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Lessons in Sustainable Dairy Farming to Kenyan Dairy Sector from the Dutch Dairy Sector

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Abstract

Dutch dairy sector is a premier player in the global arena. The Dutch have also been associated with the world's most productive dairy cattle in Friesian-Holstein. There are many important breakthroughs on sustainable intensification and successful running of a dairy farm from the Dutch. Kenya on the other hand is just entering the transitionary phase in dairy development. It is already an important player in dairy farming in Africa whose production is second only after South Africa. There are several lessons that the dairy industry in Kenya may be able to learn in order to rise to its optimal potential. This paper, through an intensive interrogation of the Dutch dairy sector through; field excursions, group discussions, expert presentations, and lectures makes important situational analysis of the Dutch dairy sector and compares this to the Kenyan dairy industry situation. The Kenyan dairy industry situation was studied through a thorough desktop review of major government, Non-government organizations, discussions with experts and other major players in Kenyan dairy landscapes' publications. This study makes cognizant the fact that in designing any interventions in the Kenyan dairy industry it is vital to understand the trends and the drivers that shape the dairy industry in Kenya. Based on these prevailing circumstances it has discussed the vital lessons that the Kenyan dairy sector may learn from the Dutch dairy industry to ensure that any gains from the improvement in the Kenyan dairy sector remains sustainable.

Keywords: Dutch dairy sector; Sustainability; Dilemmas; Kenyan dairy sector

Introduction to the Dutch Dairy Sector

The Dutch dairy sector has been hailed worldwide as one of the most developed in the world [1]. This view is replicated by Dutch dairy farmers and evidence available on visit to dairy farms in the Netherlands. The Friesland province which boasts as being the home of the Friesian dairy cow, though history disputes this [2] is a province with great interest in dairy farming in whole of the Netherlands. It has one of the highest numbers of dairy cows per hector by municipality [1]

At a glance, the Dutch dairy sector has about 18,000 farms with about 150 farms having more than 300 cows. These farmers own about 1.6 million cows producing up to 12.7 billion kilograms of milk annually and about 0.28 million dairy goats [1] There are about 23 milk processing companies, and 53 dairy factories spread across the different provinces in the Netherlands. The Dutch farmers are in a class of their own with a majority at least experimenting with the latest technologies in dairy management and production [3]. In these farms are found new technologies ranging from the use of robot in milking to, the application of sand beds and rubber floors for cows comfort. The innovations which are aimed at making the Dutch dairy efficient exist not only with regard to housing but also with regard to feeding, disease control and prevention, in the area of environmental sustainability. The Dutch dairy sector is renowned for its great innovations, diversity and quality of products, displayed widely in supermarkets worldwide. This depicts a strong feature of the sector that has enabled it to bounce back and grow stronger even during times of crisis. This paper discusses the Dutch dairy sector with emphasis on the use of dairy cows and relates it to the Kenyan dairy sector one of the most prominent on the African continent. This will enable the drawing on of experiences for improvement in dairy production and sustainability.

Methodology

This paper came about through the use of a series of different methods during a two week intensive short course on milking to potential organized by Centre for Development Innovations, Wageningen UR, The Netherlands. The study used a mix of lectures, discussions, group work and field trips to offer background, theoretical foundations, as well as practical approaches for production and market development of Dutch dairy industry. This approach exposed the author extensively to the Dutch dairy. The dairy sector of both the EU particularly the Dutch and the global south economies were considered in the lectures, discussion groups and expert presentations. The Kenyan situation was studied through a thorough desktop review of major government, Non-government organizations, discussions with experts and other major players in Kenyan dairy landscapes' publications. Taking the participants' own situation as a starting point, the current situation was analysed with a view to explore options that are already available for further development and design new dairy systems in a responsible and sustainable manner [3].

Results and Discussion

Comparison of the Dutch and Kenyan dairy sectors

The Dutch dairy sector has about 150 years of consistent performance and experience [4]. Compared to the Dutch dairy sector,

the market oriented Kenyan dairy sector is about 100 years old (National Dairy Master Plan, 2010). The beginning of the market oriented dairy sector in Kenya was as a result of the introduction of exotic dairy cattle breeds by European settlers from their native countries. The early 60 years or so were under the colony of the Great Britain and Kenyan farmers were not allowed to participate in commercial dairy farming. The Kenyans were allowed to keep cross breeds of dairy cows from the year 1954. These two eras are distinct in their characteristics [5]. The dominant player in the Kenyan dairy sector before the liberalization was the Kenya cooperative creameries (KCC) established in the year 1922 by a group of white settlers. In its market orientation and inception, the Kenyan market oriented dairy sector has almost similar history. Post-independence dairy sector in Kenya may further be classified in to two distinct periods, that is the period from 1963 to 1991 before the liberalization of the Kenyan dairy sector and later the period after liberalization of the Kenyan dairy sector. The immediate post-independence period was characterized by a land redistribution policy leading to the rise of small dairy cooperatives. The era before the liberalization, show a time of great involvement of the government in the dairy sector. The government stimulated dairying through subsidized and efficient clinical services, provision of artificial insemination (AI) services, restructuring the operations of the main formal output market through the operationalization of the KCC, and the removal of quotas that stipulated minimum milk deliveries which therefore favoured large-scale producers only [6]. Compared to the Dutch Dairy sector, the government involvement has been in the area of provision of subsidies. The main thrust however was with the cooperatives and farmer associations. However, the post liberalization period of Kenyan Dairy sector between 1995 and the year 2000 was unique. In this period, the dominance of KCC as a major player was greatly reduced and it finally collapsed in the year 2000. Few cooperative movements began during this period.

