

# **SUSTAINABLE DAIRY VALUE CHAIN DEVELOPMENT AND GOVERNANCE IN FORMAL AND INFORMAL DAIRY CHAINS IN THE NETHERLANDS, BRAZIL AND ETHIOPIA**

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## **ABSTRACT**

This paper describes dairy value chain development and governance in the Netherlands, Brazil and Ethiopia, representing respectively highly, moderately and poorly developed dairy chains. Chains are controlled and governed by lead firms, often cooperatives, and in the absence of lead firms, milk collection, quality control and milk marketing are not or poorly organised. The process of mergers among cooperatives has been taking place since long and continues today, making some of them strong players. In the Netherlands, the dairy chain is very well organised with a strong milk collection infrastructure and strict quality control including sustainability criteria for the 99% formal chains. The biggest challenge is the huge mineral accumulation and the limited (non) potential to grow. In Brazil both formal and informal chains exist. In formal chains, lead firms control milk collection and quality control, but efficiency in milk production and quality control needs to be improved. The potential of the Brazilian dairy sector to grow is enormous. In Ethiopia formal chains are rare and if they exist milk collection and quality control are substandard. Government and donor support are mobilised to take first steps in producing safe milk for urban markets but it will take decades before milk powder imports can be replaced. Each dairy chain has its own challenges. Active learning from other chains needs to be promoted.



## INTRODUCTION

Some dairy value chains are truly global, others are national or local. Local chains are everywhere and can be both formal and informal. In the Netherlands, farmers selling milk to their neighbours are exceptional as most deliver to the cooperative or processor. In Brazil most milk is delivered to processors and this share is on the increase. In Ethiopia households sell milk around the corner in the absence of good market channels (Figure 1). One dairy farm might produce for different chains: local, national and export. The farm delivers milk to the processor which subsequently process and market dairy products worldwide.

This paper describes the concept of dairy value chain development and governance through milk procurement and quality control in three selected countries: the Netherlands, Brazil and Ethiopia. The choice for these three countries allows comparison of highly developed dairy chains (the Netherlands), moderately developed chains with a high potential for rapid improvements (Brazil) and poorly developed chains for which long term strategies are required to make a substantial chance (Ethiopia).

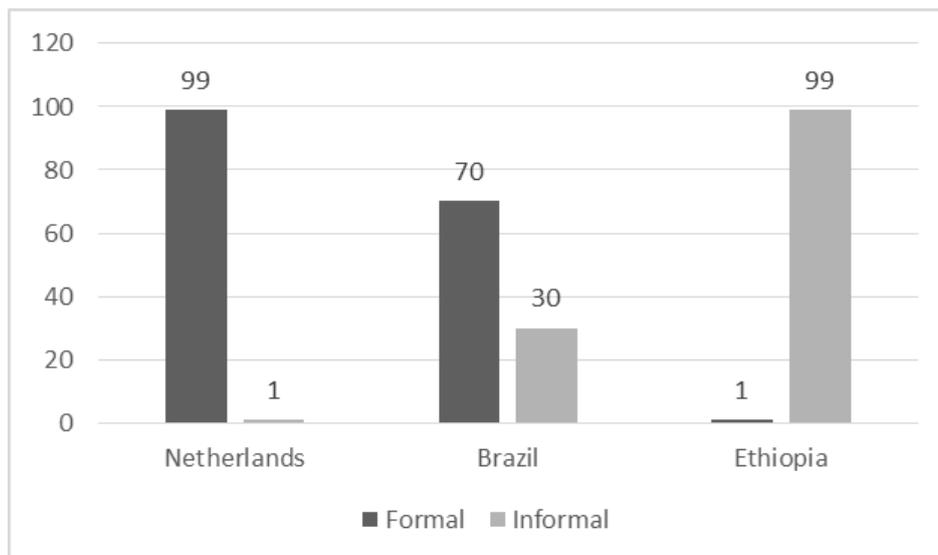


Figure 1 - Milk delivered to formal and informal dairy chains (in %) in 2015. Selection of two extremes and one medium dairy value chains.

Sources: IDF 2016 (Ethiopia estimated by author).

## DAIRY VALUE CHAIN DEVELOPMENT AND GOVERNANCE

### Dairy chain definition

A chain is a set of products and services linked together in a sequence of value-adding economic activities (McCormick and Schmitz, 2001). The value addition of milk in the chain is higher after collection of milk from the farm than before collection, which has obvious implications for the returns to labour. The farmers' share of the consumer price of fresh milk in 2013 in China and the Netherlands was 37% and 36% respectively (IFCN, 2013) but much lower shares were observed in 2016 when global farm gate milk prices were low. The way a chain is governed helps to understand how benefits are distributed among chain actors.



The simplified dairy chain has six main actors: input suppliers, dairy farmers, milk collectors, milk processors, wholesalers and retailers. In reality chains are complex networks, including global buyers and trading companies such as Unilever but also small local retailers.

### **Lead firms and governance**

The governance of value chain refers to the relationships among all actors and stakeholders including service providers and institutions that operate within or influence activities required to bring a product or service from inception to its end use (Humphrey and Schmitz, 2008). In value chains two aspects of control or governance can be considered. The first one is the control within the chain itself, often with a lead company setting standards, or the vertical governance. The second one is the institutional environment in which value chains operate and develop, or the horizontal governance (Tallontire et al., 2011). Different actors may exert more or less influence as one moves from local to global markets.

