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Í FUTURES FACES OF FOOD AND FARMINGS: REGIONAL INSIGHTSÎ

Í Dairy policy in Senegal, subject to technological and political challengesÎ

Sergio D. Magnani, Véronique Ancey, Bernard Hubert

Abstract

Over the last 15 years, Food Policies implemented within the livestock sector have pointed out tensions between the sharply increasing global demand for animal products, the environmental and health issues due to the production's intensification, and the competition for land between human food and animal feed.

In Senegal, the State and some dairy companies are claiming for an intensification of the dairy production, focused on technical stakes, which does not match the logics of the pastoralists who stand for the multi-functionality of their systems; moreover this new industry is exposed to the fierce competition of imported powder milk. A new industrial model is spreading.

This case study questions a new growing pattern of public action in poor countries, where joint firms, foundations and NGOs assert acting to link profit with the needs of the poor, and are often presented as local development actors. Its future as new standard of public action for food security and food policy is questioned.

Keywords: Dairy Production, Pastoralism, Intensification, Technical changes, Food Policy, Senegal.

Over the last 15 years, Food Policies implemented within the livestock sector have pointed out tensions between the global demand for animal products, which is increasing sharply (Delgado and al. 1999), the environmental and health issues due to the production's intensification, and the competition for land between human food and animal feed (Steinfeld and al. 2006; Steinfeld and al. 2013).

Ever since colonial times the concept of intensification has been the core of a techno-scientific paradigm that has oriented pastoral development intervention in Africa. This paradigm has included other notions (i.e. capacity of charge and desertification) which have proved non-operational in arid environments (Ellis and Swift, 1988; Behnke and Scoones 1993; Homewood 2008) but have been successful in sustaining powerful narratives (Hodgson 1996; Swift 1996) underlying a set of development interventions aimed to constrain pastoral mobility, privatize natural resources and fragment grasslands. These development patterns, misunderstanding the characteristics of pastoralism as a specialized production system exploiting unpredictability and climatic variability (Krätli 2008; Krätli and Schareika 2010), have largely contributed to increasing pastoralists' vulnerability and destitution (Galvin and al. 2008). This is partly due to the focus of development patterns on vegetal production: in Senegal for instance, peanuts, cotton and rice attracted more attention than livestock did.

Despite a strong set of evidence, the techno-scientific paradigm of intensification is still considered by development actors as the most valuable option in achieving the growing demand for animal products in

western Africa. This is as well asserted concerning dairy production, which is the focus of this paper. Since the late 2000s, the increasing agricultural commodity price volatility is questioning the import of tax-free powdered milk as an easy solution to answer the urban demand for dairy products. The powdered milk price instability combined with the rapid growth of the regional demand is strengthening claims, by both national authorities and international institutions, in favor of the development of a local milk production. This process can only come about as the result of an intensification of dairy production, which can only be achieved through the settlement of livestock herders, as well as systematic feeding inputs use and genetic improvement of cattle breeds.

This paper aims to discuss the limits of viewing an animal production policy as a technical issue. By focusing exclusively on technical stakes and productivity growth, this process has two main implications. On one side, it conceals some political choices and economic conditions that hinder the development of a local dairy production in western Africa: the effective competition of milk powder which remains tax-free; the lack of supportive framework of public policies to produce and process milk. On the other, it neglects the links between the herders, their environment, markets, livestock and social dynamics. Given the limits of the conventional production models, which are becoming more and more obvious, the economic and environmental aspects can no longer be ignored in political choices.

The case study presents three successive forms of public action at work over the last three decades in Senegal, dealing with dairy production and collection. The most recent one is a dairy factory settled north of the country, illustrating the social business and a new mix model relying on both powdered and fresh milk. The European exports booming expected after the end of dairy quota, will contribute to the local milk supply remaining marginal.

