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# Dairy Livestock Value Chains North Africa Regional Report

Assessment of the National Breeding Objectives and Implementation of Supporting Programs/Initiatives for Dairy Livestock Value Chains, DLVCs, in North Africa

**Case Study: Algeria, Egypt, Mauritania, Morocco, and Tunisia**

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## Summary

The North Africa region (UMA state members plus Egypt) prioritised “Milk Value Chains” for future Live2Africa project implementation activities. This regional choice was made during the “Livestock Value Chain Prioritization” workshop held in February 2019 in Nairobi, Kenya (AU-IBAR, 2019).

Three DLVCs strategies were retained for the region: 1) develop animal genetic resources, 2) establish regional markets, and 3) improve training in dairy value chains. Following the AU-IAR desk review and stakeholders workshop on the characterization of milk value chains in North Africa in August 2019, three regional DLVCs strategic actions were identified: 1) Increase the value of regional dairy herds by producing high-quality breeding stock (females and sperm), 2) Increase the value of natural animal feed resources, and 3) Capacity building. Within this framework, AU-IBAR launched national and regional consultancies to assess national DLVC breeding objectives and implement supporting programs/initiatives for North African DLVCs.

National DLVCs country reports from Egypt, Mauritania, Morocco, and Tunisia, as well as the current regional report, identified dairy bovine species as the most important contributor to milk production in North Africa. Their contribution varies from more than 40% in Algeria to more than 90% in Egypt, Morocco and Tunisia. Dairy cattle and buffalo value chains are a source of income and employment for small and medium holders who represent more than 90% of bovine owners in the region. However, the region is still importing powder milk, dairy products, proven bovine bull semen and breeding heifers.

More than 5 million dairy females were imported to the region and, maybe more, with their needs in doses of semen. Importing exotic dairy cattle goes back to the seventies when native cattle breeds dominated the national cattle population size. Today, the bovine genetic makeup situation is reversed in favor of imported exotic breeds and their crosses with one exception for Mauritania. The region continues to import exotic bull semen and pregnant heifers from Europe and North America. Average milk consumption is estimated to grow in the coming years and imports of milk, milk powder and breeding stocks will be at a very high cost. The COVID-19 pandemic, which forced countries to close borders, should serve as a wake-up call to regional policymakers to strengthen their countries' livestock sectors, with a particular emphasis on dairy bovine chain values and suitable alternatives to reduce breeding animals and semen imports. This option would reduce their reliance on imports of dairy bovine breeding stock and dairy products to meet their growing population's demand for livestock products.

This strategic option is feasible given the region's abundance of specialised dairy bovine germplasm. North Africa now has a total population of 203 million people. Egypt is the most populous country in the region, with 101 million people. Algeria and Morocco have populations of 42 million and 36 million, respectively. Tunisia, Libya, and Mauritania have populations of 12.8 million, 6.7 million, and 4.4

million, respectively. The total land area is 706 million ha, with only 72 million ha, or 10%, being arable. Mauritania has the most arable land in the region (44 million hectares), followed by Morocco and Algeria, which have 9.2 and 8 million hectares, respectively. Tunisia ranks fourth with 5.3 million hectares. Egypt ranks fifth with 2.7 million ha, followed by Libya with 2 million ha. For Mauritania, Tunisia, Libya, Morocco, Algeria, and Egypt, the number of ha/caputs is 10 ha, 0.4 ha, 0.3 ha, 0.26 ha, 0.19 ha, and 0.03 ha, respectively. However, Egypt has the highest irrigation potential in the region, with a high level of intensification.

If the various roles livestock played in the region are fully counted, the region's agricultural contribution to national GDPs ranges from 9% to 20%, and livestock contribution to the country economy, on average 30%, is underestimated (AU-IBAR-DLVCs country reports, 2020). The region is a reservoir of a diversity of species and breeds with more than 72 million heads of sheep, 26 million heads of goats, 12 million heads of cattle, 3 million heads of dromedaries (the number of dromedaries in Tunisia is for females) and more than 3 million heads of buffalo. Egypt is the only country in the North Africa region that has buffaloes.

Demographic changes and high consumption of animal products have increased demand for dairy products in the region. The region's annual growth in demand per capita for milk equivalent reaches 2%. Faced with poor productivity levels of native cattle due to a lack of genetic improvement since 50 years ago, policymakers chose to import milk (fresh and powder) and live exotic dairy animals to meet a massive local demand for milk and milk derivatives.

Since the 1970s, countries in the region have pursued distinct political strategies to supply milk and milk derivatives to meet local consumption demands. Countries with high incomes from fossil energy, in addition to cattle imports, chose to import milk powder. Algeria chose importing powder milk as a national strategic option for providing milk. It is now the world's third most reliant on powder milk imports.

Following the global economic crisis of 2008, Algeria resumed investment and encouraged local milk production. Egypt, Morocco, and Tunisia chose to produce milk locally by importing exotic dairy bovine and proven semen and upgrading native cattle with exotic specialised dairy breeds. Mauritania, despite having more livestock than people, is still dominated by a pastoralist livestock production system, and it is the region's only country that has not imported massive exotic breeds. This option allowed Mauritania to preserve the integrity of its indigenous cattle population.

Empowering the region's livestock sector through the implementation of Live2Africa DLVC's strategic actions to produce high-quality breeding stock (heifers and semen) represents an opportunity to shift the North African region from importer to exporter of dairy bovine breeding stocks. According to the DLVCs country reports for Egypt, Mauritania, Morocco, and Tunisia, the three countries are capable of producing a maximum of more than 103 000 heifers and a minimum of more than 11 000 good quality heifers for the North Africa Regional Heifers market. Through the Live2Africa project,

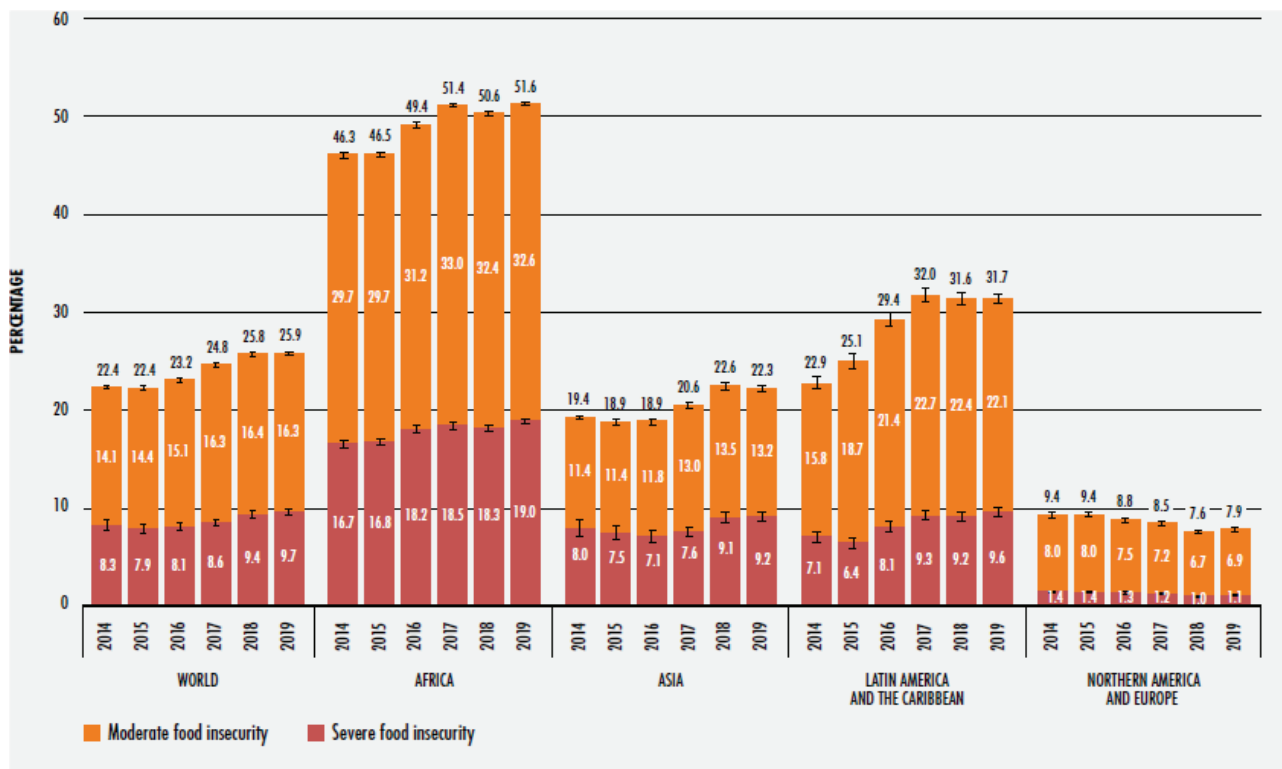
AU-IBAR can play a critical role in enabling the North African region to value its existing bovine genetic potential in producing high-quality breeding stock while improving the livelihoods of millions of small and medium-sized farmers and workers across the DLVCs. To achieve this realistic goal, a North Africa Dairy Heifers Pilot Project “North Africa-Dairy” is proposed and documented.

It will be implemented as a regional catalytic action during Live2Africa. The regional pilot aims to produce high-quality dairy bovine breeding stocks in UMA country members and Egypt through a consistent genetic gain/breeding programme supported by feeding and health management systems, as well as farmer organisations comprised of small and medium-sized farmers. The pilot project will help to fill gaps in DLVC’s breeding goals and create synergies among its various stakeholders, including national research and extension services. The pilot project is regional in nature, but its foundations are country-based strategic DLVCS actions. Given that the six countries are at different stages of development in terms of producing high-quality dairy breeding stock, the regional North Africa dairy is flexible enough to allow countries to choose their project phase. It is important to note that, while Algeria and Libya were not included in the current consultancy, future participation in the pilot project is possible.

This decision by AU-IBAR through UMA to consolidate and support the livestock sector in the region through its bovine dairy value chain and, in particular, its dairy herd valuation is a wise choice. All country reports indicate that the region lacks coherent breeding objectives and sustainable breeding strategies, despite the presence of fragment ingredients such as artificial insemination and animal identification. This was one of the recommendations made at an online validation workshop organised by AU-IBAR and UMA on December 16, 2022, with the participation of the main DLVCs stakeholders from Algeria, Egypt, Mauritania, Morocco, and Tunisia.

## Background and Justifications

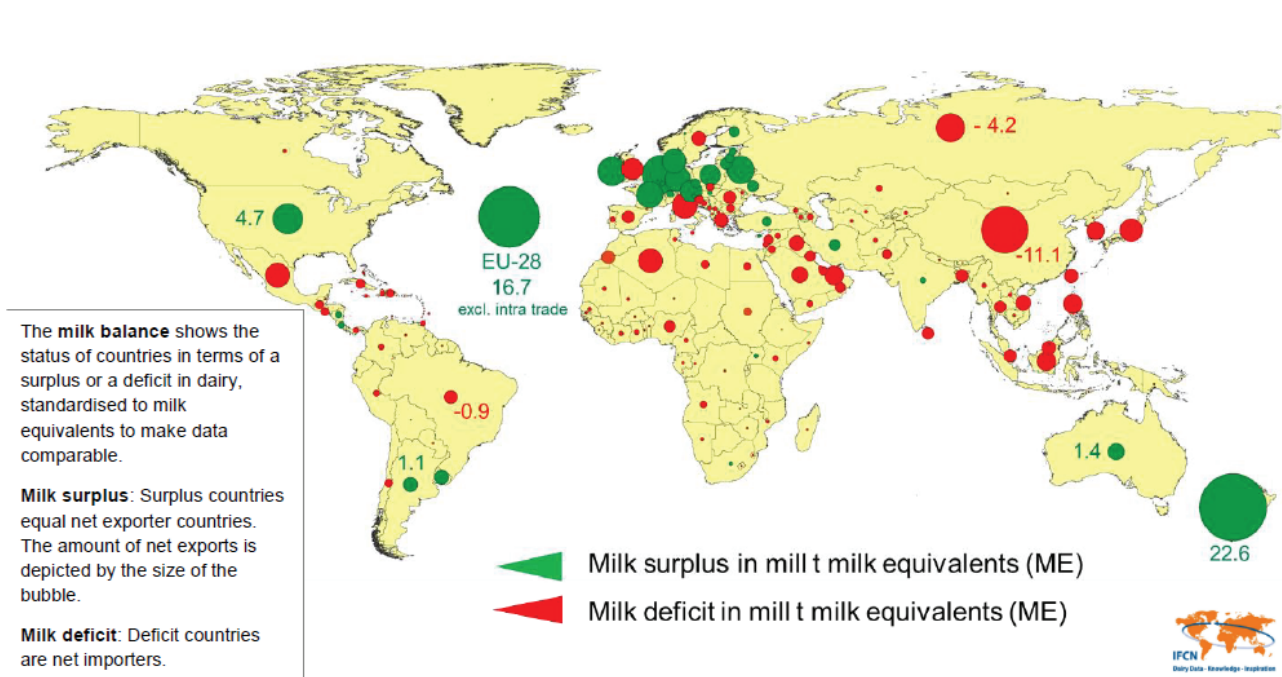
Africa is the continent with the highest rates of severe food insecurity and moderate food insecurity. These percentages represent more than half of 687.8 million hungry people reported in the world (FAO, 2019) as shown in figure (1).



**Figure 1.** Moderate and severe food insecurity in the world (FAO, 2019).

It is worth noting that this dramatic situation does not reflect the existing potential of Africa to feed itself. Unfortunately, even though Africa has a variety of agricultural potentialities, including arable land, a rich biodiversity of animals and plants, and water supplies, Africa's contribution to feeding the world and itself is very little. As an example, the completely African continent produces only 6% of the world total milk (696 billion kg) (Bulletin of the International Dairy Federation, 2018). Katrin et al. (2018) reported on the global dairy situation (world map (1)) showed that almost all African countries display a Milk Equivalent (ME) deficit.





**Map 1.** World situation in milk deficit and surplus (in ME)

Acknowledging these difficulties, AU-IBAR oversaw a multi-stakeholder process that included participants from the livestock sector from all over the African continent to create the Livestock Development Strategy for Africa (LiDeSA). The AU Heads of State and Government agreed and accepted the Strategy in January 2015, which offers a 20-year framework for the coordinated and collaborative development of the livestock sector on the continent. The LiDeSA is to be jointly implemented by all sector actors including Member States and Regional Economic Communities (AU-IBAR, 2019).

*“The European Union provided funding for an AU-IBAR effort to launch the deployment of the LiDeSA’s continental components. (The Sustainable Development of Livestock for Livelihoods in Africa (Live2Africa) Programme), which will be put into practise in collaboration with Member States, Regional Economic Communities, and other important livestock stakeholders. The program’s overarching goal is to promote the transformation of the cattle industry in Africa in order to increase its contribution to socioeconomic development that is equitable, environmentally sustainable, and climate resilient. The specific goal of Live2Africa is to increase the systemic capacity of stakeholders in the continental, regional, and national livestock sector for the transformation of the livestock sector in a way that is economically, environmentally, and socially sustainable.” (AU-IBAR, 2019).*

In order to determine three LVC priorities for each of the five regions of the continent, a workshop on “Livestock Value Chain Prioritization” was organised in Nairobi, Kenya in February 2019. The workshop was attended by a variety of participants representing operators from regional and national livestock value chains (public, private, NGO’s, Regional Economic Communities (RECs) (UMA for North Africa), International and Regional representatives (FAO, FARA, ILRI...) and Livestock Value Chain Experts. Based on a SWOT analysis, participants from North Africa in the mentioned “LVC prioritisation workshop” chose the three livestock Value Chain Priorities of Milk, Beef, and Eggs.

The region retained “Milk Value Chain” as its priority for Live2Africa project’s future implementation activities (AU-IBAR, 2019). Three strategies for the region were identified through a SWOT analysis, to be 1) develop animal genetic resources; 2) establish regional markets and 3) enhance training in dairy value chains in each country of the region (Box 1).

**Box 1. Livestock Value Chains Prioritization Workshop outputs-Kenya, Feb. 2019.**

**North Africa Region Livestock Value Chains (SWOT Analysis)**

**One Priority:** Dairy Livestock Value Chains (DLVCs)

**Three Strategies:**

1. Develop Animal Genetic Resources
2. Establish Regional Markets
3. Enhance Training in DLVCs at the country level

Following Nairobi workshop, a desk review on Livestock Value Chains in North Africa was undertaken during the Stocking Exercise of the Stakeholders workshop in Cairo, Egypt (4th-8th August 2019) (AU-IBAR-Desk review, 2019) to facilitate discussions, clarifications, adjustments and validation of the defined Regional LVCs interventions areas. Three Strategic Actions were finally selected with the largest consensus. Participants to both workshops agreed that North Africa Priority Value Chain is the “Dairy Livestock Value Chain” with three Strategic Actions:

**1. Strategic Action 1. Valuation of the Region Dairy Herd**

- a. Production of high-quality breeding stock to cut down on animal and semen imports into the region
- b. Young people and rural women should be included in the creation and strengthening of professional groups.
- c. Establishing intelligent systems for herd and flock management and enhancing current artificial insemination (AI) facilities.

**2. Strategic Action 2. Valuing Natural Resources**

- a. Sustainable management and optimization of water resources
- b. Management and optimization of forage resources
- c. Valuation of agricultural by-products

**3. Strategic Action 3. Capacity Building**

- a. Farmers organization with a focus on small to medium holders
- b. Training and supervision to increase performance of DLVCs in milk production and transformed milk.
- c. Harmonization of milk standards.

The DLVCs regional priority, the three DLVCs regional strategies and the three regional DLVCs strategic actions are summarized in Box (2).

**Box 2. Desk review and Stakeholders Workshop outputs, Cairo, August 2019**

**North Africa Region Livestock Value Chains Priorities**

**One Priority:** Dairy Livestock Value Chains (DLVCs)

**Three Strategies:**

1. Develop Animal Genetic Resources
2. Establish Regional Markets
3. Enhance Training in DLVCs at the country level

**Three Strategic Actions:**

1. Strategic Action 1. Valuation of the Region Dairy Herd (Genetics)
2. Strategic Action 2. Valuing Natural Animal Feed Resources
3. Strategic Action 3. Capacity Building

In August 2020, AU-IBAR launched regional consultancies for six national consultants and one leading consultant to prepare country reports for Algeria, Egypt, Libya, Mauritania, Morocco, and Tunisia as well as one regional report in order to implement DLVC's strategic actions in North Africa (UMA member states plus Egypt). The main objective was the Assessment of the National Breeding Objectives and Implementation of Supporting Programs/Initiatives for Dairy Livestock Values Chains (DLVCs) in North Africa.

The Live2Africa project organized a 3-day consultative Workshop on Annual Implementation Plan of Life2Africa Activities in North Africa. The focus was on Inception and Implementation Meeting for Strategic Implementers held in Cairo, Egypt from 28th to 30st January 2020 (Consultative workshop, 2020). The workshop was attended by about 35 participants comprising various types of actors in the North Africa region and AU-IBAR staff. The workshop aimed to:

- Building consensus on the list of strategic actions (SA) and interventions, and modality of implementation,
- Identification and mapping of significant stakeholders and tactical partners (implementers) to aid the implementation process
- Building consensus on the detailed implementation plan by implementers; including actions, budget lines, and timeframe,
- Building consensus on distribution of tasks and responsibilities for the implementation process,
- Mapping areas and modalities for strategic communication and knowledge management for supporting the implementation process,

- Identifying potential challenges and constraints and the road map to overcome,
- The AfCTA framework includes a road map for increasing intra-North African trade in the dairy value chain.