Chain governance exists when some firms work to the parameters set by other powerful firms in the chain (Humphrey and Schmitz, 2002). The lead firm determines the standards with which other firms in the chain must comply. Governance includes both direct and indirect control in a value chain (McCormick and Schmitz, 2001). The actors in a chain directly control their own activities and are directly or indirectly controlled by other actors. A dairy farmer, for example, controls the way milk is produced, but is directly controlled by the quality standards checked by milk processors. Milk processors are subsequently influenced by powerful retailers having their own quality standards (BRC Global Standards, 2017) which put pressure on prices and delivery conditions. Global and international dairy chains are normally governed by large cooperatives, which are lead firms. Lead firms provide on the one hand restrictions to producers (demands with



regards to pricing, quality, and terms of delivery) and on the other hand opportunities to producers (secured delivery, transmitting best practices, advice, market access, etc.).

Large dairy cooperatives, in their role as lead firm, have invested research and innovations in branding, marketing, product development, communications and new forms of sourcing. That is why they are very concerned that farmers produce milk of excellent quality. Increasingly, lead firms enter international markets and become the entry point for many small and medium-sized farmers. Lead firms can unify product differentiation strategies, environmental issues, social rules and quality standards. And these are to a large extent influenced by external stakeholders, end customers included.

### **Necessity of good governance**

The 2008 Chinese milk scandal was a food safety incident in China in which milk and milk products were adulterated with melamine. Melamine gives the appearance of higher protein content when added to milk, leading to protein deficiency in the product. The melamine scandal points to the importance of governance and of the control lead firms can and need to exercise as well as the control exerted by controlling institutes like governments. The initial focus of the melamine scandal was on Sanlu, but Chinese government inspections revealed that the problem existed to a lesser degree in products from 21 other companies. These included international dairy concerns with a share in Chinese enterprises (Xuequan, 2008). The Sanlu Group, which was the lead firm in the chain, was declared bankrupt in December 2008 which affected many dairy farmers (Gereffi and Lee, 2009).



## Historical perspective of dairy cooperatives as lead firms

Dairy cooperatives have played a very significant role in the procurement, processing and marketing of milk and dairy products and in representing farmers politically. They almost automatically took the lead in chain development. The basic reasons why dairy farmers choose to market through a dairy cooperative include: bargaining for the best price terms possible; to be guaranteed a market outlet; efficient marketing of milk surpluses; having the highest quality producer milk possible; representation in legislative, regulatory and public relations arenas (Cropp and Graf, 2001).

In the USA the first dairy cooperatives were established in the early 19<sup>th</sup> century with a peak in number of cooperatives in 1910 (Figure 2). As quickly as the number of cooperatives increased in the 19<sup>th</sup> century, it declined in the 20<sup>th</sup> century as a result of a series of mergers (Cropp and Graf, 2001). And subsequently the size of cooperatives in members and milk delivered increased. During the process the roles of cooperatives expanded in addition to the collection and marketing of milk. In the early 20<sup>th</sup> century they started to represent the political interests of farmers, to produce milk free from tuberculosis, and to standardize and improve product quality. In the early 21<sup>st</sup> century the large cooperatives such as Lactalis, Fonterra and FrieslandCampina appear, despite being genuine cooperatives, also like industrial corporations rather than just cooperatives, which can be seen from the international acquisitions and investments. Part of the profits made by the “corporation” are paid back to the members of the cooperative, in case of FrieslandCampina 25% of the profit (FrieslandCampina 2016).

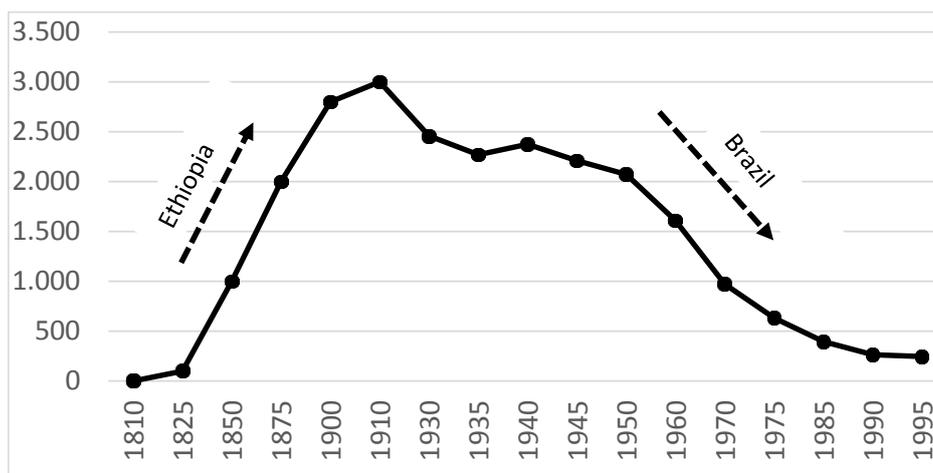


Figure 2 - Historic development in the number of dairy cooperatives in the USA.

Source: Projections of USA data by author, based on estimations of Cropp and Graf (2001).