This analysis is grounded on social sciences within an interdisciplinary framework taking into account how natural and living resources gain different senses and values (Hubert and al. 2011) for the actors. The changes in public policy for food and development address socio-economic issues (Binet 2014; Gabas and al. 2014). This research took place in a collective research program on ecological intensification of livestock in France, Brazil, Uruguay and Senegal¹. A PHD socio-anthropological fieldwork was conducted in Senegal over three years², mobilizing qualitative standard methods from the discipline (participant observation, open interviews, study of written local sources). An investigation on national livestock and dairy development policies was realized based on interviews with public servants, development experts, researchers, livestock professional organization leaders, pastoralist families and NGOs workers. Dairy development dynamics were explored in three peri-urban areas (Magnani 2016).

This paper is made of two parts:

Firstly how industrial patterns are directly or indirectly altering livestock development.

Secondly how public policies are designed and implemented in order to achieve food security by increasing agricultural production.

¹ (Mouvet, with financial support of Agence Nationale de la Recherche)

² Three field works were conducted: from June to May 2011; from June to November 2012; and from June to December 2013.

1. Livestock development subject to industrial rationalities

Agricultural productivity templates are derived from an industrial rationale where mechanically more input and intermediary consumption lead to more output. It is on that basis that maximisation of biological, vegetal and animal production systems have operated, by intensifying the use of various effective inputs with a view to obtain more output. This quest for maximisation stage by stage defines in a way the implementation to the maximum of the potential of these systems. It ends up rejecting the collateral side effects (such as pollution) as external phenomena. These collateral side effects are precisely the basis for the questioning of those very systems in industrialized countries.

There are however other characteristics of the industrial rationale which are directly linked to other systems, themselves initially built on different economic, social and cultural foundations, such as pastoral herding. In industry there is a straightforward link between the increase in size and the increase in the efficiency of the technical capital. Productivity rises by way of economies of scale. To be precise, the increase in productivity within one stage of the industrial process leads to seek a complementary and consistent increase in productivity in the other stages of that process. In the end innovation leads to an overall increased productivity and size of the technical frameworks. In the same way the division and specialisation of tasks have allowed an increase in productivity in industry, but at a cost, in terms of job satisfaction for the workers and in terms of quality of production. There is a divide between the design-stage activities (remit of engineers and researchers) and the operational and practical implementation stage, where practitioners end up using technologies created elsewhere. Their professional validation is thus dependent on their ability to develop good technical practice, with the risk of losing knowledge and skills acquired through exposure to the biophysical world (with its reactions and dynamics). In the majority of cases this division of labour and the split between the various types of skills, when transferred to agricultural production systems, goes hand in hand with the segregation of the various activities and their dedicated spaces, i.e. vegetal/animal, even if some crops are destined to animal feed production, either rough or concentrated feed. Such a divide in territories threatens the balance, as herding used to be based on the seasonal use of several areas throughout the year, as in the case of transhumant or nomadic pastoral herders. This will be explored further in one of our case studies.

This conceptual system has been implemented in a number of agricultural development models in southern countries, either explicitly or implicitly. It was used as a model in the three Senegalese cases we are focusing on, specifically dairy production. This was done either in a direct way, to create new production systems in the vicinity of Dakar, or to help transform existing systems in an indirect manner, focusing mostly on targeting vegetal crops used to agro-industrial ends. Thus, these latter case-studies offer different examples of how technical and political models subordinate livestock development to the dynamics of two local agro-industrial chains (cotton in Casamance and sugar cane in the Senegal River valley).

Since 2008, the main public action in livestock development in Senegal has been a national breeding program designed to improve the dairy cow genetics through artificial insemination. This technical option is presented as the best way to rapidly increase national milk production and reduce imports of dairy products. But as long as the imported milk powder remains tax-free, the chain of value for milk production and processing lacks a

supportive framework in the public policies. Beyond the promotion of the interests of influential socio-professional groups (veterinary medicine, public servants, leaders of livestock professional organizations, providers of animal genetics), the rationale behind this choice can be traced back to the traditional thinking about livestock development policy, in terms of the mainstream industrialization patterns. However, if the national breeding program is implemented by the government as a specific policy, an industrial development policy for livestock and dairy productions is yet to be invented in Senegal. This illustrates the disconnection between, on one side, the technical nature of development ideologies and schemes and, on the other, the political, social, economic and ecological realities of the Senegalese herders.

