Report for:
*Rijksdienst voor Ondernemend Nederland*

Dairy quick scan Sudan

The Netherlands, October 2016
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>AAAID</td>
<td>Arab Authority for Agricultural Investment and Development</td>
</tr>
<tr>
<td>B2B</td>
<td>Business to Business</td>
</tr>
<tr>
<td>CBPP</td>
<td>contagious pleuropneumoniae (cattle disease)</td>
</tr>
<tr>
<td>CBS</td>
<td>Centraal Bureau voor de Statistiek</td>
</tr>
<tr>
<td>CRV</td>
<td>Cooperative Rundvee Verbetering</td>
</tr>
<tr>
<td>FAO</td>
<td>United Nations Food And Agriculture organisation</td>
</tr>
<tr>
<td>Feddan</td>
<td>unit area (1 feddan = 0.42 hectare or 1.038 acre)</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>ha</td>
<td>hectare (2.46 acre)</td>
</tr>
<tr>
<td>HF</td>
<td>Holstein Friesian (cattle breed)</td>
</tr>
<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
</tr>
<tr>
<td>JV</td>
<td>Joint Venture</td>
</tr>
<tr>
<td>K</td>
<td>1,000 units</td>
</tr>
<tr>
<td>km²</td>
<td>Square kilometre (100 hectares or 247.1 acre)</td>
</tr>
<tr>
<td>L</td>
<td>Litres</td>
</tr>
<tr>
<td>M</td>
<td>Million</td>
</tr>
<tr>
<td>MW</td>
<td>Mega Watt</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Governmental Organisation</td>
</tr>
<tr>
<td>NIRS</td>
<td>Near-infrared spectroscopy</td>
</tr>
<tr>
<td>PSI</td>
<td>Private Sector Investment programme (Netherlands Government /RVO)</td>
</tr>
<tr>
<td>PTC/DTC</td>
<td>Practical Dairy Training Centre/Dairy Training Centre, Leeuwarden, The Netherlands</td>
</tr>
<tr>
<td>T</td>
<td>Tons</td>
</tr>
<tr>
<td>SDG</td>
<td>Sudanese Pound</td>
</tr>
<tr>
<td>UHT</td>
<td>Ultra High Temperature</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environmental Programme</td>
</tr>
<tr>
<td>UNHCR</td>
<td>United Nations High Commissioner for Refugees</td>
</tr>
<tr>
<td>USAID</td>
<td>US Agency for International Development</td>
</tr>
<tr>
<td>US</td>
<td>Unites States</td>
</tr>
<tr>
<td>US $</td>
<td>United States dollar</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
<tr>
<td>WUR</td>
<td>Wageningen University and Research</td>
</tr>
<tr>
<td>WWS</td>
<td>World Wide Sires</td>
</tr>
<tr>
<td>$</td>
<td>United States dollar</td>
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Executive Summary

The goal of this quick scan is to have insight in the specific constraints and requirement for the development of the Sudanese dairy sector as well as to make an overview of possible business opportunities for Dutch companies that will contribute to the development of the Sudanese dairy sector and for bi-lateral B2B activities.

The scan is implemented in three steps i.e. (1) a desk study to get some general orientation on the dairy sector, followed by a field visit (2) mainly aiming at the dairy sector in and around Khartoum and a second visit (step 3) targeted at meeting the major commercial stake holders in the dairy sector and a site visit to eastern Sudan.

In terms of land size, Sudan is 22 times larger than The Netherlands. The amount of irrigated farmland already covers halve of the size of The Netherlands. The country has 36 million inhabitants and over five million people live in the capital Khartoum. The Nile is a vital source of water and energy (hydropower). Dairy is an important feed source for the people of Sudan. Estimation of dairy consumption varies between 80 and 120 litres of milk per capita per year. The economy of the country is slowly growing and there is demand for knowledge, goods and dairy animals. In past several Dutch companies exported cattle and milk processing equipment to Sudan.

There are 40 million cattle in Sudan, of which most of them are of the local Zebu breeds. Beef production is the main focus of the livestock sector, however the interest for dairy farming is growing. According to government, cattle produce 13 million litres of milk per day of which half is used for human consumption. Most commercial dairy farms are located near the big cities. The majority of the fresh milk is sold loose to the consumer and a cold chain does not exist. The processing sector is small and processes only 2% of the total fresh milk amount. Part of their products is (partly) made of recombined milk powder. Sudan imports annually 20,000 tons of milk powder, which is equivalent to 420,000 litres of milk per day.

The majority of the farmers have mixed herds of cattle: sheep and goats. The number of cattle varies from 1 to 50, but most of them are smallholders. Most of these cattle graze on rain fed land at (communal) pastures or on stubble of irrigated land.

The main milk processing companies procure mainly milk from their own farms. These are modern large-scale farms with several hundreds to a few thousand milking cattle. Besides these large-scale farms, there are several farms with 100 to 1,000 milking cows. Around Khartoum there also large dairy settlements (villages) where hundreds of dairy farms are grouped together milking 10 to 25 thousand cattle per settlement. The average farmer on such a settlement owns 30 to 50 head of dairy cows. Dairy farming in the rural areas is dominated by nomadic and semi-nomadic farmers what is all based on range and farming.

The majority of milk is sold to middlemen, who transport the milk to the towns and cities. Milk is sold directly (untreated or boiled) to consumers and street based milk bars. In some cases milk bars cook milk before selling. DAL Dairy Factory is the main processor and besides DAL, there are several smaller processors like FAAPY, Premier and Best. DAL Dairy Factory does process about 150,000 to 250,000 litres of milk per day. The smaller processors process about 5,000 to 30,000 litres of fresh milk per day.

Mechanization grade at the dairy farms is (very) low with exception to the commercial large-scale farms. Cattle are hand milked even at farms with over hundred milking cattle. A forage conservation technique like silage making is not done as year round zero grazing system is the most common feeding practice . Most commercial farms buy all feed and fodder. Cattle are loose housed in paddocks with roofs for shade. With temperatures rising to 40°C and above, the housing conditions are not suitable for high producing dairy cattle.

Sudan has thousands of square kilometres of land under irrigation. Here crops like cotton, groundnuts, sesame, wheat, sorghum and corn are grown. Also many acres are used to grow alfalfa as fodder. This alfalfa is mainly grown for export to the Arabic peninsula. Saudi Arabia is decreasing its own production of fodder crops in order to save water, which forms an opportunity for Sudanese agriculture businesses.
Major infectious cattle diseases like foot and mouth disease, brucellosis and contagious bovine pleuropneumonia are a major thread for the dairy herd and cause major losses. There are no coordinated vaccination or eradication programs.

The government has a clear vision on how to revive agriculture but has no clear strategy for the dairy sector. There are irrigation programs and programs to provide credits, in which the government is supported by IFAD. One of the major gaps is the lack of practical dairy education, since there is only agricultural and veterinary education at university level. During the mission it was remarkable how many alumni we met who had visited Dutch education centres.

There is potential for Dutch business activities. Sudan has the possibility to grow sufficient forage and feeds for a growing dairy sector and also there are plenty of agricultural by-products suitable as nutritious dairy cattle feed. Dutch businesses have experience in growing and conservation of forage and in preparing feed and calculating high yielding dairy rations.

The whole infrastructure of the dairy chain in Sudan has to change in order to fulfill the growing demand of the Sudanese consumer for high quality, food safety and affordable dairy products. The establishment of a cold chain with quality control points will be key in this. Other Sub-Saharan countries are showing that this can develop quickly. Dutch companies and NGOs can play a role in this, by providing expertise and equipment.

There is a clear demand for dairy cattle. The large-scale farms want to import Holstein cattle and also there are plans to provide farmers with dairy cattle. Another way to improve the national dairy herd is by import of semen. AI service is available, although the majority of the cattle get pregnant by natural mating. Also the government just as the large-scale farms look for possibilities to improve dairy genetics by high quality semen.

The consultant was surprised by the fact that Eastern Sudan has a good potential for agricultural (dairy) development due to its huge availability of land, water and labor resources.

It is recommended to promote the Dutch dairy sector in Sudan. Organizing seminars and road shows for relevant stakeholders in the public and private sector can be a promotion tour. Organizing the Sudanese alumni educated at Dutch education centres can also give a boost. In The Netherlands similar actions can be undertaken, to make Dutch dairy companies familiar with the situation and the possibilities for the dairy sector in Sudan.

On the long term the dairy chain in Sudan will develop. The growing middle class will demand safe dairy products. This is a trend worldwide and emerging markets like many countries in South East Asia, but also in Sub-Saharan Africa show a growing dairy processing sector. In many of these countries, foreign governments (also the Dutch government) and NGOs, act as catalyst in this process.
1. Introduction

The Rijksdienst voor Ondernemend Nederland (RVO) requested the in The Netherlands based company The Friesian to conduct a quick scan of the Sudanese Dairy Sector.

Purpose of the quick scan is to have insight in the specific needs for the development of the Sudanese dairy sector and to have an overview of possible business opportunities for Dutch companies resulting in an increased support in the development of the Sudanese dairy sector and bi-lateral B2B trade activities.

The Netherlands Embassy therefore would like to have a general overview of the Sudanese dairy sector by identifying its current constraints, its needs and challenges to develop the dairy value chain with special focus on the dairy farming sector.

The quick scan includes:

- A general overview of important stakeholders in the dairy sector (i.e. the large and smaller dairy companies, cooperatives and dairy farmers).
- Insight in the main constraints, challenges and needs of the dairy sector and dairy farmers.
- Overview of Dutch expertise and equipment that could meet the demand and that could contribute to the development of the dairy sector.
- Identification of possible Sudanese and Dutch partner(s) for further (B2B) cooperation (including public and financing organisation).
- Overviews of actions to be taken in order to develop the dairy sector and to further generate B2B activities.

The terms of reference for the quick scan of the Dairy Sector in Sudan (LED15KHA02) is attached to this report (Appendix 1).

For this assignment, Mr. Berend de Leeuw visited the Khartoum region during the period of 4 - 12 March 2016 mainly focused on the dairy sector in and near Khartoum. A second visit was conducted in May 2016 by Mr. Martin de Jong and was focused on Eastern Sudan and the business opportunities for Dutch companies. A visiting schedule of both visits is attached to this report (Appendix 2).

The missions were supported by the Dutch Embassy, which arranged all logistics and appointments.

The Friesian wishes to express her gratitude for the excellent support received from the Dutch Embassy with special thank to Mrs. Hala Khalil who arranged all formalities and Mr. Ali Abbas, who accompanied the experts of The Friesian at all of their visits.
2. Country profile

2.1 Land features

Sudan's total land area amounts to 1,886,068 km² and is twenty-two (22) times larger than The Netherlands (41,543 km²) including 18% water surface. Sudan is divided into 18 states, i.e.:

<table>
<thead>
<tr>
<th>Nr.</th>
<th>State</th>
<th>Nr.</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Khartoum</td>
<td>10</td>
<td>White Nile</td>
</tr>
<tr>
<td>2</td>
<td>North Kordofan</td>
<td>11</td>
<td>River Nile</td>
</tr>
<tr>
<td>3</td>
<td>Northern State</td>
<td>12</td>
<td>Red Sea</td>
</tr>
<tr>
<td>4</td>
<td>Kassala</td>
<td>13</td>
<td>Al Qadarif</td>
</tr>
<tr>
<td>5</td>
<td>Blue Nile</td>
<td>14</td>
<td>Sennar</td>
</tr>
<tr>
<td>6</td>
<td>North Darfur</td>
<td>15</td>
<td>West Darfur</td>
</tr>
<tr>
<td>7</td>
<td>South Darfur</td>
<td>16</td>
<td>Central Darfur</td>
</tr>
<tr>
<td>8</td>
<td>South Kordofan</td>
<td>17</td>
<td>East Darfur</td>
</tr>
<tr>
<td>9</td>
<td>Al Jazirah</td>
<td>18</td>
<td>West Kordofan</td>
</tr>
</tbody>
</table>

Table 1: 18 states of Sudan

These 18 states are grouped into 6 regions; i.e.:
- Blue Nile comprising states number 9,5,14,10
- Darfur comprising 15, 16,17,6,7
- Kassala comprising 4,13,12
- Khartoum comprising 1
- Kordofan comprising 2,8,18
- Northern State comprising 3,11

Image 1: Map of Sudan with state division

The Blue and White Nile, which join each other at the capital Khartoum, feed the country with water. Major part of the river water is used for irrigation leading to an estimated area 18,630 km² that is irrigated.