A similar pattern as shown in Figure 2 has been observed in the Netherlands in the same period (Willemsens and de Wit, 1995). Brazil also follows the same curve, except that the country is transitional. In some areas informal dairy chains dominate. In important milk sheds in southern and south-eastern Brazil, mergers have been taking place for decades, yet in other areas local cooperatives are the main access to markets (Chaddad, 2007). So Brazil is somewhere in the right side of the curve, heading towards fewer and larger cooperatives or processors. In Ethiopia the establishment of cooperatives and the process of mergers will also show a similar path in the future. It is obvious that Ethiopia is in the steep incline stage of Figure 2. The same growth towards the peak will continue in coming decades during which mergers will follow as well. Projection of Figure 2 to the past, present and future situations in Brazil and Ethiopia might give an idea about their stage of development. Has the peak in number of cooperatives and alike been reached yet? In Ethiopia



certainly not! Has the process of mergers started yet? In Brazil certainly yes!

### **Dairy chain development scan**

The stage of dairy chain development can be quickly assessed using the quick scan of Table 1 in which four phases of development are described. What if we apply the scan to the three case countries of this paper? For the Netherlands most parameter can be assessed as 'phase 4'. For Ethiopia most parameter can be assessed as phase 1. The assessment for Brazil is more interesting because for each parameter a different phase can be distinguished. In a well-organised dairy chain in the south, many parameters will be in phase 3 while the chain controlled by an average local cooperative might be in phase 3 for some parameters and in phase 1 for others. The shaded blocks in the scan of Table 1 represent most of Minas Gerais in Brazil. It can be observed that the capacity of processors is much higher than that of producers.



**Table 1 - Dairy chain development scan. The shaded blocks represent a typical dairy chain in the State of Minas Gerais.**

Note: To enable a quick scan only few parameters are shown, it is acknowledged that more useful parameters exist.

Parameters	Phase 1	Phase 2	Phase 3	Phase 4
<b>Inputs</b>				
Concentrates, fertilisers, drugs	Inputs not always available, quality often substandard	Quality inputs usually available, occasionally not	Certified high quality inputs available	Wide variety certified high quality inputs available in abundance
Distance and access to inputs services	Difficult to get inputs	Inputs available in major towns	Inputs available in small and major towns	Inputs usually delivered at farm, often contractual agreements
Services	Shortage of experts	Experts available upon request, often not available	Experts usually available upon request	Adequate experts on feeding, health, equipment, management, accounting
<b>Dairy farm</b>				
Breeds	Very few (<10%) pure or crossbreeds dairy breeds	Few (<50%) pure or crossbreeds dairy breeds	Pure dairy breeds suited for prevailing climate is norm	100% pure dairy breeds suited for prevailing climate
Forage	Shortage in large part of the year	Medium and good quality forage produced and purchased	Year-round supply of good quality forage produced and purchased	Year-round supply of good quality forage produced on own farm
Contaminants in feed and milk	Poor prevention and control, contamination is common	Control measures taken but contamination occurs	Effective measures taken in case of exceptional contamination	Minimum levels in milk. Norm aflatoxin M1 < 0,05µg/kg
Milking	Hand milking, no cooling	Hand or machine milking, cooling beyond 2 hours	Machine milking, cooled within 2 hours	Efficient machine and/or robot milking, directly cooled
Record keeping	Limited records	Milk recording and sometimes additional records	Regular records on production, breeding, feeding, animal health and drugs	Up-to-date daily records on production, breeding, feeding, animal health and drugs



**Table 1 - Dairy chain development scan. The shaded blocks represent a typical dairy chain in the State of Minas Gerais. Continuação...**

Note: To enable a quick scan only few parameters are shown, it is acknowledged that more useful parameters exist.

Parameters	Phase 1	Phase 2	Phase 3	Phase 4
<b>Collection</b>				
Quality milk at farm gate	Limited quality control or high contamination levels	Regular milk testing. Levels < 200,000/ml bacterial count	Regular milk testing. Levels < 100,000/ml bacterial count	Regular milk testing. Levels < 100,000/ml bacterial count. Occasional external farm audits
Transport	No chilled transport	Limited chilling transport	Chilled transport from farm to processor	Excellent cooling from farm to processor. Milk chilled at the farm
Milk collecting centres (MCC) or cooperative sub-centres	Absence of MCC in many areas or irregular supply or no cooling	Milk handling and cooling facilities; MCC nearby; regular supply but under capacity	Milk handling and cooling facilities; MCC nearby; regular supply regular	Automated chilled milk handling; MCC nearby or milk collected at the farm; regular supply
<b>Processing</b>				
Chain governance	Ad hoc milk collection and quality control	Processor in full control of milk collection and quality control	Processor in full control of milk collection, quality control, information sharing, and payments	Processor in full control of milk collection, quality control, information sharing, payments, and training of farmers
Quality control – bacteriological, solids, residues	Bacteriological and cell count not or infrequently assessed	Testing of bacteriological count, cell count and residues	Testing of bacteriological count, cell count, total solids, and residues	Testing of bacteriological count, cell count, total solids, and residues. Audits of facilities
Payment of producers	Checks for adulteration only (density)	Based on bacteriological and cell count as well as fat content	Fair payment based on bacteriological and cell count as well as total solids	Fair payment based on milk quality and total solids. Premium payment for sustainability parameters



**Table 1 - Dairy chain development scan. The shaded blocks represent a typical dairy chain in the State of Minas Gerais. Continuação...**

Note: To enable a quick scan only few parameters are shown, it is acknowledged that more useful parameters exist.

