries, namely vegetable fat dairy blends, whole milk powders and locally collected milk**. The kilogram of yogurt is thus the "functional unit" in our study, in line with assessment approaches (Bassett-Mens *et al.* 2009).

The designation of the types of products and inputs involved in the production of milk and yogurt is based on Codex standards as well as on the harmonized customs nomenclature used by ECOWAS, which is very similar to that of the EU. Dairy products are listed in Chapter 04 of the customs nomenclature. Skimmed (040210) and whole (040221) milk and cream powders, as well as butter oils and industrial butterfat (040590), constitute the bulk of imported dairy raw materials, along with sweetened (040221) and unsweetened (040291) condensed milk.

Vegetable fat dairy blends are not dairy products in the strict sense according to Codex standards. They are described as "mixtures of skimmed milk and vegetable fat in powdered form". In the customs nomenclature, they fall under Chapter 19, which includes several types of food preparations. In the ECOWAS nomenclature table, vegetable fat dairy mixtures are

included in "milk-based preparations containing vegetable fats, in powder or granules". They are referenced in 19019010 when sold in packages of more than 25 kg, and in 19019020 when sold in packages of 12.5 to 25 kg. **In the new EU customs nomenclature of October 2020, they are referenced in 19019095** as "food preparations in powder form, consisting of a mixture of skimmed milk and/or whey and vegetable fats/oils, with a fat content not exceeding 30% by weight".

Impacts are addressed at the "value chain" (or "sector") level to take into account the functional links between the raw material and the finished product. A value chain is understood as "*the set of functions and actors involved in the production process of a product or a type of product, and that confer its value*". This approach makes it possible to take into account all of the links in the chain, from the livestock farm (and the different inputs used in milk production) to consumption (considering the different food uses), via collection, processing, transport and distribution (Figure 8).

Based on the available data, value chains are considered at the local level (as in the case of the Laiterie du Berger or the city of Bobo-Dioulasso data), at the national level (in particular thanks to the data on Senegal and Burkina Faso) and at the regional level (ECOWAS level).

The assessment of the impact of the dairy trade on local value chains is addressed in the framework of UN Sustainable Development Goals (SDGs), which now constitute a reference framework for the evaluation of public policies. On this basis, we identify four major "domains" for assessing this impact: economic, social, health and environmental. For each of these four areas, we identify several "critical points" (López-Ridaura *et al.*, 2002) that raise questions of sustainability. These "critical points" are the perceptible expression of the major debates or controversies related to the impact of vegetable fat dairy blend imports. For example, poverty and mass unemployment in the Sahel (social domain) is one of the "critical points" raised by the controversy on the insertion of the African sector in international trade presented in the previous paragraph (Table 2).

For each critical point, impact "criteria" and "indicators" are defined. The "criteria" refer to concrete elements of perception or evidence of the impact of vegetable fat dairy blend imports. For example, job creation within value chains (social area) is a criterion for assessing their impacts on local economies. Each of these criteria can then be assessed by "indicators" which are measurable or estimated variables that generate a value for comparison (Table 4).

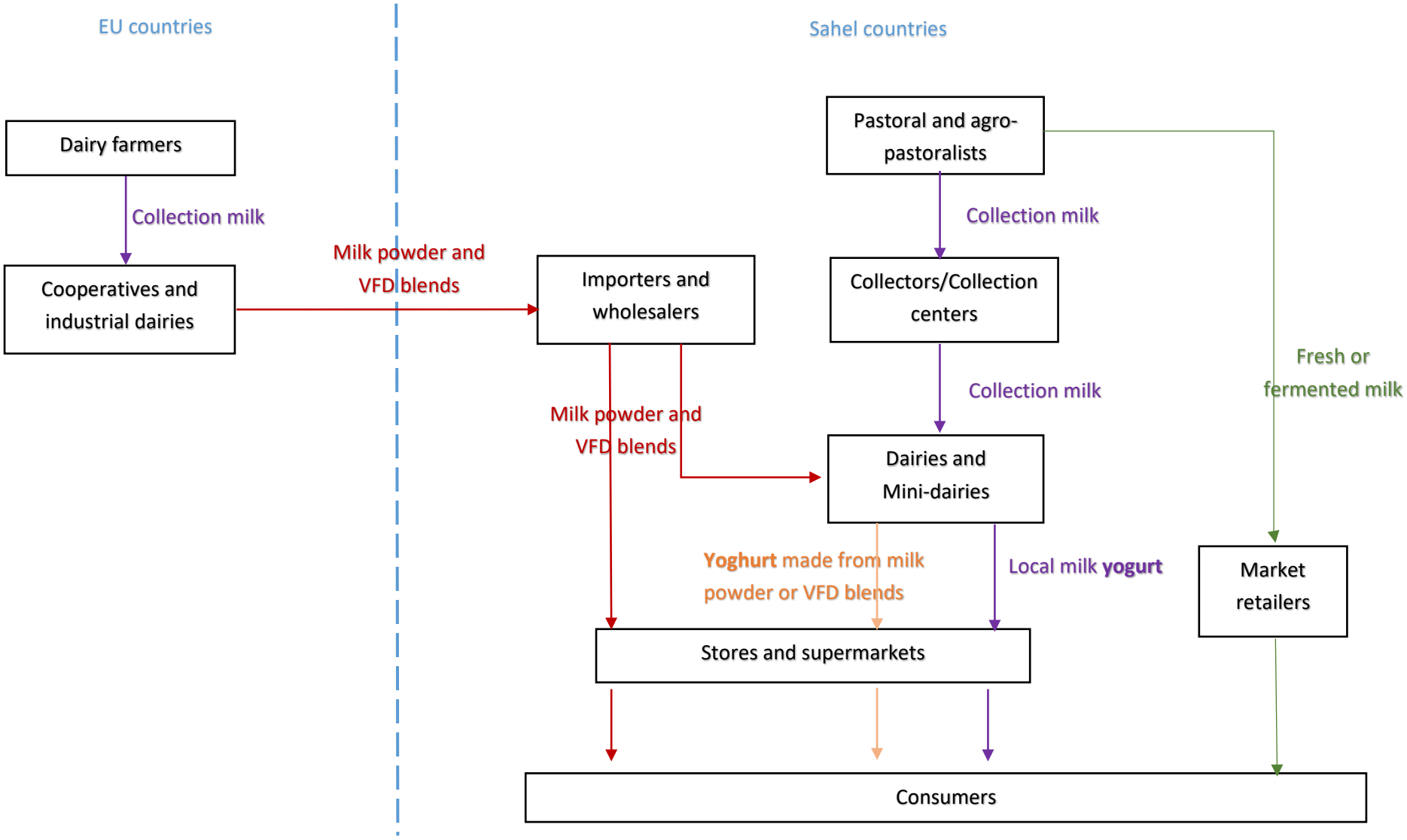


Figure 8: Graph of the yogurt value chain in West Africa

Table 4: Indicators for assessing the impacts of different dairy commodities on sustainable development in the Sahel

Controversy	**Critical point**	**Dimension**	**Impact criteria**	**Indicators (to compare the 3 value chains)**
Controversies involving the insertion of the African dairy sector in international trade ***(Socioeconomic impacts 1)***	1. Meeting local consumer demand for milk and dairy products requires a rapid increase in supply	Economic	1.1. Overall availability of milk and milk products 1.2. Retail dairy products available	1.1. Global market share 1.2 Market share of retail products
	2. Industrialists need cheap, regular and quality raw material	Economic	2.1 Available raw material 2.2 Production costs of one kg of yogurt 2.3 Technological constraints 2.4 Ethical issues related to the incorporation of plant compounds in milk	2.1 Market share of milk processed by manufacturers 2.2 Raw material prices 2.3 Number of technical constraints encountered by processors 2.4. Share of products complying with Codex standards
	3. The commercialization of milk produced in camps and on peri-urban farms suffers from a lack of market outlets	Economic	3.1 Existence of industrial or artisanal processing units that collect local milk 3.2 Existence of a direct sales market	3.1 Number of industrial or mini-dairies that collect local milk (exclusively or partially) 3.2. Share of local milk in the supply of dairies 3.3 Quantities of local milk sold directly
	4. The Sahel is marked by household poverty, mass unemployment, and significant economic migration	Social	4.1 Local job creation 4.2 Job quality and equity 4.3. Position of women	4.1 Number of direct and indirect jobs created 4.2 Salary levels 4.3. Number and quality of women's jobs

Controversies	Critical points	Dimensions	Impact criteria	Indicators (to compare the 3 value chains)
Controversies over labeling practices and the potential for consumer deception ***(Socioeconomic impacts 2)***	5. Labeling practices lead to consumer deception	Economic	5.1 Compliance of product packaging with Codex standards 5.2 Loss of consumer confidence in products	5.1 Market share of products not meeting Codex standards 5.2. Number of expressions of consumer concern about product quality (media)
	6. There is a demand for identity dairy products with high cultural, environmental or heritage value	Social	6.1. Availability of specific quality dairy products (typical products, geographical indications, etc.)	6.1 Number of specific quality products developed (fermented milks, pasteurized milk, etc.) compared to standard products
Controversies over consumer health risks and benefits ***(Health and nutritional impacts)***	7. The substitution of dairy fats by vegetable fats implies differences in the nutritional quality of the products	Health and nutrition	7.1 Fatty acid composition of the product 7.2 Vitamin content	7.1 Hydrogenated fatty acid content 7.2 Vitamin D content
	8. The physical-chemical and microbiological composition and the organoleptic quality of the raw material condition the health and nutritional quality of the products	Health and nutrition	8.1 Physical and chemical quality 8.2 Organoleptic quality 8.3 Microbiological quality	8.1 Fat content and creaminess 8.2 Protein content 8.3 Taste 8.4 Presence of pathogens and contaminants