The water is not only used for irrigation, but also for generating energy. There are six hydropower stations of which the Merowe Dam is the largest with 1,250 MW capacity of a total country production of 2,400 MW. The
largest power plant in The Netherlands (Eemshaven) has 1,600 MW capacity. The Merowe can supply most of the electricity for the capital Khartoum with over 5 million inhabitants.

An estimated 67,000 km² of land is used for rain fed agriculture and 240,000 km² is used as pasture land and in use by nomadic cattle farmers. Also huge areas of non cultivated land is used for grazing by the approximately 40 million cattle, 32 million goats, 39 million sheep and 4,7 million camels in Sudan.

Main cash crops grown under irrigation are sugar cane, cotton, sesame, peanuts, dates, citrus fruits, yams, tomatoes, mangoes, coffee and tobacco. In addition, the cultivation of alfalfa has become booming in the last 5 to 10 years. Alfalfa hay is exported to the Arab Peninsula.

Main subsistence crops cultivated by the rural farmers are sorghum, millet, wheat, cowpeas, beans, pulses, corn, and barley.

Sudan has a tropical climate, temperatures are high and the air is dry. Summer temperatures often exceed 43,3°C Celsius in the desert zones, and rainfall is negligible. In Khartoum the average annual temperature is about 26,7°C Celsius and annual rainfall, most of which occurs between mid June and September, is about 254 mm. (Source Wikipedia.org FAO.org)

Irrigation and water availability

According to UNEP (2007), there are five main types of farming practised in Sudan, i.e.:

1. mechanised rain-fed agricultural schemes
2. traditional rain-fed agriculture
3. mechanised irrigation schemes
4. traditional irrigation, and
5. livestock husbandry /pastoralist

The irrigation schemes are further divided into two categories:

- the Nile flood and pump schemes, and
- the national irrigation schemes such as Gezira, Rahad, New Halfa and Suki which constitute over 60 % of the total irrigated area. These schemes are the four largest national schemes in the country and consume 60 % of the current Sudanese annual water abstraction.

See next page for the location of the various irrigation schemes.
After gaining independence, Sudan planned to increase agricultural production by expanding irrigated areas, mechanization, rain-fed agriculture and promoting efficiency.

However, although Sudan’s irrigated agriculture has been its most important economic investment, many studies have shown that its performance has been below expectations (UNEP 2007). Although the Gezira is still the largest irrigation scheme in the world, it has turned out that it has a general irrigation efficiency of less than 50%. The farmers cannot earn a satisfactory income from their crops and the siltation in the canals has caused parts of the scheme to be without sufficient irrigation water (Government of Sudan and the World Bank 2000).

The Gezira scheme is not an exception and the situation of many irrigation schemes, such as New Halfa, portrays a gloomy picture at present. In many agricultural schemes siltation in the canals has increased. Thus, the storage capacity of water has decreased, land fertility has decreased and equipment has become outdated (Omer 2007).

Nevertheless, irrigation schemes have long been a strong part of the Sudanese economy and continue to be so. There is no lack of arable land or absolute water scarcity in Sudan, but the challenge is the maintenance of the schemes, the irrigation systems and bringing enough profit to the farmers.

Most of the irrigation schemes were started as parastatal establishments but since Sudan adopted a free market economy, privatisation and decentralisation system, the aim is to turn the schemes into private, financially independent corporations. Farmers’ associations should have the upper hand in the funding and management and the communities should take more responsibility. Furthermore, agricultural cooperatives and the private sector are encouraged to operate the schemes (Omer 2007).

2.2 Demographics
Sudan has an estimated 36 million of inhabitants. The main ethnic group is the Sudanese Arab (approximately 70%) next to the tribes of Fur, Beja, Nuba and Fallata. The rural areas are covering two third of the population, and thus only one third of 36 million people is living in urban areas.

Both Arabic and English are the official languages.

The main religion is Sunni Muslim with a small Christian minority.

Alike in many developing countries the average age of the population is very low: 19.3 years. (42.1 year in The Netherlands). Population growth rate is 1.72% (The Netherlands 0.41%, Kenya 1.93%) The life expectancy at birth is 64 years (The Netherlands 81 years, Kenya 64 years), and there are in average 3.8 children (The Netherlands 1.8, Kenya 3.3) born per woman. About three quarter of the population is literate.

Khartoum is the main population centre and most people live near the large rivers. The top 10 of cities according to number of inhabitants are presented underneath.

<table>
<thead>
<tr>
<th>Nr.</th>
<th>City</th>
<th>Inhabitants</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Khartoum</td>
<td>6,866,738</td>
<td>Khartoum</td>
</tr>
<tr>
<td>2</td>
<td>Nyala</td>
<td>532,183</td>
<td>South Darfur</td>
</tr>
<tr>
<td>3</td>
<td>Port Sudan</td>
<td>474,373</td>
<td>Red Sea</td>
</tr>
<tr>
<td>4</td>
<td>Kassala</td>
<td>419,031</td>
<td>Kassala</td>
</tr>
<tr>
<td>5</td>
<td>Ubayyid</td>
<td>410,941</td>
<td>North Kurdufan</td>
</tr>
<tr>
<td>6</td>
<td>Kosti</td>
<td>364,331</td>
<td>White Nile</td>
</tr>
<tr>
<td>7</td>
<td>Wad Madani</td>
<td>345,291</td>
<td>Al Jazirah</td>
</tr>
<tr>
<td>8</td>
<td>Qadarif</td>
<td>336,522</td>
<td>Al Qadarif</td>
</tr>
<tr>
<td>9</td>
<td>Al-Fashir</td>
<td>264,734</td>
<td>North Darfur</td>
</tr>
<tr>
<td>10</td>
<td>Daein</td>
<td>225,569</td>
<td>South Darfur</td>
</tr>
</tbody>
</table>

Table 2: top 10 of cities according to number of inhabitants

Many people are displaced due to the political situation in the country. The regions Kordofan, Darfur and the Blue Nile are still instable. According to the OCHA there are 3.1 million people internally displaced of which 2.5 million in Darfur. The FAO considers 58% of the population poor and according to the WHO 2 million children are suffering from acute malnutrition and 500,000 children are severely acutely malnourished.


2.3 Eastern Sudan
On request of the Dutch embassy a field visit was made to eastern Sudan to assess the potential for dairy development in that specific region. The embassy experienced that this region was neglected by The Netherlands business society, due to its distance from Khartoum on the one hand and due to the long-lasting issue with Eritrean refugees on the other hand. Despite these documented challenges, the embassy would like to have an expert view on the dairy sector in Eastern Sudan. Background information and a visiting report is presented in Appendix 3.

The consultant was surprised by the fact that Eastern Sudan has a good potential for agricultural (dairy) development due to its huge availability of land, water and labor resources.
2.4 Economics

The Sudanese economy is highly dependent on agriculture. Recent data are not available, but data from 2010 show that 31% of GDP derived from agriculture, of which an estimated 60% derived from livestock production and 40% from crop cultivation.

The GDP per capita is slowly growing and estimated at $4,500 (The Netherlands $49,000, Kenya $3,300) per capita. Visiting the country makes clear that the differences in people’s income are large. Khartoum has middle class suburbs were inhabitants have comfortable air-conditioned houses and drive cars, while on the other hand farm workers live under a straw roof with nearly no possessions. 80% of the population works in agriculture while agriculture not even counts for one third of the GDP.

The oil sector is an important economic and financial factor for Sudan. In the recent years oil production has dropped considerably. Oil production accelerated from 1995 after several important discoveries of oil and production reached a capacity of 489,000 barrels per day in 2010. This was equivalent to around 90% of national income, and around 8% of GDP. The export from oil dropped by 58% from 350,000 barrels per day to 150,000 barrels per day in 2013 generating just 10% of the national income. The lack of hard currency and its dependency on large importation of foodstuff triggered the attention of the Sudanese Government who recently put more focus on the development of the agriculture sector.

The inflation rate is high with an estimated 37% in 2014 and 18% in 2015. The trade balance is negative with 4,4 billion dollar export and 8,1 billion dollar import in 2015.

Trade relation with The Netherlands

Sudan is a small but growing business partner for the Dutch agri business. According to the Dutch statistics office i.e. CBS, Dutch companies exported goods in 2015 at a value of 83.5M euro to Sudan. This amount is relatively stable from 2012 onwards. The most important categories were food and live animals (29.5M euro), equipment/machines and transportation materials (32M euro).

Trade constraints

One of the major constraints for export is the shortage of US dollars and the floating exchange rate.

In theory, US $ can be purchased from the banks at a rate of around 6.91 Sudanese Pond (SDG). In reality there are not enough US $ at the banks, so that most businesses have to buy dollars on the black market at a much higher rate. Therefore, the existence of a parallel exchange rate supported the tendency to turn successful enterprises into loss-generating business.

Another major constraint for the Sudanese business is the trade embargo of the USA for Sudan. US sanctions fall into two categories i.e.:

- The blocking of the government of Sudan and the trade embargo against Sudan, and
- Targeted sanctions against individuals and entities contributing to the conflict in the Darfur region

These sanctions are also applicable on non-US countries who are active in the US which is applicable, amongst others, to all Dutch banks and financial institutions. However exemptions are possible through:

- General licenses for specified areas (including food, agricultural equipment)
- General licenses for non-specific areas (including agricultural commodities)
- Individual licenses for non-specified areas (including agricultural commodities)

Based on these exceptions, export for agricultural products by companies in the US and Europe started slowly.
3. Dairy sector in Sudan

3.1 General facts
People in Sudan are used to consume dairy products. According to the Ministry of Livestock an estimated 4.8 million ton of milk per year is produced of which 50% is used for direct human consumption and the remaining for bakeries and for feeding young stock. According to international statistics (2007) the total annual consumption/capita in Sudan is estimated at 180.7 kg (320.2 kg for The Netherlands and 61.8 kg for Egypt).

This volume is similar to a country like Kenya and double compared with Uganda. The average consumption is 6.5 million litres per day, which equals 0.18 litre (one cup of milk)/capita per day or 66 litre per year. Most of this milk is consumed directly without processing. Milk is consumed at home or sold loose at milk bars.

Anually, Sudan imports 20,000 tons of milk powder. When this milk powder import is included in the consumption assessment, consumption of liquid milk is estimated at 71 litres of milk/capita/year.

Accurate data on dairy cattle numbers are not available, however when estimating that the average dairy cow produces 5 litres of milk per day, the total number of dairy cattle is estimated over 2.5 million head. This is less than 10% of the total cattle herd of estimated 40 million head.

Most cattle in Sudan are Zebu beef cattle (native breed). Export of beef cattle is an important source of income. Within the overall type of Zebu breed, the Kenana and Butana breeds are most suitable for dairy production. Therefore in the last decade these breeds have been crossbred with Holstein Friesian breed. Since the seventies many Dutch companies have exported dairy cattle to Sudan.

3.2 Dairy farming

3.2.1 Types of dairy farms
According to the Ministry of Livestock three main systems of animal production can be distinguished, i.e.:

- The traditional system, which involve nomadic, semi-nomadic and transhumance, which are all based on rangeland feeding.
- Intensive farming, which is based on irrigated fodder and industrial by-products and located near the population centres mainly for milk and poultry production.
• Feed lots located around livestock markets; the animals are drawn from the traditional production system and subjected to concentrate feeding to support export and local consumption after fattening and reconditioning.

NOTE: As feedlot farming is aimed at beef production, it is not discussed in this document.

Traditional farming system
There is a variety of herders in Sudan, including:

- nomadic and settled herders
- large herders with hundreds of animals, and
- small herders typically with just a few goats.

Herders often specialise in either cows or small ruminants (sheep and goats). Cows are more valuable than sheep or goats but less costly than camels, which is the species with the highest price on the market.

Most herders have a starting herd that is mainly inherited. While some herders purchase animals to grow the size of their herd, most rely on natural breeding to increase their livestock assets. The birth rate of a herd also highly depends on the animal feed, and herders interviewed reported that a standard birth rate was one calf per every two cows per year.

One of the main characteristics of herders is that they keep the female in the herd and sell the male infants at livestock markets. Females are very rarely sold while males are sold to generate direct income for the purchasing herder, or for meat (mainly exported). As a result, across species, a typical herd is composed of about 90% female and 10% male, the latter being kept mainly to inseminate the females.