Parameters	Phase 1	Phase 2	Phase 3	Phase 4
Whole sale/retail				
Price	No clear pricing strategy among chain actors, poor consideration for farmers	Unfair price control by large processors or retail	Fair price for dairy products among chain actors	Fair price for dairy products among chain actors and consideration of sustainability parameters
Education				
Trained manpower	Shortage of skilled manpower, poor training levels and facilities	Moderate management and skills compared to international standards, shortage of expertise	Good national education and training in management and skills, shortage of expertise	Good national education and training in management and skills, sufficient expertise
Sustainability				
Emissions, minerals	Losses to the environment not on the agenda	Discussion started about reduction of losses and increase circularity	Plans to start inter(national) programmes promoting circularity in air, water and land	Inter(national) programmes promoting circularity in air, water and land
Animal welfare	Animal welfare not on the agenda	Movement, socialization, and access to outdoor grazing is limited	Good movement, socialization, and grazing opportunities. Average longevity 4 lactations or less	Good movement, socialization, and grazing opportunities. Average longevity > 4 lactations
Biodiversity	Nature conservations not on the agenda	Discussion about allocating farm land to nature has started	Concrete plans to transform parts of dairy farms to nature	Parts of dairy farms (> 10%) kept for trees and/or birds



## Power play in de dairy chain

The society (politicians, dairy sector and general public) welfares from a sustainable dairy chain. Sustainability is defined here as entrepreneurship geared towards the optimal balance between people, planet and profit for the future. What is the situation today and what is needed for optimal sustainability in 2050? Politicians, sector stakeholders and the general public all have their role to play. At present there is already a lot of interaction, cooperation and dependency among each other. For example, politicians develop laws which the sector must implement, and often dairy cooperatives or processors govern these new laws through their members or clients. And lobby organisations perfectly know how to influence politics through the general public. Lobby organisations and media have a big influence. The result of globalization is a shrinking number of firms that dominate both the distribution and the input side of the agro-food chain (HLPE, 2016). And the larger a concern is, the more power it can and will exert. Since the 1990's, large supermarkets have become powerful and put pressure on the dairy industry (Figure 3).

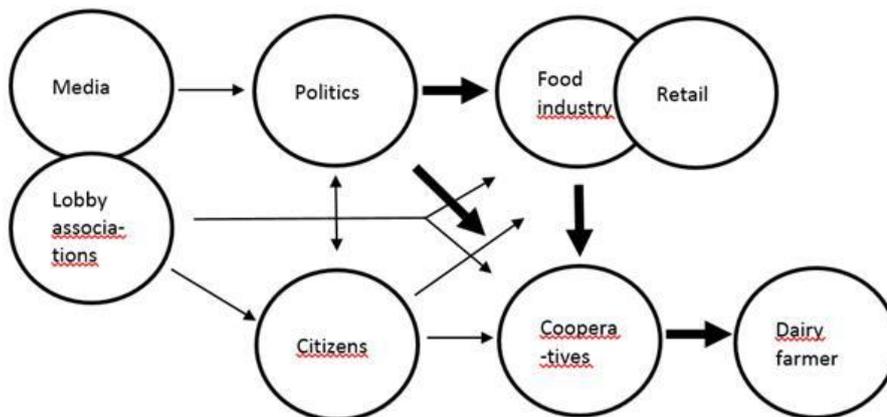


Figure 3 - Influential pathways among chain stakeholders leading to increased sustainability in the Dutch dairy chain.



## DUTCH DAIRY CHAIN

### Milk procurement in the Dutch dairy chain

In 2015, the annual milk production in the Netherlands was 13.5 billion kg of milk produced by 1.6 million dairy cattle on 18,625 dairy farms. The average yield per animal per year was 8338 kg. 80% of the farms have 30 to 150 dairy cows, and the number of cows per farm is continuously increasing. All farms have machine milking and 21% use automatic milking systems (robots) (ZuivelNL, 2016).

In 2015, the Dutch dairy processing industry consisted of 25 companies among which five cooperatives (ZuivelNL, 2016) and 99% of the milk was delivered to them (IDF, 2016). In all chains these companies are the lead firm. All milk is collected in refrigerated trucks in excellent condition equipped with pipes through which milk is pumped from the milk tanks on the farm. All farms have tanks which store milk at 4°C. Milk processors have experts visiting dairy farmers. Ideal would be regular visits focusing on prevention but in practice most visits occur due to problems. The cooperative FrieslandCampina is by far the largest company, so most farmers deliver to cooperatives. Dutch cooperatives are obliged to buy all the raw milk produced by their member-farmers and the member-farmers have to sell their entire production to the cooperatives. The link between Dutch dairy cooperatives and its members is stronger than a mere economic relationship because conditions of supply are more stringent for both parties (De la Mano, 2009). Member-farmers are owners of their cooperatives so they are involved in the governance of the cooperative. The result of this reciprocal obligation is that there is a continuous flow of raw milk from farmers to dairy plants. The supply arrangements give members security of outlets. Non-cooperative dairy industries collect milk from their clients in the same way as cooperatives, also under the strictest hygiene conditions possible. The distance from farms to processing plants



is not very far. Trafficking of milk between competitive processors occurs to balance surpluses and shortages.

High levels of production per cow and per hectare combined with well-organized collecting schemes, processing and marketing, has made the Netherlands the second largest exporter of dairy products in the world.

### **Quality control in the Dutch dairy chain**

The production of safe and good quality milk is conditional to a good functioning dairy chain. Countries with a front running dairy industry such as New Zealand, The Netherlands, USA and Denmark, have a well-organised milk quality monitoring and evaluation system. It is geared towards early detection of problems, and by all means avoiding situations like the melamine scandal in China in 2008. Such scandals hurt the farmer, the sector and the consumer. Contamination of milk at the farm, e.g. due to aflatoxin in animal feed, will travel alongside in the chain after milk has left the farm. So quality control is necessary at each stage of the chain from inputs to consumption.