1.1 Dairy farming around Dakar: the failure of an industrial livestock farming model disconnected from the dairy processing sector.

Since the middle of the 1970s, the public research on zoo-technical development (LNERV)³ has identified the intensification and the specialization of livestock systems in dairy production as a way to satisfy the growing urban consumption of milk products⁴. A set of research was carried out to test exotic breeds adaptation and performance. Results were perceived to be encouraging. As a consequence, in 1982 a seven years dairy development project was implemented in the peri-urban area of the capital. Several hundreds of cows of Montbéliarde and Pakistani breeds were imported and delivered to fifty-five farmers who also benefited from a set of services: subsidized animal feeds, technical and veterinary support, artificial insemination. Despite these facilities, the project was a failure: due to the cows mortality rate and the high production costs, the large majority of the monitored farms collapsed within ten years (Ba Diao 2005).

Since the beginning of the 90s, the intensive dairy model (specialized breeds fed with ensiled corn and industrial feeds) has been adopted by a few local businessmen to build big dairy farms. Three structures of this kind are still operating. For their owners dairy production is mainly the economic justification of the farm as a prestigious object. This attitude explains the large-scale (from 200 to 800 hundreds cows) and the expensive and unrealistic nature of their projects. The farms management is complex in terms of animal feeding, health and reproduction. If the production costs are high (approximately 0.5 euro per liter of milk), the most significant constraint is the disconnection of the farms from the urban market. Raw and curdled milk is sold through a network of several hundred independent sellers who are unable to absorb the whole production (from 700 to 3000 liters per day). In order to valorize the surpluses, the farmers have invested in expensive dairy infrastructures to process milk and to supply the urban formal market. The processing of milk failed because of the competition of the cheaper powdered milk-based products. The intensive farms are today in a precarious situation and their survival depends on the unconditional economic support of their wealthy owners.

More recently, in the 2000s, a pool of smaller farms (10 to 50 dairy cows) have emerged in the countryside around Dakar. During our fieldwork we monitored seven of these structures to compare their performances, technical models and social organization. The social profiles of the promoters are diverse (three traders, one veterinarian, an army colonel) but only one owner, a French herder, has relevant experience in dairy farming.

³ Laboratoire National de Elevage et de Recherches Vétérinaires.

⁴ Imports of powdered milk expanded from 50 000 t/year at the beginning of the 70s to 100 000 t/year at the end of the decade (Duteurtre and Corniaux 2013: 35).

Their attitude towards investment is cautious and sensible, compared to the owners of the big farms. Milk is also sold directly on farms or in local shops. However, these small farms face the same challenges in terms of high production costs and lack of technical skills. As a result, only two farms out of seven monitored were able to make profits.

The dairy systems in the peri-urban area of Dakar are ~~intensive~~ in inputs and capital but seem to be by far less accomplished regarding knowledge and skills. This is partly due to the fact that dairy farming models have been implemented without involving the local herders. In this context, intensive systems need strong technicality and niche markets to survive: inputs prices are high; the access to land and water is difficult; the powdered milk competition is hard. Public support is non-existent; all in all, the publically funded research worked for fifteen years, mainly in experimental stations, and supportive public initiatives were implemented only for seven years.

1.2 Two dairy development models subordinate to the local agro-industrial dynamics

1.2.1 Dairy production in the peri-urban area of Kolda (Casamance), successes and failures of a development model based on agriculture & livestock integration