Controversies	Critical points	Dimensions	Impact criteria	Indicators (to compare the 3 value chains)
Controversy over environmental issues in dairy trade ***(Environmental impacts)***	9. Dairy farming and oil palm cultivation practices have an impact on biodiversity	Environmental	9.1 Deforestation due to milk and palm oil production 9.2 Management and enhancement of rangeland areas 9.3 Conservation and development of local breeds and forage species	9.1 Deforested area per kg of milk equivalent (LCA) 9.2 Valued range area per kg of milk equivalent (LCA) 9.3 Number of cattle or camel breeds and forage species in the value chain
	10. The upstream and downstream activities of the sector exert a strong pressure on the consumption of fossil fuels (non-renewable)	Environmental	10.1 Fossil fuel costs	10.1. Fossil energy consumption per ton of milk (or ELR, UEV...)
	11. Dairy farms and dairy industries contribute to the emission of greenhouse gases (GHGs) that contribute to global warming	Environmental	11.1 Greenhouse gas (GHG) balance of the value chain	11.1. Balance emission / sequestration per kg of milk (LCA) 11.1. Emission / sequestration balance per ha (territorial evaluation)
	12. Dairy farms and dairy industries contribute to the depletion of non-renewable water resources (groundwater) and to the pollution of water and soil	Environmental	12.1 Share of non-renewable water in the value chain	12.1 Share of groundwater in the production of a kg (LCA)

2. Socioeconomic impacts (1): How does the dairy sector fit into world trade?

Controversies over policy coherence stem from tensions between the development of European milk imports and ambitions of developing the local dairy sector. While milk powder has been imported into West Africa for a relatively long time (Pinaud, 2013), imports have been strongly boosted by recent policy changes.

In West Africa, the creation of the common market led to the establishment of a Common External Tariff (CET) that came into effect in 2000 for WAEMU and in 2015 for ECOWAS. The CET ratified the definitive lowering of customs duties on imports of milk powder and blends to only 5% of their value. Yet at the same time, several national and regional policies were introduced to promote the development of local milk production (Corniaux *et al.*, 2014). Many civil society actors also have called for the abolition of VAT on products made with local milk in order to encourage industrial investment in collection.

In Europe, the end of milk quotas in 2015 reinvigorated dairy manufacturers' efforts to conquer new export markets, particularly in Africa. Meanwhile, many development programs were funded by the European Commission to support the development of agriculture and livestock farming in Sahelian countries, including via the formation in 2018 of the Sahel Alliance.

Finally, at the international level, some actors are going so far as to ask for the revision of WTO rules intended to authorize "dumping" (*sic)* by exporting countries through direct and indirect aid to EU livestock farmers.

To determine the coherence of these policies with respect to sustainable development in the Sahel, we propose to analyze the impacts of these developments by considering four "critical points" (Table 4).

- **Meeting local demand for milk and dairy products from a quantitative point of view**

First, it should be noted that European imports are helping meet the rapid growth in local demand for milk and dairy products in the region. **In 2013, powder imports accounted for about 32% of dairy consumption** in West Africa (Duteurtre and Corniaux, 2019). **In 2018, this share was estimated at 40%,** with **28% for vegetable fat dairy blends alone** (Figures 5 and 6 above).

This contribution is all the more important because the average level of consumption of dairy products is low in West Africa (20 kg/capita/year) compared to the rest of intertropical Africa (28 kg/capita/year) and, above all, the rest of the world (90 kg/capita/year). The share of imports is proportionally higher in coastal countries, which consume little milk and where livestock production is low. On the other hand, the share of imports is less important in heavily landlocked livestock countries such as Burkina Faso, Mali and Niger, where consumption is also high (98 kg/capita/year in Mali) (Duteurtre and Corniaux, 2019). In addition, **the share of imports** is much higher in cities: it **has been estimated at about 50% in Nouakchott, and 90% in Dakar** (Corniaux and Duteurtre, 2019).

In total, milk powder imports (not including vegetable fat dairy blends) have helped respond to rapid population growth. Between 1970 and 2018, these **imports increased from 25,000 to 204,000 tons per year**. While there were almost no imports of VFDB before the 2000s, their place became significant stating from 2009. Over the past 10 years, they have gradually become the norm (without, however, entirely replacing milk powder imports in the strict sense), representing **329,000 tons in 2019**, or 28% of the milk consumed in West Africa.

A GRET study conducted as part of the "My milk is local" campaign (Levard *et al.*, 2018) simulated the impacts of different trade policy scenarios on the West African dairy sector. This work highlights the role of imported raw materials in satisfying West African consumers. The poverty of urban consumers must be considered in any decision to change tariffs. The potential impacts of higher tariffs on product prices could, however, be offset by lowering the VAT on products made from local milk. Levard *et al.* (2018) also recommend that tax rates should be different for vegetable fat dairy blends and whole milk powder, with higher rates for the blends (of around 30% for scenario 5 of the study). Finally, others point to the impacts of imports on government revenues through import taxes, which again must be considered in the impact of this trade.

These tax recommendations are at odds with the liberalization regimes foreseen by the draft **Economic Partnership Agreement (EPA)** under discussion between the EU and ECOWAS. This agreement envisages the elimination of import duties for milk powders and blends (Levard *et al.*, 2018).

- **Availability of cheap, regular and quality raw material for industries**

Imports of powder have played an important role in the development of milk processing industries in West Africa. While most dairies in urban areas only process milk powder, many industrial units that had relied on the collection of local milk have collapsed. Today, **all the dairies in West Africa** (about 100 in all) **use imported milk powder,** 80% of which exclusively. It is estimated that **only 20% of them collect local milk**. For these dairies, collected milk is only a complement to a more regular and cheaper supply of powder.

The situation is quite similar for artisanal processing workshops, but with a significantly higher proportion using local milk. In Bobo-Dioulasso (Burkina Faso), **98% of the mini-dairies used powder**, and 70% exclusively. In fact, only 1 of the 50 mini-dairies surveyed collected local milk exclusively. Furthermore, only 15 (**30%) used local milk in addition to powder** (Orasmaa, 2020).

The main impact of the use of milk powder on the processing lines is the **reduction of costs**. This reduction comes from the fact that milk powder is cheaper than local milk, especially if one takes into account collection costs in pastoral areas, which are significant. The price advantages of vegetable fat dairy blends are even greater, with a selling price in West Africa that is 30% lower than that of whole milk powder (Tables 5 and 6).

Table 5: Average prices of local milk, milk powder and vegetable fat dairy blends in Burkina Faso and Mali in 2013

	Local milk	Whole milk powder	VFD blends

	(FCFA per liter delivered to the factory)	(FCFA per reconstituted liter)	(FCFA per reconstituted liter)
Winter price	275-350	250	200
Dry season price	275-400	250	200

Source: Duteurtre and Corniaux, 2019

Table 6: Average prices of local milk, milk powder and vegetable fat dairy blends in Bobo-Dioulasso in 2018

	Local milk (FCFA per liter delivered to the factory)	Whole milk powder (FCFA per reconstituted liter)	VFD blends (FCFA per reconstituted liter)
Winter price	373	323	230
Dry season price	454	323	230

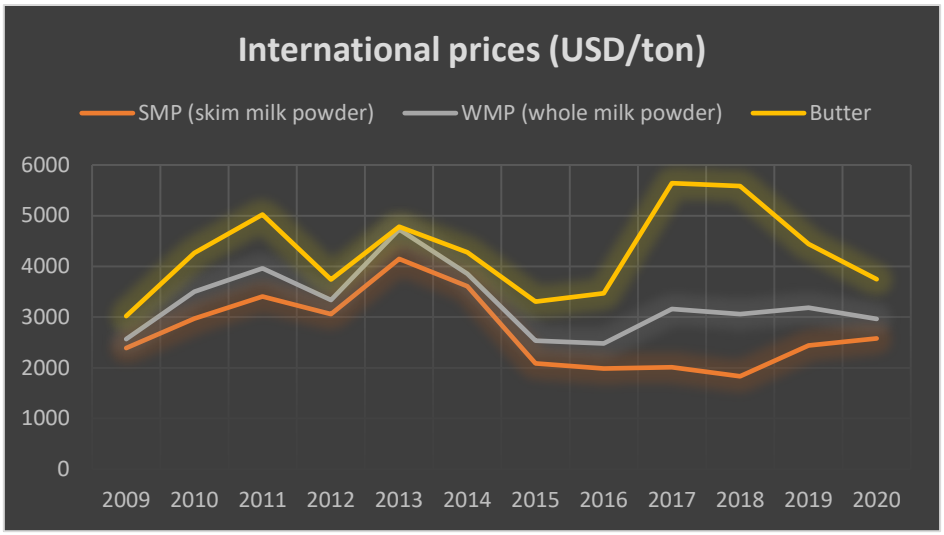
Source: Orasmaa 2020, supplemented by Levard *et al.*

However, these average values do not take into account the very high volatility of international prices for dairy products, especially butter and whole milk powder. This instability has led many processors to turn to vegetable fat dairy blends (Fig. 9).