Milk quality control in the Netherlands and other developed dairy countries is daily business for all chain stakeholders. The biggest challenge is at producer's level because there are so many producers and they vary in capacity and attention for hygiene. Processors put regulations and conditions that farmers need to follow and their milk will be rejected if they fail to comply. In the Netherlands milk is visually checked and sampled at each truck collection and tested for major quality parameters in a centralised fully automatic central lab (QLIP, 2017). There is daily trafficking of samples from farmers to processors to the central lab.

In addition, biannual audits are conducted in which the entire farm is checked. An independent auditor screens four categories: milk, cow, production process, and environment. The last category "environment" is relatively new and goes much



further than milk hygiene and includes sustainability parameters. For these four classes, 36 parameters and for each parameter one or several (measurable) criteria (in total 166!) have been developed (Table 2). If the audit is negative, the farmer will get a 4-week recuperation period, and if it fails the second audit, milk will be rejected for a period of two weeks (situation in 2012). This is the procedure of the largest cooperative (FrieslandCampina) but similar procedures exist among all other cooperatives and processors in the Netherlands.

The number of criteria is slowly increasing while farmers continuously adapt to these new situations. Adaptations are governed by the cooperative and their members, and producer representatives are involved in this process. Frequently, criteria are added under the pressure of public opinion, new laws and large retailers. In fact, expansion of criteria concerns the implementation of the Plan-Do-Check-Act circle.



Table 2 - Dairy farmers conditions used by Dutch dairy cooperative at bi-annual audits. (Source FrieslandCampina 2011)

Classes (no. of parameters)	Parameter	Indicators (no.)	Example indicator (the first one listed in reference used)
Milk (10)	Technical milk quality	9	Bacterial count < 100,000/ml
	Milk tank hygiene + storage	15	Milk storage in cooling tank, placed in a special room
	Milk cooling	7	Milk is cooled below 4°C within 3 hrs after milking
	Milk collection	3	Loading dock and route towards it is clean
	Milking parlour	11	Sufficient light for proper milking
	Milking	12	Persons milking wear clean clothes
	Filtering of milk	5	Milk is filtered before storage in tank
	Cleaning process	7	Equipment is cleaned immediately after milking, or regularly in case of automatic milking
	Residues control	8	Suspected milk is separated and not delivered
	Reporting suspicious milk	1	Farmer knows procedure in case of abnormalities
Cow (12)	Cow health	16	Feeding conditions are sufficient
	Health check	1	Existing protocols are followed
	Reporting diseases	2	Farmer is aware of procedures and acts if necessary
	Veterinarian	2	Certified veterinarian has full access to farm records
	Administration diseases	1	Records of all diseases of past 5 years
	Administration medicines	9	Only registered medicines are used
	Storage medicines	6	Medicines are stored in a closed cabinet or in a fridge
	Application medicines	4	Materials and medicines applied are clean and good
	Administration medicines	6	Records of medicines used in past 5 years
	Traceability milk	1	Records per cow of delivered and non-delivered milk
	Housing	5	There are sufficient relaxing places
	Cow trafficking	1	Conform national policies
Production process (8)	Forage and feed	4	No contamination during cultivation and dry storage
	Feeding	2	Feed of milking cows has no effect on smell or taste or health
	Purchase animal feed	3	Feed is obtained from certified dealers
	Administration animal feed	2	Receipts of feed industry of last 6 months are present
	Drinking water	3	Drinking water is clean and of good quality
	Dangerous chemicals	2	No forbidden agents/chemicals/medicines on the farm
	Crisis management	1	If..., application of rules government or cooperative
Energy reduction measures	2	The farmer attended workshop energy saving	
Environment (6)	Farm	5	Farm is clean and in good order
	Registration farm	1	All locations where animals are kept are registered
	Grazing	4	Outdoor grazing is practised according to policy
	Nature and landscape	1	Nature conservation is practised according to policy
	Energy production	3	There is a biogas installation
Minerals	1	Manure production is recorded	



## **Chain differentiation**

Chain differentiation is an approach to add value to milk before collection. In the Netherlands there are basically four differentiated milk chains: standard (cows in-stable), outdoor grazing, organic and biodynamic (van Ginneken, 2014). Outdoor grazing is a quality mark for cows that have spent grazing a minimum of 6 hours a day, 120 days a year (Grazing Foundation, 2017). Outdoor grazing milk produced by farmers of FrieslandCampina obtained 0.50 euro premium per 100 kg milk compared to standard milk, and about 10 euro per 100 kg milk extra if organically produced (FrieslandCampina, 2014). CONO Cheesemakers stimulate farmers to graze their cows according to the grazing norm and farmers get a premium of € 1.00 per 100 kg compared to standard milk (Cono kaasmakers, 2015). Outdoor grazing is only profitable for small to medium Dutch dairy farms and not for large highly intensive farms (Grazing Foundation, 2017). Initiatives that lead to value addition through differentiation are welcome but to be sustainable they need to be based on market demand (van Ginneken, 2014).