## *Objectives of the DLVCs North Africa-Regional Report*

The objectives identified were based on AU-IBAR terms of references (TOR) relative to the “Assessment of the National Breeding Objectives and Implementation of Supporting Programs/ Initiatives for Dairy Livestock Value Chains in North Africa”. Preparatory meetings and conversations with UMA and AU-IBAR representatives were arranged through a number of internet consultancies. They were followed by several online talks with national consultants from Egypt, Mauritania, Morocco, and Tunisia to explain the primary and specific goals of the current activity.

Global Objective: Identify catalytic actions and programmes that can be undertaken at the regional level and that are shared by all participating countries using the information and data provided by the country reports of the region.

### *Specific objectives*

Specific objectives were to:

1. Create the table of contents that will be followed when the six national consultancy missions’ reports are being prepared.
2. Design Guidelines to be utilized in the process of data collection to secure harmonization of the country reports
3. To follow up the execution of the 6 national consultancies with national consultants
4. To harmonize results of country reports in a regional report.

## *Methodology*

The design and development of the North Africa DLVCs national reports was based on a number of online sessions with representatives from UMA and AU-IBAR, as well as National Consultants from Egypt, Mauritania, Morocco, and Tunisia. Nine principal parts/sections were defined for country reports preparation guidelines with supported explanations and specific tables (DLVCs Guidelines.). The recommendations are intended to provide a uniform format for national country reports, assist national consultants in describing the current situation of the most prevalent DLVCs, and evaluate national dairy breeding goals. The assessment of DLVC gaps and necessary strategic initiatives in respect to the mission core assignment received particular attention. The current regional report included submitted national country reports with a proposed North Africa DLVC Pilot Project (North Africa Dairy).

The guidelines include an explanatory paragraph at the beginning for national consultant's attention (Box 3).

### **Box 3. Remarks relative to country preparation reports.**

Introducing remarks by the Authors

“The preparation of the indicated National Dairy Livestock Value Chains was based on the agreed upon structure of the developed Guidelines. National Consultants were kindly invited to use these guidelines when preparing their country reports. National reports should indicate their sources of information. Collected information in interviews and group-discussion should indicate name, position and contact information of the interviewees (as source of the data). Kindly take as much photos as possible in the interviews and group discussion (after obtaining the agreement with interviewees) as visibility material of the activities related to the preparation of the national country report”. In case of non-availability of information, at the national level, for any given “item or element” of the report, Consultants are kindly invited to visit a rich reservoir of useful information available in FAOSTAT or any other referenced sources of databases.

The present guidelines were developed specifically to capture key information on the DLVCs in the country to allow further reliable analyses and conclusions. The developed guidelines are not an end of a task mission. They are intended to be used by national consultants as a tool to produce a country report that translates the reality of the DLVCs in UMA member states plus Egypt. Guidelines will also help national consultants identify the most common DLVC to all countries while developing some common catalytic actions easy to implement which will constitute a foundation for further support to boost the DLVCs in the region.

The different parts/sections of the developed guidelines are in Annex (I, Djemali, 2020):

#### **Part 1. Justification and objectives**

Part 2. Country presentation and key indicators. The national presentation with the bare minimum of details is included in this section. It displays the country's location in relation to its overall area and population. It looks for data on the country's water, food, and climate conditions. The agricultural, cattle, and dairy livestock sectors are all interested in economic statistics. This section will include population trends, dairy livestock trends, milk and derivatives production, imports and exports, and milk and milk derivative consumption per capital.

Part 3. Assessment of the Base-Line status of the Dairy Livestock Value Chains (DLVC). The third section deals with describing the many DLVCs in the nation and identifying the most significant economic and social DLVCs to be chosen for the implementation of strategic actions, activities, and

programmes. In this section, National Consultants were instructed to pick the most prevalent DLVC out of those listed by the AU-IBAR study (2019). There are numerous milk value chains in the region of North Africa. Three major milk value chains were described as follows:

- a. Imported milk powder-based Value Chain: It is a value chain where the powder milk is imported, processed and marketed in the country.
- b. Milk produced locally and marketed with little processing
- c. Milk produced locally, collected, processed and marketed

To assess the importance of the available DLVCs in the country, a method of scoring was proposed going from Very important role (5), medium role (3), small role (1) and absent (0). The same scoring is used to assess the strength of relationships among the DLVC actors (Very strong (5), medium (3), small (1), absent (0)). The many DLVCs stakeholders should be involved in the assessments that National Consultants are to conduct. It is important to note that dairy cattle are important in UMA member nations, according to earlier AU-IBAR reports (2019, 2020). Dairy cattle and buffaloes are important species in DLVCs in Egypt. These factors led to the selection of dairy bovine (cattle and buffalo (Egypt)) as the preferred dairy species for the area in the used criteria.

Part 4. National Dairy Breeding strategies within the selected DLVC. This section of the national country report is crucial. It encompasses the evaluation of breeding tactics within the region's chosen dairy cattle or buffalo value chains. This section's goal is to first assess the significance of small to medium holdings in the production of milk within the chosen DLVC. It assesses the capability of regional nations to produce breeding stocks (males and females/semen). This part examines the Breeding Strategies within the National selected DLVC and the Ongoing Dairy Breeding programs within the selected DLVC. Breeds used to produce semen

1. Breeds used to produce live bulls
2. Levels of activities (national, regional or both)

## **Part 5. Dairy Value Chain Enabling Environment**

Part (5) is reserved to describe the enabling environment of the selected DLVC. National Consultants were asked to outline the goals of national policy in relation to the dairy industry and the livestock sector in general. Ongoing national initiatives in the areas of animal identification, livestock law, forage production, imports of breeding stocks (semen), and investments in livestock received attention. As important components of the chosen national DLVCs' enabling environment, animal health measures and health human resources (vets) serving in public and private, national research and extension programmes, farmers, and inter-professional organisations should be taken into consideration.

Part 6. Marketing livestock and dairy products within the North Africa region. Part (6) responds to strategy number (2) of North Africa region DLVCs priority. Giving countries in the region the chance to sell dairy breeding stock (live or semen) locally and lower import costs is intended to boost their economies. Policymakers in the area might promote and develop this market space. AU-IBAR is

paving the way to a future regional market for dependable breeding stocks with this report and the proposed Regional Pilot Project for the value chains of dairy cattle and buffalo (heifers and semen).

Part 7. Risk and Disaster Management Systems. Part (7) helps to raise awareness of the existence (or lack) of international and national regulations in animal health and responsible actors in this field. In order to assess a country's natural disaster and pandemic catastrophe response and resilience mechanisms, risk assessments and implemented measures are reviewed.

Part 8. Previous supporting Programs and Gaps left and opportunities. National Consultants have realized until this part (parts 2-7) a coherent description of the state of the art of their selected DLVC, its breeding objectives and its enabling environment. These achievements enabled them to zoom on gaps left and opportunities ahead in relation to the assessment of the selected DLVC breeding objectives. The first strategic action that the region defined had three priority: the production of high-quality breeding stock, intelligent herd management, farmer organisation, and capacity building. National advisors were called to take these priorities into consideration. National gaps could be crucial building blocks for the upcoming North Africa Regional DLVCs Breeding pilot project.

Part 9. Road Map and Budget. Part (9) was reserved to describe the implementation of the strategic actions to empower the selected dairy value chain. In order to create the North Africa Regional Pilot project, national consultants were requested to suggest strategic initiatives that may meet both local and regional DLVC needs. The production of high-caliber heifers was encouraged as a possible tangible example.

AU-IBAR, UMA, and the Leading Consultant examined and provided comments on the initial draught nation reports initially. During the validation workshop held online on December 16, 2020, invited national DLVCs stakeholders adjusted, validated, and then endorsed the planned catalytic activities. National Consultants were asked to present their national catalytic activities to be implemented.

## *North Africa specific Indicators*

### *People, land and agriculture*

In this research, the five UMA members (Algeria, Libya, Mauritania, Morocco, and Tunisia) as well as Egypt are collectively referred to as the North Africa area. Table lists the metrics for people populations, land acreage, and the economic contribution of agriculture to each region (1). There are 203 million people in the area. With 101 million citizens, Egypt is the most populated nation in the Arab world and the third most populous nation on the continent of Africa (after Nigeria and Ethiopia) (Wikipedia, 2015). There are 42 million inhabitants in Algeria and 36 million in Morocco. Tunisia, Libya, and Mauritania are the regions' least populous countries, with respective populations of 12.8 million, 6.7 million, and 4.4 million. North Africa total land area covers 706 million ha of which only 72 million ha, representing 10 %, are arable. Mauritania has the largest arable land in the region (44 Mo ha), followed by Morocco and Algeria (9.2 and 8 Mo ha, respectively), Tunisia comes in 4th

position with 5.3 Mo ha. Egypt comes 5th with 2.7 Mo ha and then Libya with 2 Mo ha. For Mauritania, Tunisia, Libya, Morocco, Algeria, and Egypt, the number of ha/caputs is 10 ha, 0.4 ha, 0.3 ha, 0.26 ha, 0.19 ha, and 0.03 ha, respectively. However, with a high level of intensification, Egypt has the largest potential for irrigation in the entire region (100%) The region's contribution to national GDPs from agriculture ranges from 9% to 19%. (AU-IBAR-DLVCs country reports, 2020).

**Table 1.** Human populations and land areas in North Africa region\*

Country	Population (million)	Urban (%)	Total area (Million ha)	Arable area (Million ha)	% Arable	Arable land / person (ha)	% irrigated area	Agriculture in GDP (%)
Algeria	42	73	238.174	8	3	0.19		9.37
Egypt	101	57	101	2.7	3	0.03	43	11.9
Libya	6.7	80	176	2	1	0.3		1.9
Mauritania	4.4	55	103	45	44	10		20
Morocco	36	63	71.085	9.2	14	0.3	0.17	19
Tunisia	12.8	67	16.5	5.3	32	0.41	8.9	12.85
<b>Total</b>	<b>202.9</b>		<b>705.759</b>	<b>72.2</b>	<b>10</b>			

\*(The Global Economy.com, 2019, (Romdhani, B.S, El-Fadhili, M., El-Saied, U., Ould, A. 2020. AU-IBAR-DLVCs country reports)

There are numerous socioeconomic responsibilities that agriculture fills. In Egypt, 11.9% of the country's GDP comes from agriculture. Agriculture accounts for 20% of the GDP in Mauritania. Morocco's agriculture accounts for 15% of the country's GDP and 4% of its agroindustrial output. Agriculture produces about 39% of the nation's employment, while it accounts for about 74% of the employment in rural areas. In Tunisia, the agricultural sector contributes 12.85 percent of the GDP (9.85% from agriculture and 3% from agroindustry) (AU-IBAR-DLVCs NA country reports, 2020).

## Climate

The climate zones of North Africa show that the region has a very small proportion of its land with Mediterranean climate characterized by a long summer from May to September and a relatively rainy season between October to May. Three UMA nations—Algeria, Morocco, and Tunisia—that share the Atlas Chain Mountains exhibit a variety of climates, ranging from humid and subhumid in the north to arid and semi-arid in the south, and finally desert regions. Desert climate predominates in North Africa. The agricultural land varies between 1 (Libya) to 44% (Mauritania) compared to the total area of the region. Exception made for Egypt that relies on irrigation, water stress is a major limiting factor in UMA countries. Scarcity of water, aridity and limited areas for agriculture are key features that characterize the North Africa region.

## Livestock in North Africa region

About 1% of the world's cattle are found in the North Africa region, which includes Egypt and the UMA member countries (FAO, 2015). Table lists the number of livestock in the area by species (2). With more than 72 million heads of sheep, 26 million heads of goats, 12 million heads of cattle, 3 million heads of dromedaries (the number of dromedaries in Tunisia is for females), and over 1



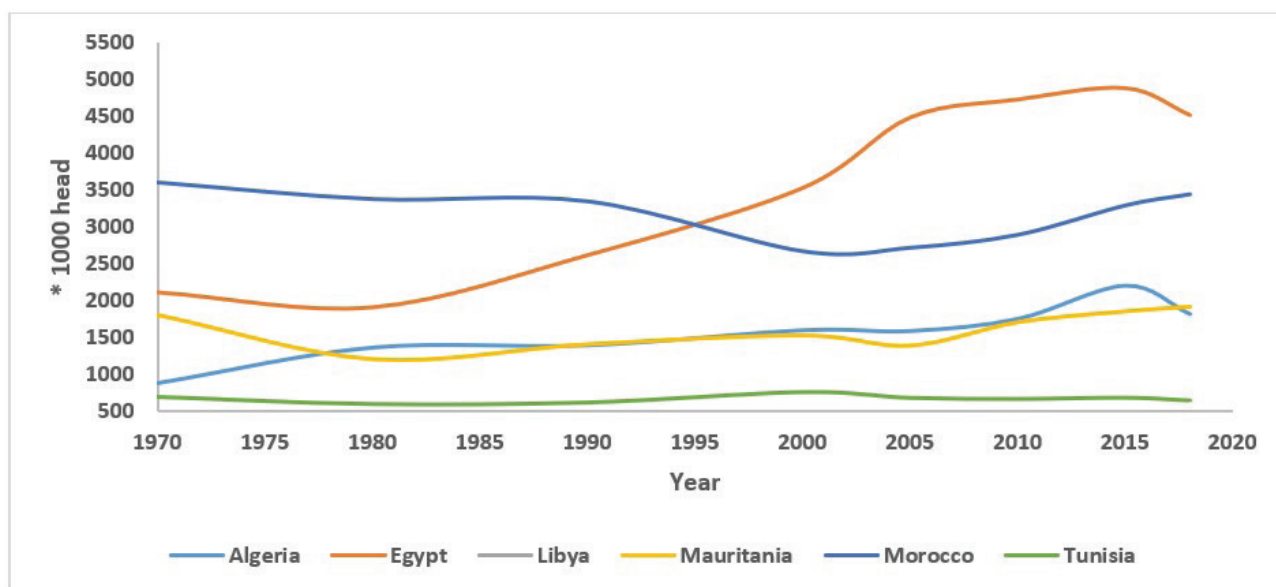
million heads of buffalo, the region is a reservoir of a diversity of species and breeds.. Egypt is the only country in North Africa region with more than 3 million heads of Buffalo. Buffaloes were introduced in Egypt during the 7th Century (Borghese, 2005). Livestock is an essential component of the region's economy with various roles played at social, cultural and employment levels.

**Table 2.** North Africa Region's Livestock in 1000 heads/species\*

Country	Cattle	Buffalo	Sheep	Goats	Dromedaries
Algeria	2000		27000	5000	35
Egypt	4387	3433	1760	3974	156
Libya	185		5305	1900	66
Mauritania	1900		11040	7510	1496
Morocco	3500		20600	6500	250
Tunisia	759		7000	1500	70 (Females)
<b>Total</b>	<b>12731</b>	<b>3433</b>	<b>72705</b>	<b>26384</b>	<b>2073</b>

\*(Romdhani, B.S, El-Fadhili, M., El-Saied, U., Ould, A. 2020. AU-IBAR-DLVCs country reports)

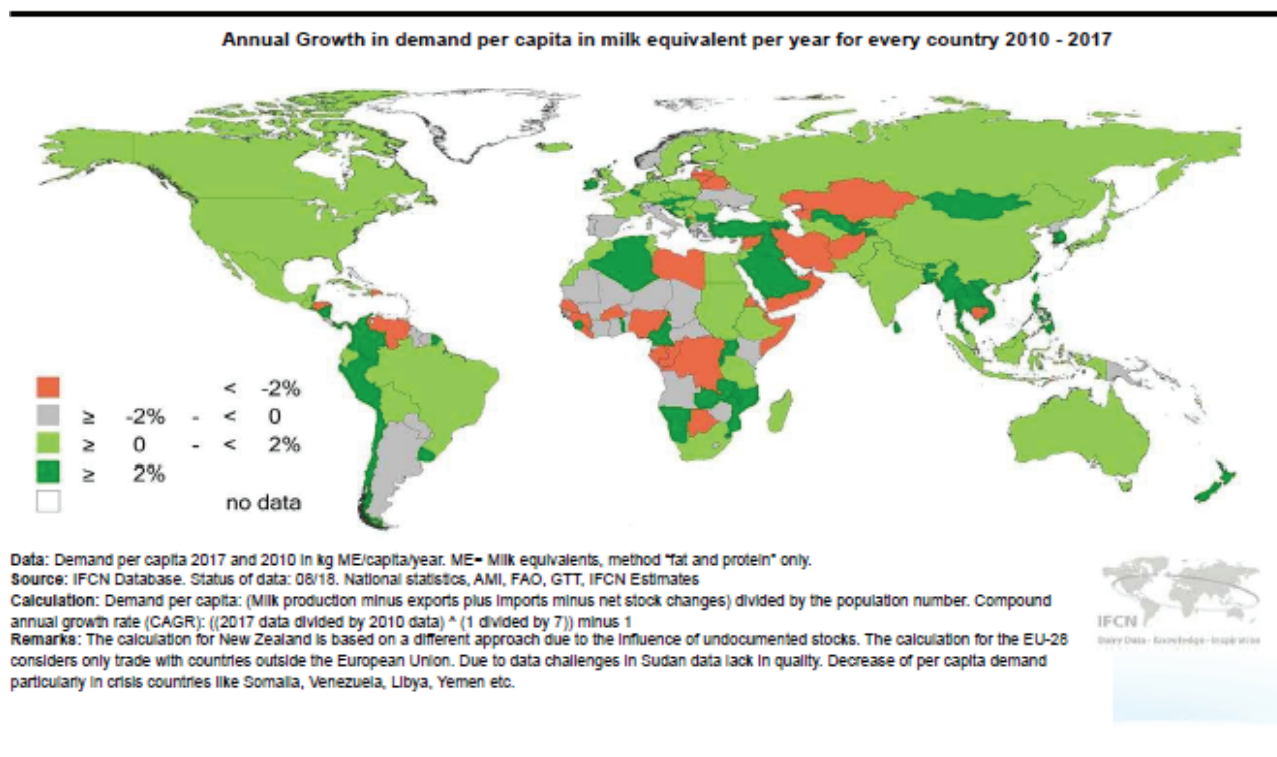
In 2015, there were about 1.5 billion cattle in the world. Asia makes about one-third of the total, with India and China having the biggest percentages at roughly 21% of the global total. With Brazil alone accounting for 14% of the global total, Latin America makes up 27% of the population. Africa makes about 17% of the global population, with the biggest proportions in Ethiopia and the United Republic of Tanzania. The Near and Middle East account for 4% (with the highest numbers in Sudan and Egypt), North America for 7% (with the highest numbers in the United States of America), Europe and the Caucasus account for 9% (with the highest numbers in the Russian Federation and France), and the Southwest Pacific account for 3% (with the highest numbers in Australia) (FAO, 2015). Trends of cattle populations in North Africa region since 1970 are shown in figure (1).