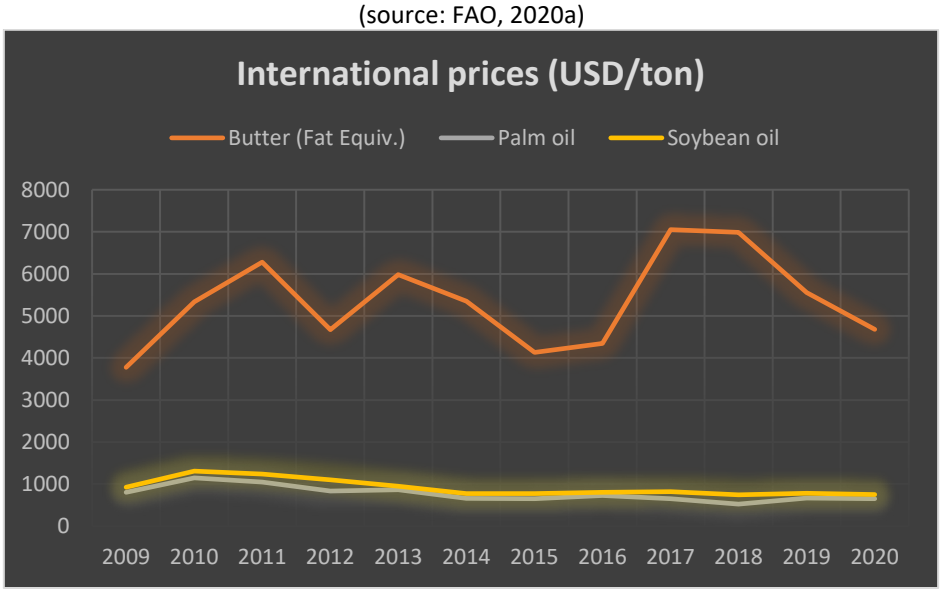
In addition, the production costs of milk on agropastoral farms are estimated at about 150 FCFA francs/liter (Duteurtre, 2007), and **collection costs at about 100 FCFA/liter** (Bagoré Bathily, personal communication), which gives a production cost of 250 FCFA/liter for milk delivered to the factory. **The difference in competitiveness between local milk and imported powder therefore essentially lies in the collection costs**.

To explain this cost differential, three elements must be considered. First, differences in the economic performance of the European and West African dairy production sectors explain why production costs are lower. **These differences are less related to the production costs of the farms themselves than to the performance of the upstream and downstream activities of the sector**. Indeed, the production costs of "on-farm" milk are more or less the same in Africa and Europe, around 250 to 350 €/ton. On the other hand, in Europe, the organization of access to inputs and services to farms, collection systems and milk processing units are better structured and benefit from economies of scale.

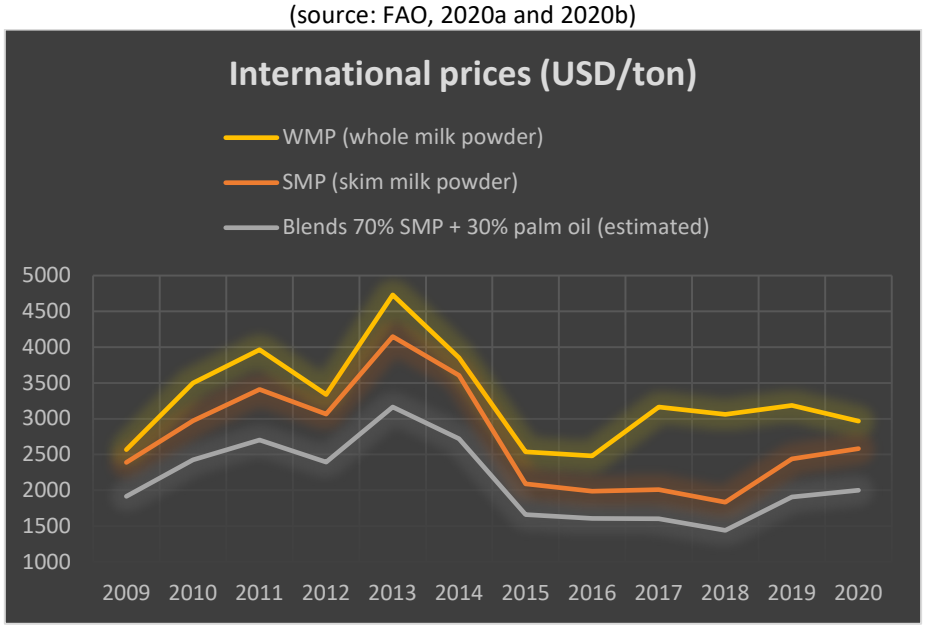
The second element is linked to direct and indirect CAP subsidies which allow farmers to be more competitive with regard to the selling price of their products.



(source: FAO, 2020a)



(source: FAO, 2020a and 2020b)



Source: FAO (2020a) for milk prices. Our calculations for vegetable fat dairy blends, based on oil prices in FAO (2020b). The year 2020 refers to the months of January to July.

Figure 9: International prices of dairy products and palm and soybean oils

Finally, the third element relates to the composition of vegetable fat dairy blends, and the substitution of dairy fats by vegetable fats that are much cheaper. **In 2019, palm oil was 13 times cheaper than butter in fat equivalent**. Based on FAO monitoring of palm oil and milk powder prices, it is estimated that over the past 10 years, **vegetable fat dairy blends have been on average 20% cheaper than skim milk powder** and **30-50% cheaper than whole milk powder** (Figure 9).

The technical constraints of imported milk are not widely analyzed in the literature. It is generally considered that powdered milk is a raw material suitable for the manufacture of UHT milk, yogurt and fermented milk. It is also particularly suitable for storage in tropical climates. However, **milk powder cannot be used to manufacture pasteurized milk, cheese or butter.**

The use of vegetable fat dairy blends seems to present the same technological constraints as skim milk powder. However, very little information exists on this subject in the literature. In addition, operators seem to indicate that there is great variability in the quality of these mixtures, their taste, and their suitability for processing (CFSI, 2020).

Finally, the use of this product raises ethical and deontological questions around nomenclature and labeling issues that are discussed in the following paragraphs.

- **Creation of outlets for milk produced by camps and local farms**

Although local cow milk production in West Africa is estimated at 3.5 billion liters, most of this production is self-consumed. Pastoral and agropastoral systems mainly use the milk produced by the herd to meet the needs of the calves and households, and, to a lesser extent, for the sale of products on local markets. The share of milk collected by dairies and mini-dairies is very low. **It is estimated that only 2% of the milk produced in the region is collected regularly. These rates are about 1% of milk produced in Nigeria and 7.8% of milk produced in Senegal** (Corniaux and Duteurtre, 2018a). Several technical and organizational constraints explain this low collection rate. In particular, the scarcity of transport infrastructure, the spatial dispersion of farms, and the mobility of herds are among the reasons that dairies are reluctant to develop collection systems in pastoral and agropastoral areas. The availability of cheap milk powder also plays a role in these strategic choices, as we have seen above.

From this perspective, the importation of milk powder and vegetable fat dairy blends has a very negative impact. These imported raw materials compete with local milk and dissuade manufacturers from investing in collection equipment. It is this negative impact that justifies the use by many countries of tariff barriers, as is the case in the EU, Morocco and Kenya.

- **Reducing poverty, mass unemployment, and economic migration**

The employment impacts of agricultural commodity chains are at the heart of the controversy surrounding the trade in milk powders and vegetable fat dairy blends. The aim here is to compare the jobs generated by this trade with the jobs generated by the collection of local milk. In general, a distinction is made between "direct jobs" generated by the milk trade, "indirect jobs" generated by upstream and downstream activities, and "induced jobs" that result from expenditures related to the activities of the sector, but which are generated in

other economic sectors. While the evaluation of the number of direct and indirect jobs generated can be done on the basis of an inventory of the sector's activities, the **evaluation of the number of induced jobs requires the use of multisectoral databases such as Input-Output Tables (IOT) or Social Accounting Matrices (SAM)**. In the case of the West African dairy sector, such tools do not exist at sufficient levels of detail to evaluate the jobs induced by the livestock sector.

Table 7: Inventory of jobs generated by the three sub-sectors

Scale		VFD blend yogurt	Powdered whole milk yogurt	Local milk yogurt
Direct, indirect and induced jobs in Indonesia and Malaysia	Planters Refinery employees Transporters Suppliers of inputs and materials to oil mills Employees in sectors benefiting from the income of agricultural household consumption and industrial employees.			
Direct jobs in Europe	Livestock farmers (European) Employees of dairies (European) Transport and logistics employees			
Indirect jobs in Europe	Livestock input and service providers Suppliers of industrial inputs and materials Suppliers of logistics companies			
Induced employment in Europe	Employees of sectors benefiting from the consumption income of livestock farmers, employees of dairies, etc.			
Direct jobs in West Africa	Pastoralists and agropastoralists Intensive peri-urban livestock farmers Milk collectors Wholesalers and importers Employees of dairies and mini-dairies Distributors			
Indirect employment in Africa of West	Suppliers of inputs and services to livestock farms Suppliers of inputs and materials to dairies Input suppliers and distributors			
Induced jobs in West Africa	Employees in sectors benefiting from the income of livestock producers' consumption. Employees of sectors benefiting from the consumption income of merchants, employees of dairies, etc.			

Table 7 provides an inventory of the types of jobs involved in the three sub-sectors whose impacts we wish to compare. This inventory highlights the wide diversity of activities involved in the African dairy sectors.

Assessing the relative importance of these different jobs would require substantial research. To date, very little data has been produced on this subject in West Africa. Nevertheless, it is possible to propose a number of hypotheses based on the available literature.

First, it should be considered that **the jobs created in the producing countries are the main justification for exports of milk powder and blends.** Jobs in livestock and the dairy industry are difficult to evaluate, but they are the main argument behind European trade policies. The jobs generated by palm oil production also are relatively significant.

In addition, **the sub-sectors that use imported powders generate a significant number of local jobs**: in trade, first of all, but also in industry, in distribution, and in the supply of inputs

and materials for industries. In Senegal, for example, the Berger dairy, which works mainly with milk powder but also with local milk, employs about 250 people and supplies more than 6,000 sales outlets through a network of distributors.