## **Challenges Dutch dairy chain**

The Dutch dairy sector with its efficiency, innovation capacity and beautiful cows gets internationally a lot of credits. However, the Netherlands has since the introduction of the EU milk quota system in 1984 strongly experienced limitations of expansion. Dutch milk production peaked in 1983 and has remained more or less constant since then. Despite the quota, the Netherlands has remained one of the leading dairy export countries in the world. The milk quota system ended in 2015. It sounded like hallelujah, but not for long. To avoid excess production, the Dutch government demotivated new expansions through the introduction of phosphate regulations. This heavily impacted the sector but was necessary because the boundaries of



maximum mineral production (nitrate and phosphate) had also been reached. Nevertheless, the manure levels allowed for Dutch farmers are almost 50% higher than other EU countries because the Netherlands is exempted to produce extra manure. The effect of the milk quota and phosphate regulations were the same: control of expansion.

The pressure on dairy farmers to produce milk sustainably increases continuously. This is a result of increasing public awareness which is translated by processors under pressure of supermarkets as well as lobby organisations. Dutch dairy companies and farmers work therefore together towards a dairy sector that is future-proof. The sector has formulated goals for 2020: development towards climate neutrality, continuous improvements in livestock health and welfare, preservation of grazing, and protecting biodiversity and the environment (ZuivelNL, 2016). The future and survival of Dutch dairy is based on continuous innovations. What can be further increased or improved and what should be done less? Some examples:

- Further differentiation of chains with niche markets with high prices versus efficient bulk production with fluctuating world market prices.
- Better perception of the society through niche markets.
- Increase in solar panels (already widely practiced).
- More extensive farming. For example farm land that is changing ownership, could be faced with more environmentally friendly regulations.
- Innovations in recycling excess manure. Bio-based processing of manure in order to improve nutrient cycles within the farm or farming system.
- Reduction of losses (in addition to manure) in the entire dairy chain.
- A reduction in the importation of raw materials for the livestock feed industry.
- Higher farm gate prices. The profits of animal feed industry, supermarkets and dairy processing industry are promising, but



profits of farmers are low. This does not give farmers room to manoeuvre towards sustainable dairy (read less intensification).

- Higher consumer prices of milk in the supermarkets. However, prices depend on the world market. Stabilising prices so that they cannot fall below a minimum price is an option but needs commitment of too many players.
- Dutch Ministers frequently speak about the export of knowledge along with products. But this will have detrimental effects on the Dutch agricultural export in the long run.
- New policies are needed to develop laws and regulations within the framework of sustainability in 2050 in which the interests of dairy farmers, the sector as a whole and citizens is considered. It is inevitable that future decisions are not always beneficial for all stakeholders. The objective should be coming to the most beneficial balance.
- Politicians need to take positions in their programs that lead to a sustainable dairy chain in 2050. Which parties have the courage to do that considering their electorate? Politics can consider topics such as more or less intensification of production per hectare; measures for or against increase in dairy exports; imports of animal feed raw material; more sustainable grazing lands to favour biodiversity; adjustment of the ceiling of manure.

An excellent example of successful collaboration in the entire livestock sector is the reduction of antimicrobials (antibiotics). The overuse of antimicrobials posed a public health risk due to the development of resistance. The total use of antimicrobials in farm animals in the Netherlands decreased with 56% in the period 2007–2012, a result of good collaboration in the sector (Speksnijder et al., 2015).



## BRAZILIAN DAIRY CHAIN

### Milk procurement in the Brazilian dairy chain

Brazil was in 2015 with 35.3 billion litres the fourth milk producer in the world. Both formal and informal dairy value chains exist, and 70% of the national milk production was delivered to formal processors (IDF, 2016). Okano et al. (2014) distinguished 5 categories of producers in the State Sao Paulo; unskilled, traditional, transitional, modern conventional and modern industrial. Most producers are small-scale unskilled and traditional farmers which pose a big challenge to milk procurement. However, the number of farms with less than 10 dairy cows will quickly reduce from 1 million in 2013 to 150,000 in 2020 (Beldman et al., 2015) and probably be insignificant in the future. The trends are that the number of dairy cows per farm, kg milk per cow and the national production increase versus a decline in the number of dairy farms and dairy cows (Beldman et al., 2015). This scaling-up will have a positive effect on coordination, milk procurement and logistics in the chain.

Milk is collected in cooled trucks, but transport in Brazil is relatively expensive. The diversity in farms types is very large. 80 to 90 % of the milk in farms producing up to 200 kg per day is cooled on the farm, and larger farms cool 100% of their milk (Beldman et al., 2015).

In the period 1900-1960, local dairy cooperatives were formed in the emerging milk sheds in southern and south-eastern Brazil, with the help of government subsidies. By the end of the 1980s, they were collecting about 60% of the total milk produced in Brazil (Chaddad, 2007). Dairy markets were completely deregulated in the 1990s, as the government discontinued its price control programs, and the market share of dairy cooperatives in Brazil fell to 40% of total milk procurement in the early 2000. In 2004 the formal market share was (again!) 62% of total production (Martins et al., 2004), and since 2009 there has been an increase



in annual milk delivery to formal processors of 4.8% (IDF, 2016). There is no strong dairy chain structure, and usually there are no contracts between suppliers and processors. The processors are relatively weak chain leaders. The dairy industry is very fragmented, and the country's top-ten processors took in 35% of the total milk collected in 2015 (IDF, 2016). Compare this with the Netherlands, where the largest cooperative FrieslandCampina collected more than half of the country's milk in 2015 (FrieslandCampina, 2016; ZuivelNL, 2016).