**Figure 1.** Cattle populations trends in North Africa (FAOSTAT, 2018)

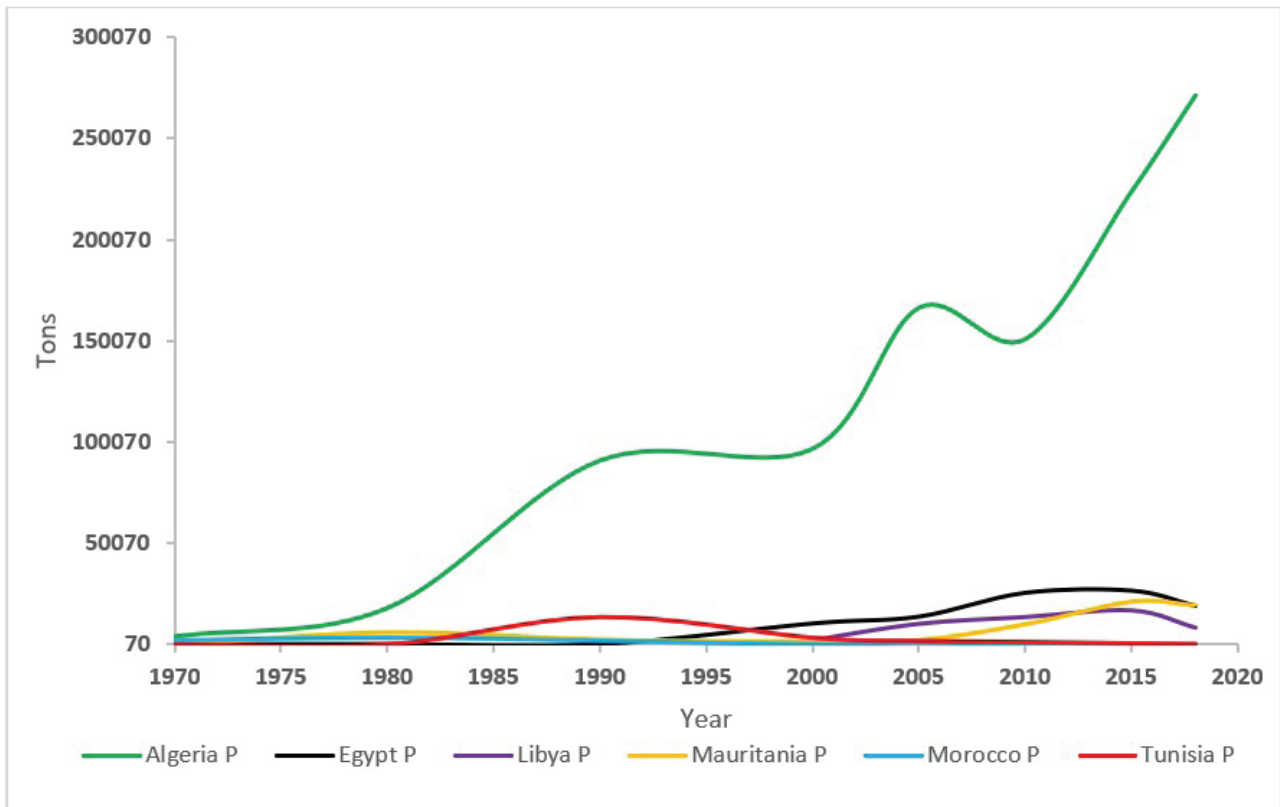
## Imports of Dairy Products

Demand for dairy products has increased in the area as a result of a growing population and increased consumption of animal goods. In order to meet the rapidly rising demand for milk and milk derivatives, policymakers chose to import milk (fresh and powdered) as well as live foreign dairy animals. This was done in response to the low productivity levels of domestic cattle caused by a lack of genetic improvement. Algeria's annual growth in demand for milk equivalent per capita is typically greater than 2%, while Egypt, Mauritania, Morocco, and Tunisia's annual growth is typically between 0% and 2%. (Map 2).



**Map 2.** Demand per capita in milk equivalent in the world (IFCN, 2018).

Imports of powder milk are illustrated in figure (2). It translates that countries of the region followed distinct political strategies since the seventies to provide milk and milk derivatives to their people. Countries that witnessed high incomes from fossil energy, in addition to cattle imports, chose to rely on milk powder importation. Algeria is the country that chose importing powder milk as a national strategic option to provide milk. It rose to become the third nation in the world that imports powder milk. Following the 2008 global financial crisis, Algeria resumed investment and supported regional milk production. Libya used to import milk powder as well, but it changed to importing exotic dairy breeds to make its own milk locally. In order to produce milk locally, Tunisia, Morocco, and Egypt imported exotic purebred cattle and tested sperm. Even though Mauritania has more livestock than people, its pastoralist livestock production method and local cow populations remain dominate the country.



**Figure 2.** Imports of Milk powder in North Africa region (FAOSTAT, 2018)

### Imports of Dairy Exotic Breeds

In the seventies, exotic dairy cows represented less than 10% of the total cattle population in Tunisia, Algeria and Morocco. Currently, more than 56% of Tunisians, 57% of Moroccans, more than 50% of Egyptians, and 17% of Algerians are women (AU-IBAR, Desk review, 2019, AU-IBAR-DLVC country reports, 2020). Due to unchecked, indiscriminate crossbreeding, the immigration of alien breeds is creating a genetic degradation at the population level in native cattle. The process of upgrading and the transfer of genes from exotic to native cattle have been accelerated by the use of artificial insemination. It has been challenging to manage artificial insemination to improve native cattle, which has resulted in a trend of replacing native cattle with imported exotic breeds and their crosses (Figure 3). (AU-IBAR, 2019).

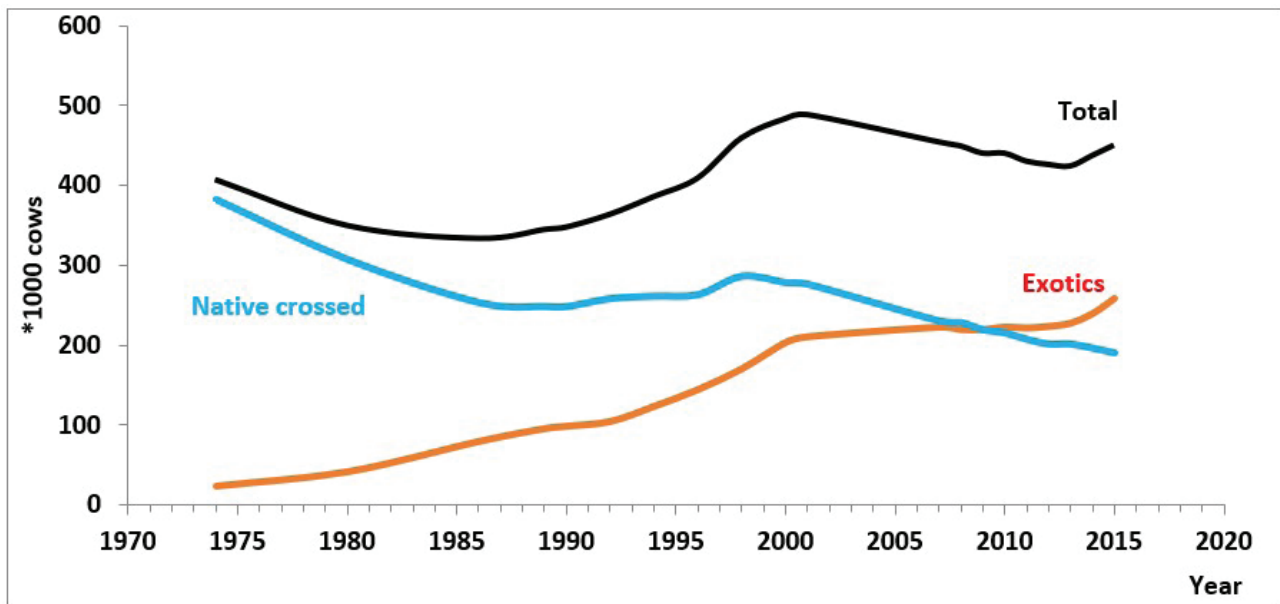


Figure 3. Effect of upgrading of native cattle by exotics (Case of Tunisia, AU-IBAR, 2019)

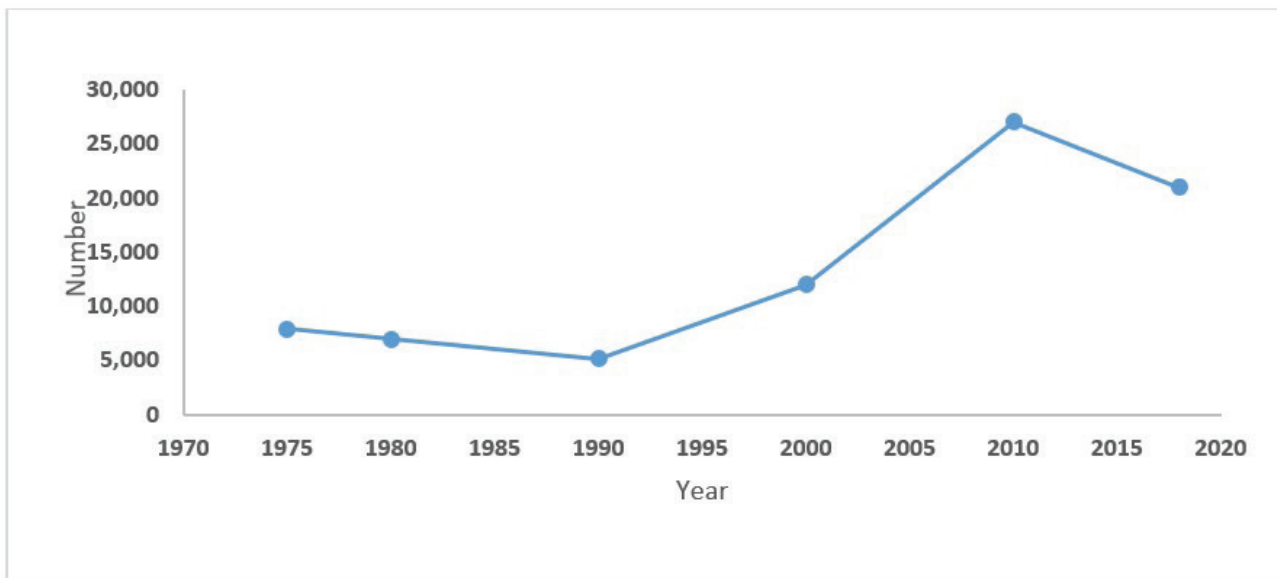
The imports of dairy heifers since the sixties were 387 000, 350 000 and 80 000 in Algeria, Morocco and Tunisia, respectively (Srairi et al. 2013). Relying on imported purebred cattle and the willingness to upgrade native cattle has led the region to use Artificial Insemination and, consequently, to import proven semen in large quantities. Srairi et al. stated in 2011 that Algeria, Morocco, and Tunisia imported, respectively, 204 600, 320 000, and 305 000 doses of semen. As a result, native cattle have decreased in number while purebred cattle and their crosses have increased. Between 1980 and 2000 and 2000 and 2020, respectively, Egypt imported 974,000 and 2995,000 dairy cow heifers. Between 1980 and 2000 and between 2000 and 2020, Egypt imported 1250,000 and 2653,000 buffalo heifers, respectively (table 3). In 2019, Egypt imported more than 260 000 and 3000 dosages of semen for dairy cattle and buffalo, as well as over 124 000 heifers between 1 and 2 years old (AU-IBAR-DLVCS Egypt Country Report, 2020).

Table 3. Imported heifers and proven semen in Egypt\*

Dairy Species/ breeds	1980-2000		2000-2020	2019
	Females (1000)	Semen (1000) or Live bulls	Females (1000)	Semen (1000)
Cattle	974.0	N/A.	2995.3	260
Buffaloes	1250.0	N/A.	2653.2	
Sheep	52.5	N/A.	96.0	N/A.
Goats	9.0	N/A.	18.2	N/A.
Dromedaries	N/A.	N/A.	N/A.	N/A.

\*El-Sayed, U.2020. AU-IBAR-DLVCS Egypt country report

To enhance milk output and create a national core of high milk-producing cows, Morocco started importing large numbers of heifers in the 1970s. A peak in 1996, when Morocco imported 37,255 heifers, marks the end of a continuous and consistent rise in imports (Figure 4). The number of heifers imported in 2018 was 21,000, down from a peak of 26,737 in 2010. Breeds of Holstein, Montbéliarde, and Fleckvieh dairy cows were imported (AU-IBAR-DLVCS Morocco country report, 2020).



**Figure 4.** Imported exotic purebreds trend (heifers) in Morocco. El-Fadhili, M. 2020. AU-IBAR-DLVCs Morocco country report)

Imported heifers in Tunisia was dominated, since the seventies, by Black and white Friesian cattle and pure Holsteins with little Brown Swiss and Tarentaise until recently. Since 2011, new breeds were imported and encouraged like the Montbéliarde and the Fleckvieh with a relative increase in Brown Swiss heifers. Since 2013, Tunisia has imported 4165 exotic dairy cows (Table 4). 33% of the total number of imported heifers in 2019 were Holstein calves (AU-IBAR-DLVCs Tunisia country report, 2020). Breeding stock suppliers have had a significant role in shaping national rules about the breeds that should be imported into the nation, particularly after 2011.

**Table 4.** Dairy heifers imports in Tunisia\*

Year	2013	2014	2015	2016	2017	2018	2019
Heifers	1091	389	643	228	362	647	805

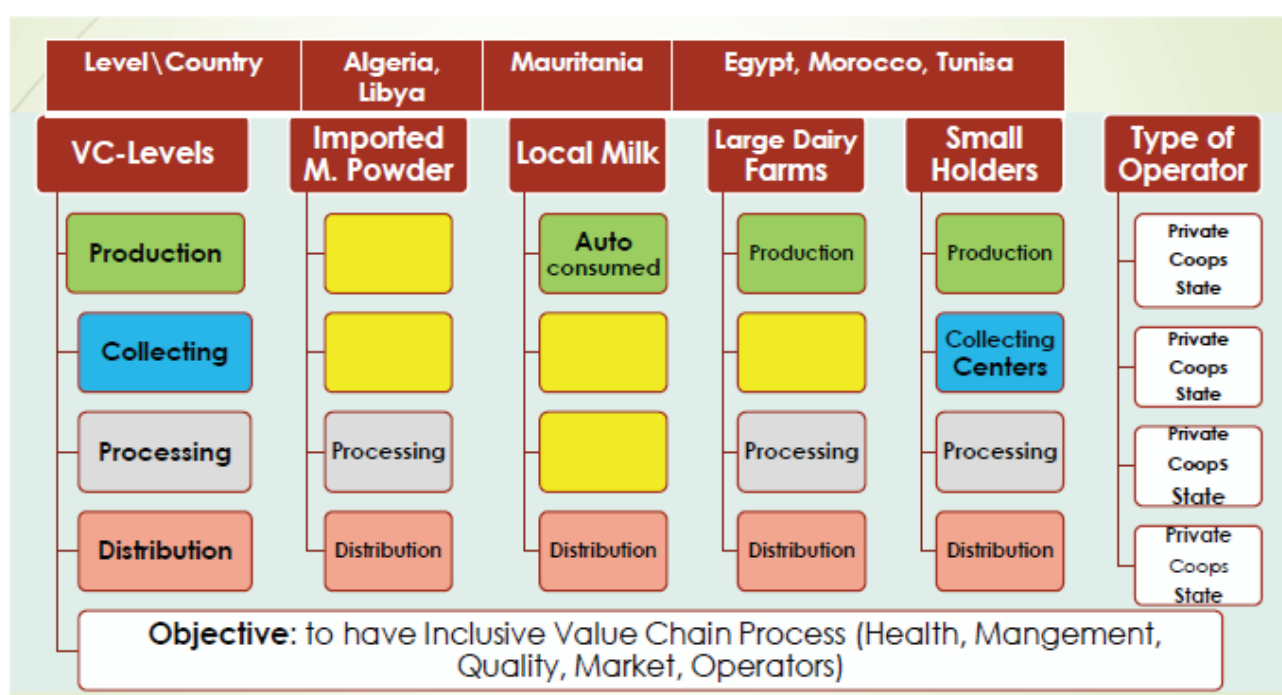
\*Romdhani, B.S. 2020. AU-IBAR-DLVCs Tunisia country report)

Tunisia has a legal procedure to create centers for the production and marketing of pregnant heifers since 2001 (Order of the MARH of April 16, 2001, JORT N ° 32 of April 20, 2001). The nation built a system of production facilities for purebred heifers run by both the public and private sectors (AU-IBAR-DLVCs Tunisia country report, 2020). It would be highly beneficial to duplicate this experience using the Islamic Development Bank's reverse linkage programme in the area.

More than 5 million dairy females—possibly more—have been introduced into the region, but the position of DLVCs in each nation remains precarious on all fronts, particularly in terms of output. Breeding stock and dairy product imports (powder, cheese, whey, butter, etc.) are a major drain on the region's hard currency. The region has all the ingredients to reduce such bleeding in producing breeding stocks locally.

## Dairy Livestock Value Chains in the region

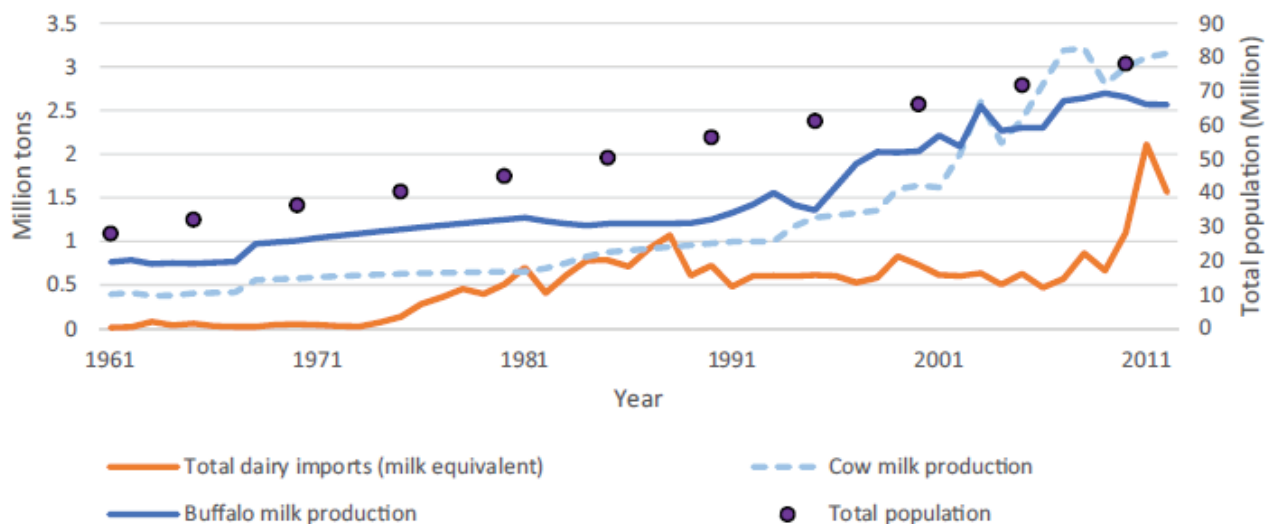
The dominant types of Milk Value Chains in North Africa region were described in the AU-IBAR desk review report on characterization of milk value chains (MVC) in North Africa (AU-IBAR-Desk review, 2019) as shown in Matrix (1). The matrix, which breaks down the MVC into its four components—production, milk collection, processing, and marketing—shows that Algeria and Libya have MVCs that are built on milk powder, processing, and distribution. Currently, the two nations are promoting domestic milk production through the importation of dairy animals and financial incentives. In Mauritania, the second type of MVC, where milk is locally produced and consumed by automobiles with little industrial processing, is encountered. Egypt, Morocco, and Tunisia are where you may find the third kind (Production, Collection, Processing and Distribution) and its two sub-types (Large Dairies, Small Holders).