Recent work in North America shows that the jobs generated by the industry are significant. In some states, they are as numerous as the jobs generated in raw milk production. In other states, such as Washington, they represent only half. Of the total jobs generated by raw milk production and the dairy industry, about 50% are direct jobs, 30% are indirect jobs, and 20% are induced jobs (Figure 11)

In West Africa, the "local milk yogurt" sub-sector is the only one that generates employment in rural areas. In economic terms, it is therefore an "inclusive" sub-sector that strengthens the links between urban agribusinesses and pastoral and agropastoral areas.

Fieldwork on this issue was conducted in the city of Bobo-Dioulasso in Burkina Faso (Orasmaa *et al.*, 2020). These surveys, conducted in 2018, showed that the dairy processing sector employed 481 people, and generated 122 additional upstream jobs in collection and production activities (Table 8). Wages received by dairy employees averaged 34,000 FCFA/month (about 52 euros), which is equivalent to the country's minimum monthly income. **Women held 39% of the jobs** (same figure for units using and units not using milk powder). This study highlighted the importance of the dairy sector for job creation in the informal sector, and the **considerable potential of developing local milk collection systems for job creation in rural areas.**

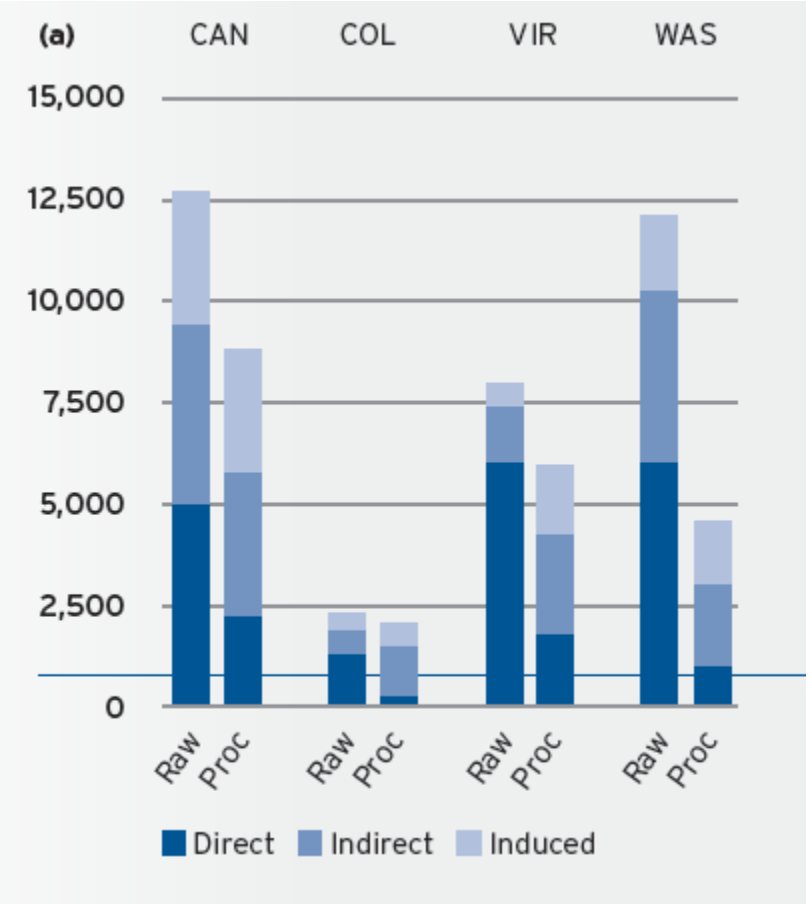


Figure 11: Number of direct, indirect, and induced jobs in raw milk production and milk processing in Canada (CAN), Colorado (COL), Virginia (VIR), and Washington state (WAS) (Source: FAO, GDP and IFCN, 2018)

NB: for Canada, the number of jobs must be multiplied by 10

Table 8: Jobs generated by the dairy processing sector in Bobo-Dioulasso

	Units using only powder (35 mini-dairies)	Units using milk powder and local milk (15 mini-dairies)	Total processing sector (50 mini-dairies)
Dairy employees	346	135	481
Upstream jobs (collectors and producers)	-	122	122
Total	346	257	603

Other data on the subject were compiled by Corniaux and Duteurtre (2019). They concern the jobs generated by the industrialists who collect milk in the subregion: "*The jobs generated by the twenty or so industrialists who collect milk in West Africa are significant. In total, local*

industrial collection now directly supports 15,000 to 20,000 families of farmers and collectors in West Africa. It is these 20,000 families, as well as the tens of thousands who supply the other local milk channels (informal market, mini-dairies), who are weakened by the development of milk powder imports.

For example: (i) in Mauritania, the Tiviski dairy directly employs nearly 250 staff in Nouakchott, Rosso and Bogué, but the company estimates that it has indirectly created 3,000 jobs among livestock farmers, collectors and suppliers of fodder and concentrates; (ii) in Senegal, Laiterie du Berger employs 250 people and collects from 800 families. Its products are also distributed in several thousand stores throughout the country; (iii) in Niger, the Solani company employs 85 people and about 30 suppliers (including collection centers) which involve nearly 1,500 producer families."

These data on West Africa should be linked to the social dimension of the dairy sector in the world. It is estimated that milk production provides a living for 150 million livestock farming households, or more than 750 million people worldwide. Half of these households are located in India and Pakistan. In total, the global average dairy farm herd consists of three cows, which highlights the potential of this sector to support the livelihoods of the poorest (FAO, GDP and IFCN, 2018).

3. Socioeconomic impacts (2): what are the risks of misleading consumers?

Controversies over the naming and labeling of vegetable fat dairy blends are not unique to West Africa. In Quebec, for example, the trade in vegetable fat dairy blends was prohibited until 2014, and their manufacture remains prohibited today. The law also condemns the use of the terms "milk", "cream", "butter", "cheese" or a derivative of one of these words to designate a dairy substitute. In France, the production and importation of dairy substitutes also was prohibited for a long time. However, France was condemned in 1988 by the European Court of Justice for hindering "the free movement of goods". This ruling was issued at the end of a case opposing the EEC and France that began in 1984 (Duteurtre and Corniaux, 2019).

Two elements appear essential to consider when addressing trade regulation issues: on the one hand, the labeling practices specific to vegetable fat dairy blends mislead consumers; and, on the other hand, there is a demand for identity-based dairy products with a high cultural, environmental or heritage value, which means using local milk for their manufacture.

- **Labeling of vegetable fat dairy blends and the risk of misleading consumers**

While the major European dairy groups operating in West Africa have adopted labeling of vegetable fat dairy blends consistent with Codex standards, the technical terms used are sometimes difficult for the majority of consumers and retail traders to understand. This vagueness in the nomenclature used on packaging, maintained by the weakness of local standards agencies, generates risks of consumer deception.

However, most of the risk of deception concerns products manufactured or repackaged locally using vegetable fat dairy blends. This is the case, for example, of locally repackaged blends bearing local brand names which do not comply with Codex standards and are

described as "milk powder" or "powdered milk". This is also the case for "milk powder" sold in transparent bags without a label, and for processed products such as "yogurts" that do not mention the type of raw material used. Consumer confusion can also be caused by misleading advertisements that use dairy terms or images of country life. This situation contrasts with European countries where these products are rarely marketed.

It is estimated that almost all the products manufactured by mini-dairies using vegetable fat dairy blends are sold under the inappropriate term "yogurt", "curdled milk" or "fermented milk". Similarly, products made by the dairy industry from vegetable fat dairy blends do not comply with Codex standards if they are sold under these names, which are normally reserved for products made from milk. On the basis of the data presented in the first part, it is estimated that blends of milk proteins represent 80% of the milk powders used by the industries. The share of non-compliant products from industrial dairies could therefore represent 80%. Finally, we propose to estimate the share of informally repackaged powder without labeling at only 10% of the retail powder market.

This evidence allows us to hypothesize about the proportion of improperly designated products in retail stores. In Bobo-Dioulasso, for example, it is estimated that **30% of the dairy products sold on the market do not meet Codex standards** (Table 9).

Table 9: Inventory of dairy products sold at retail in Bobo-Dioulasso

	Tonnage consumed by households (tons milk equivalent)	Share of products misdescribed by dairy product names	Total products not in compliance with Codex standards
Milk powder and condensed milk sold retail	10 560 t	10%	1 056 t
Fermented milk from mini-dairies	3 730 t	89% (11% = local milk)	3 320 t
Fermented milk from dairy industries in the ECOWAS zone	890 t	80%	712 t
Liquid milk	1 460 t	0%	-
Other products (butter, cheese…)	n.d.	0%	-
TOTAL	16 640 t		5 088 (= 30%)

Source: Orasmaa (2020)

This negative impact of vegetable fat dairy blend imports generates consumer concerns about product quality. These feelings have been relayed in the "My milk is local" campaign. However, no survey data has been published to date about these consumer concerns.

- **Need to use local milk to make certain heritage products**

The African dairy tradition is rich in widely diverse dairy products made "on the farm" or "in the camp". The Fulani of West Africa, the Arabs of central Chad, and the Borana of Ethiopia,

for example, uphold this heritage, which is at once symbolic, cultural and economic. Some authors speak of "*matrimoine*" (a play on the French word for heritage, *patrimoine*) to express the particular know-how of women in the elaboration of these products. Made for the most part from cow milk, African dairy products nonetheless also come from other species such as goats and dromedaries. This milk is produced by local animal breeds (often zebus), which make use of local forage resources ("rangelands"), and which benefit from the action of yeasts and lactic bacteria also present in the natural environment.