The dairy basin around the city of Kolda in southern Senegal was created at the beginning of the 90s through a partnership between a public cotton factory (SODEFITEX) and the national agricultural research institute (ISRA). The technical reference model was the integration between agriculture and cattle rearing in a context in which cattle population was abundant: 599 000 head enumerated in 2007 (ANSD, 2010: 81). This model relied on the local breed: the ~~Ndama~~, poor dairy breed but trypano-tolerant. The local policy focused on agricultural intensification thanks to the manure and the animal power obtained by stabling and supplementing oxen with cotton seeds. However, local farmers⁵ rejected this technical solution as they were used to allowing the cattle to graze in the fields and as the consequence, fertilize them, researchers suggested converting the stables to produce milk during the dry season. The sale of milk was seen as a good solution to increase the farmers' income and to encourage them to grow cotton. The number of dairy barns grew fast to 1 000 in 1992 (Fall and Faye 1992: 7) thanks to the delivery of attractive services: subsidized cotton seeds as supplementary feed; credit; technical and veterinarian support. To process the increasing volumes of milk produced, a Non Governmental Organization (Vétérinaires Sans Frontières) funded the creation of a mini-dairy in 1996. For around a decade the dairy basin of Kolda was considered a successful experience based on the improvement of cattle feeding through the association of inexpensive protein supplements (cotton seeds) with agricultural residues and natural pastures. In 2004, eight mini-dairies processed 208 105 liters of milk (Faye and al. 2005).

Things changed radically in the following years due to a major reorganization of the support framework. The privatization of the cotton factory (2003) and the cut in development assistance funds (2006) led to an increase in the price of cotton seeds and to suspending the free interest loan scheme. Between 2006 and 2010, milk became scarce during the dry season and mini-dairies were forced to process powdered milk. Nevertheless, several changes occurred. If local farmers seemed reluctant to adopt the main technical innovations proposed

⁵ In the region of Kolda crop and livestock farming are practiced by most of rural population even if differently depending on the socio-cultural belonging and the history of social groups' interaction.

(forage crops, mowing and stabling), they adopted the use of protein supplementary feeds, which proved to be a successful way of developing the complementarity between agriculture and cattle-herding to produce milk throughout the year. According to our fieldwork results, milk production is still considered an attractive option in the peri-urban area, also, if not primarily, due to the income generated by milk sale. If the latter is not the more important economic activity in the area, benefits of supplementing milking cows are appreciated in terms of a significant improvement of cattle productivity, health and calves' physical conditions. The milk sale also allows taking charge of the family during the dry season without selling livestock when the terms of trade are unfavorable. However, when the support framework is weak or absent, the farmers go back to a more economical model in terms of external inputs.

1.2.2 The dairy basin of Richard Toll, to improve pastoral systems production

In 2006, a local dairy factory was set up in Richard-Toll city, in the Senegal River Valley, that hosts the most important agro-industry of the country growing and processing sugar cane. The groundbreaking dairy business project supplies the factory with milk collected by several hundreds of pastoralists. Between 2006 and 2008, the dairy factory exclusively processed local milk and targeted a niche market of urban high-middle-class and expatriate consumers. Within this period, the dairy faced severe economic difficulties due to the low volumes collected⁶. In 2008, thanks to the innovative character of the initiative, the dairy was able to build an alliance with the foundation of a global dairy group, Danone.communities. It provides the Senegalese dairy with a technical expertise in strategic areas such as manufacturing, marketing and distribution. Moreover, new stockholders joined the project and several private and public donors financed development interventions in the dairy basin. The creation of a successful brand leading to a significant increase of sales volumes⁷, new injunctions are served on the milk collection service. In 2011, the industrialists stress the necessity to stabilize and increase the milk production by implementing a conventional approach in order to increase and stabilize the milk collection that in this arid environment is strongly affected by seasonality and pastoral mobility. The main goal of the development intervention is to convince the pastoralists to settle their milking cows during the dry season by promoting, through a loan scheme, a systematic use of industrial feeds and residue of sugar cane. During our fieldwork (2011-2013), the intensification patterns failed to significantly reduce the seasonality of pastoralists' milk production that depended mainly on the high variable quality and quantity of natural pastures.