**Matrix 1.** Main Milk Value Chains in North Africa region (AU-IBAR, Desk review, 2019)

### Dairy Livestock Value Chains in Egypt

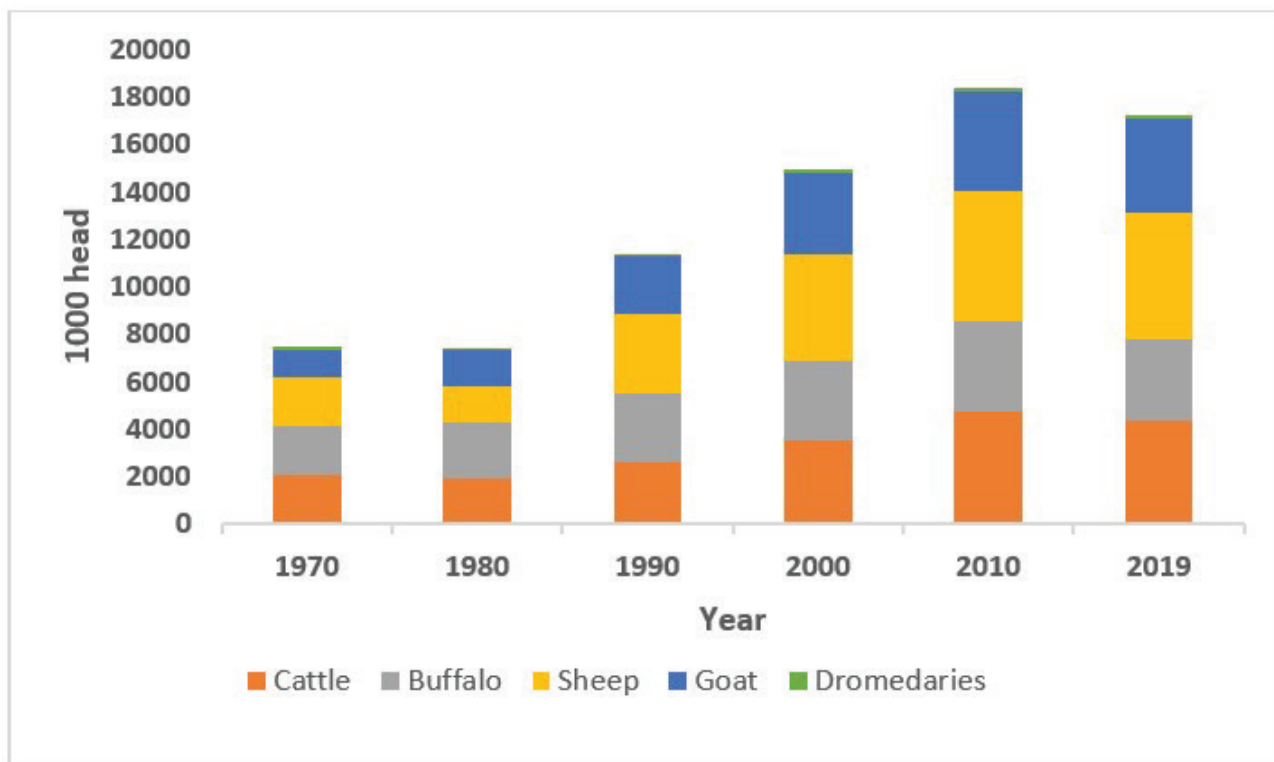
Dairy cattle and buffalo are two major species contributing to milk production in Egypt, with dairy cattle producing more (Figure 5, Daburon et al., 2016). However, there are no accurate statistics on the approximate number of dairy females by particular breed to determine how much each breed contributes to the overall amount of milk produced in Egypt. Future research in this area is interesting.



**Figure 5.** Cow milk and Buffalo milk trends in Egypt (Daburon et al., 2016).

The trends of livestock populations by species are reported in table (3). In general, all species increased in number in 2020 compared to their population sizes in 1970. There is an approximate increase of 2-3% of the different species (El-Saied, U. 2020. AU-IBAR-DLVC Egypt country report).

Egypt has invested in importing high-quality foreign breeding stock (heifers and semen), which has increased output with fewer animals as seen earlier in (Table 3). Due to the indiscriminate breeding, indigenous (Baladi) cattle have suffered significantly from the introduction of exotic breeds. Since 1991, Baladi cattle have lost 19% of their national cow herd share and finding pure Baladi cattle outside of a few research facilities is challenging (Galal, 2007).



**Figure 6.** Cattle and Buffalo trends in Egypt (FAOSTAT, 2019)

## DLVCs Breeding Goals and Producing Breeding stocks gaps in Egypt

In assessing the DLVCs in the country, the DLVC Egypt country report (2020) identified that the DLVC where milk is produced locally and distributed with little processing is the one that describes the most the situation in Egypt. By using scores provided by the developed guidelines (Djemali, M. 2020.AU-IBRD-LVC-Regional report) from 1 “least important” to 5 “most important”, to assess the most important economical-social-environmental DLVCs, results showed that DLVCs using buffalo milk had highest scores in both Upper Egypt and Delta, followed by cattle in Upper Egypt and Delta. Sheep and Camels had the highest ranks in the Desert region (Table 5).

**Table 5.** Selected LDVC in Egypt \*

Farm size and Number of Owners		Total number of females (1000)		Identified females (1000)	% Identified (females)	Number of herds/flocks recorded
Less than 10 cows owned by small holders (85-90%)	N/A.	Baladi	1444.6			
10-<=25 cows	2837	Cross Cows	1390	540.5	18.3	N/A.
25-<=50 cows	1769	Foreign Cows	124			
>= 50 cows	1567	-	-			
N/A.		Egyptian Buffaloes	2406.8	18.5	0.8	N/A.
N/A.		Sheep	3307.9	209.5	6.3	N/A.
N/A.		Goats	2278.4	N/A.	N/A.	N/A.
N/A		Camels	85.3	19.9	23.3	N/A.

\*El-Saied, U. 2020. AU-IBAR-DLVC Egypt country report, 2020

Ninety percent of Egypt’s dairy producers are small-scale farmers (Table 6) According to the Egypt study by the AU-IBAR-DLVCs (2020), it is difficult to determine the precise number of small holders there. The study revealed that 10% of all farms in the nation have more than ten cows, according to national statistics. An educated assessment would be that Egypt has 6 173 000 small holdings based on the later reported number.



**Table 6.** Number of females of farm animals identified by farm size and species\*

Species/breed	Region	Economical-Social-Environmental ranking Chains (1 to 5 with score 5 the most important)
Producing Buffalo	Upper Egypt.	5
Cattle		3
Sheep and goats		2
Camel		1
Buffalo	Delta	5
Cattle		5
Sheep and goats		2
Camel		1
Buffalo	Desert	0
Cattle		0
Sheep and goats		5
Camel		5

\*El-Saied, U. 2020. AU-IBAR-DLVC Egypt country report, 2020

All genetic improvement programs for farm animals rely on essential components: Animal identification, performance recording, genetic evaluation including genomics and genetic superiority dissemination or breeding schemes. According to Egypt's 2020 AU-IBAR-DLVCs country report, the country has already made investments in the identification of its cattle, sheep, and goats (Table 7). Animal identification is a multipurpose process that aids in animal immunization programmes, animal health monitoring, and forms a part of animal genetic enhancement projects. If particular genetic enhancement projects are created and executed in Egypt, the nation stands to gain significantly. According to the results in Table (7), large farms and dairy service providers are Egypt's most significant actors at the DLVC production level.

**Table 7.** DLVC Stakeholders influence in Egypt\*

Actors	Production level	Collecting level	Processing level	Marketing level
Dairy production inputs providers (Feeds, Equipment, Vet services, heifers, semen ...)	5	3	3	2
Small Holders	2	2	2	2
Large Dairy Farms	5	4	3	3
Extension Services	1	1	1	0
Universities	1	0	1	0
Policy Government and incentives	2	2	4	0
Farmers organizations	3	3	2	2
Inter professional Organizations	3	1	2	1

\*El-Saied, U. 2020. AU-IBAR-DLVC Egypt country report, 2020

## Areas in need for DLVC development in Egypt

The various discussions among the Egyptian team who prepared the report with the different stakeholders of the Buffalo and Dairy Cattle milk value chains reached a consensus that described real needs of Buffalo and dairy cattle milk value chains. Egypt key priorities in relation to these DLVCs are: 1) Genetic improvement and Breed Association at the production level, 2) milk quality and traceability of dairy products at the DLVC's production, collecting and processing levels and 3) legislation and incentives at the DLVC collecting and processing levels. Organizing farmers in the form of Breed Associations appears to be a stronger need than just organizing farmers based on a general feature (table 8).

**Table 8.** Areas in need for DLVC in Egypt\*

Areas	Production	Collecting	Processing	Marketing
Legislation and incentives	3	5	5	1
Feeding	3	3	5	1
Reproduction and management	3	3		1
Genetic improvement	5	-	-	-
Milk quality	5	5	5	2
Traceability of dairy products	5	5	5	1
Farmers Organizations	2	2	2	2
Breed association	5	0	0	0
Regional and International Cooperation	1	2	2	2

\*El-Saied, U. 2020. AU-IBAR-DLVC Egypt country report, 2020

Egypt has the chance to start strategic breeding initiatives in the dairy cattle and buffalo value chains thanks to the AU-IBAR Live2Africa North Africa DLVCs priority. By investing in dairy animal identification systems, specific breeding goals, performance tracking systems, and establishing breeding plans for dairy cattle and buffalo, Egypt is able to close the gap in its dairy bovine value chains. Due to the quantity of females found in exotic cattle (reportedly Friesians), Egypt is able to produce more replacement heifers than it needs for its purebred dairy herds to meet demand in local or regional markets. Table (9) summarizes an alternative that describes how Egypt is capable to become a country that produces dairy cattle breeding stocks for its local needs with a surplus for the market and becomes an EXPORTER of good quality cattle breeding stocks instead of importing them. The same advice for dairy heifers also applies to buffalo. The suggested alternative satisfies the areas identified by the AU-IBAR-DLVCs Egypt country report as being in need of the DLVCs (2020).

**Table 9.** Egypt capacity in producing good quality pure bred dairy heifers

OPERATIONAL MODEL	Pure bred Cattle
Number of cows identified	124000
Fertility	0,8
Number of born calves	99200
Mortality 5%	4960
Number of live calves	94240
Number of female calves	47120
Culled heifers 10%	4712
Produced Good quality heifers	42408
Natinal Dairy herds needs in replacements with a culling rate of 20%	24800
<b>SURPLUS HEIFERS</b>	<b>17608</b>

## Marketing Heifers in Egypt

Prices for Egyptian heifers are displayed in Table (10). For the neighbourhood market, heifers are raised. The same statement applies to milk and milk products.

**Table 10.** Prices of heifers in Egypt by age

Type/Age	6 mo.	12 mo.	15 mo.	Pregnant heifers
Native	437.5-500 \$ (7000-8000 EGP)	562.5-625 \$ (9000-10000EGP)	687.5-750 \$ (11000-12000EGP)	812.5-875 \$ (13000-14000EGP)
Holstein or Friesian	750 \$ (12000 EGP)	1500 \$ (24000 EGP)	1875 \$ (30000 EGP)	2500-2625 \$ (40000-42000 EGP)
Buffalo	500-562.5 \$ (8000-9000 EGP)	656.3-718.8 \$ (10500-11500 EGP)	750-812.5 \$ (12000-13000 EGP)	812.5-875 \$ (13000-14000 EGP)

## Risks and Disaster Management Systems

Egypt works to provide its population with wholesome meals. National laws are enforced in the cattle sector in accordance with the OIE's current international laws. One of the key strategies to lower the risk of infections is vaccination. Other strategies include requesting health certifications when moving animals and monitoring food quality. Early warning systems based on extension and communication campaigns with livestock owners are essential for risk assessment and response. Typically, this service is offered via government channels, primarily the MOA services. "Rapid reaction teams are sent to any suspicious cases, conducting clinical investigations on the affected animals and gathering the necessary samples to be sent to a national lab for diagnosis; Animal Health Research Institute (AHRI) as soon as possible, apply movement control around suspicious cases, conduct symptomatic treatment to prevent secondary bacterial infection and subsequently reduce the losses." (El-Saied, U., 2020. The Egypt country report from AU-IBAR-DLVC. A Risk Based Strategic Plan (RBSP) for FMD Control is intended to help countries plan and manage their efforts to raise the level of control of FMD from the early stages up until the point where an application to the OIE for official recognition of freedom from FMD is made (with or without vaccination). 2020 (El-Saied, U. The Egypt country report from AU-IBAR-DLVC.

## ROAD MAP Egypt chosen-DLVC

The country report identified the location and catalytic actions for Egypt box (4).

### **Box 4. Selected strategy or activities for Egypt**

#### **Location:**

Two governorates were selected; one representing the Delta region (Kafr El-Shaiekh) and the other governorate represents northern Upper Egypt (Fayoum). In both governorates, Friesian cows and Egyptian buffaloes are raised by small and medium dairy livestock holders, the category of farmers targeted by the AU-IBAR.

#### **Number of small holders or others:**

The project will consider 2 milk collection centers, the first one is located in Kellin district, Kafr ElShaiekh governorate and the other is located in Seyala district, Fayoum governorate. The former district, for example, has 5 villages including their dependencies (around 500 residential areas). Number of families cannot be precisely counted; however, the project will try to serve as much families as possible in view of their desire and the available budget.

#### **Specific activities:**

The project will be implemented in the crop-livestock mixed farming system. Important related activities to the milk collection centers are animal identification and milk recording to identify good breeding animals. There exists a program for animal identification carried out by the General Authority for Veterinary Services. Such a program should be enhanced with the cooperation of APRI. Moreover, there exists an Information System (called the Cattle Information System/ Egypt (CIS/E)) for cows and buffalos at the Faculty of Agriculture of the University of Cairo that records milk yields in buffalos and cows. This system should be expanded in association with the expansion of the milk collection centers. Setting up a smart herd and flock management system (data recording, management, feeding, product quality) while strengthening existing AI centers in the region.

## *Dairy Livestock Value Chain in Mauritania*

Livestock is very important in the national economy of Mauritania since it represents more than 20 % of the national GDP. Mauritania has a wealth of Animal Genetic Resources as shown in table (11).

**Table 11.** Trends of livestock species in Mauritania\*

	1970	1980	1990	2000	2010	2020
Cattle	1.800.000	1.197.000	1.350.000	1.519.590	1.701.112	01.912.564
Dromedary	0.728.000	0.734.100	0.950.000	1.356.000	1.360.306	01.495.764
Goats	3.000.000	2.596.500	3.400.000	5.086.826	5.799.842	07.510.412
Sheep	4.500.000	5.197.200	5.100.000	8.034.880	8.701.555	11.035.860

\*Ould, A. 2020. AU-IBAR-DLVCs Mauritania country report

Fresh milk output rose from 189,000 tons per year in 2009 to 237,000 tons per year in 2018, a 25% increase. Estimated national milk production is 422,000 tons, of which 187,000 tons, 131,000 tons, 14,000 tons, and 90,000 tons, respectively, are produced by cattle, dromedaries, sheep, and goats (table 12). This data demonstrates the significance of cattle, dromedaries, and goats in milk production. Mauritania has a high average per capita consumption of milk and milk derivatives (0.46 kg/day, about 4 times the average per capita consumption in sub-Saharan Africa). Only 4% of the nation's total milk production would be sold; about 72% would be used for personal use.

**Table 12.** Milk and Milk derivatives trends in Mauritania (tons), FAOSTAT, 2020.

	1970	1980	1990	2000	2010	2020
<b>Cattle</b>						
Raw milk	98560	84000	97405	458003	500470	579612
Butter	623	559	656	759	787	896
Cheese	1688	1515	1778	2058	4931	6961
Skimmed milk	14214	12761	14974	17301	17946	20447
<b>Dromedary</b>						
Raw milk	16500	18000	19725	23750	25851	26250
<b>Goats</b>						
Raw milk	74700	70200	80100	82747	94334	112298
<b>Sheep</b>						
Raw milk	53350	56650	69850	57671	73193	78869

The dairy cattle and dromedary value chains, which are primarily found in the eastern and southern parts of Mauritania, are the principal DLVCs, playing significant economic and social roles in the nation. (Ould, A. 2020). These milk value chains cover production, but also unofficial levels of gathering, processing, and marketing. Despite being a significant source of revenue, particularly in rural areas, the cattle industry's performance and market potential are not fully acknowledged. This sector was not well integrated into the national economy and has long been relatively neglected. Since 1985, the government established a program to strengthen this sector by investing in its basic infrastructure and veterinary services. Natural pasture makes up a large portion of the nutrition of livestock. Two thirds of the exploitable land is located in the East of the nation, which also has the most significant pastoral potentialities. The remaining third is split between the Center and South (the river area) of the nation. Notably, Mauritania is the only nation that did not rely on dairy alien breeds and is still renowned for the health of its indigenous cattle herd.

## DLVCs Breeding Goals and Breeding stocks gaps in Mauritania

The AU-IBAR-DLVC Mauritania country report (2020)'s sparse material makes it clear that the nation has a serious need for inventories and characterisation of its farm animal genetic resources. Mauritania will be assisted in managing its animal genetic resources in a sustainable manner by a national strategy that identifies breeding objectives for each breed and is connected to national animal identification and performance-recording systems. The problems listed above are translated in Table (13). To demonstrate their absence from strengthening the cattle sector, extension services, universities, and research received the lowest scores. The inter-professional associations were not reported on. Mauritania needs to work to turn these flaws into strengths.

**Table 13.** Weight of roles of different DLVCs in Mauritania\*

Actors	Production	Collecting	Processing	Marketing
Dairy production inputs providers (Feeds, Equipment, Vet services, heifers, semen ...)	4	2	2	1
Small Holders	4	3	1	2
Large Dairy Farms	4	3	1	1
Extension Services	1	1	1	1
Universities-Research	1	1	1	1
Policy Government and incentives	2	2	2	2
Farmers Organizations	3	3	1	1
Dairy industries	4	4	4	3
Inter professional Organizations				

\*Ould, A. 2020. AU-IBAR-DLVCs Mauritania country report

## Marketing heifers and dairy products

The information on production and marketing of heifers is lacking in Mauritania. However, there are three well known dairy basins:

1. Rosso dairy basin (agro-pastoral area with the largest collection centers and close to the dairy unit in Nouakchott)
2. Boghé dairy basin (agro-pastoral area with collection centers but far from the dairy unit in Nouakchott)
3. Nema dairy basin (pastoral area near the Nema unit).

## Risks and Disaster Management Systems

**Animal Vaccinations:** There is an annual national vaccination campaign against certain diseases in Mauritania. The vaccination rate has increased by 200%, or 6 million head vaccinated in 2018 against 2 million head in 2009. But the health constraints arise forever mainly for the foreign trade of livestock.

**Animal transport:** There is a lack of rules to respect the welfare of the animal. Transportation is done in large trucks several factors are not respected: density, resting area,

Risks assessment and measurements taken little information was provided for this component, which makes it difficult to assess. One “wild guess” is if no information is shared, this means the absence of risks assessment and measures taken to reduce risks.

## **Road Map- Mauritania National Priority for DLVCs**

Between Egypt and UMA members, Mauritania has the biggest amount of arable land. It has a large pool of genetic resources from animals. The two main species that supply the nation with milk are cattle and dromedaries. Any dependable pilot project to support DLVCs will have a significant impact on the advancement of animal productivity and farmer revenue in the future. The value of the dairy cow livestock chain has been singled out for Mauritania (5).

### **Box 5. Mauritania DLVCs priority**

#### **Implementation Location**

In Rosso, targeting several villages in this dairy basin

#### **Number of small holders to be included**

50-100 breeders with a workforce (500 cows) that can be used as a pilot core for this

#### **Specific activities**

##### *i. Breeding*

Designing a simplified breeding program based on selection of the “Maure Breed” and its use with Exotic males to produce FI Males for genetic improvement of the rest of the Maure breed population. A simplified recording program will be implemented with performance data analyses and genetic evaluation procedures.