Milk from female cows and goats is collected and consumed at home, or sold to small processors and collectors.

The first and main challenge for herders is feeding their livestock. Herders are dependent on seasonality for feeding their animals and they have access to different feed channels. During the rainy season (July to November), and according to the land available around them, herders let the animals graze on public grasslands around the camps or the villages, where animals can eat for free.

During winter (December to February) and summer (March to July) when grass is scarce on public grasslands, herders have to rear their herd on farmlands until the farming season is over. Herders typically rent the land for their livestock to eat mainly sorghum residues that cover a majority of the farmed land. Access to land is key to provide the animals with sufficient feeding in particular during the dry months (November to June) when grasslands are arid and free access to food is scarce.

The high demand for land in this period triggers high rental prices at around 36 to 63 US$ per feddan in Fashaga locality and 500 to 89 to 107 USD per feddan in Um el Ghoura locality where land in Rahad Irrigation Scheme is limited (reducing the land available). The space required for feeding depends on the size of the herd and the land yield (a season with low production will generate less crop residue, requiring more land to be rented).

From interviews, it was estimated that on average, one cow would require approximately half a feddan per dry season to get sufficient feeding. Therefore, it is a great advantage for herders if they own land and conduct farming activities in parallel to herding activities to save on the cost of renting land for feeding.
Intensive (larger scale) farming

This group can be divided to three forms of dairy farming, i.e.:

- Dairy farming societies
- Small to medium sized private dairy farms
- Large scale corporate owned dairy farms

The main dairy herds are grouped around the major cities, especially Khartoum with over 5 million inhabitants.

**Dairy farming societies**

A very special way of dairy farming is done at dairy farming societies. Already in the fifties of the last century the government established dairy societies i.e. co-operatives near Khartoum. In name they are still co-operatives, but in practise it is each farmer for himself. Every farmer sells his milk individually and purchases his feed individually. For this reason it is chosen to use the word dairy farming society.

A dairy farming society is a location where hundreds of dairy farmers manage thousands of cattle. In average they manage 30 to 50 milking cattle each/farm unit. Their farms are located next to each other in a large compound. Cattle are kept in a fenced area with a feed gut and a shadow roof.

Most easy it is to imagine it as a town with individual dairy farms instead of individual houses. The farms lay adjacent to each other in structure with streets. At some societies, farms have some land outside the compound to grow fodder. Other societies do not own or lease any land except for the cattle shed on which the cattle are housed.

Such a dairy society has some unique features. The cattle at dairy societies are highly susceptible for major infectious diseases, like foot and mouth disease and brucellosis.

Due to the high cattle density, non-disposal of cadavers and buying and selling of cattle from outside (even for an internationally experienced dairy expert) it is shocking to see carcasses all over and around the place.
Owners of these type of society farms are not always farmers themselves, but a mix of various entrepreneurs. The consultant spoke with a surgeon, a lawyer and a retired general major, who possessed such a dairy farm. Labourers, who live at these farms, are employed there.

**Small/medium sized commercial oriented dairy farms**

An emerging farming group; are the commercial orientated private dairy farms each individual located around the Khartoum area. These farms are established by local entrepreneurs who are also active in the non agricultural business, such a steel and civil works). Few of these farms where visited in the Omdurman region.

These farms have (in general) a modern layout i.e. fenced run yards and roofed eating and resting places for the cattle. Most of these farms do not have (or very limited) land to grown forage and are purchasing this from the market or have contracts with local forage producers. Cattle breeds are a mix of crossbred HF and local breed and are milked manually.

In general the owners/manager have limited knowledge and experience in “confined” dairy farming and therefore technical and thus financial performance is poor. Milk is sold (fresh and not chilled) to a local trader at SDG 6.25 (€ 0.41/l).

It is estimated that there are around 100 to 150 farms with 300 to 1,000 cattle/farm and 500 to 600 farms with 100 to 300 cattle/farm. Most of these commercial farms are very basically equipped.
**Large scale corporate owned dairy farms**

Most milk processing plants have their own large scale dairy farms. These are modern dairy farms with imported high productive Holstein Friesian dairy cattle and equipped with modern high capacity milking equipment climate controlled cattle housing.

Some of these leading large scale corporate farms are listed underneath.

**DAL Agriculture** (www.dalgroup.com) develops and manages its own large-scale farms, including two in Khartoum State, two pilot farms in northern Sudan, and is rapidly expanding in other areas of the country. It also boasts a dairy farm (*Blue Nile Integrated Dairy Farm*) established in 2006 near Alafoun with 6,600 head of high-yielding Friesian-Holstein dairy cows imported from Australia, Saudi Arabia and the USA. Current milk production is approx 8,000 l/milk/lactation). The farm has expatriate management from Australia. DAL is planning to extent the farm to reach 10,000 head of milking cows. See also chapter 3.3. (milk processing) for information on DAL’s milk processing activities i.e. **CAPO brand**.

DAL’s new dairy farming operation required a secure supply of forage, so the establishment of alfalfa plantations was the next priority; by 2010, a new farm, Al Waha, was established to focus on crop farming. In addition to this, the company also 100,000 ha of agricultural land for the production of corn (for animal feed), local wheat (for pasta). DAL has 127 large scale pivots to irrigated the land.

At last but not least, DAL’s engineering company is offering farmers in Sudan and the surrounding region with quality products (animal feed brand KAFI) and services for a wide variety of agricultural activities from land preparation to harvesting.

The company **Premier** has its own dairy farm with 850 head of milking cows with an average production of 6,500 l/lactation. By mid 2016 Premier engaged experts from Australia to manage the dairy farm as it plans to expand to 3,000 head. The farm has 15,000 ha of land for forage production and uses 117 central pivots for irrigation.

According to the (expatriate) farm manager, heat stress is a major limitation to achieve high production levels. See also chapter 3.3. (milk processing) for more information on Premier dairy plant.

**FAAPY** www.faapyfoods.com have their own farms organised within the **Mondial Agricultural Company**, comprising three key farms/activities, i.e.:

- Fayet project for agricultural production area Guendtoo (200 ha.)
- Alshohda agricultural Project south of the city Shendi (240 ha.)
- Altrajma agricultural Project (32,380 ha.)

These three projects/farms are aimed to produce a range of forage crops (Rhodes grass, alfalfa and corn (maize silage), vegetables and fruits. These farms are using latest technology in the field of agriculture by such as pivotal irrigation systems and harvesting systems.

FAAPY dairy farm is covering 400 milking cows with an average daily milk production of 6 to 9T/day. The intention is to grow in due time to a farm of 1,300 head. FAAPY is currently discussing with the Nile Government and the Agricultural Bank to establish a scheme for family based dairy farms aiming at a daily fresh milk production of 40 T (phase I) to 100 T/day.

Kenana Sugar Company (www.kenana.com) stopped with dairy processing but still operates a dairy farm.

Kenana has firmly established itself as one of the biggest integrated and diversified sugar complexes in the world. Kenana has an unique diversified model by successfully integrating around the core sugar business other value added agro-industrial projects such as animal feed, bio-fuels, milk products, poultry, meat, woody products from the commercial forests, certified seeds and other engineering goods and services. This is all fed by a co-generation project capable of producing 75 MW of electricity using bagasse. It has recently launched an ambitious Mahaseel Agricultural Investment Fund and currently managing mega agricultural schemes for the production of grains and oilseeds.

Kenana Integrated Agricultural Solutions (KIAS) KIAS was established in 2010, and is a fully owned Kenana Sugar Company Subsidiary and comprises three farms with a total of 176,500 ha for the production maize, soybeans, sunflower, peanut and cotton. KIAS is planning to extend its farming unit with at 250,000 ha more.

The Northern Gezira Dairy Unit was registered in 1982 as a JV between AAAID and the governments of Sudan, Saudi Arabia, Kuwait and Iraq. The initial plan was to establish at the Albagair area, Gezira state a dairy farm for 5,000 milking cows, a milk processing plant and 1,980 ha of land for forage production. The project got into problems due to changes in legislation, hard currency issues and drought. The farm and factory stopped operations in 2003. Currently AAAID is considering to restart the project and has commissioned a feasibility study to rehabilitate the farm and milk processing plant.

The Arab Authority for Agricultural Investment and Development (AAAID) was established in 1976 with its legal entity as an independent financial agricultural investment institution, where twelve Arab states are shareholders.

3.2.2 Dairy farming economics
The field visits revealed that dairy farming can be a commercially interesting business. Milk prices paid to farmers vary from 40 to 60 eurocent per litre. This was calculated with the unofficial exchange rate of 13 SDG per euro. The official exchange rate is 8 SDG per euro.

When compared to the leading milk producing countries, the paid price for milk is very good; for sure when taking into account the milk composition and quality. In Europe the average (2015) price was 30 eurocents and in the US 35 eurocents.

Milk processing company CAPO dairy pays nearly 60 eurocents/ltr when milk is collected from farmers delivering over 500 litres/milk/day. The prices were obtained by asking farmers near Khartoum and are comparable with figures in the UNHCR report on the dairy sector in East Sudan.

A large factor in the cost of milk production, is related to forage feed cost. Most farms around the city have only a limited acreage of land (or no land at all) to grow forage crops. Therefore most dairy farms purchase roughage and concentrates. Even the larger farms with land prefer to purchase roughage commercially from big enterprises producing mainly alfalfa. On the next page price of feed are listed.
Table 3. Market prices of cattle feed (March 2016)

<table>
<thead>
<tr>
<th>Feed item</th>
<th>Price /kg x €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum</td>
<td>0,27</td>
</tr>
<tr>
<td>Groundnut cake</td>
<td>0,35</td>
</tr>
<tr>
<td>Wheatbran</td>
<td>0,24</td>
</tr>
<tr>
<td>Kenana complete feed</td>
<td>0,23</td>
</tr>
<tr>
<td>Cargill/Provimi Dairy Concentrate</td>
<td>0,29</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>0,25</td>
</tr>
<tr>
<td>Imp Maize Silage (35%DM)</td>
<td>0,10</td>
</tr>
</tbody>
</table>

Concentrate prices are comparable to the prices of concentrates in the Netherlands. In Sudan the prices of concentrate and roughage are comparable. It should be mentioned that very little is known on the protein levels of these concentrates and its composition. Most smallholders will just “graze” their cattle on “communal” pastures and will feed no concentrated feed at all. This way, the cost of farming will be minimal, but also milk production will be low. They will have just enough milk to feed their family.

Based on information provided by a young and progressive farmer having farm at a dairy farming society in the South of Khartoum the following quick and rough calculation was made.

<table>
<thead>
<tr>
<th>Al Saeg Dairy Farm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm income per day: 300 litre/day times 6 SDG/ltr (0,46 euro/ltr) = 1,800 SDG/day (144 euro/day)</td>
<td></td>
</tr>
<tr>
<td>Feed cost per day:</td>
<td></td>
</tr>
<tr>
<td>Feed</td>
<td>600 SDG</td>
</tr>
<tr>
<td>Labour</td>
<td>100 SDG</td>
</tr>
<tr>
<td>Milk transport</td>
<td>100 SDG</td>
</tr>
<tr>
<td>Others</td>
<td>100 SDG</td>
</tr>
<tr>
<td>Total</td>
<td>900 SDG</td>
</tr>
</tbody>
</table>

Cost price is 3 SDG/ltr (0,25 euro/ltr)

A herd manager of a modern large-scale farm owned by a dairy processor estimated the cost price of milk between 0,44 – 0,48 eurocent per liter at the moment. Last year it was 0,28 - 0,36 eurocent per liter. The high production cost for this modern large-scale farm compared to the small commercial farmer can be explained by the higher cost for mechanization and depreciation on imported cattle, milk equipment and modern housing systems. The small commercial farm has, except for the value of the cattle, nearly no fixed assets.

The increase in cost price this year is mainly caused by increase of feed prices. There are two reasons for this increase. Due to low rainfall, yields of rain fed agricultural feed crops have decreased and irrigation cost are increased. Furthermore Saudi Arabia is decreasing its fodder production in order to save water and therefore the demand for Sudanese alfalfa has been increased.

Interesting was the herd manager’s remark, that according to what he had heard, Almarai, the biggest dairy in Saudi Arabia, estimated that production cost in Sudan are 40% lower compared to Saudi Arabia.