In West Africa, many fermented milks exist, with names related to their geographical origin or to the language of the communities that produce them. One example is *Rouaba* in Chad, which is a fermented skimmed milk. There are also fermented or ripened creams as well as solid and clarified butters, which are used in cooking and in cosmetics. There are also mixtures of fermented milk and cereals in flour or couscous, such as *thiakry* or *lakh* in Senegal, *degué* in Mali, etc.. West African pastoralists also make two traditional cheeses. *Wagashi* is a fresh cheese made by the Fulani of Benin and Togo. It is obtained by acid curdling of cow's milk. *Tikommart* or *Tchoukou* is a cheese of Tuareg origin made in Mali, Niger and Algeria. It is obtained by curdling with rennet followed by drying on a mat.

Unlike **powdered milk, which only can be used to make standardized products, local milk can be used to make a wide variety of products with specific qualities**. The preservation of this heritage and its protection from the misuse of traditional product names by industrialists is one of the challenges for the sustainable development of the African dairy industry (Duteurtre, 2019).

This differentiated impact of local milk compared to imported powders is due to the technological and nutritional characteristics of local milk.

4. Health and nutritional impacts: what benefits for the health of consumers?

This paragraph examines the controversies over the health risks and benefits related to the consumption of different dairy raw materials. It addresses the differences in nutritional quality that come from the fat composition on the one hand, and from the differences in the overall physical-chemical composition of the various dairy raw materials on the other.

- **Impacts due to the substitution of milk fat in blended products**

In response to the concerns of some consumers about the health impact of vegetable fat dairy blends, "My milk is local" campaigners have sought to better understand the health and nutritional impacts of these products.

Regulatory questions were reviewed first. On the basis of the 1988 judgment against the French government, it appeared that "health risks" was not an acceptable argument to justify banning the sale of vegetable fat dairy blends. The Advocate General's closing argument in this case emphasized that, firstly, "*it has not been proven that all of the products from which the substitutes are derived are necessarily of inferior quality to dairy products, particularly in*

terms of protein, mineral salts and vitamins". Secondly, the substitutes "*are not more harmful to health than other vegetable fat products such as margarine or oils*". And third, substitutes may present deficiencies for some people, "*but these deficiencies do not justify prohibiting their trade*" (European Court of Justice Reports 1988, cited by Duteurtre, 2019). **These findings of deficiencies were intended to highlight the importance of stating "NOT FOR INFANTS" on the packaging of vegetable fat dairy blends**, as recommended in Codex standards.

Work then was undertaken to better understand the vitamin and fatty acid content of milk and vegetable fat blends. An analysis of several samples of milk and vegetable fat mixtures marketed in West Africa provided informative results. They confirmed that the fatty acid content of the blends was very different from the composition of whole milk powders (Larondelle, 2020).

The mixtures made with palm oil (Gloria, Mixwell, Dano, Ndéki, Laclait, Rose brands), which represent the majority of the products available on this market, **are quite rich in saturated fatty acids**. Palmitic acid, in particular, which constitutes 45 to 55% of the fatty acids present in palm oil, is present in large quantities. It is known that saturated fatty acids increase cardiovascular risks, and are hypercholesterolemic (especially for LDL cholesterol). However, milk naturally contains between 65 and 75% of saturated fatty acids, including palmitic acid, although some of these fatty acids are shorter-chained than palmitic acid. It therefore is possible to conclude that from the **point of view of fatty acid content**, **vegetable fat dairy blends made with non-hydrogenated palm oil have a neutral effect on health**.

The mixtures made with partially hydrogenated[1] palm oil (Vitalait and Vivalait brands) **have particularly high levels of trans monounsaturated fatty acids**. It is known that trans fatty acids increase cardiovascular risks and are hypercholesterolemic (especially for LDL cholesterol), more clearly than saturated fatty acids. Although the whole milk samples also contained trans fatty acids, they were present in smaller quantities. It can therefore be concluded that **vegetable fat dairy blends made with partially hydrogenated oils are potentially unhealthy**.

Mixtures made with coconut oil (Bonilait brand) had high levels of short-chained saturated fatty acids, but did not have high levels of trans fatty acids (Larondelle, 2020).

Finally, it should be noted that the absence of Vitamin D in vegetable oil constitutes one of the nutritional risks linked to the consumption of vegetable fat dairy blends. For this reason, most manufacturers of these blends artificially add vitamin D.

- **Impacts due to differences in physicochemical composition and organoleptic quality of products**

Most of the local milk produced in West Africa comes from zebus. **Zebu milk is particularly nutritious**, rich in fat and protein (Table 10). This difference is all the more striking because most milk powders and blends are standardized to contain relatively low fat levels (3.5% for

[1] The hydrogenation of an oil aims to make it solid at room temperature. Hydrogen fixation transforms unsaturated fatty acids into saturated fatty acids, which have a higher melting point. Hydrogenation is rarely complete. When hydrogenation is partial, this process results in the creation (in addition to saturated fatty acids) of trans monounsaturated fatty acids.

whole milk, and 1.5% for skim milk). Artisanal products made from local milk are therefore particularly creamy. Furthermore, local milk produced in West Africa has distinctive quality attributes related to the composition of natural pastures and the hardiness of local breeds (Isra-Bame, 2009).

Table 10: chemical composition of milks (in g/liter)

	Fats	Nitrogenous materials	Lactose	Mineral materials
Cow milk	35-40	30-35	45-50	8-10
Zebu milk	45-58	31-44	39-46	7-8
Goat milk	39	33	44	12
Sheep milk	70	53	44	13
Camel milk	41	50	48	6

Sources: Data from the CNIEL Observatory of Food Habits (except for zebu milk) and Ngiriyanbandi-Minani (1999) (for zebu milk)

These differences become more pronounced when vegetable fat dairy blends are low in protein. **The protein content varies according to the desired application**. For example, when the blends are intended to be mixed with coffee or more generally **with "milky" beverages**, the content drops from 22-24% to less than 15%. These blends can then no longer be used to make yogurt or curd.

This is also the case with new products that are appearing on the West African markets. **Some vegetable fat dairy blends now contain a significant proportion of whey powder**. Derived in large quantities from the cheese industry, new technologies (2018) make it possible to produce processed ingredients incorporated into food products. They no longer contain caseins, the main milk proteins, and are therefore unsuitable for the manufacture of fermented products (especially yogurts and curdled milk). On the other hand, their price on the world market is very low (less than 1000 €/t), i.e., half the price of vegetable fat dairy blends. It therefore seems essential to identify (labeling) and monitor the evolution of the use of whey powders in West Africa, which are problematic from a nutritional point of view (the fat content and the main protein content of milk are absent) and from an economic point of view (increased competition).

- **Impacts due to the microbiological quality of the products**

The marketing and processing of local milk require vigilance because of the **health risks** associated with this product. These include microbiological risks related to the development of pathogens on farms (INSAH, 2003). Livestock must be monitored by veterinarians to reduce these risks upstream in the value chain, and to limit the risks of contamination downstream. These risks also are reduced by the traditional practices of livestock herders, who tend to heat the milk in their camps or use lactic fermentations, thereby compensating for the absence of a cold chain. The development of "good dairy hygiene practices" also makes it possible to compensate for the limited resources of local health inspection agencies at all levels of the value chain (GRET and Enda-Graf, 2011).

Some analyses of milk produced by peri-urban farms in Benin also have shown the presence of contaminants such as pesticide residues, aflatoxins, or heavy metals (Dossou *et al.*, 2016). These results call for better support for intensive livestock farms, especially those located in urban or peri-urban areas.

5. Environmental impacts: what are the ecological consequences of this trade?

The use of palm oil in vegetable fat dairy blends raises the question of how the trade in these products is impacting the environment. Indeed, palm oil is widely criticized for its intensive nature and destructive effect on equatorial forests. To address these issues, five critical points should be identified:

- **Impact of the dairy trade in the management or erosion of biodiversity**

Palm oil represents 39% of the world's vegetable oil production, but only 7% of the agricultural land used for oilseeds. Due to the particularly high yields (3.5 t/ha on average), the production costs of palm oil are 20% lower than those of soybean. This explains the rapid development of oil palm cultivation (FFAS, 2012).

However, this development is partly at the expense of biodiversity. In the countries concerned, it contributes strongly to deforestation. In Indonesia, for example, Kemen et al (2019) estimate that from 2001 to 2016 oil palm plantations were the main factor in deforestation (23%), ahead of the establishment of grasslands (20%). Current dynamics show a continuous evolution of land under cultivation for palm oil in Asia. In Malaysia and Indonesia, for example, which account for 80% of global palm oil production, Xu *et al.* (2020) estimate that plantations expanded by 147% and 322% respectively between 2001 and 2016. Furthermore, approximately 50% of new palm plantations in these two countries were established at the expense of forests and peatlands (FFAS, 2012).

Oil palm plantations are, in fact, ecologically and structurally much less diverse than tropical forests. Numerous studies have shown this using various indicators, including the identification and counting of the diversity of fauna/flora species present in a forest and an oil palm plantation (Gallmetzer & Schulze, 2015; Meijaard *et al.*, 2018; Meijaard & Sheil, 2013; Danielsen *et al.*, 2008). Furthermore, the sustainability of an oil palm plantation can be assessed by measuring criteria such as the size of buffer zones, carbon stock per ha, soil erosion risks, drainage intensity, etc. For example, if the risk of erosion is higher than 60 t/ha, then there is a high risk of environmental degradation and therefore low sustainability of agricultural production (Smit *et al.*, 2013)

In response to this situation, there are now various sustainability standards that encourage responsible and environmentally-friendly cultivation practices (such as the RSPO label). However, no mention of this type of standard is indicated on the packaging of vegetable fat dairy blends. Hence, **the incorporation of palm oil in vegetable fat dairy blends seems to be**

helping to provide an outlet for cheap palm oil from environmentally-unfriendly production systems.