##### *ii. Feeding*

It is necessary to introduce the forage crops of the local species highly adapted to the national climatic conditions and especially that the area proposes the water does not pose a constraint

##### *iii. Health*

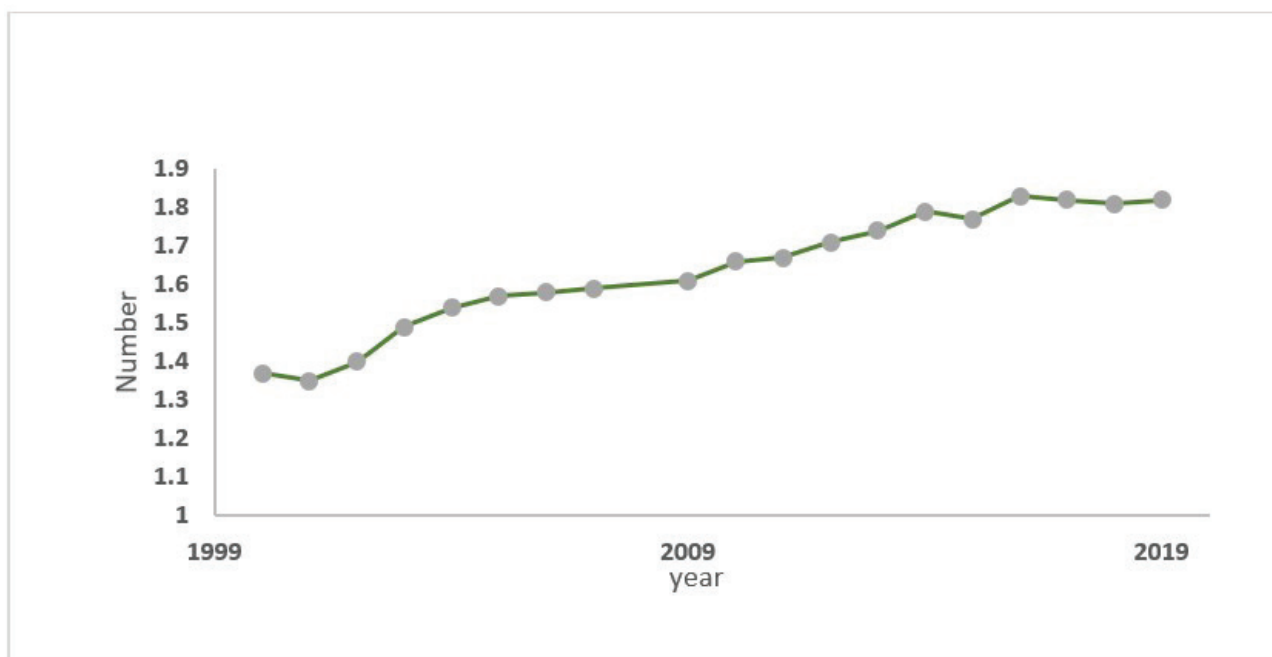
See prophylaxis program in coordination with veterinary services

##### *iv. Dairy Collecting, cooling, product quality control*

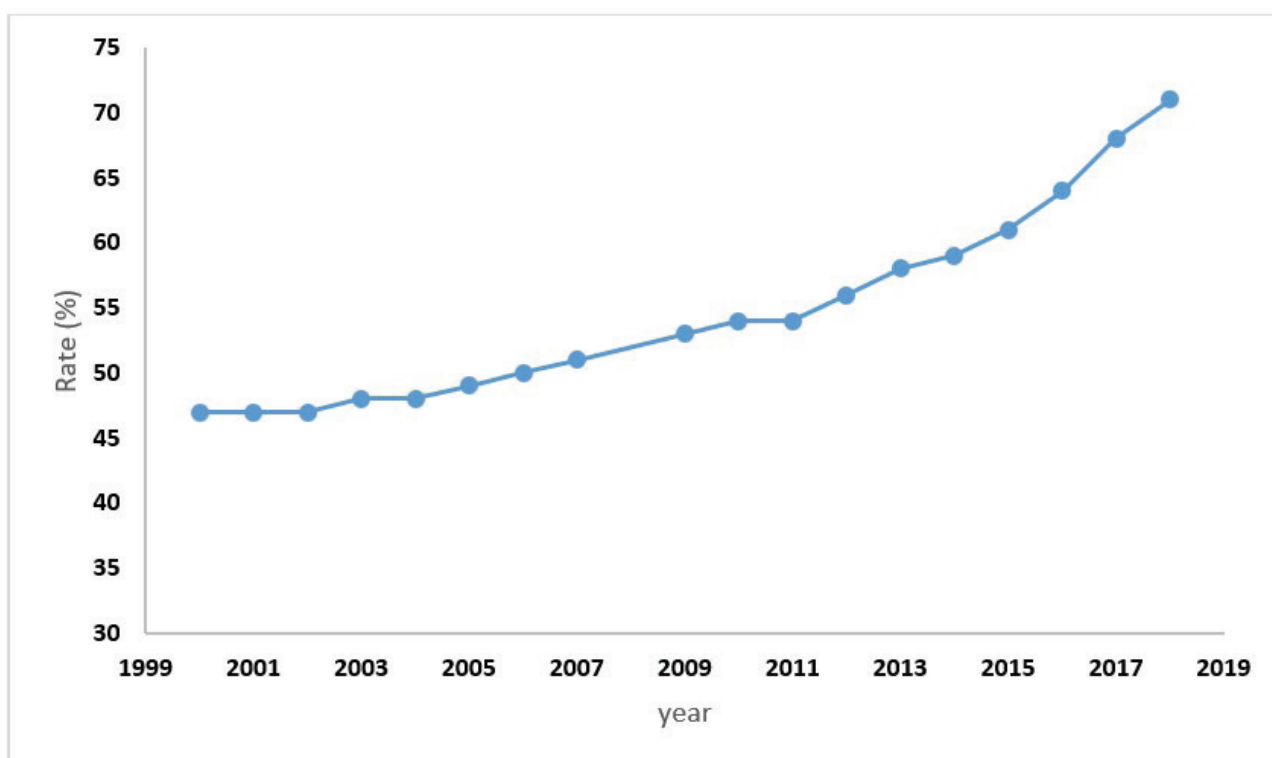
Make a convention and work in synergy with the collection centers in the area

## Dairy Livestock Value Chain in Morocco

When Morocco decided to acquire exotic dairy breeds to expand its domestic milk production and satisfy a rise in demand for milk and milk derivatives, the genetic makeup of dairy cattle in Morocco gradually changed. The trends of the cattle population in Morocco are depicted in figure (7), which translates the rate of growth of the country's herd. The growth of purebred cattle and their crosses, which came at the expense of native cattle, was the primary cause of the realised increase (72%) (Figure 8). (El-Fadhili, M., 2020).



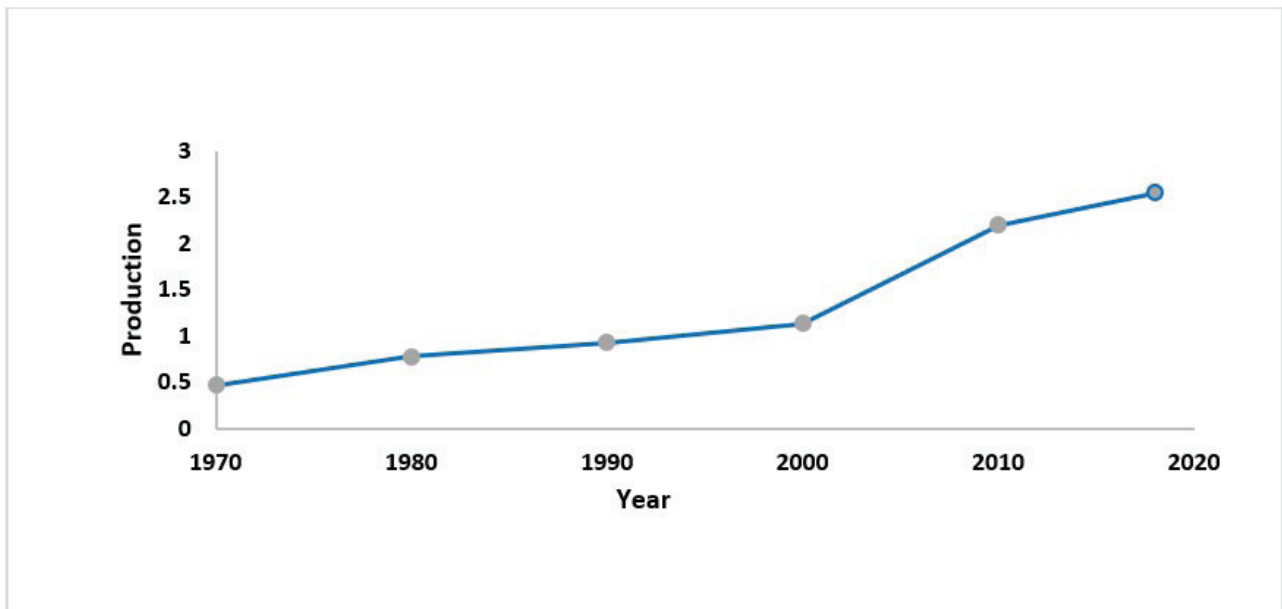
**Figure 7.** Cows population trends (million) in Morocco



**Figure 8.** Rate of the improved cattle (purebreds and crosses) in %



The output of milk has continuously expanded since the Dairy Plan of Morocco was introduced in the 1970s (1970–1975) (Figure 9). For purebred and improved crosses, the average milk output per cow and per lactation grew from 3500 to 4000 litres per cow and from 1250 to 2100 litres for the years 2009 and 2015, respectively. According to El-Fadhili (M., 2020), the import of milk and milk byproducts is insignificant compared to that of cheese, powdered milk, butter, and lactoserum.



**Figure 9.** Cow Milk production trend (billion liters)(FAOSTAT,2019)

In Morocco, the consumption of dairy products is around 74 liters/capita. The annual exported milk volumes remain very low (less than 1%). The main country destinations for exports of Moroccan dairy products are Mauritania (63.4%), Qatar (20.9%), and Senegal (7%) (El-Fadhili, M., 2020). Different DLVCs are met in Morocco according to the AU-IBAR-DLVCs Morocco country report (2020). The simplest one involves dromedaries, native cattle, and local goat varieties. Native breeds are mostly raised for their meat, and because of their limited milk production, households consume it. These breeds are raised in mountainous, semi-arid, arid, and desert regions using low input production methods. Cheese made from goat milk is produced in northern Morocco. Dromedary pasteurised milk is offered for sale in tiny shops close to cities in Southern Morocco (El-Fadhili, M., 2020). Less than 3% of the milk produced in the country comes from goat species. Less than 2% of the total national milk production is produced by dromedaries, according to the AU-IBAR-DLVCs Morocco country report (2020).

According to the AU-IBAR-DLVCs Morocco country report (2020), the most significant value chain for dairy cattle in Morocco is supported by a network of 260,000 milk producers, the majority of whom are small holders with fewer than five cows (national average is 3). There are 130,000 milk producers who deliver their milk through 2,700 organised Milk Collecting Centers (MCC), 800 of which are supplied directly by major dairy farms and individual dairy businesses and 1,900 of which are established as cooperatives. A total of 82 milk processing facilities (coops and private) with 16 operators handle the processing and packaging of milk. This represents 1.7 billion liters processed

and 15,000 jobs created. The overall milk processing capacity in Morocco exceeds 2.5 million liters/day, for a total of 2.5 billion liters processed in 2018. In Morocco, 80% of milk produced go through well organized channels. Coops (COPAG) and the private operator (Danone) are key operators in getting milk from producers or milk collecting centers and process it in milk or milk derivatives by ensuring at the same time their high quality. The remaining 20% are frequently sold as raw milk to Mahlabats (local dairy shops), where it is then transformed into customary goods, or even sold directly to cafes and homes. They are mostly active around big cities in the dairy basins (El-Fadhili, M., 2020).

The country's many regions are home to the various parts or tiers of the dairy cow value chain, including production, milk collection, processing, and marketing. But particularly in irrigated areas, there are huge densities of dairy cattle (85%). Three main dairy cattle production methods were noted in the AU-IBAR-DLVCs Morocco country report (2020). Forage and concentrates are heavily used in feeding in the intensive dairy cattle production method, which accounts for 40% of dairy cattle herds and is found in irrigated regions (71%). 1.6 million acres of land are irrigated, and this area provides more than 82% of the milk produced. The primary dairy basins are located in the irrigated regions of Ghrab, Loukkos, Tadla, Doukkala, Chaouia, Souss Massa, and Saiss. The majority of the cattle raised in these irrigated areas are exotic dairy pure breeds (Holstein). The main dairy basins are the irrigated areas of Ghrab, Loukkos, Tadla, Doukkala, Chaouia, Souss Massa, Saiss. Cattle breeds raised in these irrigated areas are mainly exotic dairy pure breeds (Holstein Friesians "Black and white and Red and white", Montbéliarde and Fleckvieh. The mixed dairy cattle production system is met in different regions of the country. It is characterized by the utilization of agricultural and agro-industrial byproducts and less forage in cattle feeding. This system includes about 45% of dairy farms located mainly in favorable rainfall agricultural areas. The most common genotypes employed are crossings between local females and exotic sires, which can result in better F1 and F2 offspring. In marginal (arid, semi-arid, and mountainous) areas, where native cattle breeds (Brown Atlas, Oulmes-Zaer, and Tidili) are historically raised under pastoral feeding techniques, the extensive cattle production system is met. Around 80% of the total cattle population in this system is formed by native cattle. It is important to emphasise that during the past few decades, the number of these native breeds has severely decreased. In 1975, they constituted more than 95% of all the cattle in Morocco, but by 2017, that percentage had dropped to fewer than 43% (AU-IBAR-DLVC-Morocco country report) (2020). In actuality, about 71% of the nation's cattle population comprises purebred cattle and their crosses with local cattle. The study of table (13) translated the AU-IBAR-DLVCs guidelines' assessment of the various DLVCs in Morocco. The Dairy Cattle Value Chain received the highest rankings from the various DLVC stakeholders in the nation (DCVC). The importance of the latter in terms of the economy, society, and environment was considered to give it the highest score. The Dairy cattle value chain contributes up to 96% of the total milk produced in the country and the assessment of the DLVC in Morocco in presented in table (14) (El-Fadhili, M., 2020).

**Table 14.** Assessment of DLVCs in Morocco

Actors	Dairy Species	Region	Ranking Economic, Social, environmental criteria
Milk produced locally, collected, processed and distributed	Cattle	Entire country	4
	Goat	Mountains	2
	Dromedary	Arid and Saharan	2
Milk produced locally and distributed with little processing	Cattle	Entire country	4
	Goat	Mountains	2
	Dromedary	Arid and Saharan	2

1: Rank from 1=least important to 5=most important; 2: Average calculated from different assessment of different persons

## DLVCs Breeding Goals and Breeding stocks gaps in Morocco

Morocco has a significant potential to develop its dairy cattle breeding industry and become able to genetically increase the productivity of its current dairy cattle while producing enough high-quality heifers to meet its domestic demands and the regional market in North Africa. The latter goal could be achieved through a national strategy with well-defined breeding goals, enhanced existing recording system, implemented genetic evaluation methods and establishment of reliable dairy cattle breeding schemes. Tables (15 and 16) show that Morocco has enough dairy cattle owners and dairy cattle to aim for a coherent national dairy cattle genetic improvement program.

**Table 15.** Number of herds by size \*

Size of the herd (cows)	Number of Owners	Owners %
Less than 20	360.000	90
20 – 100	32000	8
More than 100	400	2

\*El-Fadhili, M., 2020. AU-IBAR-DLVCs Morocco country report.

**Table 16.** Dairy cattle owners and recorded herds\*

Dairy Cattle breeds	Total of owners	Total of females	Herds recorded (million)	Recorded females*	% Recorded females
Dairy pure breeds	1800000	1200000	650	60000	5

\*El-Fadhili, M., 2020. AU-IBAR-DLVCs Morocco country report.

In addition to importing 625000 doses of semen, Morocco imported 21000 heifers in 2018 (89% Holstein, 7% Montbéliarde, and 4% Fleckvieh) (El-Fadhili, M., 2020). The alternative given in table (17) translates the capacity of Morocco to generate its demands for national dairy herd replacements with a surplus of more than 68 000 heifers for marketing, presuming that 40% of the total 1.2 million females reported in table (16) are purebred cattle. Additionally, Morocco has two major artificial insemination centres that are well-equipped and aid in the creation of sperm. Aware of the importance of healthy products, Morocco established an electronic identification system in accordance with the required international standards.

**Table 17.** Morocco capacity in producing good quality pure bred dairy heifers

OPERATIONAL MODEL	Morocco
Number of cows identified	480000
Fertility	0,8
Number of born calves	384000
Mortality 5%	19200
Number of live calves	364800
Number of female calves	182400
Culled females 10%	18240
Produced females	164160
Natal Dairy herds culling rate for replacements 20%	96000
<b>SURPLUS HEIFERS</b>	<b>68160</b>

### Areas in need for DLVC development in Morocco

The table below provides an assessment of the sectors in the Moroccan dairy cattle value chain that require strategic intervention (18). The most important factors at the production level were genetic improvement, milk quality, farmer organisations, and feeding and breed associations. Legislation and incentives were identified for milk collection. Legislation, genetic advancement, milk quality, and availability to credit loans were noted at the processing level. The area of marketing that scored the highest was loan access.

**Table 18.** Areas in need for Dairy Cattle Value Chain in Morocco\*

Areas	Production	Collecting	Processing	Marketing
-Legislation and incentives	3	4	4	3
-Feeding	5	3	0	0
-Reproduction and management	3	3	0	0
-Genetic improvement	4	3	0	0
-Milk quality and prices	4	3	4	3
-Traceability and milk quality monitoring	3	3	4	2
Farmers Organizations	4	3	3	3
Breed association	5	0	0	0
-Regional and International Cooperation	3	3	3	3
-International markets access	3	3	2	2
-Insurance for disasters	3	3	3	2
-Subsides	4	3	3	2
-Access to bank and finding	3	3	4	4

\*El-Fadhili, M., (2020).

The nation in the area that made investments in farmer organisations is Morocco. In the DCVC, specific examples include breed groups, cooperatives, and the Inter-professional. Currently, MAROCLAIT is the country's inter-professional organisation that brings together a variety of dairy industry participants, including breeders, cooperatives, associations, and representatives of the milk industry.

## Marketing of heifers and dairy products

Since 1993, milk prices in Morocco, which were previously fixed by the government and were liberalised for farmers and consumers, have been determined by the market and are not subsidised. Less than 1% of the annual milk volume is still exported. Moroccan dairy products are primarily exported to Mauritania (63.4%), Qatar (20.9%), and Senegal (7%) (El-Fadhili, M., 2020). The current milk prices used at the various DCVC levels are displayed in table (19).