3.2.3 Breeds and AI

The Kenana and Butana cattle breed are the traditional Zebu breed used for dairy farming in Sudan. For decades these cattle breeds have been cross-bred with Holstein Friesian breed (HF). Under the harsh climate HF cattle can reach full yield levels only when they are housed in barns with good climate control and fed a well balanced feed ration. At most visited dairy farms the dairy cattle were crossbreds.

AI is available but not generally practised. At most farms one or more HF sires, or a crossbred bull with strong HF genetics, service the cattle. The representative of the Sudanese AI project (formerly known as Semex) told that they sold about 25,000 HF breed straws/year.
At Helat Koko, where the Dutch helped to establish in the 70s a dairy school, the Sudanese AI project has an experimental farm. This company was established in 2004 and is one of the first private companies. Their main focus is not on dairy cattle but on beef cattle. Local breeds are crossed with Simmental and Red Angus. They try to breed cattle, which can reach 400 kilograms of live weight within one year. Currently, the company co-operates with World Wide Sires, Semex and CRV.

3.2.4 Dairy farm management and housing

The majority of the ‘smallholder’ farms are grazing their herds and have no cattle housing at all, except for a simple coral, where they keep their cattle overnight.

In Sudan there is a limited number of modern large-scale dairy farms equipped with modern stable equipment and climate control in which HF cattle can reach productions up to 30 litres/day. Major number of the commercial dairy farms are minimally equipped. Cattle are held in fenced paddocks on bare soil. Most paddocks have roofs where cattle can shelter from the sun. The fences are made from all possible materials, like zinc plates, car bumpers, barb wire, etc. The roofs are not insulated and often covered with zinc plates or straw like materials. At most visited farms there are three groups of cattle: young stock, milking cattle and dry cattle. All farms use a zero grazing system. At most visited farms cattle have free access to drinking water or troughs (old bathtubs) or filled from water towers or directly from a well.

Cattle are fed from feed guts, which were mostly empty or filled with uneatable feed residues. There is ample feed storage at the farms. Feed and forage is bought in limited volume and only sufficient to cover the needs for few days or maximum one week.

Manure is removed regularly. Cattle themselves were in general clean. How this will be after a “rare” rain shower is questionable. At some farms manure is used to make bricks, however in general the manure is just dumped; farmers mentioned that manure was not used to fertilize the land. At the farms visited also other animals like goats, sheep, goose and chicken are kept. Local veterinarians recommend chickens as tick predators.

3.2.5 Milking

Only modern large-scale farms and some smaller commercial farms have milking equipment. DeLaval and Kurstan (Turkey) milking equipment have a local representative office. The use of a milking machine is not the standard and in general milking is done by hand even in farms with a few hundred animals. Most farmers are milking the cattle only once/day (afternoon). Only at commercial farms cattle are milked twice a day. Milk is
brought into the city in the afternoon, either by the farmer but in most cases by traders/vendors. Milk bars are open in the afternoon and evening.

At the dairy societies the government was busy with constructing communal milking parlours. Farmers at the dairy societies showed us the parlours, but were not very enthusiastic about it. They had doubts about how the milk volume would be measured and how the milk money would be paid.

The farms in the dairy societies have in average 30 to 50 milking cattle. Farms have staff to milk and feed the cattle. At visited farms, labour ranged from one worker for 10 to 20 heads of cattle. As long as buyers do not have quality demands on milk and labour costs stay relatively low, the urge to use milking machines will be low.

Milk is not cooled at the farm or brought to a milk cooling centre. The cold chain, which is developing quickly at the moment in Sub-Saharan countries like Kenya, Uganda and Rwanda, does not exit in Sudan.

Image 7: Milking and on-farm milk storage

3.2.6 Feeding
Smallholders depend on grazing their cattle. Cattle are grazed on communal pastures or on the stubble of cropland. Farmers pay a fee to the landowner, which allows them to feed their cattle on this cropland. Feeding concentrate is rare. In times of draught the amount of feed will be scarce and milk production will drop or stop.

Commercial farmers purchase nearly all the feed. Only small amounts of roughage are home grown. Even when farmers have own land, they sometimes choose to buy roughage, because production (mechanization and irrigation) cost is higher than when buying roughage.

Sudan has nearly 18,000 square kilometres of irrigated land. Part of this land is used to grow alfalfa commercially. Large companies like the DAL GROUP grow this alfalfa. Next to alfalfa, sorghum and maize are grown as fodder crops. The visited farmers who grow maize and sorghum themselves were green feeding it. They did not have the tools and the knowledge to make silage. This is a very inefficient way of feeding. Most of the crops are harvested, when not fully ripened. This way a lot of feed value does get lost. For maize 60% of the feed value is present in the ripe cob.

A large area of land that can be irrigated land lies idle at the moment. An IFAD financed program is aiming to rehabilitate these irrigations schemes.

The Kenana Sugar Company is offering a complete feed for cattle. The feed is pelleted. The remnants of the sugarcane production, called bagasse, are the fibre source. This bagasse is mixed with sorghum grain and wheat bran as energy source and oilcakes as protein source. They sell about 40,000 tons of these products per year.
Cargill (Provimi) sells complete dairy concentrates and also pre-mixes. De Heus is active on the Sudanese market with poultry feeds. DETASI www.detasi.com is amongst others representing the companies Koudijs, FSD (Intervet) Ms. Schippers and Neogen and provides technical support and sells animal feed (mainly poultry) and animal health products. DETASI has also a diagnostic and feed analysis lab with NIR equipment established within the Dutch Government funded PSI project.

The impression is that feeding for optimal production can be improved a lot. At all farms except for one, cattle were standing over empty feed guts. The exception during our mission was a young farmer who had been educated at PTC/DTC for half a year and brought his gained knowledge into practice.

The general impression during the mission was that cattle had a good body condition score. The rumens were filled and skinny cattle were rare. Nevertheless feed guts were mostly empty when visiting the farms and milk production was low. Nowhere one saw cattle quietly lying down chewing the cut. At all farms the cattle were standing up even though there was no feed present. When cow comfort is optimal, it is expected that 70% of the cattle is lying down. Maybe the conclusion should be, that cattle get enough feed to maintain their body condition, but not enough for optimal milk production.

Good dairy feeding practice is possible in Sudan. All required feeds are available on the market. Due to the various irrigation schemes, feed rich in protein like alfalfa and oil cakes is available. The oil cakes are made from groundnut, sesame, cotton and sunflower. When farmers also get access to knowledge and equipment to make silage, well-balanced rations can be made.

3.2.7 Animal health and food safety

Infectious diseases
Major infectious diseases like foot and mouth disease, brucellosis and contagious pleuropneumoniae are serious threats for a dairy farmer in Sudan. At one of the visited dairy societies a recent outbreak of long plaque (CBPP) caused severe damage. At another dairy society there had been an outbreak of foot and mouth disease last year. The visited farmer at the dairy society lost 20% of his herd. On yet another farm an outbreak of brucellosis had caused a lot of damage a few years ago. In a study around Khartoum it was concluded that brucellosis was prevalent on 36% of the tested farms.

Infectious diseases can spread quickly as herds of different farmers graze together. At dairy societies only an open fence separates cattle from the different farms. Bulls can spread diseases when they service cattle. Carcasses of dead animals are not incinerated or even buried. Dozens of carcasses were lying on the side of the road in profound state of decay when visiting an area with several large scale dairy farms.

Currently the government is not planning to organize vaccination programs. Dairy farmers who want to vaccinate against certain diseases have to import vaccines themselves. Quality of these vaccines will be difficult to check.

Tick born diseases are common, but spraying stations are not observed during the mission. In a scientific paper veterinarians recommend poultry to eat the ticks in the farmyard. In a study it was found that 141 of 150 tested farms in Khartoum had serious tick infestations.

Management diseases
The visited farmers said that it was not difficult to get their cattle pregnant. This can be explained by the fact that bulls are held among the cattle. However, farmers complained about the high number of abortions.

The condition of hoofs and legs of the animals is poor. The dry sandy grounds where cattle walk on are clean. Laminitis is a disease of high productive dairy cattle. Nevertheless many cattle were spotted in need for hoof trimming. When asked, hoof trimming was not practised and also no hoof trimming equipment was observed at the farms.
One would expect low prevalence of mastitis at farms where cattle are hand milked and production is low, but a study around Khartoum showed that 69% of the farms had a high somatic cell count. According to the study this was due to poor hygienic conditions around milking and the cleanliness of the bedding.

**Food safety**
The food safety of the milk is a point of high concern. The hygiene around milking is low, consequently milk will have high bacterial counts, which will increase rapidly when milk is not cooled. Next to bacteria causing food poisonings, zoonosis like brucellosis, leptospirosis and tuberculosis can be spread through milk. Moreover, aflatoxin might be also an attention point. Good boiling of the milk is crucial for consumption.

Antibiotics are freely available and there is no control on contamination of the milk with antibiotics. Also aflatoxins are expected to be present in milk by feeding groundnut and sunflower cake.

**3.2.8 Conclusions**
- Compared internationally; farmers receive a (very) good milk price for poor quality milk
- Milk quality is poor and a hazard for food safety.
- Milking is done by hand, whereas milk is not cooled after milking.
- Cattle have a reasonable body condition score.
- Condition of legs is poor.
- Each farm has one of more service bulls. AI service is available.
- Housing is poor/basic and with only a roof for shading not suitable for high productive dairy cattle.
- Prices of concentrate and roughage are comparable.
- Forage production is hardly done at the farms, whereas most forage is purchased from the market.
- Cattle are fed what is available on the market or present in the field. No balanced rations are made.
- (Unclean) drinking water is available.
- Silage making and use is unknown. Alfalfa and Rhodes grass Hay or green fed sorghum or maize is the roughage fed.
- Concentrate can be mixed at the farms.
- Pre-mixes, full concentrates or even complete feeds are also available at the market.
- Manure is not used as fertilizer.
- Major infectious cattle diseases are a real hazard and cause regularly a lot of damage.

**3.3 Milk processing sector**
The milk processing sector in terms of volume related to national production is very low and according to the government covers only 2% of the total amount of traded fresh milk volume. The percentage of the total liquid dairy market is much higher, as dairy processors recombine milk powder in their products whereas also imported dairy products are available in the shops.

CAPO Dairies is the largest processor. According to a marketing person of Kenana Sugar Company there are 8 dairy processing plants around and in Khartoum, all producing far below plant capacity (< 50%). The estimated output of used raw milk is around 200,000 litres per day. Main milk processors are listed underneath, i.e.:

**DAL Dairy Factory**
Most prominent in the processing industry is the DAL Dairy Factory processing a wide range of dairy products under the name of CAPO www.capodairy.com, CAPO is part of the DAL Group www.dalggroup.com.

It is estimated that DAL dairy (CAPO) processes about 150,000 to 175,000 litres of fresh milk per day while having an installed processing capacity of 500T/day. CAPO is mainly collecting its own fresh milk from their modern large-scale dairy farm with 6,600 cattle (Blue Nile Integrated dairy farm). In addition, CAPO has 22 milk collection centres of which 60% are located in the greater Khartoum area. Furthermore they also buy milk
directly from local dairy farms delivering over 500 litres per day.

DAL is also considering to start collecting fresh milk from eastern Sudan (cooperation with UNHCR).

![DAL Dairy Factory at Bahri Industrial Area (North Khartoum)](image)

DAL produces a range of yoghurt products (liquid and set yoghurt), fresh milk, long life milk, mish and whipping cream. Only fresh milk and whipping milk products are made from 100% fresh milk. In the other products whole milk powder or skimmed milk powder is added. CAPO advertises on its website about the importance for health of fresh milk and warns about the quality of milk sold by donkey men.

**FAAPY**

FAAPY Dairy Factory was established in 2001. FAAPY [www.faapyfoods.com](http://www.faapyfoods.com) is owner of the Mondial Agricultural Group, which manages three farms of which one is a dairy with 500 milking cattle producing 11,000 litres of milk per day. FAAPY Dairy uses about 10,000 litres of milk per day and makes fresh milk, yoghurt, fresh cheese and mish.

FAAPY only uses milk produced by its own farm. FAAPY has plans to expand to 2,000 cattle and is trying to establish a new dairy compound together with the Sudanese Government, for which they want to import a few thousand cattle.

**Premier**

Premier Dairy [www.premierfood.net](http://www.premierfood.net) is established in 2002 and sells a wide range of dairy products under the name of DAIMA (main brand), TAZA and Latti milk (flavoured milk, yogurt and fresh cheese). Premier processes approximately 30T of fresh milk and uses large amounts of milk powder to recombine in its products.