In contrast, **local West African livestock systems make the most of natural ecosystems that are very rich in biodiversity** (Sahelian rangelands and Sudanian savannas). Pastoralism maintains a mosaic of habitats important for wildlife such as breeding birds. Given the dependence of pastoralism on the continuous supply of ecosystem services (forage, water resources), traditional management practices naturally incorporate many of the principles that aim to maintain or enhance the health of rangeland/savanna ecosystems. At the same time, pastoral animal husbandry practices (seasonal movements, use of woody fodder during dry seasons, controlled fire management, grazing crop residues, penning animals to concentrate manure deposits, promotion of local breeds, etc.) contribute to soil fertilization and the maintenance of the diversity of plant and animal resources.

However, increasing environmental constraints and changes in policies and practices, such as restricted access to land and water, are intensifying the pressure of grazing on these ecosystems which needs to be regulated (Secretariat of the Convention on Biological Diversity, 2010). Tools and indicators to visualize the evolution of the vegetation and fauna present have made it possible to observe a degradation of certain environments. Satellite imagery has made it possible to refine observations of vegetation cover, at the regional scale, particularly from surface albedo measurements (indicator of surface changes, effective in arid/semi-arid areas). As a result, the aridification of Sahelian environments has been demonstrated (Carrière, 1995). However, studies have demonstrated that desertification often occurs where policy choices have underestimated pastoral systems, whereas appropriate policies supporting pastoral systems have led to improved ecosystem integrity and biodiversity (Hatfield & Davis, 2006).

An important indicator of these environmental impacts is the vegetation survey, i.e., the survey of variations in abundance within species that testifies to the health of an ecosystem. Indeed, the presence of each species indicates a particular characteristic of the local environment, whether climatic (chorology, floristic range), physical (nature of the soil, humidity, etc.), biological (aptitude for competition, mode of reproduction, etc.), or ecological (sensitivity to grazing, crop weeds, pyrophile species, etc.). For example, in Mauritania, 100 species was shown to have declined between 1989 and 1995, particularly woody species such as *Sterculia setigera*, *Diopyros mespiliformis*, and *Celtis integrifolia* (Carrière, 1995).

Biodiversity cannot be summarized in a single indicator, as various studies have demonstrated (Duelli & Obrist, 2003; Danic *et al.*, 2014; Asselin *et al.*, 2020). For European dairy farms, agro-zootechnical indicators are the most appropriate to assess the intensity of biodiversity loss. They fall into four categories (Peeters *et al.*, 2004; EPE, 2013): (i) agricultural biodiversity, which is assessed by counting species/varieties of gametes and legumes within temporary grasslands, the presence or absence of tillage (impact on soil macrofaunal diversity), counting domesticated animal breeds (dairy cow breeds) and stocking, as well as carabid beetles, spiders, staphylinids (as they limit the proliferation of sometimes harmful communities and maintain soil balances), etc.; (ii) non-agricultural biodiversity, which is evaluated by counting species of grassland birds and butterflies, the presence or absence of bees and wild

pollinators, and the counting of rare and/or protected flora and fauna, etc.. This can be done through the IUCN (International Union for Conservation of Nature) Red List and the Living Planet Index, which aim to produce taxonomic groupings that allow a better description of the evolution of biodiversity and the risks it faces; (iii) habitat diversity and connectivity, which is estimated by determining the total number of habitats within the usable farm area (wet/dry/natural grasslands, forests, Natura 2000 sites, etc.) using Geographic Information Systems; and (iv) indirect measures of biodiversity such as the amount of mineral/organic fertilizer used per unit area, frequency of cutting hay meadows, frequency of application of phytosanitary products, soil phosphorus richness, etc.

- **Impact of the dairy trade on fossil fuel consumption**

The consumption of non-renewable energy is an important element of current thinking on sustainable development.

West African dairy production systems' consumption of fossil energy is particularly low compared to European dairy systems. Vigne et al (2013), for example, have shown that the fossil fuel use of Malian dairy systems is more than 10 times lower per liter of milk produced than that of other European or New Zealand systems (Figure 10). This better "energy efficiency" of livestock production is due in particular to the use of natural pastures and integrated crop-livestock systems.

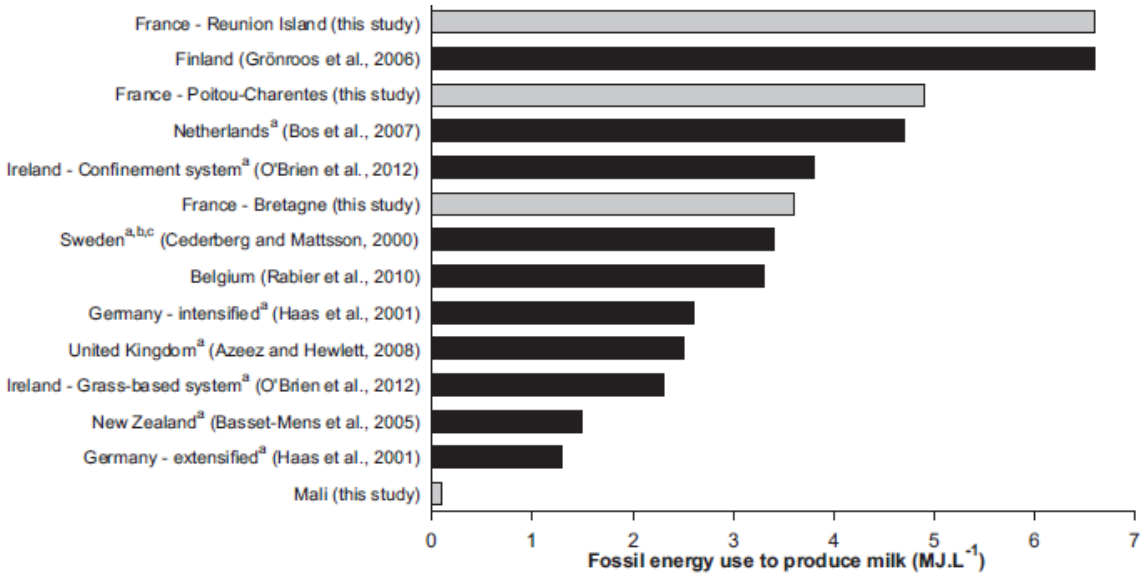


Figure 10: Comparative fossil fuel efficiency of several dairy farming systems (source: Vigne *et al.*, 2013).

Moreover, the addition of palm oil to milk powder contributes to an increase in fossil energy use per liter of reconstituted milk. Indeed, one must consider the energy consumption related to mechanized work, fertilizer application, industrial processing and transportation. Palm oil is imported into Europe by cargo ship from Malaysia and Indonesia, then the powders are transported by cargo ship to West African ports, and by truck between the ports and the dairy processing industries. Fossil energy use also is quite high for the production of feed resources

used by European dairy farms (Jensson and Kongshau, 2003 cited in Chase *et al.*, 2012). In France, the Dia'terre® tool is currently recognized for the energy assessment of agricultural systems (Vigne, 2014).

Conversely, it is important to emphasize the value of local food systems that make use of local agro-industries and nearby agricultural areas. **These local economies, of which the "dairy collection basins" are clear examples, make it possible in principle to limit the environmental costs of transportation and therefore fossil fuel consumption.** In West Africa, dairy chains have gradually been built around small units (mini-dairies) located close to producers (Vias, 2013), thus reducing collection distances. Of course, one should exercise caution with regard to this point, as research on French food systems has shown that short circuits are not always the most energy efficient. Furthermore, very little data is available for African value chains, which makes it difficult to extrapolate the results of these studies. However, the accumulation of energy consumption at each stage of production, in addition to that used during the various phases of transport, leads us to assume **that vegetable fat dairy blends have a greater impact on fossil energy consumption than local milk, which is** largely produced in extensive systems.

However, these hypotheses need to be confirmed by field data. In particular, the impact of the intensification of local livestock systems on their energy efficiency needs to be assessed. The increasing use of concentrates and fodder crops, and the development of motorized collection could, for example, modify the impact levels of local livestock systems.

The issues are relatively similar when it comes to assessing the impact of the dairy trade on climate change.

- **Impact of the dairy trade on greenhouse gas emissions and sequestration**

The environmental impacts of European imports into Africa also are compared on the basis of their share of greenhouse gas (GHG) emissions that contribute to global warming. Recently published research has highlighted the capacity of extensive pastoral and agropastoral livestock systems to produce milk with virtually no carbon impact.

The study, conducted in northern Senegal (Assouma *et al.*, 2019), used an original method to estimate the feeding behavior of ruminants and their methane emissions. The carbon footprint of the area was calculated by assessing all GHG emissions (CH_4, CO_2, N_2O) and the carbon that is sequestered (Figure 11).