The Dutch dairy sector has about 18,000 farms with about 150 farms having more than 300 cows. These farmers own about 1.6 million cows producing up to 12.7 billion kilograms of milk annually [1]. There are about 23 milk processing companies, and 53 dairy factories.

In Africa, the Kenyan dairy industry is the second largest in terms of the number of people it employs and amount of milk produced after South Africa. Kenya has an estimated 1.7 million dairy farmers with average herd size of 4 cows [7]. Almost 80 per cent of Kenya's total milk production of about 5 billion Kg is produced by the small holders [4]. Kenya has about thirty active milk processors, of which the largest are Brookside, New KCC, Githunguri Dairies and Daima Dairies Ltd. Together, these four are processing 85 per cent of the 1.5 million kilograms of milk that are processed daily in Kenya [8]. The 1.7 million Kenyan farmers is a staggering figure keeping in mind that the Dutch has only 18,000 dairy farms. Despite its pivotal position in Africa, when compared to the Dutch dairy industry, in many respects, Kenyan dairy industry can only be described as 'crawling' at the moment.

The common characteristics of the Dutch dairy sector and contrasts with Kenyan dairy sector

The use of state of the art technology: By embracing intensification; every stage of the Dutch dairy farm has utilized the best possible technology. From automatic feeding system that dispenses exactly how much milk and feed the calf or the cow needs, to a tracking system that tells how much distance the cow had travelled, how long the cow grazed, slept and so on, all these systems have become an integral part of the dairy farm. Added to these, the robot milking, rubber embedded floors, automatic feeding systems and smart cow signal sensors and emphasizes the use of the latest technologies the Dutch dairy system of production. While a few large dairy farms in Kenya have modelled this, the dairy industry in Kenya remains largely manually operated. Due to a significant number of the Small holder dairy farmers, automation remains a challenge and less cost effective. For the Dutch farmer the state of automation has greatly reduced the cost of labor. Although the cost still remains high per man-hour compared to what is paid for in Kenya, yet in many farms having between 80-150 cows, the farm is easily run by the husband and wife with a hired hand mostly being required sparingly for maximum 3-5 hours a week. In general, in Kenya, a farm of 80-100 cows would require employees of about 10-15 people.

Strong cooperative movement: It is difficult to imagine that a cooperative society in the Kenyan context can become a dominant player not just within Kenya, but more so in the global arena. Yet, that is exactly the position of the Dutch Royal FrieslandCampina dairy cooperative which is currently number 6 leading global dairy company in sales and global supply of dairy products. It earned an estimated turnover at 11.1 billion euro in 2014 [1]. Since its inception in 1871, the cooperative has been run so well that its company arm rakes in billions of EUROs in revenues and several million Euros profits annually for the stakeholders who are farmers. The latest statistic puts the FrieslandCampina profits at euro, 343 million in 2015 [9], (personal communication). The Campina brand was however introduced in 1947 and since then has grown through mergers and acquisitions in leaps and bounds to become the major world player in the dairy sector that it is today. This has also enabled the company to employ and retain several qualified and high caliber professionals. This is in stark contrast to the Kenyan farmer cooperatives which have been known for the wrong reasons like financial misappropriations, corruption, inefficiencies, and board wrangles leading to perennial collapses [10]. In spite of these challenges the dairy cooperatives have played a significant role in helping farmers' access to services, stable raw milk prices, and subsidized input supplies. There are however few cooperatives in Kenya like the Githunguri dairies corporative which have provided a good example worth emulating in running successful cooperatives even in the Kenyan context. Githunguri Dairies whose products go by the brand of Fresha is one of the oldest in Kenya having been established in 1961 [11]. From humble beginning of 31 farmers to current 76 collection centers and 6 cooling centers spread over the catchment area, their growth has been phenomenal. Currently the cooperative society has about 23,000 registered members who practice zero grazing. It commissioned its own processing company in 2004 and this move has made it one of the largest dairy processors in the country. The cooperatives' current annual turnover is estimated at 6 billion Kenya shillings or about 60 million euros [11]. The development of such strong successful cooperatives could be the basis of a stronger performance by the Kenyan dairy industry.

It is important to note that unlike Kenya, the Governments' interference in the Dutch Dairy sector particularly with regard to setting up and running of cooperatives has been at best, minimum. This has provided conducive environment for growth and success of cooperatives such as the Friesland Campina [2]. From the monopoly policy implemented by post-independent Kenyan government, to the current none-interference by Governments, such policies have worked to destabilize the Kenyan dairy industry, and at times stifled innovations in the sector. However for cooperatives which have

resorted to professional operations, their chance at success is heralded by the story of the Githhunguri Dairies.