Premier produces also fruit juices under the name of Primo. Furthermore Premier is the local distributor of Nestle products. Premier dairy is part of a huge group of companies representing companies like Toyota, CAT and many more. The group is also engaged in mining and fish farming.

**Best**

Moawia Mohammed Ahmed Elberier Group of Companies [www.moawiaelberier.com](http://www.moawiaelberier.com) sells dairy products under the name Best. They have an estimated use of 15 tons of milk per day. They have milk yoghurt and cheese in their sales portfolio. Part of their products is made of recombined milk powder.

Other players are Al Rawabi Dairy and in the past Kenana Friesland Dairy. Established in 2003 as a joint venture between Kenana Sugar Company, the Sudanese French Bank, and Van der Ploeg International (the Netherlands), mainly to process raw milk from Produce Farm Business Unit into pasteurized milk, yogurt and three types of cheese. The dairy plant has a capacity of intake tanks of 30,000 litres of milk per day with a processing output of 12,000 liters of milk products/day. Kenana Friesland Dairy has been closed down. Reason for this closure is unknown.
3.4 Milk/dairy products marketing

3.4.1 Loose selling of milk
The most distinctive feature on the Sudanese dairy chain is the fact that 98% of the milk is sold loose and unprocessed. The dairy processors only process 2% of the total amount of traded milk according to estimates of the Ministry of Livestock.

Most traded milk is sold to middlemen/traders, who sell the milk directly to consumers or to milk bars. At some milk bars, the milk is cooked on gas heaters before selling. The middlemen are dressed as donkey men, but around Khartoum you can see many pick up trucks loaded with milk churns or 200 litre blue plastic barrels filled with milk. The “real” donkey men can also still be spotted in the streets of Khartoum with his donkey and his car loaded with milk churns.

A cold chain is completely absent. Even the larger farms visited have no cooling facilities. A farm visited with 1,000 heads of dairy cattle and delivering to CAPO Dairy did not have a milk-cooling tank. This has as a consequence that milk has to be produced within an hour drive from the consumer or processor. If farmers live further away from the market, milk is locally processed into fresh cheeses.

Around Khartoum there is a complex logistic system for the sales of loose fresh milk. Dairy farmers bring milk to markets where milk traders buy milk or milk buyers have to visit their farm to pick up milk directly after milking. The milk buyers have to sell their milk to milk bars or directly to consumers. This milk trade is clearly visible in the streets of Khartoum. Everywhere there are milk bars and pick up trucks and donkey cars filled with milk in the streets.

Anticipated that an average citizen of Khartoum drinks one cup of milk per day, as estimated consumption of dairy per capita by the government, over 1 million litres of milk is sold daily in this way.

Taking into account that the consumption of milk increases when incomes are higher, the traded amount will even be over 1 million litre in a city with inhabitants, who will have more income compared to the rest of the country.

The situation in the rest of the country differs from the situation in and around Khartoum. The UNHCR describes the situation in the east of Sudan as; consumption of dairy products is strongly linked to level of wealth of refugee and host community households, in particular their access to livestock. Only 40% of refugees and 60% of host community members have access to at least one animal. Milk is rarely traded and the market is almost not existent in the camps. Furthermore, herders do not milk their animals in a commercial way, just in the evenings to fulfil the family consumption. It was felt that the milk production falls far short of its true potential.
Processed products such as cheese and yoghurt are mainly produced at the micro-scale in houses, and one small-scale factory was identified in Showak.

In June 2015, The United States, through the U.S. Agency for International Development (USAID), signed an agreement on Sunday with DAL Food to provide locally sourced, pasteurized milk to 5,000 malnourished school children in Red Sea State, as part of a public-private partnership to improve education and nutrition through dairy distribution.

Initiatives to start sourcing and marketing the milk locally will have considerable impact, not only on marketing and consumption, but also on the development of the dairy sector.

3.4.2 Supermarkets

The processing sector is selling their products in the (small) supermarkets of Khartoum. Dairy products are prominently placed in the supermarket. The processors have provided refrigerators with their brand name on it to the supermarkets for fresh products.

CAPO Dairy has mostly two refrigerators per shop and the widest assortment of dairy products and juices. They sell fresh and UHT milk in brick, plastic bottle and bags. Also they sell several yogurts and flavoured milk in cups and bottles in different tastes. In their refrigerators only CAPO products were available. CAPO claims that fresh milk is made from fresh milk only. This claim is not made for UHT.

FAAPY has a smaller assortment and is offering mainly fresh milk. Their refrigerator was on the end of the afternoon nearly empty and according to the shop owner the brand is popular because it is fresh milk. Refrigerators were often used for other products as well like olives and fresh cheeses.

3.4.3 Dairy markets

Next to fresh dairy, milk powder (mainly full cream) is sold in tins and bags, but also skimmed and fortified milk powder is available. The tins with powder take considerable shelf length, suggesting that there is considerable turn over. The brands sold are Anchor, Nestle and Foremost (FrieslandCampina). Nestle does not import milk powder to Sudan; the Nestle milk powder in shops is imported from the Arabic Peninsula, so called parallel import. Prices vary from 19 to 23 SDG per 2.5 kg. This is comparable to a price of around 1 euro per litre milk and to the price of local pasteurised milk and UHT (partly skimmed). Imported UHT from Saudi Arabia will nearly cost 2 euro per litre.

Butter and (hard) cheese is in some shops available for high prices. The local dairies (Daima) produces feta like soft cheeses and from outside Khartoum State fresh cheeses are brought to the shops. Along the value chain the cooling chain is completely missing, so if farmers want to sell milk to far away cities, they have to expand the shelf life by turning it into cheese.

<table>
<thead>
<tr>
<th>Product</th>
<th>Amount</th>
<th>Price SDG</th>
<th>Price Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw milk</td>
<td>Litre</td>
<td>6</td>
<td>0,48</td>
</tr>
<tr>
<td>Product</td>
<td>Unit</td>
<td>Price (in 3.80)</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Loose milk at milk bar</td>
<td>Litre</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Pasteurized milk</td>
<td>Litre</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Yogurt</td>
<td>Litre</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>IHT (local, skimmed)</td>
<td>Litre</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>UHT (imported)</td>
<td>Litre</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Fresh cheese (local Daima)</td>
<td>1 kg</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Butter (imported)</td>
<td>250 gr</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Milk powder (imported FC)</td>
<td>2.5 kg</td>
<td>275</td>
<td></td>
</tr>
<tr>
<td>Milk powder imp. In milk equivalents</td>
<td>Litre</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Milk powder local</td>
<td>1 kg</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Milk powder local in milk equivalents</td>
<td>Litre</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: overview of milk prices (March 2016)

It was difficult to obtain prices in the supermarkets; products were not priced on the package.

### 3.4.4 Conclusions dairy marketing and processing
- 98% of the produced milk is sold loose
- The processing sector processes only 2% of the fresh milk, mostly procured from their own modern dairy farms
- CAPO Dairy is the most prominent dairy processor
- A cold chain is non-existent
- ‘Donkey men’ play an important role in the trade of milk
- Supermarkets offer a wide variety of fresh and long shelf life dairy products
- A substantial part of dairy products is imported or partially made of imported dairy products
- Prices of dairy products are high compared with the EU prices, even prices of loose milk are comparable with high quality long shelf life fresh milk in The Netherlands
- The situation has some strong similarities with countries in East Africa

### 3.5 Research, education and extension
Sudan has several agricultural and veterinary universities. Students are not educated in practical and operational issues. University students and staff published many studies on the internet about the Sudanese dairy sector. The papers are written in English and make a good inventory of the situation of the sector. The papers clearly show the gaps of the system (theoretical knowledge and practical skills), but do not give any solution on how to improve the dairy sector.

Practical dairy (training) schools are missing and all interviewed stakeholders recognize this as a severe problem. The farmers of Helat Koko Dairy Cooperative said, that when a new veterinarian comes at their farm, they have to educate him. The importance of proper education was shown by a farmer, who did a half year course at PTC in Oenkerk (became DTC, Leeuwarden). After returning to Sudan he turned his knowledge into practice and established a dairy farm.

The management of this dairy farm was clearly different from other dairy farms visited. 24 hours per day roughage was available and cattle were quietly lying down and ruminating in the stable. The calves were healthy and had access to water, concentrates and good alfalfa hay. The young stock was in good condition and shiny. This in contrast to other visited farms. Although there was plenty of land around the farm, they purchased alfalfa hay. In land they rented at 30 km from the farm, rhodes grass was planted for forage.

The farm showed, that with practical knowledge and experience good results can be achieved. The farmer was very enthusiastic about his dairy farm and suggested that their farm could be a practical school to teach others.
There are more people with experience in dairy. Veterinarians and agronomists gained their experience while working on dairy farms at the Arabic Peninsula. Also during our interviews it appeared that many of the interviewed people had been trained in The Netherlands. They followed courses and studies at PTC+ and Wageningen University.

Dutch dairy training in Sudan. It was remarkable that many people we met had been in the Netherlands for education. The appointments were of course made by the Dutch embassy, but meeting persons trained at PTC, Delft or Wageningen University, at the Ministry of Livestock or the FAO office must be accidental. All alumni of WUR and PTC spoke highly of the Netherlands and their education in the Netherlands. In the seventies of last century with Dutch support a dairy training centre was established at Helat Koko near Khartoum. This centre has turned into an agricultural university and practical aspect of the trainings has disappeared. The group of alumni can possibly be promotors for the Dairy sector in Sudan.

Currently there are no NGOs, working on improvement of the dairy sector in Sub-Saharan countries. After the separation of South Sudan, the activities and attention of the NGOs and the international development community shifted to South Sudan. The only exception was the planned school milk program of USAID with CAPO Dairy.

The FAO and IFAD of the United Nations are present in Sudan. Both organizations do not give special attention to dairy. IFAD focuses on enhancing productivity and making access to credits available in cooperation with Sudanese Government and with special attention to smallholders and subsistence farmers. The dairy farms around Khartoum producing the bulk of the milk cannot be considered as smallholders or subsistence farmers. They run specialized farms focusing on dairy with 30 milking cattle or more.

The Ministry of Livestock, Fisheries and Rangelands has a group of 90 extension workers to support dairy farmers. The effectiveness of their work could not be judged during the mission, but interviewed farmers did not have contact with them.

The Sudanese AI Project has a company called Dairy House. For $1.5 per cow extension workers give dairy management support. About 10 extension officers work in this team. The general manager of this private enterprise Amir H. Elmanofi is an entrepreneur looking for business opportunities. He had just returned from a business trip to the Netherlands.

Conclusions
- Research and education is done at university level
- Practical dairy training centres do not exist
- There is no NGO involvement in dairy, except USAID and UN organizations like FAO and IFAD
- Initiatives have been taken to bring extension workers to the field
- There are alumni from PTC and Wageningen in Sudan

3.6 Finance
In Sudan the large scale companies like the DAL group, are investing in dairy farming and milk processing. These companies sometimes have government involvement or are ‘partly’ owned by foreign investors. The commercial dairy farmers of Sudan are often businessmen, who often have a dairy farm as side businesses. This group of farmers will have access to credits. For smallholders there are micro credit facilities.

Sudan has a modern banking system respecting the religious rules considering banking. The government obliges them to have 12% of their loans in micro credits. Characteristic to this system is the absence of interest rates. The purchased good is bought by the bank and sold to the client with a certain margin.

Micro credits are maximally 20,000 SDG. This is a really small amount and just enough for the purchase of one dairy cow. Micro credits often have a grace period and can be granted as a group credit. This means that when
a group of farmers want to purchase for instance a milking machine or tractor, the relatively easy conditions for micro credits can be applied. When the loan amount increases the conditions increase and collaterals have to be put in. This can be for instance land, machines or building.

Dairy farmers said that it was difficult to get credits. Banks see agriculture as a risk. Dairy farms have no contracts with dairy processors to guarantee their income.

The trade US embargo has consequences for Dutch companies, concerning financial transactions, when doing business with Sudan. The Dutch banks have all major interests in the US. Therefore they work according to American regulations even if they are subject to the Dutch law. This means that they do not accept money transfers from Sudan. In Sudan European credit or cash cards have no value. Notwithstanding the US has lifted the embargo for products concerning food production and starting to export to Sudan, Dutch banks still maintain the financial embargo.