In fact, the industrialists' vision of change does not match the logics of the pastoralists in several ways. The latter, by participating to milk collection, try to take advantage of the new trade opportunities during the rainy season. At this time of year selling milk is extremely advantageous. Thanks to the fresh and green pastures, production is abundant and doesn't require the use of inputs. In contrast, during the dry season the milk sale becomes less profitable because the income generated rarely cover the inputs' cost. The herders who allow to let some milking cows at their camps, while moving the rest of the herd in search of water and pastures, act that way for many strategic reasons other than milk production and sale: 1) to ease the mobility of the herd by stabilizing the elderly and the children, while ensuring their access to milk; 2) to secure their access to animal

⁶ In 2007, the dairy collects on average 1 066 liters of milk per day on a plant's processing capacity of more than 10 000 liters per day.

⁷ 1 140 t in 2011, compared with 430 t in 2007.

feeds on a credit basis; 3) to ensure their rainy season milk sales, the dairy factory prioritizing the herders who never stop the sale.

While the industrialists try to induce a relative specialization on milk production and promote a systematic use of animal feeds, pastoralists stand for the multi-functionality of their systems and try to limit the use of the expensive inputs.

2. Public Policy changes, dairy pattern remains

The first attempts of industrial dairy policies in Africa, at the end of the 1960s, were an imitation of the Indian flood model : aiming at accelerated industrial development, the transformation units of imported powdered milk were supposed to be incentives for local milk chains of value, which should gradually replace the imports (Danau 2009). This policy failed for local and international reasons, among which the growing competition of imported powdered milk (Vatin 1996). But over the last decade, dairy companies have been spreading around the main towns in Africa (Duteurtre 2007; Corniaux 2015), relying on both powdered and fresh milk, whose relative amounts are variable and unknown. As these dairy companies initially relied either on powder or fresh milk, their convergent supply dynamics can be analyzed as a new syncretic industrial design (Corniaux and al. 2012). Even those products could be used in the same family and mixed in the same meal, they can be considered as incommensurable: on one hand a freight of technologically dried powder circulating over oceans from one continent to another, on the other a critical nutrient for all mammals that has to be consumed within several hours (Hubert 2015). The powder is mainly produced by "industrial like" farms anywhere on the planet and it can be stocked over the seasons elsewhere; fresh milk if not consumed within a few days has to be transformed into butter or cheese as well as being heated to be preserved in a liquid form, much more difficult and costly to transport. From 2015, the end of the milk quotas in European Union and the expected exports booming towards African markets will challenge this mixed model: does it still guarantee a market opportunity for the Sahelian herders, or even favor the development of a dairy policy in sub-Saharan countries?

2.1. Two dynamics of dairy policy, around Dakar and Kolda

The case study on dairy transformation near Dakar, the capital of Senegal, and Kolda in Casamance, illustrates the marginal place held by the livestock production in the political scheme of agricultural industrialization. Beyond the different technological changes made to improve the local breed potential or to import exotic dairy breed, the case tackles significant changes in public action over the last 30 years, and food policy issues for the future.

In Kolda, the livestock industrialization was initially designed to increase the productivity of cotton sector through hitched culture and innovations in fertilization (stables). SODEFITEX's main interest in livestock was more linked to soil fertilization and draught oxen, but the support to the dairy production was taken into account as part of its mandate in regional development. The system is built on feeding the cattle cotton seed, a by-product of the SODEFITEX. The privatization of the SODEFITEX in 2003 changed its mandate and priorities: first, the company from now on intervened in milk collection, in direct competition with the units already at work; secondly the credit supply of feed inputs was cancelled and the prices increased dramatically.

Free from 1985 to 1988, each cotton seed kg was sold at 15 FCFA in 1988, and the price rose to 65 FCFA in 1992, 122 FCFA in 2007-2008, and 150 FCFA in 2013.