Responsiveness to consumer demand and market conditions

The Dutch not only 'love' their cows but also even more, their dairy products. Cheese, fresh milk, yoghurt, and other dairy desserts are a regular part of their daily diet [1]. There is a wide variety of dairy products available on the market in the Netherlands. For example, a quick scan through the major supermarkets in Friesland province, the Jumbo supermarket revealed a total of about 550 different dairy products on the shelves a scenario replicated in all major supermarkets across the country. This gives indication of the great diversity in the demands of the Dutch consumer regarding dairy products and the responsiveness of manufacturers and processors to meet these demands. Another feature is the offer of premium price for organic dairy products and products from grazing dairy animals. For example the higher pricing for the Dutch meadows branded products 'weide melk'.

To an average Kenyan consumer the thought of a price differentiation on the basis of the mode of grazing cows is a foreign idea. In fact, farmers who can afford to zero graze are the envy of those who graze their cattle free range. There is currently no supermarket outlet that uses this criterion in selling dairy products in Kenya. The ability of farmers, processors and supermarkets to meet these different sensitive needs is a key strength of the Dutch dairy sector. In addition, the integrated, timely knowledge and data sharing mechanisms in place among all industry players, is key to helping the Dutch farmer navigate possible demand and supply driven crisis. For example, due to the import ban on cheese by Russia in 2014, the Dutch farmers and processors responded almost in tandem by reducing cheese production by 2.7%. This responsiveness is drastically different from what happens in the Kenyan situation. Even with the almost certain increase in milk supplies due to the long rainy season from March to June, the industry players are still caught napping on several occasions year in year out with the resulting being a reduction in profits by farmers due to low prices during glut [12].

Organized input and services supply

The Dutch dairy farmers have a well-coordinated mechanism for the provision of input suppliers and services. In the first place, the government subsidies amounting to the tune of euro 25,000 annually go a long way in cushioning farmers from the market shocks [13]. The Veterinary professionals work directly with farmers and are paid according to how much treatments they perform or how many hours of consultancy they spent on the farm. They offer unlimited services in disease control and prevention to farmers [14]; personal communication) partner in Vetvice Ltd. Recently some farmers and veterinarians have started an innovative project in which they investigate the possibilities to pay veterinarians based on the improvement in health and production realized on the farm.

For several reasons, the Kenyan dairy industry input and services supply is in a fragmented state. The only exception to this are the few well run cooperatives who offer support to farmers to access services and inputs as a group. This means that the average small holder farmer is mostly on their own in obtaining the services and inputs necessary for his farming needs. Mostly due to the high cost of feeds and cost of services, a majority of farmers are unable to operate their farms at optimum with regards to prevention of diseases, provision of a suitable stable/housing or adequate and well balanced feeding of dairy cows. This lower than average provision of adequate needs to the dairy cows is reflected in the poor quality milk produced and supplied by several farmers [15]. The cost of improving breeds through the use of Artificial Insemination (AI) services remains extra-ordinarily high, about 80 euros, per service per cow. This is far beyond what a typical small holder farmer can afford to pay for. Furthermore, the industry suffers a lack of reliable and credible input suppliers that farmers could enter into long term agreements with [12]. Initiatives like the Kenya Market-led Dairy Development Programme is a 4.5year programme supported by the Embassy of the Kingdom of the Netherlands in Nairobi with the aim of contributing to the development of a vibrant and competitive dairy sector, driven by the private sector, with beneficiaries across the value chain is a step in the right direction [8]. However for a total transformation of the dairy sector in Kenya, such programmes, ought to be scaled up quickly.

The current state of Kenyan dairy sector

According to the BLGG Group [16], Kenya is in a transitory period of dairy development emerging from phase -I-, referred to as the initiation phase (start-up). Kenya is placed at the transitory phase where some segments are already into phase II – (growth phase) while other segments remain in the start-up phase [8]. The current situation in the dairy sector is marked with low productivity due to several reasons top of which is inadequate feeding, seasonal production and poor quality milk produced and supplied. In addition, there are evidenced large skills and knowledge gaps for actors within all phases of the value chain coupled with substandard provision of services and input supplies that further lead to a dip in productivity [8]. The dairy sector in Kenya has a large proportion of marketed and traded milk going through the informal sector [17]. This sector has several fragmented chains which are difficult to govern and monitor. At the same time, there is lack of effective institutions for sector governance given that the Kenya dairy board (KDB) mandated with this task is mostly under equipped and under staffed to perform the statutory inspections and law enforcement adequately [15]. The sector lacks a coordinated infrastructure to help with training of skills and knowledge, policy formulation, sector governance, and quality in the supply of services and input supplies [8]. A large part of the dairy sector is picking up and some segments are already in phase (II). But there is no clear vision or inadequate communication of the vision among all stakeholders regarding the direction the dairy industry should go or what it aims to achieve. Kenya developed the first 20 year National Dairy master plan in 1991. However its implementation was overtaken by rapid changes occurring in the industry due to liberalization of the dairy sector.