Potentially Dutch Banks with international experience in (cooperative) agriculture banking can play an important role in the development of the dairy sector, not only financially, but also institutionally. The RABO foundation and the RABO development fund support worldwide agricultural banks and agricultural cooperatives.

There are possible regional sources for private agribusiness finance. Harvest Financial Service listed them, see the list underneath:

- International Fund for Agricultural Development (IFAD) emphasis on Livestock value Chains Development
- African Development Bank (AFDB)
- Islamic Development Bank
- The Arab Authority for Agricultural Investment & Development
- Arab Company for Livestock Development
- Arab Organization for Agricultural Development
- Arab Fund for Economic & Social Development (AFESD)
- Inter Arab Investment Grantee Corporation (IAIGC)
- OPEC Fund for International Development (OFID)
- African Export-Import (EXIM)
- Arab Company for Drug Industries & Medical Appliances
- PTA Bank (The Eastern and Southern African Trade and Development Bank)
- Arab Fisheries Companies
- Arab Company for Equipments of Poultry & Livestock
- Over (50) private equity funds
- Diaspora remittances

**Conclusions**

- Sudan has a modern banking system respecting religious rules and providing agricultural (micro) credits.
- There are possible regional sources for private agribusiness finance.
- The US trade embargo has influence on the relation between Dutch and Sudanese banks.

**3.7 Equipment and input supply sector**

Most commercial dairy farms are very basically equipped and have limited mechanization such as equipment for milking and milk cooling, manure-handling, food choppers or climate control. In case dairy farming will develop, all these items are required. The Sudanese AI project is the only company as far as we are informed,
selling semen and certain imported utensils.

The modern large-scale dairy farms in the country are in need of all kind of equipment. A farm manager of a large-scale modern dairy farm came up with a complete list of goods he was looking for.

1. Semen, especially sexed semen. Currently they buy semen from WWS. According to him it is cheap semen but he has not much choice in selection criteria.
2. Cattle. However, he prefers American cattle, because he thinks they will better adapt to the climate and have higher milk production than Dutch cattle.
3. Air-conditioning systems. The farm only has a fogging system and would like to purchase air-conditioning systems.
4. Silage making equipment. The farm has its own land but till recently they bought all roughage.
5. Feed ration programmes an/or management systems.

If the milk processing sector develops, the demand for good quality milk will increase. Now the processing sector chooses to produce its own milk or to recombine milk, in order to guarantee a certain quality. Import of milk powder with high import duties will be costly and consumers prefer fresh milk, as stated by the websites of the Sudanese dairies. Purchase of good quality milk is only possible when a cold chain is established and preferably when cattle are machine milked.

The milk processors will also require equipment and in most countries where the dairy sector develops, small processing plants are established and often equipped by Dutch companies. One of the people we spoke to, said: “dairy is growing, now is the time to enter the dairy business”. He also mentioned that big Saudi dairy companies have plans to establish dairy farms in Sudan and do cost studies.

They basically have three options:
- To expand farms, what they actually do.
- To recombine more milk powder.
- To start purchasing from private farmers and to establish a cold chain.

Conclusion
There is a demand for all kind of inputs and supplies.

3.8 Governmental policy
Sudan is not self-supporting for dairy products and imports each year 20,000 tons of milk powder. The milk per consumption per capita is below the WHO recommendation of 200 litres per capita per year. The Ministry of Livestock estimates the consumption on 80 litres per capita per year and a group of Sudanese scientists estimated it on 120 litres per capita per year according to a presentation of the Sudanese AI project.

Food security
Food security for the people is important for the government and especially ensuring that people get a sufficient amount of proteins. According to the Ministry of Livestock the government gives priority to meat production, in order to bridge this gap. The average meat consumption is estimated on 36 kilogram per capita per year. Neither at the ministry nor at their webpage any attention was given to food safety.

Extension
Nevertheless the government does take some action to encourage dairy production. The Ministry of Livestock employs 90 extension officers. According to interviews with farmers in the field, their visibility in the field is low. At the Ministry of Livestock they acknowledge that dairy farmer skills should improve.

Breeding
According to the director of the dairy department, the government will focus on improving the dairy herd by selection of cattle, cross breed programs and dairy cattle import. We heard (not confirmed from another
source), that Mondial, the owner of FAAPY Dairy, together with the government is establishing a new dairy society for which they will import 3,000 dairy Holstein Friesian cattle.

**Finance**
Government stimulates access to credits to encourage agriculture in general and therefore dairy production. The banks are stimulated to have a micro credit system, which should be at least 12.5% of the total amount of loans given by the banks.

IFAD, an organization of the United Nations, supports the government with this. IFAD has considerable funding and their main aims are to enhance productivity and to make sure farmers have access to financial services. IFAD is focussing mainly on smallholders and subsistence farmers.

**Animal health**
The government does not run vaccination or eradication programs concerning major infectious diseases in cattle. The larger dairy farms import vaccines to protect their herd.

**Education**
The government runs agriculture and veterinary universities. College staff and students have placed quite some articles on the internet about their research on dairy farms and this information was a valuable source for this report. A considerable amount of field studies, inventorrying the situation on the dairy farms is published on the worldwide net.

Schools for practical education to dairy farmers is completely lacking. Nearly all stakeholders interviewed and spoken to, during the mission, see this as one of the major constraints for the development of the dairy sector.

The livestock police of the Ministry of Livestock, Fisheries and Rangelands can be found on the English webpage of the Ministry of Livestock on [http://extension.sudanagri.net/posts/518893](http://extension.sudanagri.net/posts/518893)
4. Opportunities for the Dutch dairy sector

4.1 Strengths, weaknesses, opportunities and threats

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
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<tbody>
<tr>
<td>• 35 million consumers of which 5 million live in Khartoum consume dairy products</td>
<td>• Lack of modern dairy knowledge and skills</td>
</tr>
<tr>
<td>• Huge acreage of arable and irrigated land</td>
<td>o Forage production</td>
</tr>
<tr>
<td>• (High protein) feeds available as by-products from horticulture</td>
<td>o Feeding</td>
</tr>
<tr>
<td>• Sufficient water resources</td>
<td>o Breeding</td>
</tr>
<tr>
<td>• Network of agricultural faculties across the country</td>
<td>o Farm management</td>
</tr>
<tr>
<td>• Large number of alumni of Dutch education centres</td>
<td>o Milk handling</td>
</tr>
<tr>
<td>• Developing dairy processing sector</td>
<td>• Low mechanization grade</td>
</tr>
<tr>
<td>• Size and wealth of dairy farm owners</td>
<td>o Minimal use of milk equipment</td>
</tr>
<tr>
<td>• Growing economy</td>
<td>o Absence of a cold chain</td>
</tr>
<tr>
<td>• High price for raw milk internationally compared</td>
<td>• Low organization and cooperation grade of dairy farmers</td>
</tr>
<tr>
<td>• Programs to make financial loans available for agriculture</td>
<td>o Small processing sector</td>
</tr>
<tr>
<td>• Realisation of peace and political stability</td>
<td>o Poor milk quality and absence of quality control</td>
</tr>
<tr>
<td>• Programs to make financial loans available for agriculture</td>
<td>o High average daily temperatures</td>
</tr>
<tr>
<td>• Change towards a more open economy without trade embargo’s</td>
<td>• High inflation and high bank rates</td>
</tr>
<tr>
<td>• More efficient use of technology and innovation</td>
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<tr>
<td>• Increasing demand from the Arabic peninsula for feed and dairy</td>
<td></td>
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<table>
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<th>Opportunities</th>
<th>Threats</th>
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<td>• Realisation of peace and political stability</td>
<td>• Political stability</td>
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<td>• Programs to make financial loans available for agriculture</td>
<td>• Infectious diseases</td>
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<td>• Change towards a more open economy without trade embargo’s</td>
<td>• Climate change</td>
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<td>• More efficient use of technology and innovation</td>
<td>• Trade barriers</td>
</tr>
<tr>
<td>• Increasing demand from the Arabic peninsula for feed and dairy</td>
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</tbody>
</table>

4.2 Opportunities for the Dutch dairy sector

Summarizing the SWOT analysis:
Sudan is a dairy country where its basic requirements, feed and water, are available to fulfil consumers demands for dairy products or even to export dairy products. The prices of milk and dairy products are high and the country imports dairy products. Currently the dairy sector in Sudan can not fulfil the demand for dairy products because of the weaknesses mentioned.

High temperatures are a constraint, but this can be overcome by adapting the housing climate for cattle or to breed dairy cattle more adapted to high temperatures.

The weaknesses as mentioned in the SWOT analysis are the opportunities for the Dutch businesses. The Dutch businesses have experience in transferring dairy knowledge as well in The Netherlands as local. Many companies have experience in exporting goods required for dairy production all over the world. Also there is many experience in supporting an institutional setting in which the dairy sector can develop. In many countries the Dutch have supported in setting up herd registration systems, veterinary health programs, national dairy laboratories, etc.

It is clear that the dairy sector has potential near the capital of Khartoum with over 5 million consumers. Here already an infrastructure exists in dairy trading, milk bars provide fresh milk and supermarkets sell all kinds of
Nevertheless in other parts of the country there is also potential, because people have cattle. The UNHCR report recommended: “creating a milk collection centre in Um el Ghouara and group herders in cooperatives to supply the centre. Done on a large scale, the intervention could create a demand for milk worth 35 million USD per year, generating income mainly for the host communities (who have higher access to cattle), but injecting money into the wider local economy. A partnership with a large industrial group (such as DAL Group) is recommended, as these groups have a track record of sourcing milk locally, and are willing to support introduction of modern equipment and cross-breeds.”

Such kind of project is currently implemented by USAID and the DAL Group. Dutch government and businesses have experience in establishing this kind of projects in other parts of the world, like the dairy projects in Kenya and Uganda or the milk collection infrastructure FrieslandCampina made from scratch with support of the Dutch Government in Indonesia and Vietnam.

4.2.1 Knowledge

The lack of knowledge about modern day dairy farming became clear from this mission. Farming is done in a traditional way and is not innovative. Dairy processors invest in modern large scale dairy farms, but actions taken to develop a cold chain and to support local farmers to deliver good quality milk are minimal.

Even though some farmers have money for investment on their farms, they do not know how to improve. For example, they grow maize and sorghum, but are not able to make silage. Even simple techniques to increase the palatability of green feed by chopping it are not practised. Rations are given following the availability of feed on the market. Balanced rations are not calculated or prepared. Veterinary control programmes do not exist and outbreaks of major infectious diseases are responsible for a considerable damage.

Also when more advanced techniques are used to grow forage under irrigation or to produce alfalfa for export, Sudan has problems to compete with other countries, which are able to deliver better quality for a competitive price.

The knowledge available in the Netherlands can help to fill this gap. Already for years many Sudanese have been trained in The Netherlands and also The Netherlands assisted to establish a practical dairy school in Sudan. Now the economy slowly increases, there will be space to develop such activities with Sudanese businesses or with the Sudanese government. The young Sudanese farmer only got a small scholarship. His relatives paid most of the study by themselves. Alumni from Wageningen and PTC could be great help to start up such businesses/schools.

On a more institutional level, the Dutch dairy sector can help to organize veterinary programs, cattle registration, and establishment of health and milk laboratories.

4.2.2 Live animals and semen

Already for years several Dutch cattle traders export Holstein Friesian cows to Sudan to improve the dairy genetics of the local herd. The result was clearly visible in the field. The indigenous crossbred dairy herd is mainly black and white.

The dairy processors, who expand their farms rapidly, are looking for high yielding Holstein dairy cattle. Also they are looking for high quality semen in order to improve their herd.

The more traditional farmers will depend on good crossbred cattle as long as they are not able to adapt to the climate in their stable to meet the requirements of high yielding dairy cattle. When dairy farming develops, artificial insemination will become more and more important. The practice of natural service is next to its maintenance costs, a thread for spreading diseases. Not to mention the risk for physical injuries.
4.2.3 Dairy equipment and utensils
The majority of the sector is managing their dairy without any form of mechanization. The market already demands food safety and healthy milk products. There is a potential market for all kinds of equipment:
- Milking equipment
- Cooling equipment
- Stable equipment and stables
- Farm mechanization
- Medicines and especially vaccines
- Processing equipment

4.3 How to get access to the market?

Existing trade
Already Dutch companies involved in the dairy business are active in Sudan for many years. Many Sudanese are educated in dairy farming in the Netherlands. There is considerable amount of commercial dairy farms run by entrepreneurs. Last year NABC organized a dairy trade mission to Sudan. These are all positive facts, contributing to the development of the dairy sector in Sudan and to growing Dutch business involvement.