Non Governmental Organizations (NGOs) replaced the public technical and scientific support until mid 2000s, and were acting on the same pattern and under the same constraints than the projects of rural development (Hirschman 2011; Olivier de Sardan 1999). The about twenty-five-years-long public and private action on this dairy basin can be divided into four phases up to the present day. The first phase (1988-1999) of production and transformation was launched by the joint public actors SODEFITEX - ISRA, with technical support from a French NGO⁸; during the second phase (1999-2007) a Pool of services funded by the Swiss Aid and built by several institutions acting in the sector joined the local Aid system; the third phase was marked by the end of this joint-intervention and a deep crisis in the local dairy transformation (2007-2010); the current phase is characterized by the NGOs' return and the arrival of decentralized foreign cooperation actions, with little or no coordination, on a gift basis (2010-2013). This Aid system helps the dairy production during the dry season and the dairy units in their supply, but is not designed to solve structural constraints of the sector:

The free supply of feeding inputs to the producer organizations does not incite the herders and their organization to favor sustainable ways of intensification. On the contrary, opportunistic strategies are encouraged among those who share the Aid rent and/or benefit from it.

The Senegalese decentralized public institution (Regional Agency for Development, ARD) cannot afford to supervise the external donors and actors in a coherent way with the national sectorial development perspective. Tensions appear between external organizations and local actors of development: in the absence of institutional schemes for dairy or livestock development, the ARD puts itself on the same level as NGOs. This scaling of the public action down to NGOs' action finishes deconstructing the sector. As a consequence, the dairy basin of Kolda is now considered, by both national authorities and development organizations, as a problematic case of Aid and lack of organizational competence at local level.

Another dairy industrialization model was briefly experimented with around Dakar during the 1980s. The industrialization was directly transferred from the industrial farms and breeds of developed countries and no integration was envisaged with local agriculture, nor breeds, skills and resources of local livestock systems. Modern dairy farms with European cows were built with the financial supports from the Aid for Development and private donors, with personal incentive by national civil servants. The local extensive livestock was ignored by this model, which was supposed to spread by imitation from businesses willing to invest. But these big dairy farms were specialized on a product in direct competition with imported powdered milk, without any commercial protection. Moreover, the artificialisation of methods of production failed: animals were suffering because of badly adapted installations and feed rations; their milk production dropped. Both economic and environmental factors explained why this industrial model failed.

2.2. Social business as food policy?

In the Senegal Valley, a private factory initially collecting exclusively local milk in mobile pastoral systems evolves towards a mixed system heavily dependent on industrial imported (powdered milk) and local (sugar

⁸ Vétérinaires sans Frontières (VSF) has been re-named Agronomes et Vétérinaires Sans Frontières (AVSF) in 2004, after its merger with the Centre International de Développement Agricole (CICDA).

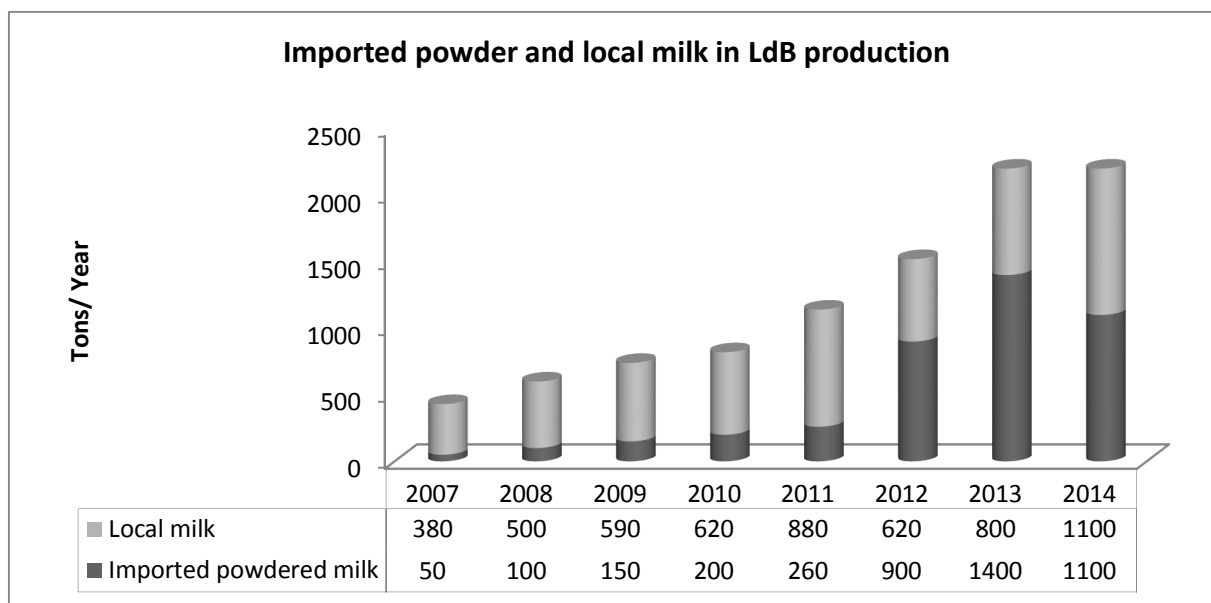
residue) inputs. Since 2006, near Richard Toll city northern Senegal, a local dairy system gained national and international visibility⁹ and is seen as a beacon of local development and social business: the dairy factory Laiterie du Berger (LdB).