The Kenyan National Dairy Masterplan plan was drafted and presented in year 2010 by consultants from Land O'Lakes international. This document provides an important assessment of the Kenyan dairy industry and proposes broader strategies to boost production in the sector [4]. The suggested strategies must be undertaken in a manner that takes into consideration the dilemmas facing the industry. In spite of these myriad challenges, the Kenyan dairy industry has several distinct strengths which have been enumerated by Makoni et al. [12]. Key among these are: the dynamic and robust private sector processing facilities which have had over 20 years of experience to draw from, the rapidly increasing investments in the value added products, the high demand for dairy products particularly driven by the rapidly increasing urban lower and middle income class populations. In addition, there is an emerging group of

entrepreneurial farmers willing to invest in technology innovations and a good stock of high performing genetic breeds [12].

Dilemmas in the Dutch dairy sector

Increasing productivity due to the abolishment of European quotas and the European Union (EU) Phosphate production Limits: The year 2015 April was an important year for the Dutch dairy farmers. It is the year the 30 year long running quota regulation by the European Union was abolished. For the first time in 30 years the Dutch would have the opportunity to increase their herd sizes without the obligation to buy additional milk quota and therefore annual milk production increased to the levels they previously reached of about 13 billion kg milk in early 1980s [18]. However, this has not turned out to be such a good news after all especially with regard to the increase of the national herd size. This is partly due to a law passed by the European Union regarding the limits of Phosphate production in the Netherlands. This led to the Dutch farm minister, Martijn van Dam informing the parliament that the Dutch farmers will have to reduce their herds by up to 100% of the phosphate production of the cows they kept in 2015. This in order to comply with the agreements made with the EU within the framework of the EU Nitrogen directive that limits the Phosphates production in the Netherlands. This directive according to the Dutch government will be translated into regulation in which farmers receive phosphate rights that they can trade among themselves [18]. This will create the need to buy extra phosphate rights in case a farmer wants to grow in herd size. Next to that, consumers are in favor of milk from grazing cows. Grazing is only possible if the farm has enough grassland to let his cows graze on pastures in a short distance from the farm buildings. The availability of land is therefore an important element for Dutch farmers in deciding the herd size to keep. The Netherlands also have an obligation to increase the amount of farm land in case they increase the stocking rate. This underlines the importance of available land even more.

At the same time, the emission of greenhouse gases by cows is a major issue of great environmental concern. Cattle have been reported as the most important greenhouse gases (GHGs) polluters far beyond even the automobile [19]. Ammonia emissions are particularly of great concern to environmentalist in the Netherlands. The little dilemma is that farmers may actually increase productivity of milk with same number of cows giving the same emissions. In contrast; the issues of phosphate emissions are not an immediate concern of the Kenyan dairy farmer. In fact, to many people setting of limits on the number of cows the farmers can keep based on Phosphate emission criteria is at the moment, unheard of.

The reluctance of the younger generation to pick up dairy farming ventures from their parents

As already mentioned the Dutch dairy farms are run by elderly persons. The average age of the Dutch dairy farmer is at 50-60 [20]. This age group of farmers is mostly second or third generation farmers who have invested their time and energy fully into their dairy farming business. They have been part and parcel of the success story of the Dutch dairy sector. Many of them are coming to a point where they need to pass on the baton to their children; generation X and Y but they are not having good luck with that. Though the same publication indicates that nearly two thirds of Dutch dairy farmers have a successor lined up, this may need a further probing. During our field excursions (milking to Potential Course, 2016) we identified reasons why the youth would not be interested in doing dairy business. Some of the most prominent reasons were: farming is viewed as the hard dirty work; there are many competing seemingly lucrative jobs in the cities, the Bank loan burden and the high cost of inheritance of farms from one generation to the other were also top on the list. Of course, one of the key strengths of the Dutch dairy sector is what De Vries [9]; personal communications) head of cooperate affairs department of FrieslandCampina referred to as "The skills of our member dairy farmers underpin the quality, safety and sustainability of FrieslandCampina's wide range of dairy products" these skills have been gained through many years of research, application, collaborations and continuous learning among dairy stakeholders. With the reluctance of the youth to take over and perpetuate this tradition, it would be interesting to see how the Dutch Government and Dutch farming community will respond to ensure that this strength is not eroded after so many years of accumulated knowledge, skills and expertise [21]. One of the initiatives – organized by a national broadcasting association – that stimulated the popularity of the farm life was the successful TV series *Boer zoekt Vrouw* ("Farmer Seeks Wife"), which has been declared as the most watched TV series in the Dutch history [22]. So far the success of the TV series in raising the plight of farmers has been hailed. How much this translates to more young people turning to farming is yet fully unclear to observers.