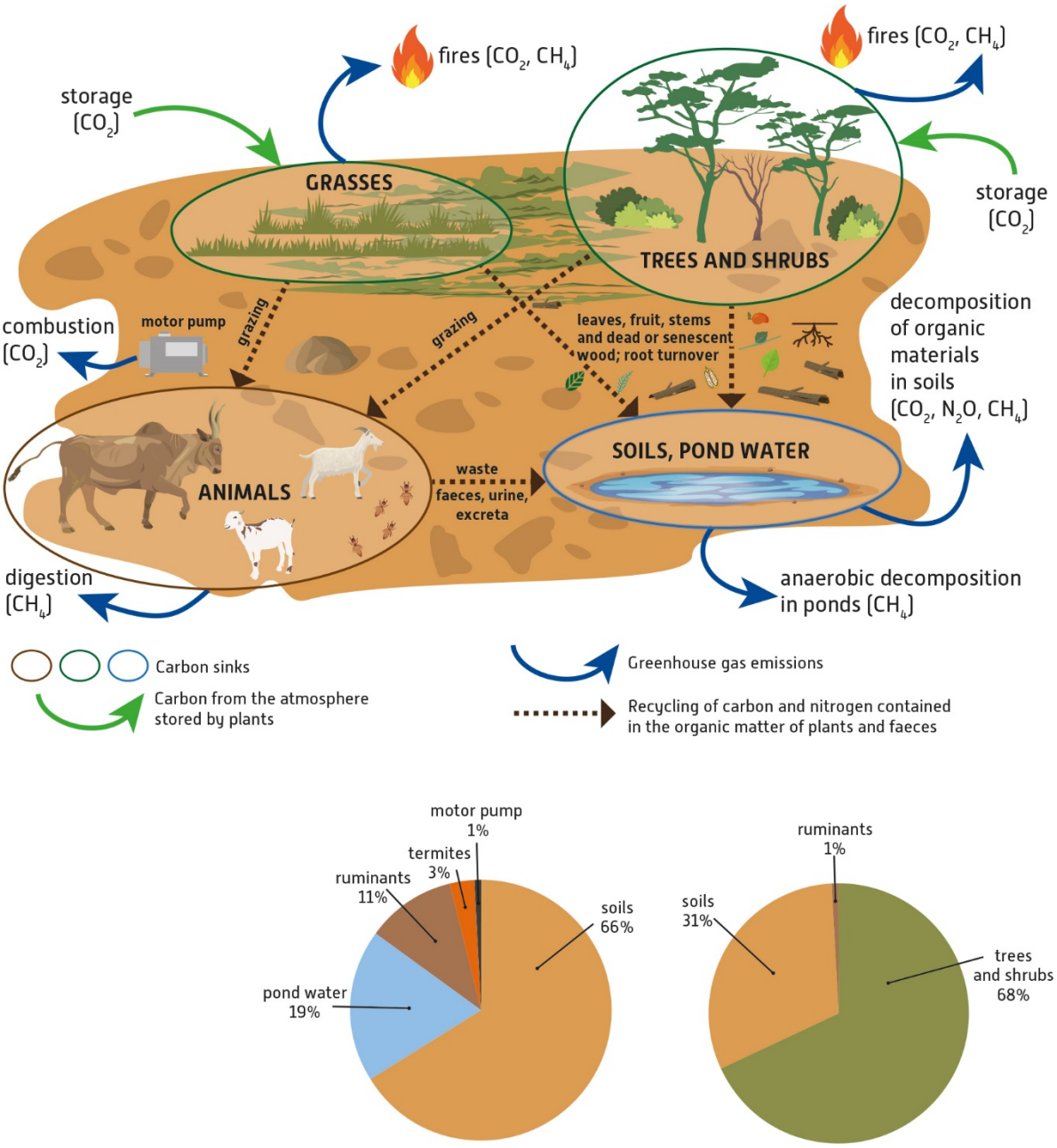


Figure 11: Simplified model of greenhouse gas emissions and carbon storage of a Sahelian pastoral territory (Assouma et al, 2019)

This work shows that **the carbon balance of pastoral systems is zero.** The carbon sequestered in the soils and vegetation of the Sahelian territory completely offsets the GHG emissions from the livestock system, and in particular from soils and feces, animals and ponds.

Conversely, and despite the carbon storage associated with the establishment of hedges, grass strips, trees, grasslands, and areas set aside for apiculture, European dairy farms do not achieve a zero-carbon footprint, particularly because of their so-called intensive practices (e.g., high addition of concentrates in the feed rations). In France, Dollé et al (2009) highlighted a net carbon footprint between 0.65 and 1.05 kg of CO_2 equivalent.kg-1 of milk produced at the farm level, using the GES'TIM method. These are quite close to the estimates provided by

the FAO (Gerber *et al.*, 2013) which mention GHG emissions of Western European dairy systems of between 1.5 and 2 kg CO_2 equivalent per kg of milk.

- **Impact of the dairy trade on water resource depletion**

Several studies have been conducted to assess the impact of dairy farming systems on the depletion of non-renewable water resources (groundwater). This work has been carried out in Morocco and India (Sraïri, 2019), as well as in Europe. The methods used highlight the risks associated with the intensification of livestock systems in regions with high water constraints such as the Sahel, although no studies have been conducted in such an environment.

According to IDELE (2018), a European cow consumes an average of 40-120 liters of water per day, or 5-10 liters of water for each liter of milk produced (13.6-45.5 kg of milk produced/day). Local African breed cows are adapted to drought and consume less water due to more efficient water recycling. Thus, a 250 kg cow can consume between 10 and 30 liters of water per day depending on the season, but also on the availability and accessibility of water (Coulomb, 1984). However, this low water consumption, which is mainly due to the difficult environmental conditions, results in low productivity, amounting to an average of 1.5-2 liters of milk per day.

However, the water used for milk production does not only involve drinking water for cattle. This use also includes the upstream production of feed, produced or imported on the farm, and the downstream processing of products. Methods for assessing water consumption in the animal product production chain usually provide an indicator for the whole chain, which can be expressed in kg of water actually consumed or "virtual" water per kg of product. "Virtual" water is characterized by the addition of three types of water (Corson & Doreau, 2013): (i) Blue Water, known as "tap water", used for watering animals, cleaning buildings and the milking parlor, and possibly water drunk by animals in rivers or ponds, or even downstream for product processing; (ii) Green Water, which corresponds to the sum of soil evaporation and plant transpiration, mainly related to feeding animals; and (iii) Gray Water, which is a concept that aims to take into account water pollution by calculating the amount of water that would have to be added to polluted water throughout the production chain to bring it into compliance with environmental standards (generally used for water polluted with nitrates).

With regard to water consumption related to feed (Green Water), pastoral livestock systems, unlike European livestock systems, use few concentrates and little cultivated land. When they do, the feed is largely produced by rainfed crops and mainly crop residues are consumed. Although this is not relevant in terms of comparison, due to the high levels of water stress in Sahelian countries compared to European countries, we can still assume that European dairy farms have a greater impact on Green Water consumption.

The water used during processing (included in Blue Water) likely represents a small part of consumption over the entire production chain in intensive production contexts (Riddout *et al.*, 2010). However, while very little data on artisanal processes in West Africa are available, it is likely that industrial transformation processes use more water than artisanal processes.

A study comparing the environmental impacts of different types of yogurt, especially with respect to water resources (water consumption, water scarcity, potential acidification/eutrophication of fresh water) reports that **yogurts with a higher environmental impact, expressed per kg of yogurt produced, are those containing milk powder and additives** (Vasilaki *et al.*, 2016). Although this study took place in Spain, we can assume that a yogurt made with vegetable fat dairy blend powder has a greater environmental impact, especially in terms of water resource depletion, than a yogurt produced only with local West African milk.

6. Summary: What is the balance of the impacts?

This review emphasizes that sustainable development strategies require trade-offs between several objectives. Several indicators should be considered simultaneously (Table 11).

Imported powders appear to be particularly effective in providing industries with cheap raw materials and in enabling them to meet a rapid growth in demand. These imports have thus enabled the emergence of a West African dairy processing sector that has created many urban jobs and made it possible to market cheap processed dairy products. Imports of powder have also helped to protect European jobs in the production and processing sector, as part of a strategy to conquer export markets.

However, the economic and social objectives that have justified the expansion of these imports have overshadowed a number of other objectives that are essential to sustainable development in Africa. In particular, the role of local livestock in creating jobs in rural areas has been forgotten, even though millions of pastoral and agropastoral families produce milk in the region. The importing industries have thus ignored the role of the dairy industry in creating outlets for local livestock farmers. Similarly, the use of imported raw materials of standard quality has led to a levelling down in terms of the quality of dairy products consumed in West Africa, and to labeling practices that do not comply with Codex standards, particularly for milk and milk products. Yet the region has a rich pastoral dairy culture based on numerous dairy products and know-how that seem to be largely undervalued today. Moreover, available data on the environmental impact of pastoral and agropastoral farming reveal that these extensive and semi-extensive production systems are particularly effective at reducing the carbon impact of the dairy sector, preserving the biodiversity of ecosystems, and limiting deforestation. The local milk collection networks implemented by some 20 industries and 300 mini-dairies in the area show that this model has a promising future.

On the other hand, the available literature suggests that the environmental impacts of skim milk and fat powder blends are problematic, due in particular to the incorporation of palm oil without environmental guarantees. These products also generate the risk of misleading consumers, as some labels do not meet Codex standards. Today, the surging share of vegetable fat dairy blends in European exports to Africa raises the question of "responsible" exports, and calls for West African policies to reconsider modes of integration into international trade.

Table 11: Summary of the impacts of the use of different raw materials

Controversies	Critical points	Vegetable fat dairy blends	Whole milk powder	Local milk
What role in international trade?	1. Meet local consumer demand for milk and dairy products	+++	+++	-
	2. Supply cheap, regular and safe raw material to industry	++	+++	+
	3. Create market opportunities for herders and peri-urban farms	-	-	+++
	4. Create local jobs to reduce poverty, mass unemployment and economic migration	+	+	+++
What are the risks of misleading consumers?	5. Marks of quality that comply with Codex standards and avoid deceiving consumers	-	+	+++
	6. Raw material for the production of dairy products with a high cultural, environmental or heritage value	-	-	+++
What are the risks and benefits for the health of consumers?	7. Raw material to produce products of good nutritional quality	+	+	+
	8. Raw material enabling the production of products of good physicochemical, microbiological and organoleptic quality	-	+	++
What are the environmental issues related to the milk trade?	9. Production methods that respect biodiversity and contribute to the maintenance of ecosystems	-	+	++
	10. Production and marketing methods that limit the use of fossil fuels (non-renewable)	-	+	++
	11. Production methods that limit the emission of greenhouse gases (GHG) and contribute to their sequestration	-	-	++
	12. Production methods that save non-renewable water (groundwater) and cause little pollution	-	-	+

Legend : - : rather negative ; + : rather positive ; ++ : positive ; +++ : very positive

Part 3: Recommendations

Based on this review, we propose a number of recommendations for the actors involved in these sectors. First, this initial review should be supplemented by research and studies to fill gaps in the data. Second, nomenclature and labeling practices should be revised. Third, European dairy companies should develop responsible export and investment strategies and approaches. Lastly, tax measures and incentives should be targeted to encourage local milk collection.