**Table 19.** Prices 2020 (US \$) used at different levels of the DCVC in Morocco\*

Level	Minimum	Maximum	Average
Producers I	0.32	0.41	0.34
Collecting Centers <sup>2</sup>	-	-	-
Processing	0.39	0.40	0.35
Wholesaler	0.71	0.76	0.73
Retailer Mahlabat	0.43	0.45	0.43

\*El-Fadhili, M., 2020

Since 1986, Morocco has been producing pure dairy heifers for three main reasons: to encourage the production of dairy cattle with selected females that are adapted to Moroccan conditions, to satisfy breeders' growing demand for cow replacements, and to lower the foreign exchange cost of heifer imports. Only 6,356 heifers were produced nationwide overall from 1980 to 2000, while more than 59,532 heifers were produced from 2000 to 2018. This heifer production is still incredibly low (4El-Fadhili M., 2020). Heifers were imported at a rate of 21,000 in 2018, up from a peak of 26,737 in 2010. In Morocco, only pregnant heifers are allowed to be imported, and cost 1515 US\$ in 1996, but today they cost much more at 3030 US\$. (El-Fadhili, M., 2020). The average annual production of semen is around 327,640 doses ranging from 106,197 doses in 2010 to 920,283 in 2013. But because Moroccan dairy producers depend on imported semen, this production still falls short of their high demands. Imported dairy dosages totaled 626118 in 2018 (El-Fadhili, M., 2020).

## Risk and Disaster Management Systems

### Drought

Drought mainly affects rainfed agriculture but, increasingly, irrigated agriculture too. The decrease in rainfall is significant and its annual variability has increased in recent years. In times of drought, the public authorities in charge of the livestock industry in Morocco (El-Fadhili, M. (2020) prioritise protecting the country's livestock breeding stock, stabilising animal and feed prices, ensuring a regular supply of animal products and feed on the market, and easing the burden of livestock on the environment. Among the measures and modalities undertaken by the Government to support livestock sector against drought are:

1. The supply of feed to the national market through subsidized prices and providing transport of feeds (barley and concentrate) from the points of sale to outlying areas (communities and cooperatives).

2. The reinforcement means watering livestock through construction of new watering points or acquisition of water tanks.
3. The sanitary protection of the livestock during droughts
4. Financial measures. In addition to the public financial support to deal with the drought, the bank “Crédit Agricole du Maroc (CAM)”, which, during drought, makes a line of credit available at very low rates and with payment facilities in favor of farmers and breeders. Whatever the production activity and the size of the farm, the agricultural sector insurance provider is the “Mutuelle Agricole Marocaine d’Assurance (MAMDA)”. However, animal husbandry does not yet have access to such insurance. This is why dairy cattle animals should be covered by this kind of insurance (El-Fadhili, M. (2020). During droughts, it is also crucial to reduce customs fees on imported livestock feed.

### *Epizooties and animal diseases*

Morocco remains free of certain diseases (BSE) due to preventive measures taken, which are part of the health policy that aims to preserve the animal heritage. But due to cross-border animal movements, which occasionally avoid veterinary oversight, the risk still exists. In Morocco, farmer-level animal health surveillance starts with the first alarm being given in the event of a disease suspect (FMD, Rabies, ESB, etc.). He needs to alert the local government, particularly the closest veterinary facility. The ONSSA’s regional and national senior management are then involved in the latter, who start by doing the following:

- Carrying out surveys of animals susceptible to disease at farms, slaughterhouses, livestock markets levels, etc.
- Raising awareness of farmers and various stakeholders (private veterinarians, local authorities, etc.).
- Conducting regular epidemiological surveys to verify the absence of viral circulation.

Morocco has implemented and consistently updates the prescribed guidelines of the Zoo Sanitary Code of the Office International of Epizooties (OIE). Animal imports are subject to ongoing sanitary inspection at the border with the provision of health certifications for live animals, semen, embryos, animal feed, and animal-derived products. In the event of FMD, ONSSA offers compensation to impacted farmers whose livestock was lost as a result of the disease. A report categorising and estimating the cost of each animal was provided at the time of the animal’s destruction by a commission made up of a veterinarian for ONSSA and an expert who represented the animal owner. The compensation is done in accordance with the current regulations, which determine the compensation rates. These rates vary according to the sex of the animal, its age and breed (purebred, cross-bred, local), and consider the market prices. Compensation is regulated by the decree of the Minister of Agriculture and Maritime Fisheries No. 3366-13 concerning the special measures to combat FMD (El-Fadhili, M. 2020).

## *COVID-19 Crisis*

The livestock sector at the production level remains in activity, which was not the case with other economic sectors of production. Among the real effects of the Covid-19 pandemic observed on livestock, El-Fadhili, M. (2020) reported:

- Difficulties in the flow of production and supply of inputs
- Scarcity of labor and increased cost of services and transportation
- Falling prices for live animals due to the closure of animal markets and traditional souks
- Decrease in the quantity of milk collected and processed, aggravated by closure of coffee, restaurants, hotels, schools, etc.).
- Weak supervision and reduction of services offered farmers and breeders.

As for the measures to mitigate the effects of drought cited above the dairy sector has benefited so far from:

- Subsidizing animal feeds and its transportation throughout the territory. The year 2020 is also a year of drought, and therefore the mechanism adopted during the drought crisis described above remains valid. Except that the problems of travel restrictions have affected seriously the achievements due to access and mobility difficulties
- Taking measures that enable easy access to financing producers and cooperatives to relieve their cash flow.
- Opening livestock markets adapted to the Covid19 crisis measures.

The development of sectorial approaches as well as considerable experience and knowledge of the dangers has been made possible by the participation of a wide range of players in the management of natural catastrophes. However, it appears that there is essentially insufficient coordination between the many ministerial agencies engaged. Consequently, rather than integrating risk management at all levels while taking prevention, control, and rehabilitation into account, the measures taken are dispersed and characterised by the response to the risk occurrence (El-Fadhili, M., 2020).

## Road map Morocco National selected DLVCs activities

Morocco proposed activities within the AU-IBAR DLVCs are reported in Box (6).

### **Morocco DCVC Catalytic actions**

The Catalytic actions will be carried out in a rain fall agricultural region principally in the triangle Casablanca–Rabat and Settat.

The project will associate both the dairy cattle farmers and cooperative Mabrouka managing the some MCCs.

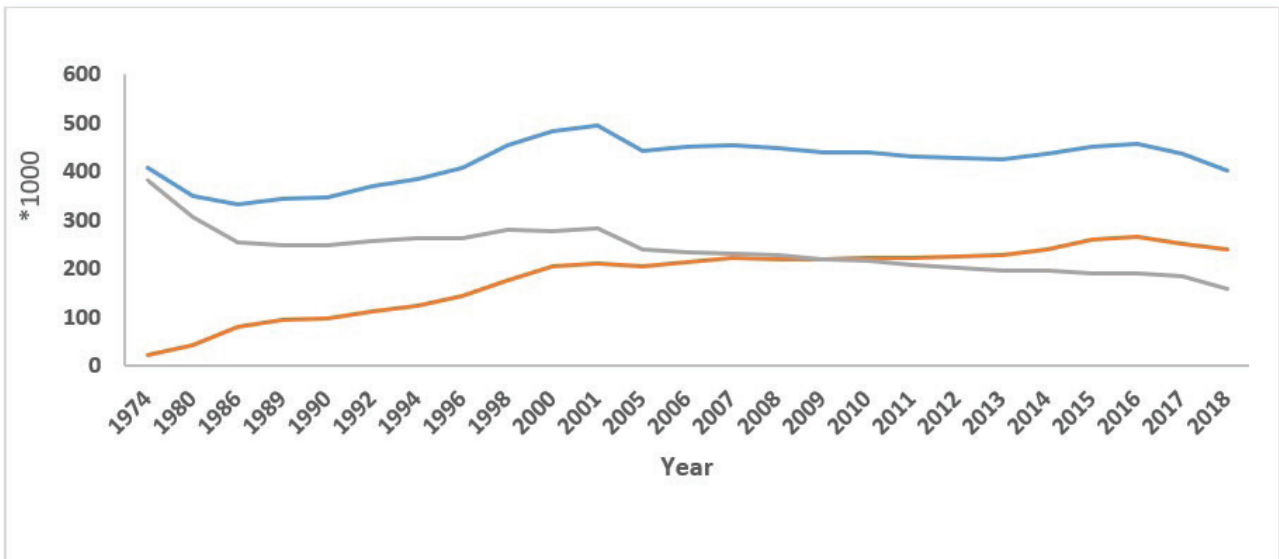
1. Two categories of farmers will be targeted by the project:
  - a. a large majority of small farmers that supply the milk to the cooperative who didn't receive today technical supervision and assistance from the cooperative
  - b. a minority of medium-sized breeders integrated in MR and heifer's production, but their benefit, nevertheless, is limited due to insufficient supervision
2. An active cooperative "Mabrouka" grouping more than 1000 members as small milk producers, managing MCCs and having technical staff and equipment's
3. In fact, this cooperative has limited resources that do not allow it to integrate more small breeders in the genetic improvement program and supervision activities.

The small and medium farmers targeted by the catalytic action raised improved purebreds (Holstein, Montbéliarde), as well as improved dairy crosses cows. In these farms, identification, AI and MR for a minority of them are carried out. The breeders also produce feeds and forages for animals into farms. However, the genetic improvement component deserves more attention because the MR is limited to the quantity of milk yield per cow and fat. Although, the heifer's selection remains subjective based on the breed standard of the pure bred.

## *Dairy Livestock Value Chain in Tunisia*

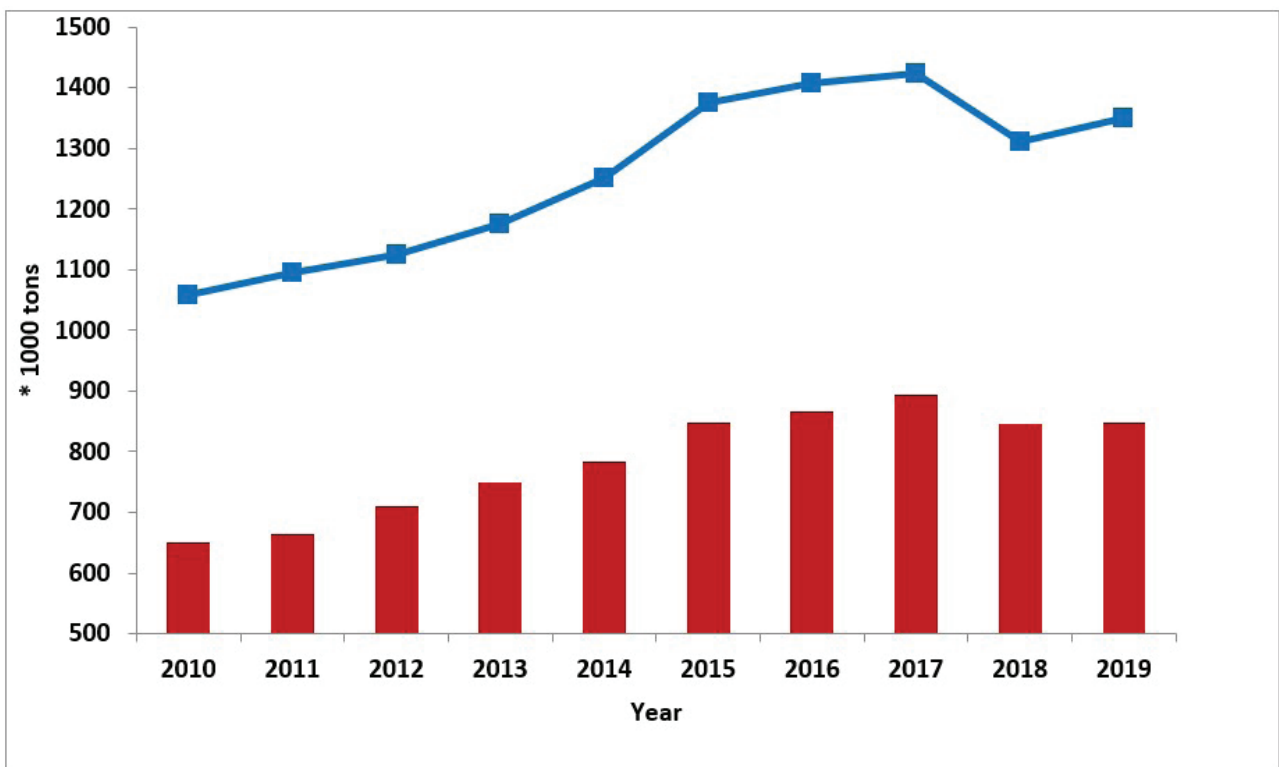
The Tunisian experience in the field of purebred dairy cattle dates to the 1970s when Tunisia formed its first nucleus of herds of cows imported from Holland (Friesians). The cattle herd at the time numbered 407,000 cows, 93% of which were of the autochthonous type with a low level of production. As a result, Tunisia suffered a large milk shortage and was dependent on the import of powdered milk to satisfy local demand for milk and its derivatives. Following the establishment of the Office de l'Élevage et des Pâturages (OEP) and private initiatives in the dairy industry fifty years later, the situation has altered, and the 401,000-cow bovine herd now consists of 58% purebred cows with a Holstein dominance and 42% crossbred native cows. Tunisia started to experience issues with seasonal dairy surpluses after reaching a dairy surplus in 1999. (Djemali et al., 2016). Figure 1 displays the country's cow population trends (10).





**Figure 10.** Cow population trends in Tunisia (AU-IBAR-DLVCs Tunisia country report, 2020)

Trends in Tunisia’s milk production and collection reveal an increase in both national milk output and milk collection (figure 11). After 2015, efforts to collect the nation’s milk produced an average of 70% of the nation’s total annual milk production of more than 1.3 thousand tonnes (AU-IBAR-DLVCs Tunisia country report, 2020).



**Figure 11.** Trends in milk produced and collected in Tunisia (AU-IBAR-DLVC-Tunisia country report, 2020)

It is important to note that total milk production is increasing annually with the same cow population size. This is, in part, due to the change in the genetic makeup of the dairy cattle population in Tunisia. Since Tunisia decided to import specialised dairy breeds, mostly Holsteins since the 1970s, there has been a continuous rise in the number of purebred dairy cattle and their crosses. Tunisia continues to import purebred heifers and sperm from other nations (Table 20). Since 2013, more than 4,000

heifers have been brought into Tunisia. A Ministerial Order of the MARH (April 16, 2001, JORT N ° 32 of April 20, 2001) to promote and develop markets of quality heifers designed for the renewal and increase of herd sizes related to the establishment of centres for the production of pregnant heifers was released. (B.S. Romadhani, 2020).

**Table 20.** Imported purebred heifers in Tunisia.

Year	2013	2014	2015	2016	2017	2018	2019
Heifers	1091	389	643	228	362	647	805

Dairy cattle are the most important provider of milk in the country and a key component of its national Dairy Value Chain. Small ruminants (sheep and goats) and dromedaries are mainly raised in low input production systems with meat production as their main output. The Sicilo Sarde bred in Northern Tunisia is the only specialised sheep dairy breed (AU-IBAR Desk review report, 2019). Less than 4% of the nation’s total milk production comes from tiny ruminants and dromedaries. In 2017, the average amount of milk consumed nationally per person was 117 litres. Between 1994 and 2017, milk consumption increased by 32%. (AU-IBAR-DLVCs Tunisia country report, 2020).

As stated in the national DLVCs country report of Tunisia (2020) “Tunisia’s dairy livestock chain plays an important economic and nutritional role in the lives of many people ranging from farmers to milk hawkers, processors, and consumers. Nearly 11% of the value of agricultural production, 25% of the value of animal production, 7% of the value of the agro-food business, and 40% of the value of employment in the agricultural sector are contributed by the dairy industry. Around 94 percent of the nation’s milk is produced by the approximately 112,000 cattle owners, the bulk of whom are small-scale farmers who have one to five dairy animals. Since 1960, milk collection and processing have improved and expanded. According to the AU-IBAR-DLVC Tunisia country report, 2020, there are an estimated 45 dairy industrial facilities with a processing capacity of roughly 5.5 million liters/day as well as a nationwide network of artisanal transformers with a sizable and diverse distribution network. Milk collecting network counts 245 centers with a collecting capacity exceeding 2.6 million liters/day. Cattle provide about 98% of the national milk production. According to the AU-IBAR-NA Report, 2019, the dairy livestock value chain in Tunisia is based mainly on cattle milk produced locally, collected, processed and marketed. It represents the most important economical-social-environmental DLVC in Tunisia” ((AU-IBAR-DLVCs Tunisia country report, 2020). Diagram (1) illustrates the Dairy milk value chain for the UHT milk and Box (7) describes the different levels of the dairy cattle milk value chain.

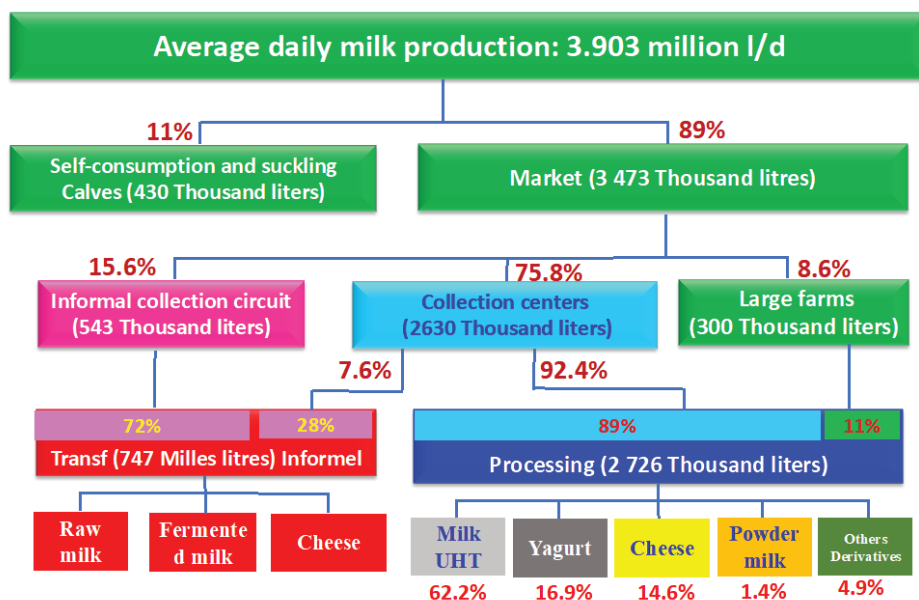


Diagram 1. Dairy Milk Value Chain for UHT milk in Tunisia (AU-IBAR-DLVC-Tunisia country report, 2020).

**Box 7. Main stakeholders of the DMVC in Tunisia as reported by the AU-IBAR-DLVC Tunisia country report (2020).**

**Production:** In Tunisia, there are 112,000 dairy producing farms with an average of 2-3 cows. The large majority is represented by small holders (94%) with less than 10 cows.

**Collecting centers:** In 2017, Tunisia has 240 collecting centers (out of which 205 are HACCP certified) with a total collection capacity exceeding 2.8 million liters of milk per day. Most of the collecting centers are private and others belong to SMSA (Sociétés Mutuelles de Services Agricoles). Milk collecting centers collect milk twice a day from small farmers and bulk it for transportation to processing units. They collect more than 75% of the milk produced.

**Hawkers:** Hawkercs are the links between farmers and other links in the supply chain. In most cases, hawkers collect milk for collecting centers. Processors and wholesalers are also buying from them directly. The hawker benefits from the lack of organization among the producers.

**Processing industry:** In Tunisia, the drink milk represents 75% of total milk processed, whereas yogurts and cheeses represent only 13-17% and 8-15% of total volumes, respectively. The remaining 4% are converted to dried milk other derivatives. The dairy industry is currently undergoing major changes. The two most recent investments are: the Sidi-Bouزيد dairy plant (CLSB) “Délice Group” with a processing capacity of 500 thousand liter/day and the Bizerte dairy plant (CLB) “Natilait Group” with a processing capacity of 300 thousand liter/day. Two ongoing projects are: The dairy plant in Kairouan with a processing capacity of 400 thousand liter/day and the dairy plant in Béja with a processing capacity of 300 thousand liter/day. Three major private actors share the processing activities of milk in the country: 1) The multinational Delice Danone group handling 50% of the overall drinking milk market shares

and 70% of total sales of yogurts.. The two others are Vitalait and Laino, both active in drinking milk and yogurts, but with limited market shares. Tunisia has a long tradition of cheese processing and some companies are specialized in like the Centrale des Produits Laitiers Souani, which represent 60% of total cheese production of the country.