The recent history of the country and the trade embargo of the US have a negative impact on dairy development. Projects to stimulate the dairy sector of Sudan have no priority for foreign governments and NGOs. For these reasons Dutch companies will feel reluctant to start business in Sudan.
- Seminars, workshops, publications to inform Dutch companies will help to inform Dutch companies about the opportunities for the dairy sector in Sudan.
- Organizing the alumni network and contacting them with Dutch businesses will provide business opportunities.
- In Sudan Dutch companies and government can market their knowledge and goods. One of the ways this could be done is by organizing a roadshow. Dutch government and companies should present themselves to relevant stakeholders in Sudan varying from governmental institutions, to farmers, processors and financial institutions.

In Sudan there are big companies, local and foreign owned, private and government owned or mixed, who are interested in dairy development. Currently they import milk or purchase milk from their own farms. These companies have international contacts and are relatively easy to approach for business. The efforts on the Arabic Peninsula to safe water and therefore to reduce forage production will give a boost to the dairy sector in Sudan.

To develop a dairy sector where Sudan produces fresh and food safe milk by thousands of local farmers will take a lot of effort. At the African continent, many countries make these kind of efforts. In East Africa the dairy sector is developing. This is sometimes done in large-scale operations, Brookside Kenya, development of the cold chain in Uganda or small-scale, establishment of small-scale dairies all over East Africa. Also in Asia with a growing middle class and increasing dairy consumption, the dairy sector is growing.

These are long term projects requiring huge investments, knowledge and a complex infrastructure and logistics. Without support of foreign and local governments and NGOs it will be very difficult to initiate initiatives. This opportunity should not be missed for a country with so much potential in dairy. In East Africa most countries are taking initiatives to develop the dairy sector, often supported by foreign governments and NGOs, but for instance in a populated country as Nigeria almost all dairy products are imported and dairy farming does not develop.
- Worldwide the Dutch Government supports dairy projects in developing dairy markets, like Kenya, Uganda, Indonesia and Vietnam with millions of euros. Such initiatives give a boost to the sector.
- Linking Dutch expertise and businesses to governmental organizations and NGOs interested in dairy will help to initiate business.
As one of the interviewed people said: "Now is the time to invest in dairy".
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Samah Omer, Dairy Cooperatives: Tackling Obstacles of Dairy Production in the Developing World – Sudan, Sep 2015

Worldbank, Doing business 2016, Economy profile
## Terms of Reference LED15KHA02 Quick scan dairy sector of Sudan

<table>
<thead>
<tr>
<th>Start</th>
<th>January 1, 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project duration</td>
<td>Three months</td>
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### Project information

**Project purpose**

To have insight in the specific needs for the development of the Sudanese dairy sector and an overview of possible business opportunities for Dutch companies that will contribute to the development of the Sudanese dairy sector and bi-lateral B2B activities.

### Institutional setting

The following organisations and its roles should be investigated during the quick scan:

- Dairy cooperatives
- Dairy companies
- The Ministry of Livestock
- AAAID
- Embassy of The Netherlands
- Harvest Financial Services

### Problem analysis

Overall aim of this project is to develop the Sudanese dairy sector and to generate business opportunities for the Dutch sector that can provide the necessary expertise and equipment.

The Dutch Embassy therefore would like to have an overview of the dairy sector in Sudan, its needs and challenges and possibilities to develop the sector with special focus on the dairy farmers.

Second, insight is needed of where in Sudan the Dutch knowledge and equipment can contribute to the development of the Sudanese dairy farmers. This is interesting information to present to the Dutch dairy sector in order to generate B2B activities between Sudan and the Netherlands.

### Results

A quick scan including:

- Institutional setting: general overview of important stakeholders in the dairy sector (a.o. the bigger and smaller dairy companies, cooperatives and dairy farmers)
- Insight in main obstacles, challenges and needs of the dairy sector and dairy farmers.
- Overview of Dutch expertise and equipment that meets the demand and that will contribute to the developments of dairy farmers.
- Identification of possible Sudanese and Dutch partner(s) for further (B2B) cooperation (including public and financing organisation (like AAAID)).
- Overview of B2B opportunities or leads.
- Overview of actions to be taken in order to develop the dairy sector and to further generate B2b activities.

### Activities

- Fine tuning of the project plan with the Dutch Embassy in Khartoum and RVO.nl in The Hague.
- Desk study
# Appendix 2

## Visiting schedules - Mr. Berend de Leeuw/ Mr. Martin de Jong

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Activity B. de Leeuw</th>
<th>People met</th>
</tr>
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<tbody>
<tr>
<td>Sat</td>
<td>4 March</td>
<td>Travel to Khartoum</td>
<td></td>
</tr>
<tr>
<td>Sun</td>
<td>5 March</td>
<td>Arrival in Khartoum</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Hilat Koko Dairy project</td>
<td></td>
</tr>
<tr>
<td>Mon</td>
<td>6 March</td>
<td>Meeting at embassy</td>
<td>Mrs. E. Loeffen Deputy Head of Mission, Mr. Ali Abbas Senior Advisor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to FAO office</td>
<td>Mr. Abdi Adan Jama, FAO Representative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Ministry of Livestock, Fisheries and Rangelands (Animal Resources)</td>
<td>Dr. Amal Hamid Al Mahi, DG of Animal Production</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Sudanese Businessmen Employers Federation</td>
<td>Dr. Isam El Din Abdel Rahman, Director Dairy Department</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mr. Eltaeb Abdelaziz Farmer</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Mr. Husam Eltayeb</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Mr. Salih Eltayeb</td>
</tr>
<tr>
<td>Tue</td>
<td>7 March</td>
<td>Visit to main office Kenana Sugar Company</td>
<td>Mr. Omer El Khidir, Head Marketing Feed Company</td>
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<tr>
<td></td>
<td></td>
<td>Visit to Farmers Commercial Bank</td>
<td>Dr. Nadir Eisa Asharif Mohamed, Chair Microfinance Department</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to three local supermarkets</td>
<td></td>
</tr>
<tr>
<td>Wed</td>
<td>8 March</td>
<td>Meeting at Embassy</td>
<td>Dr. Hanadi, Veterinary Officer Min. Liv.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Semex</td>
<td>Mr. Amir H. Elmanofi, GM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to IFAD</td>
<td>Mr. Hani Elsadani, Country Program Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yonas Mekonen, Ass. Pr, Officer</td>
</tr>
<tr>
<td>Thu</td>
<td>9 March</td>
<td>Meeting with herdmanager of FAAPY Dairy Farm</td>
<td>Mr. Abdalla Ahmed Abdella</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Ali Antalal Ahmudi farm</td>
<td>Herdmanager Mustafa</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Depbriefing</td>
<td>Mrs. Esther Loeffen</td>
</tr>
<tr>
<td>Fri</td>
<td>10 March</td>
<td>Reporting</td>
<td></td>
</tr>
<tr>
<td>Sat</td>
<td>11 March</td>
<td>Travel to Amsterdam</td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td>Date</td>
<td>Activity</td>
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</tr>
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<td>-----</td>
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<td>--------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
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<tr>
<td>Sun</td>
<td>29 May</td>
<td>Travel to Khartoum via Nairobi</td>
<td>Mrs. E. Loeffen Deputy Head of Mission, Mr. Ali Abbas Senior Advisor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meeting at Embassy</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Visit to DETASI</td>
<td>Mr. Elwaleed A. Ibrahim</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Jebal Awliya dairy farm</td>
<td>Owner and Farm management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meeting with Dutch and Local water management experts</td>
<td>Mr. Timo Gaasbeek &amp; Dr. Yasir</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mon</td>
<td>30 May</td>
<td>Meeting at embassy with DAL Group</td>
<td>Dr. Mohammad Sayed M Nour (General Manager) &amp; Ms. Wasfa Tounan (Blue Nile dairy farm manager)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Department of Animal Production, Ministry of Livestock, Fisheries and Rangelands</td>
<td>Ms. Dr. Amal Al Mahi (Director)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visit to Premier Foods</td>
<td>Mr. Liam Liddy (General Manager), Dr. Ahemed Musa Saeed (Marketing manager)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meeting with Faapy Foods</td>
<td>Mr. Alwaleed Fayet (CEO)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mr. Mohamed Babiker (General manager)</td>
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<td></td>
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<td></td>
<td>Mr. Adilzeldien (Sales Manager)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mr. Abdalla Ahmed (Animal production manager)</td>
</tr>
<tr>
<td>Tue</td>
<td>31 May</td>
<td>Visit to GIZ office</td>
<td>Dr. Alexander Solyga, GIZ country representative</td>
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<tr>
<td></td>
<td></td>
<td>Visit to WSAM dairy farm &amp; feed mill</td>
<td>Farm management and staff</td>
</tr>
<tr>
<td></td>
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<td>Visit to a private farm in Omdurman region</td>
<td>Farm management and staff</td>
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<tr>
<td>Wed</td>
<td>1 June</td>
<td>Meeting with Nestle</td>
<td>Ms. Dalia Yousif, Brand activation manager</td>
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<tr>
<td></td>
<td></td>
<td>Fight to Kassala</td>
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<tr>
<td></td>
<td></td>
<td>Visit to private farm</td>
<td>Mr. Ibrahim Laban</td>
</tr>
<tr>
<td>Thu</td>
<td>2 June</td>
<td>Visit to two nomadic farmers in New Haifa region</td>
<td>Roadside meeting</td>
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<tr>
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<td></td>
<td>Visit to three local dairy farms in Al Qadarif region</td>
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<tr>
<td>Fri</td>
<td>3 June</td>
<td>Meeting with UNHCR</td>
<td>Mr. Mustafa Hassan, assistant Livelihood officer</td>
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<tr>
<td></td>
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<td>Visit to private dairy farm near Wad Madani</td>
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<td></td>
<td></td>
<td>Transfer by car to Khartoum and by plane to Amsterdam via Nairobi</td>
<td></td>
</tr>
<tr>
<td>Sat</td>
<td>4 June</td>
<td>Arrival in Amsterdam</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3

Eastern Sudan

The Eastern Region of Sudan comprises three states - Red Sea, Kassala, and Gedaref. These states share a number of historical, ethnic, social and political characteristics. They also share the experience of long standing marginalization, underdevelopment and chronic poverty.

The 2009 household survey report issued by the Central Bureau of Statistics revealed that 58%, 36% and 50% of the population of the Red Sea, Kassala, and Gedaref States respectively were classified as poor.

The majority of the rural populations of the three states are agro-pastoralists. However, there are wide variations in terms of topography, climate, rain fall, natural resources, and soils among the three states, which reflect on productivity, income levels, and the nature and extent of dependence on agro-pastoral activities as a main source of living. The following paragraphs give a brief description for each of the three states.

Red Sea State is located in the northeast of Sudan. It has an area of 218,887 km2 (5.2x NL). The total population of the state is estimated at 1,368,330 with around 38% classified as living in rural areas and 20% in Port Sudan.

The rural populations are predominantly pastoralists, where livestock rearing is often complemented by a number of alternative livelihood strategies including crop cultivation and migrant labor. The total number of livestock in the state was estimated at around 985,000 representing around 16% of the animal population in Sudan.

The natural resource base of Red Sea State includes the fertile areas of Tokar (flood irrigation with the Baraka River as source) and Arbaat (it is not known to the consultants if this is the main water supply to Port Sudan and if water is used also for agriculture), natural pasture and grazing land, and marine resources distributed along the coastline. Livestock and wildlife are mostly concentrated on the inland plains, mountains and forest areas. Gold, oil and various mineral resources also exist in the state.

The total cultivable land in Red Sea State was estimated at around 750,000 feddans (2.91 feddan=1 ha) of which 100,000 – 150,000 feddans is cultivated annually. Both rain fed and irrigated farming (flood irrigation) are practiced. The main crops grown are sorghum, millet, and vegetables.

The marine system of Red Sea State has considerable fishing potential. Nevertheless, the contribution of this sector to the state economy is relatively small. The Department for Fisheries estimates that traditional fishing yield 600-1,000 tons of fish per year and that commercial fishing yields a further 900-1500 tons. Around 700-1600 tons of fish are exported to Saudi Arabia each year.
Kassala State has an area of 55,374 km² (1.3x NL) and population of 1,769,887 (2008 census). 26% of the population is urban with the rest being rural and nomads. The state’s economy is largely based on natural resources related activities and trade.