1. Expand market monitoring and impact measures

This review provides a broad overview of available data on the sector, and identifies several innovative studies that recently have enabled progress in the assessment of the impacts of local milk and imported powders. This is the case, for example, of recent work on the environmental impact of livestock farming (Vigne *et al.*, 2013; IDELE, 2018; Hassouma *et al.*, 2019), and of various field studies conducted to assess the impact of the dairy sector in terms of employment (FAO, GDP and IFCN, 2018; Orasmaa, 2020). The discussion also was informed by various studies conducted on behalf of the "My milk is local" campaign (Duteurtre and Corniaux, 2019; Levard *et al.*, 2019; Larondelle, 2020) and in preparation for the ECOWAS "Milk Offensive" (Corniaux and Duteutre, 2018).

However, data remain scarce, and need to be complemented by further research into social, environmental, health and nutritional dimensions. Environmental LCA approaches (comparison of the production of a yogurt based on local milk, whole milk powder and vegetable fat dairy blends) carried out with the help of a tool such as Simapro, and social LCA approaches (income and employment according to gender) would be particularly appropriate. To be robust, this work will require the creation of regional databases. In particular, studies are needed to monitor changes in consumption and to better characterize the vegetable fat dairy blends used (presence or absence of trans fatty acids).

The establishment of a "committee of experts" or an "observatory" to monitor the evolution of vegetable fat dairy blend imports and their impact could provide answers to these questions.

In monitoring the markets, a "point of vigilance" should be the potential development of trade in new products containing **whey powder**, which could replace the standard vegetable fat dairy blends. The emergence and dynamics of these new products on the West African market should be monitored.

2. Revise nomenclature and labeling practices

In light of this report's findings, we recommend that **the use of product nomenclatures be changed to differentiate between blend-based products and milk-based products**.

The following recommendations are addressed in particular to the heads of international trade regulatory bodies (customs, WTO, EPA negotiating bodies, Codex committees on dairy products, etc.) and local trade bodies (West African countries' standards agencies, health services, etc.). In accordance with current standards and Codex texts, it is recommended that:

- the term "blends of skimmed milk and vegetable fat in powdered form" should be used to refer to what currently is improperly called "fat-filled milk powder". The term, "blends of skimmed milk and vegetable fat in powdered form" can be shortened, as it has been in this report, to "vegetable fat dairy blends". Other options are "skim milk powder blends", "dairy blends" or "fat-filled *dairy* powders". The term "fat-filled *milk* powders (FFMP)" should not be used.
- FAO international market monitoring should include the trade in "milk, milk products and products containing milk" rather than considering only the trade in "milk and milk products".
- Vegetable fat dairy blends should be recognized by the competent services (customs and standardization agencies) in international trade as well as on local markets.
- Vegetable fat dairy blends should be integrated into FAO's market and price monitoring by including them in the basket of dairy products and dairy origin.
- customs nomenclatures should be homogenized, and the new category gathering skimmed milk powders and vegetable fat dairy blends should be operationalized for more coherence and transparency.
- the adoption of national standards and the implementation of Codex standards for labeling should be encouraged. In particular, the composition of the product and the type of vegetable oils used (especially in case of hydrogenation) should be mentioned.

In order to encourage changes in labeling practices and nomenclatures in use, **information campaigns** should be organized **for sector actors and for consumers**. These campaigns should focus on denouncing the risks of misleading consumers. Detailed **recommendations for the labeling of retail products** are:

- apply national and international standards relating to labeling: mention of the composition, origin, name of the product...
- mention nutritional precaution "NOT FOR INFANTS"

Recommendations for products sold in packages of more than 1 kg are:

- mention the need to specify that the raw material contains vegetable fat on products made from the raw material
- apply national and international standards relating to the labeling: mention of the composition, origin, name of the product...

- mention nutritional precaution "NOT FOR INFANTS

For products using palm oil, it is **recommended that sustainability criteria** related to the production of palm oil be **mentioned on the packaging** (if they exist).

3. Encourage "responsible" strategies and approaches by European companies

Recommendations also should be made to companies. They should be able to assume the practice of "re-fattening" with **full knowledge and transparency.** Firms should be made aware of the emergence of an advocacy movement calling for the respect of official standards and nomenclatures. In particular, it should be remembered that calling products made with powder containing palm oil "yogurt" or "fermented milk" does not comply with Codex standards.

This report highlights that the suspension of European quotas, alongside policies to deregulate international trade in dairy products, have contributed to the expansion of European vegetable fat dairy blend exports to West Africa. However, these policy changes were not the only factors. This report identifies how the strategies of dairy firms also have contributed to reshaping the profile of trade between Europe and Africa.

In response to this awareness on the part of consumers and industrialists, "responsible export" and "responsible investment" practices must be promoted. Such approaches have been tested in West Africa as part of Social and Environmental Responsibility (SER) strategies (as in the case of Arla in Nigeria), under the impetus of multi-stakeholder alliances (see the "Milky Way" Alliance), and within the framework of local partnerships (see the local innovation platforms supported by the Africamilk project). These responsible approaches also are discussed within the European interprofessions framework (Cniel, 2020).

4. Target local tax and collection incentives

According to a note by Corniaux and Duteurtre (2018b), which echoes some of the arguments developed in this report, "*experience shows that in West Africa, collecting local milk can pay off for industries. Guided by incentive and regulatory policies, industrialists have everything to gain from building a new alliance with livestock farmers*."

The measures to be promoted in favor of milk collection are the following:

• Reconsider the levels of taxation on imported powders in the medium and long-term

West African governments need to consider the role of imported powders in the development model of the dairy sector as a whole. Encouraging local collection requires appropriate fiscal measures. Increasing the level of **taxation on milk powder imports to levels above 5%** is one of the points most discussed during meetings between ECOWAS authorities

and West African livestock farmers' organizations regarding the "Regional Milk Offensive". The EPA negotiations also foresee the existence of a category of "excluded goods" for products from "strategic" sectors for which liberalization must be carefully assessed. These increases would improve the price competitiveness of local milk while helping to boost tax revenues. They could **first target imports of skim milk and vegetable fat blends**, the use of which has increased significantly due to distortions in competition. Should palm oil, which is 13 times cheaper than butter oil, continue to offer a "price" advantage to vegetable fat dairy blends over local milk?

These measures must take into account the purchasing power of consumers and the local dairy supply. If applied suddenly, such measures could negatively impact urban consumption. It is therefore advisable to consider a gradual increase in these taxes, in line with an increase in collection, while supporting the poorest consumers as well as investments in milk collection infrastructure (Levard *et al.*, 2019).

- **Make local milk more attractive to manufacturers**

At the same time, the fiscal measures to be recommended also should make it possible to lower the production and processing costs of milk (on average, a liter of local milk is sold at more than FCFA 300). These measures will concern the exemption of milking, pasteurization and local milk processing equipment, and to a lesser extent cattle feed. They will mainly concern exemption from VAT for dairy products made from local milk. Monitoring this type of measure will be difficult due to the practice of mixing local milk and milk powder in the manufacturing processes of certain dairy products. However, the measure would have the advantage of benefiting, a priori, both producers and industrialists if they process local milk.

- **Gradually induce industries to reach a minimum collection rate**

The States, concerned about both their trade deficit and rural development, may also consider certain measures that are more incentivizing or more coercive. These include requiring a minimum percentage or quota of milk collection in the processing of dairy products in the specifications of companies when they obtain their license. Measures exist in Mali and Nigeria, although they are not always fully implemented. The minimum scale is in the range of 10-20 percent. Firms may face a supply shortage, particularly in the dry season. This is why such measures need to be supported by policies to develop local production.

- **Promote contractualization and partnerships between dairies and producers**

Finally, producer organizations and dairies assert the need to ensure a legal framework for the establishment of sustainable partnerships between farmers and manufacturers, guaranteeing fair commitments on volumes and prices. The strengthening of existing interprofessional organizations could contribute to setting up such a legal framework adapted to local conditions, and thus make milk suppliers more responsible.

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Annexes

Annex 1: "Learn More" Web Links

- On the trade of vegetable dairy blends between Europe and West Africa (CIRAD, 2018 and 2020)
  Le commerce de "lait en poudre réengraissé": situation et enjeux pour les échanges Europe - Afrique de l'Ouest

- On trade statistics concerning vegetable dairy blends products in Europe and West Africa (Chatellier, 2020)

  https://doi.org/10.20870/productions-animales.2020.33.2.4027

- On trade and fiscal policies (GRET, 2018)

  "Quelles politiques commerciales pour la promotion du lait local en Afrique de l'Ouest ?"

- On the fatty acid composition of powdered vegetable fat dairy blends

  Université Catholique de Louvain, study coordinated by SOS Faim (2020): (https://www.sosfaim.be/vivalait-et-vitalait-cest-pas-du-lait/)

- On the detection of adulteration of "re-fattened" milk

  Journal of Dairy Science (2019): https://doi.org/10.3168/jds.2018-15620

Annex 2: Framework text on West-African imports of vegetable dairy blends

- Corniaux C., Chatellier V., Dia D., Duteurtre G., 2020 : "**De l'huile de palme dans le lait : comment l'Union européenne renforce sa présence sur le marché laitier Ouest africain en vendant un succédané de poudre de lait** ", *Renc. Rech. Ruminants*, 2020, 289-293, http://www.journees3r.fr/spip.php?article4883