The other side of the Dutch diary industry

In our view this is one of the greatest dilemmas of the Dutch dairy sector. The other side of the Dutch dairy sector was brought to the fore through the presentation of one Abrahamse, who has been a journalist for several years and currently does free-lance consultancy. The Dutch has presented itself as the world's number two agro exporter and with the Dutch Dairy being hailed as the best word producers. However, the contribution of the dairy sector to the Dutch GDP is only realistically at 0.3% and Dutch dairy production to worlds' share stands at 1.6%. The animal welfare in the Dutch is also perceived very highly given the massive investments farmers have done with regard to use of sand baths for floors, special rubber floors (meant to separate urine and dung at a go), and open well ventilated stables. Yet according to van der Waaij et al. and Abrahamse [13,23] 70% of Dutch dairy cows have leg problems, 30% suffer from mastitis, the average lactations stand 3.5 lactations per cow, and some suffer fertility problems. At the same time on the environmental degradation, dairying has been accused rightfully due to the massive ammonia emissions, water pollution, odour, and reduction in soil fertility. Also for many years, an issue that is attracting attention is the manure surplus in Dutch dairy. Dutch dairy community has made significant strides in reduction of Nitrogen and Phosphorous emissions. Statistics show a reduction by 4% and about 18% lower in 2011 respectively compared to 2010. The nitrogen surplus decreased by 17% and the phosphorus surplus by 49% after 2006, the year in which new fertilizer policy came into effect [24]. There is still a lot more to be done in this area and Dutch farmers are in need of assistance with appropriate technology to handle excess manure in their farms. In addition, the loss of biodiversity is cited as one of the major concerns of the lobby groups and other interest groups who are now requesting farmers to re-think the whole concept of how the dairy sector is operated in the Netherlands. The dilemma facing the Dutch dairy sector is how to maintain their global dominance narrative while dealing with all these issues from destroying their well-built reputation.

The high reliance on export market particularly China especially with the baby food

The baby food brand of *Nutrilon* is a special Dutch dairy product with massive demand in China and other countries. The product has been victim of several illegal exports by foreigners who would empty shelves in the supermarkets and send the products back to their homes. This trend persisted until the supermarkets felt themselves forced to introduce a quota system for the purchase of the product which is still in place to date. Currently, consumers can only buy a restricted quantity from the supermarkets at a go. The China market for Dutch dairy products is rapidly growing. With the opening of the European market, the Dutch market prices are more or less now dedicated by the world milk prices. This means that the Dutch face equal competition from other dairying countries but particularly the Asian countries whose interest in dairy production is increasingly growing. According to Jongeneel and Van Berkum [25] India is going to be the global leader in dairy production within the next 10 years. Given India's capacity and closeness to China, this is an important development that could "eat" into the Dutch products' market in China. At the same time, the Chinese government is investing massively in the dairy production and should it reach a state of self-sufficiency, the Dutch may need to look for alternative markets. Of course, being the forward thinkers, the Dutch through their leading dairy company FrieslandCampina has already ventured into other Asian territories through acquisition of the Pakistan dairy and they are active both in Indonesia and most recently in Vietnam. How successful these ventures turn out to be will be the subject of keen interest of players in the dairy sector for the next few years.

Sustainability of the intensification of the Dutch dairy sector

The - sustainability concern is with regard to; environmental sustainability, dairy farming profitability, the Dutch exotic dairy herds, animal welfare, and manure management. The rapid intensification in the Dutch dairy farming system has created problems and the question now is whether the intensification model will be sustainable for the future. Due to the responsiveness of the Dutch dairy sector, the country has had to put at times very radical measures to respond adequately to the questions raised regarding sustainability. The lobby and the NGO fraternity particularly still believe that the Dutch farming community is yet to do more. While the Dutch consumer prefers to see Dutch cows grazing in the meadows, the sustainability of this however is still questionable. Some lobbyists argue that by emphasizing on the meadows which are made mostly of English Rye grass, the biodiversity of the original farm land is greatly hampered or destroyed. For example in (Spoelstra [26]; personal communications) presentation on 'King of the meadows' in Friesland during a discussion held with the leading experts in conservation. He observed that the bird going by the names; Skries in Friesland, Grutto in the rest of the Netherlands, and Godwit (UK) was no longer a regular residence of the Dutch landscape as it once was. The Kingbird was elevated to the status of the Dutch National bird, from November 2005. *The king of the Meadows* presentation indicated that the Dutch was actually in the lowest ebb of the European Union biodiversity index [27]. The lobbyist strongly believe that in spite of the other development issues that may create a loss of biodiversity, the conversion of the nature parks and the farming nature inclusive environments to pure farming lands is the most responsible culprit. According to Abrahamse [13] personal communication; with the massive intensification; the meadows birds are gone, as well as the flowers and herbs and in their place has come the rye grass and with the rye grass, the geese.