### ***Distribution***

#### ***Wholesale***

Wholesale agents spread throughout the country and sometimes are linked to contracts with the large central dairies who play a crucial role in supplying small neighborhood grocery stores on a daily basis.

#### ***Retail and foodservice***

Over the last decade, the modern retail sector has seen in-depth development fueled by the expansion of modern distribution outlets, supermarkets, and hypermarkets through joint ventures with foreign investors, mostly with France, including Carrefour and Casino groups (Geant and Monoprix). Although the traditional distribution network, based on over 210,000 neighborhood grocery shops scattered throughout the country, continues to dominate the Tunisian market, modern distribution channels are growing rapidly. It represents now 20% of the Tunisian retail sector with a goal to increase the level to 50% in the next years. Currently, there are roughly 252 modern food retail outlets: 3 hypermarkets, 150 supermarkets and 100 'Superettes' (self-service food outlets with area less than 500 sq. m). Three main companies have emerged as the market leaders, namely Group Mabrouk (Monoprix, Géant), Ulysse Hyper Distribution (Carrefour, Carrefour Market, Carrefour Express) and Magasin Général Group. High-end hotels do import specialty cheese either directly or via import companies. Since the end of the 1990's, despite reaching a state of self-sufficiency, the dairy industry is still very unstable and has experienced successive periods of gluts and shortages. As a result, Tunisia continues to receive ad hoc imports. The main imported products are milk (in various forms), condensed whey and cheeses, mostly destined for melting. France and the Netherlands are the most important partners in supplying Tunisia with dairy products. Tunisia mainly exports to Libya (about 85% in weight). The lack of visibility did not allow the Tunisians operators to build a sustainable export strategy for UHT milk despite the opportunities (Libya, Mauritania, African countries ...). The government controls the milk supply chain and intervenes on prices based on conjunctural situations. Exporters suffer from the unstable market that is not governed by supply and demand.

## DLVCs Breeding Goals and Breeding stocks gaps in Tunisia

Tunisia has invested in dairy genetic to empower its national capacity to produce milk and meet the relatively growing population and changing consumers demand for livestock products. In 2018, the number of identified cows (national animal identification system) was 120 000. 50 000 were found by the Ministry of Agriculture's Livestock and Pasture Office (OEP), while the remaining ones were found by the private sector (OEP, 2018). 20 000 cows in all are registered with the National Milk Recording System. They are owned by 803 owners, of whom 752 are private and mostly small to medium-sized proprietors. Table (21), which reports cattle trends for purebred and native crossbred cows).

**Table 21.** Dairy cattle in Tunisia (1000 cows) by genotype\*

Years	2013	2014	2015	2016	2017	2018	2019	2020	Evolution Rate
Pure Breed	228	232	236	239	243	247	251	255	+1.6%
Local & Cross population	196	191	187	185	184	185	187	190	-0.4%
Total	424	423	423	424	427	432	438	445	+0.9%

\*Romdhani, B.S. (2020)

Table (22) illustrates that Tunisia is capable to produce good quality breeding stocks by valuing the identified recorded 20 000 purebred cows.

**Table 22.** Tunisia capacity in producing good quality pure bred dairy heifers

OPERATIONAL MODEL	Tunisia
Number of cows identified with milk recorded	20000
Fertility	0,8
Number of born calves	16000
Mortality 5%	800
Number of live calves	15200
Number of female calves	7600
Culled females 10%	760
Produced females	6840
Natinal Dairy herds culling rate of replacements 20%	4000
SURPLUS HEIFERS	2840

Tunisia has extensive knowledge and a well-established network of centres for breeding dairy cow heifers. In 2010, 11450 purebred heifers were produced in 54 sites in Tunisia to meet domestic demand. Two significant state organizations—the State Farms Office (OTD) and the Livestock and Pasture Office (OEP)—combine to make up the majority of these centres (Djemali, 2016). Such a group might include a financing request for South-South Cooperation and enable nations in the area to gain from this firsthand knowledge (IsDB Linkage project, 2019). The National Genetic Improvement Center (OEP) in Sidi Thabet is home to a total of 15 young bulls from three breeds—Holstein (4), Tarentaise (3), and Brown Swiss (8)—for the purpose of producing semen. Bulls are not progeny tested but selected on their pedigree Index. A Master research work was conducted in 2017 (Arjoun A. and M. Djemali), 2017) to describe the potential and gaps of bull testing in Tunisia. Main

results showed that the genetic breeding values and average seminal characteristics of the different bulls were low. For the Holstein breed, the index of fat percent varied between -0.46 and + 0.04 and the index of protein percent was between -0.03 and + 0.14. For the Brown Swiss breed, the index of milk of bull sires varied between +10 kg to +660kg, the % fat index was between -0.03 and +0.23 and the index of protein % was between +0.01% and +0.16. For the Tarentaise breed, the index of milk of bull sires varied between +300 kg and +557 kg of milk, however no information was provided for % of fat or % of protein. Seminal characteristics (volume of ejaculation, semen concentration, motility and percentage of live sperm cells and the number of total doses produced by ejaculation) were relatively low. They were on average  $3.34 \pm 0.97$  ml;  $1251.83 \pm 126.106$  spz / ml;  $3.7 \pm 0.43$ ;  $66.83 \pm 3.54\%$  and  $200.51 \pm 61.9$ . With the exception of the quantity of total doses produced by ejaculate, all discovered seminal characteristics in young Holstein bulls were higher than the average (194). Brown Swiss young bulls were below average, while Tarentaise young bulls were above average. The procedure employed in Tunisia to choose young bulls was found to be far from the standards set by tests on dairy bulls. Based on a standard procedure and a programme for evaluating dairy bulls, it should be enhanced. This is an opportunity for AU-IBAR to fine-tune a practical programme for the region's production of tested semen. Notably, Tunisia has advanced in its use of genomic evaluation of its dairy cattle. A PhD thesis is in Progress in collaboration between the National Institute of Agriculture of Tunisia (INAT) and the University of Perugia (Italy). With the genomic breakthroughs, it is now possible to evaluate young bulls at birth and avoid progeny testing procedures. AU-IBAR can have a catalytic back up action to speed up the Tunisian genomic work. The output of this catalytic action can serve all countries in the region.

#### Marketing Heifers and milk products

Despite the fact that dairy products like cheese, yoghurt, and butter all follow market laws, the price of milk is still currently regulated by the government. Governments have implemented a strategy to increase output by establishing a minimum price for farm-fresh milk that would be paid to the farmer (Romadhani, B.S., 2020). In 2017, the government provides the farmer with a fixed price of 766 millimes per litre of milk. The processors receive 175 millimes, whereas approved collecting centres earn a premium of 70 millimes per litre. They receive 50 cents each month for the stock of 1 L UHT milk. The consumer price is fixed again (Romadhani, B.S., 2020). In 2017, the number of imported straws was 190,000 in the Holstein breed, 20,000 in Brunus des Alpes and 200 in Tarentaise. In 2018, the total number of imported straws was 140,000 in the Holstein breed, 48,000 in Brunus des Alpes and 2,250 in Tarentaise. The Government allows incentives to heifers breeding centers going from 300 to 700 TD. Prices of heifers increased from 3000 TD (2017) to 7000 TN (2019) (Romdhani, BS, 2020).

### *Risk and Disaster Management Systems*

Regional imbalances and the democratic transition method that Tunisians adopted at the beginning of 2011 both hurt the Tunisian economy. GDP dropped by -4.4%. (Romdhani, B.S. 2020). The following rules and laws apply to the DLVCs listed in Tunisia's DLVCs country report (2020):

- The decision of April 28, 1985, relating to Special health measures to be taken to combat mammalian tuberculosis in its open state.
- Order of 22 July 1985 approving Tunisian standards relating to the presentation and labeling of prepackaged foodstuffs;
- Order of October 29, 1991, approving Tunisian standards relating to methods of analysis of milk and derivatives
- Order of 29 October 1991 on the approval of Tunisian standards relating to the specifications of products derived from milk
- Law 92-117 of December 17, 1992, relating to consumer protection;
- Order of 22 July 1994 approving Tunisian standards relating to the analysis of products derived from milk;
- Decree n ° 775 of 2001 dated March 29, 2001, regulating the management of pure heifers and those born locally and trade in breeding activity.
- The decree of April 16, 2001, approving the specifications of the conditions governing the management of heifers and trading in the breeding activity of the pure and locally bred heifers.
- NT 14.141 (2004) Raw Milk Intended for Processing - Specifications
- Law 95 of 2005 of 18 October 2005 related to livestock and animal products.
- Order of the Minister of Agriculture and Water Resources of May 26, 2006, setting the terms of veterinary health control, the conditions and procedures for granting health approval for establishments for the production, processing and packaging of products. animals.
- Order of the Minister of Agriculture and Water Resources dated October 21, 2006, approving the specifications for milk collection and transport centers.
- Order of the Minister of Industry, Energy and Small and Medium-Sized Enterprises dated 23 August 2006 approving Tunisian standards relating to raw milk intended for processing and fermented milk.
- Order of the Minister of Agriculture and Water Resources of October 21, 2006, approving the specifications setting the standards for livestock buildings and their equipment.
- Order of May 26, 2006, laying down the methods of veterinary health control, the conditions and procedures for granting health approval for establishments producing, processing and packaging animal products;
- Order of 23 August 2006 on the approval of Tunisian standards relating to raw milk intended for processing and fermented milk;
- Decree of the Minister of Commerce and Crafts, the Minister of Agriculture and Water Resources, the Minister of Finance, the Minister of Industry, Energy and Small and Medium Enterprises of April 30, 2007, fixing the support premium for the selling price of milk powder manufactured from locally produced milk for 2007
- Decree of September 3, 2008, on the labeling and presentation of prepackaged food;
- Decree No. 2009-2293 of July 31, 2009, amending Decree No. 91-1391 of September 23, 1991, relating to the institution of import levy for milk powder.
- Joint decree of the Minister of Agriculture and Water Resources, the Minister of the Interior and Local Development, the Minister of Public Health and the Minister of Trade and Handicrafts of

January 5, 2009, approving the notebook charges fixing the conditions for the transport of fresh milk.

- Order of 5 January 2009 approving the specifications setting the conditions for the transport of fresh milk;
- Order of the Minister of Agriculture and the Environment dated 23 June 2011, approving the specifications relating to the creation of collection and transport centers for fresh milk.
- Decree No. 2012-793 of July 10, 2012, establishing a premium for the State's contribution to the costs of drying fresh milk produced locally and setting the terms and procedures for its granting.
- Order of the Minister of Health, the Minister of Industry, the Minister of Trade and Crafts, the Minister of Agriculture and the Minister of Equipment and the Environment dated 13 May 2013, fixing the list maximum limits for certain contaminants in foodstuffs and methods of sampling and analysis for official control.
- Decree of the Minister of Industry of April 16, 2013, annulling the compulsory nature of Tunisian standards in the food industries sector.
- Order of the Minister of Industry of April 16, 2013, annulling the mandatory nature of Tunisian standards in the food industries sector.
- Decree n ° 2014-1324 of April 23, 2014, modifying decree n ° 2012-793 of July 10, 2012, establishing a premium for the State contribution to the costs of drying fresh milk produced locally and fixing the terms and procedures for its granting.
- Decree of the Minister of Agriculture of January 27, 2014, amending and supplementing the decree of the Minister of Agriculture and Water Resources of May 26, 2006, setting the terms of veterinary health control, the conditions and procedures for granting sanitary approval of establishments producing, processing and packaging animal products.
- Order of the Minister of Agriculture, Water Resources and Fisheries of July 29, 2015, supplementing the master plan for collection and transport centers for fresh milk approved by the order of August 2, 2013.
- Government decree n ° 2017-1403 of December 29, 2017, amending and supplementing decree n ° 2012-793 of July 10, 2012, establishing a premium for the State contribution to the costs of drying fresh milk produced locally and setting the terms and procedures for its granting.
- Order of the Minister of Agriculture, Water Resources and Fisheries of May 31, 2018, approving the master plan for collection and transport centers for fresh milk.

## *Road map and selected Tunisia priorities*

Despite the fact that Tunisia's DLVC country report did not adhere to the AU-IBAR-DLVC guidelines for evaluating, in a quantified way, areas in need of policy development and interventions to improve productivity, sustainability, and resilience of the chosen dairy cattle value chain, national priorities were given as shown in the box (8). Without even taking into account the involvement of regional stakeholders, they provided the tables following the validation session.



### **Box 8. Tunisia priorities in DLVCs empowerment**

**Location:** Sidi Thabet

An irrigated area with a dairy basin.

**Number of small/medium holders:** 150 <with 600 cows

One Milk Collecting Center

#### **Catalytic actions selected:**

1. Health
2. Heifers production (Animal identification and milk recording)
3. Smart herd management (feeding, rearing, management, ...)
4. Farmers organization

**Implementers:** OEP, MCC, Heifers Center, IRESA, Inter Profession

## **Dairy Livestock Value Chain in Algeria**

Algeria is the largest country in Africa by area. Its northern border is the Mediterranean Sea, and its eastern, western, and southern borders are Tunisia, Morocco, and Mali and Niger. Its 1600 km of Mediterranean Sea coastline are long and steep, with some mountainous areas in the north. Steppes and the Sahara Desert are found in the south. Algeria's food industry has long been distinguished by a qualified agro-importer system made feasible by oil profits. Only around 40% of Algeria's raw milk need is met locally, and the other 60% is imported as powder to meet the country's anticipated annual milk demands of more than 3.5 billion litres. Each year, Algeria imports between 250,000 and 280,000 tonnes of powdered milk. The level of milk collection remains low (25%) relative to the potential of national production estimated at 2.5 billion liters per year. The national cattle population is composed by approximately 1 million dairy cows contributing with 80% of the total milk produced in the country. Small holders with less than 3 cows represent 85% of 250 000 farmers (Kardjadj and Luka, 2016). Table 1 illustrates how different types of cattle contribute to local milk production in Algeria (23). The top four contributors are cattle (72%), sheep (16%), goats (10%), and dromedaries (2%). (Meribai et al. 2016). However, according to Kardjaj and Luka (2016), cattle now account for 80% of the nation's milk production.

**Table 23.** Local milk production by species

Species	Cattle	Goats	Sheep	Dromedaries
Number	951.03	2500.103	135.105	185.103
Owners	215.103	200.103	350000	10.103
Average size/owner	04	12	38	18
Milk produced (Tons)	186.103 (72%)	250.103(10%)	400.103 (16%)	50.103 (02%)

are made Less than 1000 delivery collectors are now working in the industry. More than 80% of the population's milk demands are met by milk processing businesses. They are made up of the following: 1) Public production units grouped under the Industrial Group of Milk Production (Giplait); 2) Medium-sized private companies that emerged from joint ventures with foreign firms; and 3) Small private firms with a regional base and specialisation in the production of one or more goods, such as cheese. The majority of the fresh or soft cheeses, yoghurts, and liquid milks produced in Algeria are prepared from imported milk powder. In Algeria, a state-owned cooperative called GIPLAIT processes powdered milk. It produces 30% yoghurt and cheese and 70% milk. liters Actual raw milk produced in the nation is processed at private facilities controlled by Candia and Danone. The amount of milk consumed on average by each person rose from 34 litres in 1970 to 121 litres in 2006 before falling to 110 litres. The worldwide milk crisis of 2008 and the doubling of the price of milk powder (3,900 USD per tonne) were to blame for this, which created a problem in the supply of milk on the Algerian market. Algeria aims to increase the quantity and quality of fresh milk production through investments and incentives in the local dairy cattle industry, as well as through the importation of specialised purebred cows and semen, better feed, improved hygiene, effective collection milk centres, and modernization of the processing facilities. (AU-IBAR-Desk review-MVC North Africa report, 2019).

Algeria is still with a great potential to boost its dairy cattle milk production as well. The AU-IBAR is invited to give Algeria a chance to assess its LDVCs profiles by including Algeria in a National consultancy similar to the ones conducted for Egypt, Mauritania, Morocco and Tunisia. Algeria can benefit from the North Africa Pilot project (North Africa-Dairy) to establish well-identified breeding objectives, reliable identification and recording systems while empowering small and medium holders within dairy cattle value chains. This option will give Algeria an opportunity to strengthen its milk collecting system and produce its own good quality breeding stocks (heifers)

## *Dairy LVCs in Libya*

The total area of Libya is approximately 1.76 million km<sup>2</sup>. The Mediterranean Sea forms its northern boundary, followed by Egypt in the east, Sudan in the southeast, Chad and Niger in the south, and Algeria and Tunisia in the west. According to the FAO country profile for Libya (2016), four distinct physiographic regions can be identified:

1. The coastal plains that run along the Libyan coast and vary in width;
2. The northern mountains that run close to the coastal plains and include the Jabal Nafusah in the

- west and the Jabal al Akhdar in the east;
3. The internal depressions that cover the center of Libya and include several oases;
  4. The southern and western mountains.

About 95 percent of the country is desert. The northern Tripoli region (Jabal Nafusah and Jifarah plains) and the northern Benghazi region (Jabal al Akhdar) have the highest rainfall, and these two regions are the only ones where the average annual rainfall is greater than the minimum value (250–300 mm) thought to be required to support rainfed agriculture. Winter months (October to March) are when it rains, but there is a lot of variation from location to location and year to year. 56 mm of rain falls on average per year across the entire nation. Agriculture employed about 6% of the active population in 2008 and contributed 1.9 percent to the GDP (GIA, UNDP, 2008). Livestock is important with poultry (24.8 million estimated in 2008), small ruminants (5.1 million sheep, 1.9 million goats) and cattle (210 000). Only small amounts of meat and dry milk are imported, but the sector relies heavily on subsidized imports of animal feed. There are currently about 170 000 farm holders of which almost 40 percent are full-time farmers. Close to 90 percent of the farms are less than 20 ha and only 1 percent greater than 100 ha (WFP and FAO, 2011).

### *Milk Value Chains in Libya*

To meet its domestic demand for milk and milk derivatives, Libya depended on imports of powdered milk. The importation of exotic, specially bred dairy animals and their sperm is now being used to promote local milk production. The situation with regard to DLVCs in Libya is challenging to characterise as a result of the catastrophic war that the nation experienced. When the political situation has been resolved, the AU-IBAR is invited to provide Libya a chance to evaluate the characteristics of its LDVCs by incorporating Libya in a national consultancy similar to those carried out for Egypt, Mauritania, Morocco, and Tunisia. Libya can benefit from the North Africa Pilot project (North Africa-Dairy) to establish well-identified breeding objectives, reliable identification and recording systems while empowering small and medium holders within dairy cattle value chains. This option will give Libya an opportunity to strengthen its milk collecting system and produce its own good quality breeding stocks (heifers) while upgrading its existing Artificial Insemination Center.

### *Capacity of North Africa to implement DLVCs Strategic Actions*

There are 203 million inhabitants in the North African region (which includes the UMA members and Egypt), and the demand for animal products is constantly rising. Arable land (10% of the region's total size of 706 million ha) and water resources are also limiting inputs. Despite having a large number of genetically diverse animals (13 million cattle, 3 million buffalo, 72 million sheep, 25 million goats, and 4 million dromedaries, to name a few), the region still imports milk, live breeding stock, and semen due to a lack of cogent breeding objectives for dairy cattle and sustainable breeding practises. The main socio-economical DLVC in the region was identified to be cattle milk value chain with some specificities (Egypt: Cattle and Buffalo) and Mauritania (Cattle, dromedary, goats and sheep).