The LdB is often referenced as a success story in the regional academic and institutional literature on poverty-focused rural development (ILRI 2014). Its risky challenge of fresh milk supply, moreover collected in dryland area, gained him support and interest from several donors and partners in the name of social business, combining the search of profit seeking action and poverty-focused development as joint objectives for the business.

This type of operation is part of a new two way model of development: on the one hand, the partners statement is consistent with the notions of Bottom of the Pyramid, including growth and inclusive markets, asserting an increase of the firms profit via a business meeting the needs of the poorer (Binet 2014; Arnani 2006; Gradl and al. 2008). On the other hand, the dairy consortium near Richard-Toll is archetypical of a modern intervention of development, because the public funds have the function of levering private investments (Gabas 2014). The partners of this small dairy factory (LdB) are a multinational firm (Danone), a foundation (Danone.communities), an agro-industrial sugar company (la Compagnie Sucrière Sénégalaise), a micro-credit bank (Grameen Bank), public donor agencies (Monaco Cooperation, French Aid Agency (AFD)) and a French NGO (Gret). Research institutions for development monitor its dynamics and effects (ILRI, CIRAD).

Though the social-business image of the company was built on the collection of fresh milk among mobile pastoral systems, the strong increase of the production is actually mostly due to imported powdered milk (see figure below).

⁹ The dairy Company received in 2012 the Prize *Africa Award for Entrepreneurship* as « best of small growing enterprises in Africa ».



Sources: Broutin 2015, LdB, 2014.

Moreover, the dairy unit appears in a territory that has been historically designed by the policy and the actors, as well as by the climate and the river. In the inland region surrounding the town of Richard Toll (*jeer*) in the northern drylands of Senegal, pastoral systems have changed considerably in the last fifty years according to the improvement of hydraulic infrastructures in the grasslands (>1950\$); the expansion towards the north of the peanut front of culture (>1960\$); the progressive exclusion from the valley of Senegal river due to the development of irrigated agriculture (>1970\$). These public actions led to a loss of some ecological levers of the pastoral production, by breaking the complementarities between heterogeneous agro-ecosystems (the humid zone of the river basin and the inland drylands; the grabbing of grasslands). Fulani pastoralists reacted by stabilizing their flocks in the inland area; they partially intensified their systems by using expensive animal feeds to offset the loss of the ecological levers.

Afterwards the support of its partners, mostly Danone S.A. and *Danone.communities*, played a key role in the fast commercial development of the LdB. Efficient marketing allowed it to create a food brand (Dolima) well-known in the whole country. The network of marketing has been extended to the popular market, thanks to innovations in the production process (range, gustative characteristics, food preservation and packaging). Within a few years, these innovations led the LdB to second rank on the Senegalese market of yoghurts and curds, with commercialized volumes reaching 2 200 tons in 2013.