Dilemmas in Kenyan dairy sector

Investing in formal (super marketization) versus informal markets and linking small holders to dairy processors or to simply establish large scale farms

Kenyan dairy industry production is currently estimated at 5.0 billion kg of milk. The small holder dairy farmers keeping 2-5 cattle and producing about 5 kg of milk per day per cow predominates. These small holder farmers have farm sizes of 3-5 acres. The small holder dairy farmers are a major contributor to global supply of milk. For instant, in India the smallholder dairy farmers account for over 143 billion Kgs [7]. The most milk is produced by farmers owning 2-3 cows. In Kenya, it is estimated that for every 1000 liters, produced the sector employs 13 people. The informal sector (not licensed by the Kenya Dairy Board) accounts for 70% of the total jobs in dairy marketing and processing. This translates to 18 jobs per 1000 Kg of milk produced. The informal sector also accounts for 70% of all marketed milk in Kenya [28,29]. The informal market sector much as is replete with several challenges, continues to thrive because paradoxically, if offers the best price to the farmers as well as to the consumers. The dominance of the informal market creates a dilemma that the Kenyan dairy sector is yet to find a way to address. Because of the scattered small holder (SH) farms and the distance from each other, it is very difficult to provide a sufficient milk collection system. The possibility of farmers using several channels to market milk leads to problems of milk adulteration, high bacterial counts, warm collection of milk due to difficulty of operationalization of the cold chain for so few Kgs of milk, antibiotic residues, zoonotic diseases and improper traceability among other challenges. It is apparent that the low quality, low productivity, and inadequate services and input supply issues facing the Kenyan dairy industry will require a shift in the number of the dairy herd to a number that can sustain a profitable business. But this could mean loss of hundreds of thousands of jobs, loss of livelihoods, and the eroding of traditional attachment to cattle.

Investing in the exotic dairy cow breeds verses investing in local breeds

Exotic breeds in Kenya have a long history. The first herds of exotic breeds were brought in by the European settlers in the early 20th Century. These were kept in the most agriculturally productive areas within the Central and the Rift valley provinces. Initially the locals did not have access to dairy farming until a policy sessional paper of 1954 allowed them to engage in agriculture. This was the start of the use of crossbreds for dairy production by Kenyan community [29]. After independence, many white settlers choose to sell their farms to the Government who subsequently sold the cows to the local small holder farms [30]. The experience of the local smallholder farming communities with Holsteins/Friesians has had serious production challenges. This is because; the small holder farmers could not meet the high nutrient requirements of the imported dairy cattle. Evidently, it is not the breed and its pedigree that determines its productivity rather the management practices of the farmer [31]. The dilemma for the Kenyan dairy industry is whether to continue to import exotic breeds, given the prevailing conditions of small scale farmer's inability to effectively manage these breeds, or simply focus on local breeds and crossbreds. The local breeds however have a limited genetic potential

and so that even though they may be fully adaptable to the local climatic and weather conditions including adaptability to low feed intakes, the local breeds cannot increase their productivity significantly to cater for the increasing demand for milk in the Kenyan and even regional market. Probably the use of well-designed crossbreeding, selection and improvement programmes which takes advantage of the heterosis from the high milk potential from the exotic and the adaptable characteristics of the local breeds to environmental conditions will be worthwhile.

Increasing oligopolistic dominance of Brookside as the only processor and large scale seller

Kenyan dairy milk processing and formal sector was initiated after the setup of KCC in 1922. The KCC was the only dominant processor for several years until its collapse in the year 2000 due to lack of government support, liberalization, corruption and embezzlement. This opened up opportunity for private sector investment in the dairy industry. Brookside dairy which has increasingly become a dominant player was established in 1993. Brookside has intensified its desire to be the dominant player through acquisition of several brands over the years. Their strategy however does not seem to favor development of stronger farmer relationships. Instead they venture through working cooperatives or other processing facilities and buyout their competitors [12]. This approach may mean death to the small holder farmers or cooperatives whose operations are not at optimal levels. The Brookside company leadership of course refute this claim and point out a number of small holder farmer improvement programmes run by their qualified extension officers [32]. On the other hand, by killing and buying out competition, the most desirable situation of a very strong and robust policy and regulatory environment by strengthening dairy chain actors' capacity and collective action in order to lobby effectively for improvement of the enabling environment becomes void. This is a dilemma that the Kenyan dairy industry players must find solutions to, or at least an amicable way to navigate.

The Other Dilemmas

There are several other important dilemmas in Kenyan dairy sector and these include: farming systems, whether to promote large scale or to improve on small scale processing, the land tenure system should the land division exercises that are going on through cultural inheritances be supported or should the Kenyan Dairy Sector adopt land consolidation strategy, on farm cooling verses the centralized cooling systems strategies, whether to go for a more labour intensive system verses more mechanized system. On policy formulation issues; whether to favor the more informal markets and more private sector driven approaches or make more government centered laws like, making it illegal to sell raw milk informally.

The major drivers in the growth of Kenyan dairy sector

The major trends, drivers, constraints, opportunities and interventions for Kenyan dairy sector have been extensively listed by Van der Lee et al. [3]. Generally the dairy sector has two major approaches to achieve any intervention: The interventions may focus on enhancing the internal environment: production and processing or be focus on the external environment (changes in the business operation landscape). In designing any intervention strategy, these trends, drivers, constraints, and opportunities must be considered. As Van der Lee et al. [3] emphasizes the best strategy must be that which renders itself to the overall national goals for the sector.

Sustainability of the Dutch Dairy Sector and Lessons for Kenya

Sustainable intensification

The Dutch dairy industry for sure has had significant success with sustainable intensification of dairy farming. Though the lobby groups may not fully agree, yet their achievement leaves a lot of lessons that countries who are getting into phase II of the dairy farming must pay attention to.