Rainfall ranges from a low of 83 mm per annum in the northernmost part of the state to 300 mm per annum across most of the southern area. Rain-fed farming and pastoral activities are widely practiced in the state and around 60% of the farmers are involved in these activities. The main crops grown are sorghum and millet. However, the yields of sorghum under rain-fed farming is only 16% of what is achieved in equivalent areas under systems of irrigation.

In addition to rain fall, the major sources of water supply in the state are the Gash River, the Atbara River and the Seteit River, as well as underground water aquifers charged by the two rivers. Kassala is host to the Gash (flood) irrigation scheme and New Halfa irrigation scheme. In the near future these are to be complemented by the envisaged Upper Atbara irrigation scheme to be fed by the new Atbara-Seteit dam. The total cultivable area in Kassala State is around 4 million feddans or 40% of the state’s total land. Of this total 25%-30% is actually cultivated and around half of the total cultivated area is irrigated.

Gedaref State; The total area of the State is 71,000 km² (1.7x NL). According to the 2008 census, the state’s population was 1,334,947 with 71% being rural. Rain fall ranges from 200 mm per annum in the northern and western parts of the state with gradual increases southward and eastward until it reaches around 900 mm. The state is endowed with a rich base of natural resources of forests, pasture lands, seasonal rivers and water courses, and swamps, which form the base of the state’s economy. The state’s economy is based on farming and livestock and commercial activities related to these two sectors.

The mechanized rain-fed sector forms the backbone of the economy where nearly 4 million feddans are cultivated annually with sorghum, millet, sesame, cereals, fodder, cotton and sunflower. Mechanized farming was introduced in 1945. About 70% of the total (rain-fed) mechanized farming in the Sudan is carried out in Gedaref. Many large and endless individual fields are scattered over the whole area surrounding Gedaref such as Um-seinat, Al-Ghadambliya, making use of the fertile soil and abundant rainfall (avg. 700 to 900 mm/year), and relatively obtainable manpower.

Next to large-scale rain-fed agriculture, the Rahad irrigation scheme is located in Gedaref. With the cultivation of sesame, sunflower, peanuts and cereals, but especially sorghum, Gedaref has become the country’s granary. Thus, if Sudan could be the granary of Africa and the Middle East, Gedaref is the bread basket of the Sudan.

Irrigation and water availability
There are five main types of farming practiced in Sudan (UNEP 2007) i.e.;
- Mechanised rain-fed agricultural schemes
- Traditional rain-fed agriculture
- Mechanized irrigation schemes
- Traditional irrigation and
- Livestock husbandry /pastoralist

The irrigation schemes are further divided into two categories;
- the Nileflood and pump schemes, and
- the national irrigation schemes such as Gezira, Rahad, New Halfa and Suki which constitute over 60% of the total irrigated area.

These schemes are the four largest national schemes in the country and consume 60% of the current Sudanese annual water abstraction.

After gaining independence, Sudan sought to increase agricultural production by expanding irrigated areas, mechanisation, rain-fed agriculture and promoting efficiency. However, although Sudan’s irrigated agriculture has been its most important economic investment, many studies have shown that its performance has been below expectations (UNEP 2007). Although the Gezira is still the largest irrigation scheme in the world, it has turned out that it has a general irrigation efficiency of less than 50%. The farmers cannot earn a satisfactory income from their crops and the siltation in the canals has caused parts of the scheme to be without sufficient irrigation water (Government of Sudan and the World Bank 2000). The Gezira scheme is not an exception and the situation of many irrigation schemes, such as New Halfa, Gash and Tokar, soon to be complemented by Upper Atbara (in the East), portray a gloomy picture at present. In many agricultural schemes siltation in the canals has increased. Thus, the storage capacity of water has decreased, land fertility has decreased and equipment has become outdated (Omer 2007).
Nevertheless, irrigation schemes have long been a strong part of the Sudanese economy and continue to be so. **There is no lack of arable land or absolute water scarcity in Sudan**, but the challenge is the maintenance and management of the schemes, the irrigation systems and bringing enough profit to the farmers. Most of the irrigation schemes were started as parastatal establishments but since Sudan adopted a free market economy, privatisation and decentralisation system, the aim is to turn the schemes into private, financially independent corporations. Farmers’ associations should have the upper hand in the funding and management and the communities should take more responsibility. Furthermore, agricultural cooperatives and the private sector are encouraged to operate the schemes (Omer 2007).


**Eastern Sudanese dairy Sector in general**

The main dairy product produced and consumed in the targeted localities is fresh cow milk. Goat milk is also popular, but almost no sheep are milked. Transformed dairy products include plain yoghurt and are consumed at very low levels if at all.

The average herder has between 1 and 50 heads of livestock, of which cows are the most valuable, hence reserved to the better off households. Herders often specialise in either cattle, or a mixed herd of goats and sheep.

Herders have several ways to feed their stocks, which include access to public grasslands, farmlands, animal feed and transhumance. Access to land is difficult during the dry months (December to May) as many herders are looking for fertile lands or crop residues to feed their animals. Herders typically resort to renting land from farmers for between 200 SDG (€ 25) per feddan for rainfed land to 600 SDG (€75) per feddan for irrigated land, until the entire crop residues are eaten.

For cultural reasons, milk is mostly used for household consumption, and rarely traded. Animals are milked only during the evening for the evening meal. When animals are not available (households without livestock or animals in transhumance), no substitution mechanism exists and herders prefer not to consume milk rather than to purchase it.

Milk yields depend on the breed and the quality of animal feed. Most animals are local breeds and have a small yield for milk (around 10 litres/day for a cow) while big industrial groups use foreign and crossbreeds in their dairy farm to increase productivity (up to 20 litre/day for a cow). These breeds have been introduced in Gedaref and Gezira states by the MoAR, but are rarely used by local herders.

Only a limited number of small scale dairy processing activities exist in the targeted localities, confirming the low supply levels of milk and dairy products. One such volunteer run factory was seen in Showak, which generated profits of yoghurt produced, although volumes are currently very low and the facility operates only two days a week. Nonetheless, the factory systematically sells all of its production, showing there is clearly a latent demand for dairy products.

Source: VALUE CHAIN ANALYSIS IN EASTERN SUDAN, prepared by Altai consulting for UNHCR and UNDP, Sudan. April 2014

**Refugee issue**
Eastern Sudan hosts more than 100,000 registered Eritrean refugees, the first of whom arrived in 1968 during the early years of Eritrea’s war of independence against Ethiopia. These days, Eritrea’s policy of indefinite military conscription, coupled with drought and poor economic opportunities, around 1,800 people cross into Sudan every month, according to the UN Refugee Agency, UNHCR.

FROM EU DOC:
Sudan is at the centre of the Eastern African migration route, towards North Africa and Europe. Hundreds of migrants, asylum-seekers and refugees are transiting through Sudan every month, with only a minority choosing to settle in the country. Traffickers and smugglers are operating in the country. About 3.1 million people are IDPs and almost 367,000 are refugees and asylum seekers (UNHCR 2015). Eritreans are the largest group of refugees with 108,075 persons, of which 90,806 are residing in 9 camps in the East of Sudan, in the Kassala and Gedaref region. Around 80 per cent of the Eritreans that are registered by UNHCR move onwards within two months after their arrival, to Khartoum, Libya and possibly to the EU. In fact, the chances of them risking onward migration is increasing due to the fact that the majority of the Eritreans coming to Sudan now are young urban people, who are unwilling to stay in enclosed camps without access to higher education or employment and do not have the same social networks in Sudan as the old generation used to have.

"A large number of refugees have been in East Sudan for the past 30-40 years, which is two to three generations, and that is quite unique," said Peter de Clercq, the UNHCR representative in Sudan. In 2002, the refugee status enjoyed by those who had fled the independence war, or subsequent conflict between Ethiopia and Eritrea, was revoked, on the grounds that the circumstances that led to their exodus no longer pertained. Most of the refugees stay inside the camps. However, many risk their lives trying to reach Europe or Israel. A UN agency was studying with the Sudanese government possible projects that would lead to the refugees’ self-reliance. Among the projects being discussed, is leasing irrigated land to refugees so they can provide for their own food needs and sell the excess produce.

From a meeting with an assistant livelihood officer of UNHCR in Kassala, following data was provided:
- 9 refugee camps in the region of which 7 near Kassala
- 21,000 families and 75,000 people mainly with an agricultural background
- The rented land from local people and all kind of crops grown + livestock
- Made with FAO and DAL group, a dairy value chain study in order to have in due time a small milk processing unit
- Provide some vocational training to the refugees
- IKEA foundation like to do something with renewable energy
- UNCHR is very interested in the Mueller solar-powered can cooling unit

Conclusion and opportunities
Prior to the visit of Eastern Sudan, the consultant was very sceptical about the potential for dairy development and business for the Dutch dairy sector. However, after the field visit and background research, this (perceived) opinion has changed into a basic believe that Eastern Sudan has a potential for dairy development mainly due to the availability of land and vast water resources.

In Kassala and Gadaref region many large scale (20 head and more) commercial oriented dairy farms are present all eager to improve their performance in terms of milk volume, herd size and financial viability.
The main bottlenecks identified are the low levels of milk production due to:

- domestic consumption mentality
- nomadic type of farming and local cattle breeds
- the difficult access to pasture lands
- lack of knowledge in adequate cattle management in terms of housing and feeding
- lack of knowledge in heat stress management and adequate water supply to cattle
- lack of knowledge in preserving forage (hay) for the dry seasons
- lack of collection and processing facilities
- inexistence of big wholesaling actors giving access to assured markets.

Interventions are recommended (thus development opportunities) at two levels of farming i.e. the nomadic way of farming and the confined way of dairy farming.

**Nomadic way of farming**

Focus on increasing the yields of herders through developing workshops on productivity increases by providing sufficient feeding during dry season, raising awareness on the benefits of crossbreeds), creating milk cooperatives or collection centres to link producers to industrial groups (e.g., DAL Group).

Some NGO’s are promoting the development of guar value chain in Sudan. The guar or cluster bean is an annual plant of the “leguminosa” family and thus also known for its nitrogen fixing properties in soil and can yields 40-50 tonnes of green fodder per hectare. The crop is extremely drought resistant and thrives in semi-arid regions where most plants do not. The green fodder can be fed to cattle as forage while the seeds (protein) can used in the cattle ration.

Use of guar crop by nomadic farmers might be a good potential for increased livestock production. An exploratory study on the potential of guar has been conducted (November 2015) by the Dutch based NGO Kubita Economic Empowerment and indicated a good potential for guar cultivation in Sudan.

**Confined way of farming**

- Balanced feeding of productive animals by using cattle concentrates
- Preserving forage (lucerne/rhodes grass hay) for the dry season
- Better cattle housing (shade above feeding and drinking places)
- On-farm milk cooling tank and supply agreements with milk processors
- Improved crossbreeding with proven HF bulls (natural and/or AI)
- Improved youngstock management
- Culling low productive cows to improve financial viability of the farm
- Adequate hooftrimming

**Project idea’s** (in random order)

1. Trail cultivation of guar for cattle feed
2. Upgrading a number of existing private farms in terms of adequate cattle sheds, animal nutrition, forage conservation, AI & breeding, youngstock management and milk hygiene and storage and to use these upgrade farms as “master farms” and regional “training centre” were nearby located farms can see the “basic conditions” for good animal performance
3. Development of basic manuals on various topics related to animal- and forage production
4. Train some of the key staff at the master farms in providing training
5. In case sufficient amount of raw milk (>5 T/day) is produced, establishment of a mini milk processing unit (fresh milk, yoghurt) could be considered and/or an agreement should be made with one of the larger milk processing plants based in Khartoum to establish a milk collection centre.

6. Establish large scale forage production farms for the production of lucerne hay either for local sales and/or export to the middle east.

7. Organise, at cooperative level, the purchase and storage of agri-industrial waste products which are produced in the Eastern Sudan.

8. Establish cattle water drinking area’s for nomadic cattle (if possible with shaded resting area’s) and use these drinking places for providing practical advice to these farmers.

9. Establish private hooftrimming services (as this is very much needed and will increase milk production by at least 10%)

10. Refugees who have established their own small-scale farms, could visit the master farms to learn best practices.