The dairy industrialization designed around the LdB cannot be reduced to one single actor dynamic, as it relies on partners and benefits from an economic, environmental and technical situation, which was historically designed. Though identified in the social business movement, it does not escape from land tenure and commercial stakes. Therefore it would be risky to ground the dairy industrialization and above all the food security policy on the expected generalization of this specific case. Whatever the future of the dairy factory will be, it challenges the political frame in which a private-foundation-aid system is credited today to support the local food security of a rural population, and urban market supply. In Senegal as well as in other sub-saharian countries, heavily depending on Aid, discontinued and weakly coordinated interventions, this option of public

action, if set up as standard, increases uncertainty on States capacities to regulate a food policy and to deliver basic goods and services to their population on a general and sustainable basis.

Conclusion

What links do these industrial models have with food security of the rural and urban population, national food policy, and livestock's future in drylands areas? The local livestock production systems, if not plainly ignored, are asked to change on bases far removed from their own constraints and strategies.

A public support framework, including financial and technical assistance, was implemented in the dairy basin of Kolda for around two decades. Nowadays, this frame of public action has been replaced by ad hoc interventions of the development aid. Despite this set of interventions, milk remains a by-product in the economy of the local farming systems that practise cattle-breeding as a multifunctional activity. Although development workers interpret this as a major failure, the multifunctional and diversified nature of farming systems contributes to the viability of the dairy basin. The herders prove to be interested in milk production and sale but their objectives are not exclusively related to income generation. It seems unlikely that specialized dairy systems dependent on investments, prices, revenues and public incentives would have lasted for such a long period of time in this context. Can it be named an industrial chain of value? It is definitely not what happened around Dakar, where, considering the 250 000 t milk equivalent imports in Senegal in 2010 (Duteurtre and Corniaux 2013: 35), the contribution of the intensive dairy farms appears extremely marginal, since the first twenty-five farms produce around 4 000 t of milk per year (ANIPL)¹⁰.

On the other hand, the technical intensification pattern promoted by the dairy Social Business project ignores the changes in the economy and society generated by a set of development interventions. Pastoralists show they have valid economic and ecological reasons to resist a further intensification of their systems, fully exploiting the potential of natural pastures and containing the use of expensive inputs by seasonal mobility: they move more than in the past. The dairy factory project, while appearing to be an innovative and socially oriented initiative, legitimises the trends of land sparing and the grabbing of grasslands. By building an alliance with a major actor of the local agribusiness (Compagnie Sucrière Sénégalaise) which is extending his farmlands including four-thousand hectares of grasslands, the milk company obtains large amounts of sugar cane residues. The fodder is distributed to pastoralists who pay the delivery costs themselves, while losing free access to their natural pasture.

The successive forms of public action in Senegal tackling livestock sector challenge the place devoted to the local animal and dairy products in the food policy, as well as the standard of public action. Around Dakar, the expected spread of modern dairy farms, which were launched in the late 1980s by public research and technical support, did not occur. Near Kolda, the scaling down of the public support to NGOs actions since the mid 2000s finished de-structuring the dairy sector but the dairy basin still exists and supplies the city, adapted to herders' constraints. The most recent pattern of industrialization referring to social business depends indirectly on public action, through economic policy. This mixed model of transformation is spreading around many cities in the Sahelian sub-saharian countries and faces harsh issues: seasonal shortages of local

¹⁰ Association Nationale pour l'intensification de la Production Laitière.

supplies are offset by mixed supply of powder and fresh milk; vertical integration, sometimes experimented to insure supply with model farms, even European breeds, will face increase in production costs; the dairy factory depends on the local agri-business. Livestock is one more time subordinated to the vegetal and agri-business logics.

Research and extension, which were at the basis of the Green Revolution, led to a substitution of labor by capital in an era and places where cities were able to absorb rural population. Thus, the technical changes were made possible by a combination of other social and organizational changes. Today, evolution in demography, urbanization, changes in diets and livelihoods (mobility, multi-activity, decreasing interest of rural population for agricultural work, etc.), tensions on resources and evolutions in the energy mix, environmental degradations, climatic changes, etc. are all interrelated challenges facing agriculture. Thus a better understanding of livestock system which were marginalized during this period and designing alternative production systems enhancing local knowledge, social values and a natural resources respectful management could present an outstanding issue in order to face these challenges.

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