Firstly, the Dutch dairy industry is built on a strong foundation of successful farmers who are running into 3rd-4th generations of family dairy farming business. This means that dairy farming is not only a profit making venture but a key tradition and passion for the farming community. This reason gives the Dutch dairy sector great opportunity for resilience, unlike countries that only invest in agriculture for profit alone. For example in Indonesia, when the beef prices got better, some of the farmers opted to sell their dairy cattle for beef [3]. The solid Dutch farmer network provides a foundation for strong cooperative society and culture with good governance and transparency that has catapulted, the Dutch leading cooperative FrieslandCampina to the 6th global processor and trader of dairy products. This buildup of experience, knowledge, and skills among farmers has been a critical pillar to the success of the dairy industry. Their experience with highly productive and intensive dairy farming is evidenced in their global position as a top country in dairying. The high density of farms, in put suppliers, and processors create an excellent opportunity for sharing of information and provision of services. This has created competent and responsive farmers, employees and service providers throughout the value chain [3]. The Dutch dairy industry is a single integrated industry with a common vision shared among all the actors and players in the value chain. There is therefore clarity on a common vision among stakeholders about how to steer the dairy industry into a more sustainable path of growth. Through Sustainable Dutch dairy chain initiative- a joint initiative of Dutch dairy processors and farmers' union the industry focus is on Sustainable Dairy Chain [33].

- **Development toward climate neutrality:** 20% reduction in greenhouse gases by 2020
- **Continuous improvement towards livestock health and welfare:** Responsible use of antibiotics, 6 months increase in average lifespan of cows; improvement sin animal welfare scores.
- **Preservation of grazing:** 80% of farms apply grazing of dairy cows.
- **Protecting biodiversity and the environment:** 100% responsible soy; phosphate and ammonia levels remain within environmental standards; no net reduction in biodiversity.

The strong farmer associations, who are competent because of the conducive environment that fosters collaboration and learning among stakeholders, is responsible for the creation of the vibrant dairy farming system witnessed in the Dutch. This is a lesson stakeholders/actors in the Kenyan dairy sector must be able to take and it should form an integral part of all dairy sector improvement intervention strategies. Intensification can only work in an environment of competence among the farmers and a quick response of actors along the value chain. The close link between the Dutch national dairy research institute; the Dairy Campus and the Dutch farming community is an important model that can greatly impact the success

of the Kenyan, dairy sector. In designing strategies, the chosen paths must be able to offer opportunity for a best sustainable case with inbuilt capacity to resilience and responsiveness among the players in the dairy sector.

Strong collaboration among stakeholders

The bedrock of success of Dutch dairy sector stems from the effective collaboration between the government, the private sector and the research institutions. There seems to be a very deeply embedded common trust that runs through these institutions. It is wonderful to see the closed gap between the practice on the farmers' fields and the situation in the research institutions. A visit and tour through the Dutch Dairy campus reveals an institution whose primary focus is research aimed at increasing profitability and answering directly to the problems of the Dutch dairy farmer. There is a very strong data recording orientation of all aspects of farming and this is also closely replicated in farmer fields than generally what pertains in Kenya. In stark contrast Van der Lee et al. [3] has presented a table on the projections of milk productions in over 30 countries in Africa and Asia including Kenya. However, the data on Kenyan milk production projection was conspicuously missing from the OECD.org source and IFCN-DairyReport, 2013. Also missing was the data on the number of farms in the various farm size categories (<5, 5-10, 10-20, 20-30>30 cows) of the Kenyan dairy farm. This lack of reliable, up to date data, in the Kenyan context is a huge obstacle to provision of suitable intervention strategies. In responding to Sustainable Dutch Dairy Chain- a joint initiative of Dutch dairy processors and farmers, the research institutions are already all guns blazing toward finding solutions to increased productivity in a climate neutral environment. From experiments with different types of barns that offer the least nitrogen emissions, to sophisticated experiments on feeding regimes with lowest emissions, the dairy campus is involved in every way in finding solutions that address the common vision for the dairy sector (de Koning, [20]; Manager, Dairy Campus, personal communications). There is clearly an integrated dairy chain approach which results into better capacity building for all the actors within the chain. This elaborate collaboration between government, private sector (including farmers and cooperatives) and Research/knowledge institutions, underpins the strength and success of Dutch Dairy Sector. Even more important is the focus toward free sharing of information with other partners in the chain with the aim of accomplishing the shared vision. Kenyan Research Institutions on the other hand have been termed at times as Ivory towers who churn excellent research output but which on many occasions remain stacked somewhere in the shelves within the confines of the institutions. Much as this problem has been blamed mostly on the Universities approach to training and academics, there is still some case for prodding the involvement of the farming community on being inquisitive to information that could revolutionize their farming activities. Irrespective of who is wrong in the Kenyan case, the lesson to learn here is that, the multifaceted challenges that face a dairy farmer in the wake of all these global challenges require a collaborative effort among all the stakeholders. Borrowing from the Dutch industry, the first steps may be to conduct an all-inclusive multi-stakeholder process to define the vision for the dairy industry players and to communicate this vision through all means possible. Through this, the roles and responsibilities of the various institutions including an agreed platform for information sharing could be mapped. The place to begin would be for Public Universities and Research institutions to initiate collaborative stakeholder fora to display whatever information that they are holding for the common good.