Within formal and informal dairy value chains, different levels of chain organization exist, ranging from weak to very well. Weak refers to informal chains where milk is often not collected and milk quality control is substandard or absent, and very well refers to dairy chains focused on export. Export chains include only milk production that is inspected by government authorities. Milk producing areas focused on export are found in southern and south-eastern Brazil. Brazil became a net dairy exporter in 2004 and 2005 for the first time in history (Chaddad, 2007). From 2004 to 2008 more value in dairy products was exported than imported. In 2015 the volume of dairy products imported was larger than the volume exported (IDF, 2016). Although most of the milk is produced for domestic consumption, Brazil exports to over 100 countries worldwide (Itambé Food Service, 2017).

Consolidation through mergers and acquisitions seems to be the best survival strategy for processors. The only central cooperative that remained strong in the 1990s, is *Cooperativa Central Dos Produtores Rurais* (CCPR), also known by its brand name Itambé. Itambé partners with Serlac in the international trade of dairy products (Seric, 2017). And other interested parties knocked on the door. In 2013, the Brazilian Dairy Group Vigor acquired a 50% share in Itambé (Russell, 2013), and in 2017 the Mexican food company Lala Group announced that it is acquiring 100% of Vigor, including 8% owned by Arla (ESM Magazine, 2017). And the next takeover or merger will come!



## Quality control in the Brazilian dairy chain

In general, milk quality in Brazil is substandard, with bacterial count as the main challenge on small farms and somatic cell count on larger farms (Beldman et al., 2015). Quality standards for milk and dairy products were introduced in Brazil in the mid-1960s. In the late 1990s, Normative Instruction 51 required that milk be collected from refrigerated tanks (or coolers) in farms. Many producers left formal dairy chains and started to commercialize their milk in local, informal markets. Between 1997 and 2005, the number of producers delivering milk to the top-14 processors decreased from about 170,000 to 80,000 (Martins et al., 2004).

The dairy chains focused on export can only perform well because they have a strong and rigid quality monitoring and evaluation systems in place. Itambé has one of the largest and most modern industrial facilities in the country. It is authorized by the Ministry of Agriculture to export to all countries with which Brazil holds a sanitary agreement. In well-organised dairy chains, raw milk is collected and stored in tanks, and chilled at the maximum 8°C until it is collected by bulk trucks. Once the truck reach the factory, a sample is collected from each tank of the truck. To maintain standards of quality, all chemical-physical tests are made. Acidity, relative density, freezing point, fat%, alcoholic strength, temperature, preservatives and antibiotics (Beduschi and de Freitas Duarte, 2017).

A study among retail milk and cheese in Juiz de Fora discovered that one brand was contaminated with *Listeria monocytogenes* out of 19 brands tested, and further research discovered that storage coolers were the source of contamination (Brito et al., 2008). The outcome of this research led to immediately action to solve the problem.

In conclusion, quality control is organized in some chains, and knowledge to implement this is available. Other less-



developed chains need a serious improvement which can benefit from knowledge in other chains.

### **Challenges Brazilian dairy chain**

The Brazilian dairy sector is changing and developing fast. The potential to expand the dairy sector is large, also because of the growing purchasing power of the Brazilian middle class. Nevertheless, it is hampered by inefficiency in the smaller dairy farms, and by substandard quality control in several chains or regions. Although both productivity and milk safety must be improved, it should also be realized that substantial progress has been made in the last decades. So continue good developments in some chains and enforce new developments in others. The development of local chains can learn from export-oriented chains. Some considerations:

- In relatively well-organized dairy chains, processors should take a stronger lead and enforce stronger quality standards to their members or clients. Step by step so that farmers have time to adapt. Not by introducing more standards, but by making sure that standards already in use are obeyed.
- Coordination among the top-20 processors to come to one system of control would benefit a lot. There is a need to align national, state and local standard systems, and instead one system applying to all levels. Do not create a complicated system like in the Netherlands, but use a manageable number of critical control indicators. The national, state and local governments should give the processors the mandate or obligation to arrange this.
- In less-developed dairy chains or in the case of smallholders, where chain leadership is absent or weak, the government should continue the *Balde Cheio* or other development programmes and play the role of chain leader until processors will take over.



- Dairy farmers should be encouraged to produce safe milk, and even be forced to change. Resistance to change cannot be at the expense of food safety. Again, step by step giving enough time to adapt. The low incentive to produce clean milk must be halted through better checks, and even penalties. This inevitably will lead to higher investments costs of farmers, and some might need to stop their business due to lack of capacity, motivation or skills. Same like in any other business.
- Transformation from informal to formal chains needs investments. Chain actors should be enabled to access loans in order to invest in cost price reduction and food safety measures, with a focus on small and medium scale dairy farms.
- There is a shortage of skilled labour partly due to migration to urban areas. There is a lack of dairy knowhow and skills on small and traditional farms. Training in milk production and quality control is necessary. Education and training institutes and processors should expand training programmes with a focus on milk production, milk processing and chain coordination skills.
- In the long term, in years of high economic growth, the government should improve infrastructure including roads network to facilitate milk collection.

## **ETHIOPIAN DAIRY CHAIN**

### **Milk procurement in the Ethiopian dairy chain**

Ethiopia has the largest livestock inventory in Africa, its productivity and commercialization is among the lowest. Ethiopia has 11.4 million milking cows kept in pastoral, agro-pastoral, mixed crop-livestock, (peri-) urban and commercial systems with a total production of about 3 billion litres of milk per year (Zijlstra et al., 2015). Most cows produce 1-1.5 litres per day and most milk is consumed at home or sold at village markets through short



informal chains. Women market household's milk alone or in small groups. Only 68% of the milk is used for human consumption. The remaining 32% is fed to calves or wasted on the farm (AGP-LMD, 2013). Only 2% of the total national milk production is produced in urban and peri-urban (semi-) commercial systems and a substantial part of the milk from this category finds its way to formal markets. The description that follows below refers to this small group belonging to the "formal chain".