Dairy cattle are contributing by the highest amounts of milk produced in the region with more than 90% of herds held by small to medium holders. Breeding objectives for the region's value chains for cattle milk have not yet been established in a trustworthy scientific manner. The dairy industry does not properly respect animal identification and registration, and there are still no genetic evaluation methodologies or sustainable breeding programmes. For the region to achieve the goals of the Live2Africa livestock development plan and the AU-IBAR regional DLVCs consultancies, empowering small holders inside the established cattle milk value chains and buffalo milk value chains, in the instance of Egypt, represents a promising avenue. The overview of the region's DLVCs (table 24) demonstrates that there is still space for development in the region's DLVCs across all of its various segment levels.

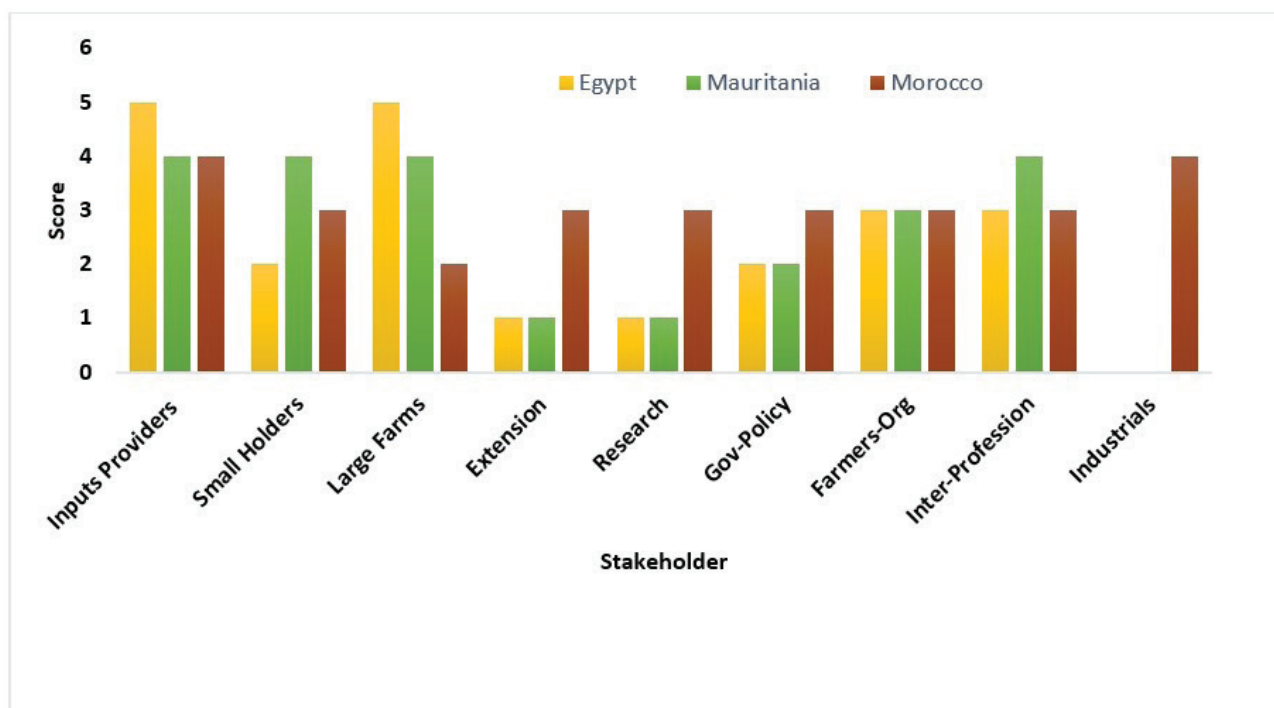
**Table 24.** Summary of basic DLVCs in North Africa Region

Country	Percent contribution in milk in the country						Self-consumption and traditional process	Milk collecting and processing through Organized channels	Average milk consumption / capita/year (kg)	Dairy producers (1000)	Small and medium holders %
	Cattle	Buffalo	Goats	Sheep	Dromedary	Imported Milk Powder					
Algeria	40					60	40	25	143		
Egypt	56	44								6 000	90
Libya										170	
Mauritania	44		23	3	31		72	4	168		
Morocco	96		2		2		20	80	74	260	90
Tunisia	96		1	2	1		38	70	117	112	94

### *Influence of main Dairy Cattle Value Chains Stakeholders at the milk production level*

The significance of the stakeholders' responsibilities and influence at the milk production level was evaluated in DLVC's country reports. Scores ranged from 1 to 5, with 5 denoting the most crucial role. The results for Egypt, Mauritania, and Morocco are summarised in Figure (12). Algeria and Libya did not take part in the current consultation, and Tunisia did not submit its evaluation. The input suppliers who serve the dairy cattle value chain tend to have the most sway at the production level. They are the ones who provide the bulk of the producers' inputs (feed grains, machinery, semen, veterinary services, etc.). In Mauritania and Morocco, small farmers have considerable sway. In Egypt, large dairy farms dominate. Small and large farms are equivalent in Mauritania in relation to their roles at the production level. Research and Extension roles at the Dairy cattle milk production level are relatively low in Egypt and Mauritania and higher in Morocco. The same can be said of government initiatives and policies. In Morocco, the milk processors have a lot of power. It is challenging to transfer scores that affect inter-professional and farmer groups into reality, particularly for Egypt and Mauritania. The

scoring may not have been based on the actual situation but rather on a judgement of the significance of these groups to the level of production.



**Figure 12.** Influence of Dairy Bovine Value chain stakeholders at the production level

### *Influence of main Dairy Cattle Value Chains Stakeholders at the milk collecting level*

According to the analysis of dairy cattle value chain stakeholders at the milk collection level, farmers' organisations, interprofessional organisations, and dairy industries all play significant roles and are significant to the milk collection system in Morocco. Second in significance to major dairy farms and research are input suppliers, small farmers, and Extension. Small landowners and huge herds are equally important to Mauritania's milk collection system. Large dairy farms are more influential than small holders in relation to milk collecting centers of the dairy chain. Research and extension ties with milk collecting centers are relatively weak in both Egypt and Mauritania.



Figure 13. Influence of Dairy Bovine Value Stakeholders on collecting milk level

### Influence of main Dairy Cattle Value Chains Stakeholders at the milk Processing level

Figure illustrates the roles and influence of dairy cattle value chain participants at the milk processing stage (14). Large farmers and input suppliers are the most influential, followed by inter-professional groups.

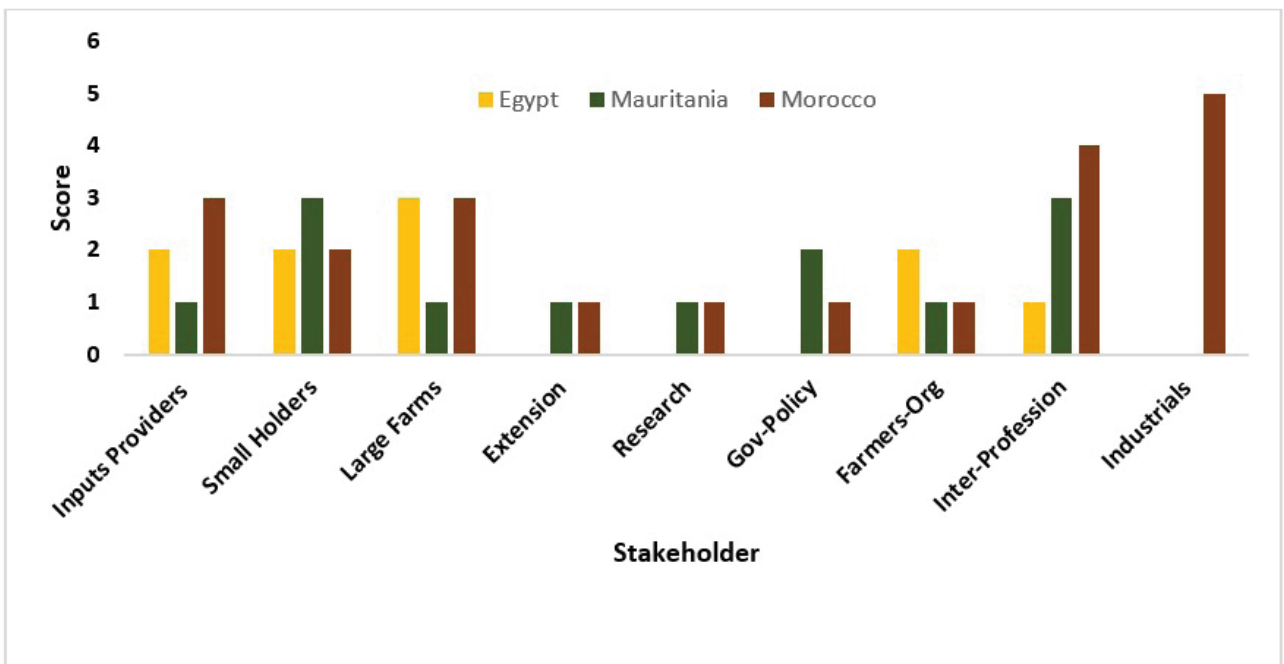
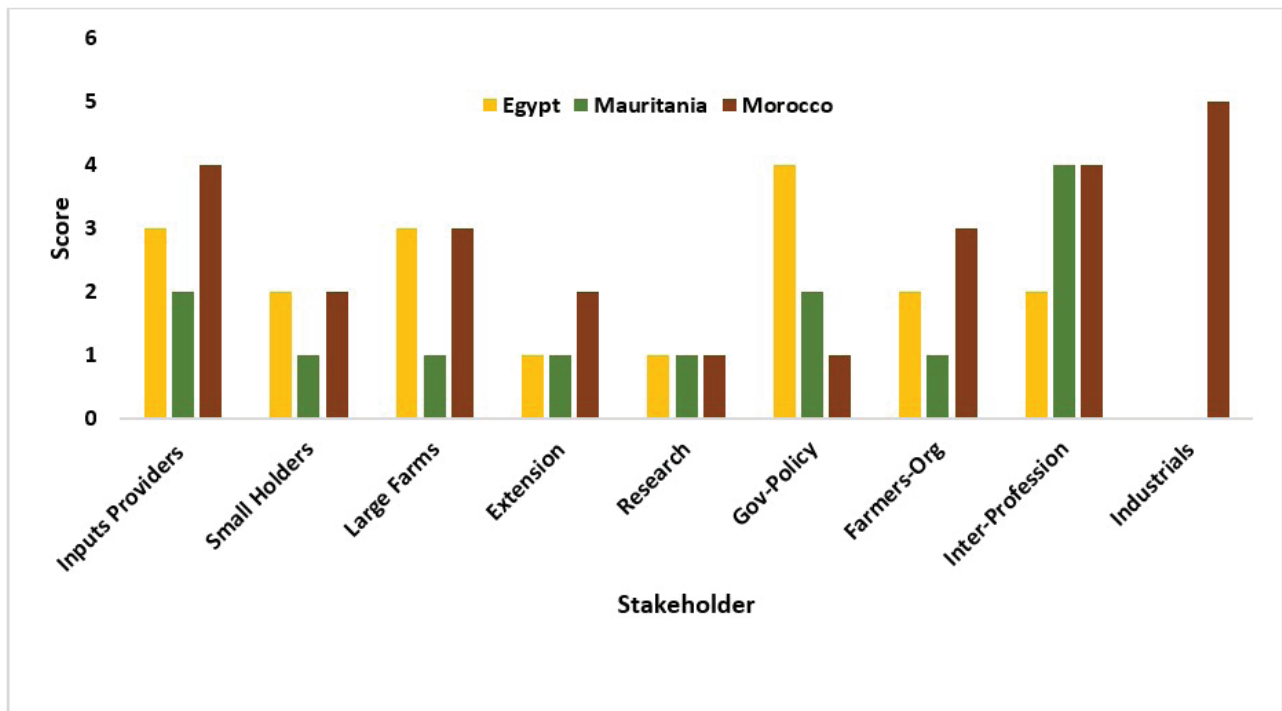


Figure 14. Influence of Dairy Bovine Value Stakeholders on milk processing level

## *Influence of main Dairy Cattle Value Chains Stakeholders at the milk marketing level*

Figure 15 illustrates how the Dairy Bovine Chain stakeholders have an impact at the market level (16). This means that at the marketing level, input suppliers, interprofessionals, and dairy industries do have a disproportionately large impact.



**Figure 15.** Influence of Dairy Bovine stakeholders at the marketing level

## *DLVCs relationships among its stakeholders*

Figure 16 depicts the connections between the Dairy Bovine Chain’s stakeholders in the region of North Africa (16). The strong ties that large farms and small farms have with farm organisations and milk collection facilities at the production level of the dairy bovine chain may be clearly seen. Both large farms and small farmers have sway at the milk collection centre. The market has a significant impact on the milk processing level. Both large farms and small landowners have a significant impact on the farm organisation. The lack of small farmers organizations in the majority of countries in the region is a real weakness to overcome. A work conducted in Tunisia on the assessment of small holders’ roles within Dairy cattle value chain, based on the “Impact Management System” approach (IMS, 2020) revealed that the majority of the dairy value chain were not in favor for small farmers to be organized (Jammeli and Ben Naceur, 2020)

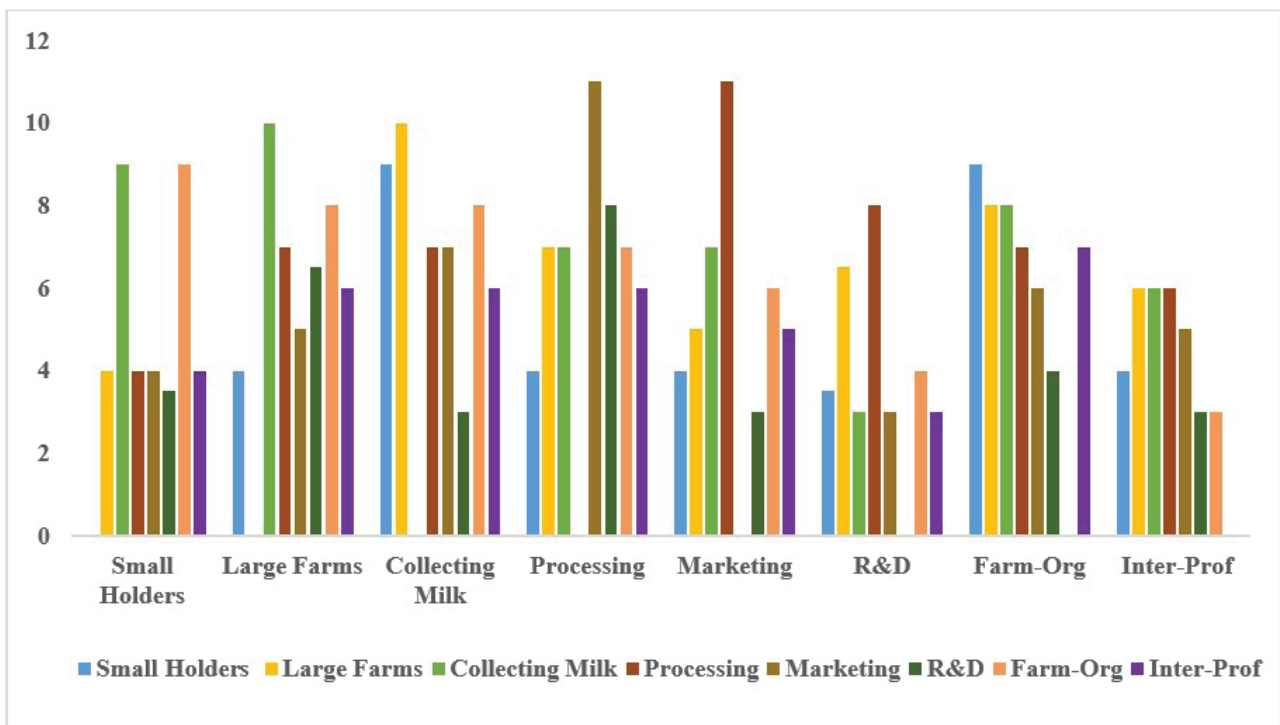


Figure 16. Relationships among the Dairy Bovine Chain Value in North Africa

## North Africa DLVCs Strategic Actions and models for implementation

North Africa DLVCs present common features with specific characteristics. The six countries have based their DLVCs on dairy bovine that produce most of the regional total milk volume. Almost 100 % of milk produced in Egypt is coming from bovine (56 % from cattle and 44 % from buffalo), more than 96% of milk in Morocco and Tunisia is coming from dairy cattle and 44% of milk in Mauritania is coming from cattle (Dromedary 31 %, goats 23 % and sheep 3 %). Since more than 40 years ago, the majority of North African nations have opted to either import milk powder (Algeria and Libya) to meet the need of their expanding populations or exotic dairy breeds to produce milk locally. More than 5 million dairy females and possibly more with their semen requirements were brought into the region, but the position of DLVCs in each country is still precarious at every level, particularly at the production level. Compared to the other DLVCs stakeholders, most dairy producers are tiny holders without any clout (Milk collecting centers, processors and distributors). Historically, the dairy bovine was a native producing unit. Today the dairy bovine unit's genetic composition has changed. It is a pure exotic or native cross. They both represent today more than 50 % of the total bovine population. These producing biological units (cows) are in constant need to be bred by imported semen, besides their high feeding costs. All countries, when asked to examine the breeding goals of the most dominant DLVCs, answered either in theory or in vague concepts translating the urgent need to focus and address breeding goals in practice. Breeding goals are a trait, or several traits weighted by their economical computed weights based on milk production costs and prices and including farmers' choices. To achieve the identified breeding goals, traits of interest should be measured and animals breeding values predicted. In doing so, breeding goals can be achieved.



Egypt, Mauritania, Morocco, and Tunisia look to be able to produce a maximum of more than 103 000 heifers and a minimum of more than 11 000 high-quality heifers for the North Africa Regional Heifers market, according to the DLVCs national reports on each of these countries (table 25). Through the Live2Africa project, AU-IBAR can significantly contribute to helping the North African region realise its potential for generating high-quality breeding stock.

**Table 25.** Egypt, Morocco and Tunisia capacity to produce dairy cattle heifers

Operational model	Egypt		Morocco		Tunisia	
	Identified cattle only	Identified cattle with dairy records	Identified cattle only	Identified cattle with dairy records	Identified cattle only	Identified cattle with dairy records
Cows	124000	NA	480000	60000	120000	20000
Fertility	0.8		0.8	0.8	0.8	0.8
Born calves	99200		384000	48000	96000	16000
Calf mortality (5%)	4960		19200	2400	4800	800
Live calves	94240		364800	45600	91200	15200
Live female calves	47120		182400	22800	45600	7600
Culled female calves (10%)	4712		18240	2280	4560	760
Produced females	42408		164600	20520	41040	6840
National Dairy herds replacement needs (20%)	24800		96000	12000	24000	4000
<b>SURPLUS HEIFERS</b>	<b>17608</b>		<b>68160</b>	<b>8520</b>	<b>17040</b>	<b>2840</b>

A regional North Africa was developed and proposed (North Africa-Dairy). The project took into considerations three North Africa DLVCs recommended main priorities: 1) Valuation of Dairy herds to produce good quality breeding stocks, 2) Valuation of Animal Natural Feed resources and 3) Building capacity through training and farmers organization focusing on small and medium holders.

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