Use of technology in dairy farm management and practice

The Dutch dairy farms are an ideal place to study the application of different and most current state of the art technology. There is an extensive use of robots in milking, automation in feed and water supply, most current types of barns and stables designed for immediate separation of cow's urine from dung to reduce ammonia emission among other things. In addition, the installations of various software that monitor the cows' performance are critical to empowering the farmer for decision making purposes [3].

	Dairy sectors		
	Kenyan	Dutch	Source
Contribution to national GDP (%)	3.5	1.2	KDB [35]
Contribution to agricultural GDP (%)	19	18	KDB [35]
Jobs created	9,00,000	60,000	Orregård [36]
Milk production annually (Kg)	5 Billion	12.5 Billion	OECD/FAO [37]
Projected milk supply growth in next 10 years (%)	4.5	2.2	IFCN-Dairy Report [38]
Milk losses post-harvest (%)	6	Almost insignificant	KDB [35]
Packaged and processed quantity (%)	Oct-15	91.8	KDB [35]
Average daily milk output per cow (Kg)	10	35-45	Kurwijila [6]
Milk production in kg per capita (Kg)	83	751	IFCN-Dairy Report [38]
Per capita annual milk consumption in (Kg)	115	320.5	ZuivelNL; European Commission [39]
Milk per Kg per cow per year (Kg)	600	8,192	Dutch Dairy National Inventory report [40]

Table 1: The Kenyan and the Dutch dairy sector key statistical figures.

If Kenya aims to exploit all her potential and perhaps become a dominant player in the dairy sector, it must learn how to apply technology cost effectively for improved productivity of the dairy herd. Because the adoption of such technologies may be quite expensive initially, any farmers going into such a venture should be prepared to go into business for the long haul in order to recoup the benefits in future. Furthermore, the herd size should to such that it enables the farmer to benefit from the economies of scale. According to Coopers [34]; personal communications; CEO Smart Dairy, the size of 25 cows is an ideal farm size. This area is ripe for government, private sector collaboration to help farmers acquire the equipment not only at a subsidized price but also on special credit facilities that farmers may then pay over an agreed period through a milk check off system. The

use of such technology is usually critical to reducing the losses that accrue from poor quality handling and handling practices of milk production. This would be good news given that one of the most important challenges to dairy milk production in Kenya is the poor hygienic and microbiological quality [5]. Successful application of technology will depend on the capacity of the users to put it to full use and exploit all its potential. This will require capacity building among farmers which may be done through sharing of the expertise of Dutch farmers with their Kenyan counterparts. The FrieslandCampina Company has pioneered this step by regularly sending in farmers to Africa and Asia to share their expertise with the local farmers in these parts of the world. The initial results are very encouraging and point to a likely success if these collaborations were scaled up (Table 1).

Conclusion

This paper has presented in a snapshot the current state and dilemmas of the Dutch and the Kenyan Dairy industry. In designing any interventions in the dairy industry it is vital to understand the trends and the drivers that shape the dairy industry. These have been highlighted for the Kenyan case. Based on these prevailing circumstances it has discussed the vital lessons that the Kenyan dairy sector may learn from the Dutch dairy industry. The Kenyan dairy industry must consider incorporating lessons of sustainable intensification, fostering stronger collaborations among all actors, and adopting appropriate technology to the benefit of the dairy farming community.

BOX 1: HOW SNV THROUGH The Kenya Market-led Dairy Programme (KMDP) IS TRANSFERING LESSONS FROM THE DUTCH DAIRY INDUSTRY TO THE KENYAN DAIRY SECTOR: The Kenya Market-led dairy Programme (KMDP-I: 2011-2016, KMDP-II: 2017-2019) is an attempt to actualize the inculcation of lessons from the Dutch Dairy Sector to the Kenyan Dairy Sector. Started in 2011, and funded by the Netherlands Embassy in Nairobi, it takes cognizance of the challenges/hindrances to Kenya's dairy sector competitiveness, including seasonality and high cost of milk production, milk quality issues, knowledge and skills gap, sub-standard services provision, and erratic input supply, especially low quality feeds and fodder. It is market driven and its business orientation means the project addresses some of the systemic issues delving the Kenyan dairy sector through international exposure and business linkages between Kenyan and Dutch stakeholders. Knowledge exchange and innovation are crucial in KMDP. The early returns in terms of improved productivity, feed & fodder, capacity building for farmers (small, medium and large scale) and farmer organisations, their focused engagement with policy, and promotion of international business linkages and knowledge exchange with Dutch experts among other positive outputs are already commendable. It will be prudent to evaluate the impact of this in project in achieving transfer of lessons from Dutch Dairy sector after the final implementation by year 2019. More information on KMDP and SNV can be found through www.cowsoko.com/KMDP and http://www.snv.org/

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