Despite decades of interventions by the government and international donor agencies to improve the dairy sector, development took place in a slow pace. There is a very low level of organization and local traders are known to profit from this situation. There are no chain or firm leaders and there are no large well-organized dairy cooperatives. Foreign investors stay away, or are very carefully looking from a distance, waiting for better times to invest. Local cooperatives are the chain coordinators and have 20-400 members (Zijlstra et al., 2015). They are heavily supported by NGO's or churches, but most do not function well. Sometimes it is the NGO itself that positions itself as the chain leader to enable milk collection.

Smallholders transport milk to collections centres by foot (women), bicycle or motorcycle. There are few milk collecting centres, but generally without cooling facilities. Many attempts to introduce cooling equipment failed due to lack of maintenance, ownership issues or simply lack of reliable electricity. Some private milk processors collect milk directly from commercial farmers.

There are, however, positive signs of a take-off of the formal dairy sector as the current government has chosen a market-oriented policy with liberalized markets and encouraging private sector investments in the dairy industry. The development towards more milk supply to the formal sector is taking place in a few milk sheds which have the best potential for dairy sector development. In these milk sheds dairy cooperatives play a major role in milk collection. After collection, the milk is sold to commercial dairy processors, or as raw milk to customers, or



processed by the cooperatives themselves. They sell the end products in their own shops or elsewhere.

The demand for milk is high. Most milk sold in the capital Addis Ababa is made from imported milk powder. The potential to establish commercial dairy farms or to invest in dairy processing is high.

### **Quality control in the Ethiopian dairy chain**

There is little processing capacity and absence of quality control in most situations. Most of the milk that enters processing units is heavily contaminated with aflatoxins. Quality control at collecting centres is insufficient. Every year new processing plants are established and 35 plant exist (Zijlstra et al., 2015). Nevertheless, processing plants work below capacity (Land O'Lakes, 2010). There is no (or hardly) a system of payment for good quality milk. So no incentives to produce good quality milk.

The quality of milk in the present market is very low compared to international standards. This creates doubts about milk safety amongst consumers. Many consumers are uncertain about the safety and expiration date of pasteurized milk.

### **Challenges Ethiopian dairy chain**

The dairy sector in the highlands of Ethiopia is dominated by male and female smallholders and growing numbers of (semi-) commercial farmers. The challenges are so many! It is characterized by low productivity, limited availability of chilling in rural areas, processing plants working below capacity, prices volatility, fluctuating demands (religious fasting) and informal dairy markets (SNV, 2008; Land O'Lakes, 2010; Yilma et al., 2011; Visser et al., 2012). To fill this gap, the domestic industry will need to expand, dairy cows will have to be more productive (cross-bred cows) and better managed and fed, and producers will have to become more market-oriented and commercialized;



An integrated development approach with focus on the main issues is required. Main issues are the organisation of producers, hygiene of milk, processing capacity and skilled manpower. The increasing number of commercial farmers and commercial processors should be facilitated and be considered as pilots for future generations. Some considerations:

- Policies on dairy development and general organisation need to be developed further. The establishment of a dairy board or similar association is necessary.
- Procurement of milk is a challenge due to seasonality of supply and demand. Christian fasting holidays heavily affect demand. The milk procurement of needs to be improved to solve this.
- There is lack of trust among producers, milk collectors and processors. The most basic system of quality control possible need to be introduced as quickly as possible. For example a wide use of density metres to detect adulteration.
- There is serious need for training of skilled manpower in milk production and processing.

There is little entrepreneurial climate. However, the “diaspora” (Ethiopians that escaped the country years ago but now return with a pocket full of money) are eager to invest in both milk production and processing. It gives great opportunities but they do not bring or find knowledge and skills to support their investments and do therefore not operate successful businesses. In general, the lack of practical skilled manpower is a great problem and needs investments through linkages of both public and private sector initiatives.

### **CHALLENGES IN ALL DAIRY CHAINS**

Despite the huge differences between the three cases described, there are also challenges that are found in all dairy chains. Some examples:



- The poor prices paid for milk at farm gate versus the huge economic value addition produced by the dairy sector.
- The process of urbanisation and the difficulty of finding successors to take over the farm.
- The education and training systems are focussed on milk production or milk processing. The connection between them, governance and coordination, a socio-economic issue, is not addressed in the curricula.

## **CONCLUSIONS**

Dairy cooperatives have played and are playing a very significant role in the procurement, processing and marketing of milk and dairy products and in representing farmers politically. They have become large and influential lead firms through mergers. Lead firms are essential in dairy chain governance and development. They provide on the one hand restrictions to producers (demands with regards to pricing, quality, and terms of delivery) and on the other hand opportunities to producers (secured delivery, transmitting best practices, advice, market access).

Each dairy chain has its own challenges. A lot can be learnt from other chains. For example, export-oriented chains in Brazil can learn from highly-developed dairy chains, like in the Netherlands, particularly the incorporation of sustainability issues in the milk control system. And Ethiopia can learn from institutional and organisational issues in Brazil related to cooperatives and their role in chain governance. Within countries one chain can learn from the other (more-developed) one as well.

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