



Characterisation of Case Studies

Bottom-up approach for services/dysservices linked to dairy farming

North Portugal

Main actors in the case study area, concerned by the services and dysservices provided by local dairy farming

2 farmers, 2 technicians (from the cooperative sector), 2 Universities, 1 participant related with the dairy industry, 1 Veterinary public administration, 1 Portuguese dairy federation, 1 Regional extension public services, 1 Public bureau for Agricultural policy and planning, 1 Dairy collector cooperative and 1 Journalist.

Invited Institutions/Entities:

- **Proleite** – Dairy4future local partner
- **Cooperativa Agrícola de Vila do Conde** - Dairy4future local partner
- **ICBAS - Universidade do Porto** – Oporto University
- **Instituto Politécnico de Castelo Branco** – Polytechnic Institut
- **Lactogal** – Dairy production and commerce
- **Gab. Planeamento, Políticas e Administração Geral** – Public bureau for Agricultural policy and planning
- **Direção Geral de Agricultura e Veterinária** – Agriculture and Veterinary public administration
- **FENALAC** – Dairy Federation
- **AGROS** – Dairy4future associated partner
- **C.M. Barcelos** – Barcelos City Coucil
- **APA, Agência Portuguesa do Ambiente** – Environment Portuguese Agency
- **Vida Económica**- Journalistic Editorial Group

Description and key figures

Portuguese North region constitutes the PT11 - NUTS II and comprises the territory between the Douro Valley (inclusive) and the Spanish border, in the northern part of mainland Portugal. It has a 568 km long border with Spain and 143 km of coastline.

The environmental conditions of the region are quite diverse due to the mountainous characteristics of the terrain, the difference in altitudes and the distance to the sea.

In the west area, near the coast, agricultural soils are fertile, typically classified as sandy-loams derived from granite, deep (> 1 m), well drained and with a slope commonly lower than 5% and, in general, located at altitudes below 400 m asl. In this area, the annual rainfall varies between 1200 and 1700 mm with 80% of that total occurring between October and April. The climate is Mediterranean type with a strong Atlantic influence. The average maximum temperatures of the hottest month varied from 24-26°C and common average minimum temperatures of the coldest month of 5-6°C.

In the inland area at the East, the relief is more rugged and soils less fertile and less suitable for arable crops. In most of this area the annual rainfall varies between 500 and 1000 mm, with a more concentrated distribution between October and April, characteristic of more pronounced Mediterranean climate. Daily and annual temperature amplitudes are bigger than in the coastal area with common average maximum temperatures of the hottest month of 28-30°C and average minimum temperatures of the coldest month of 0-4°C.

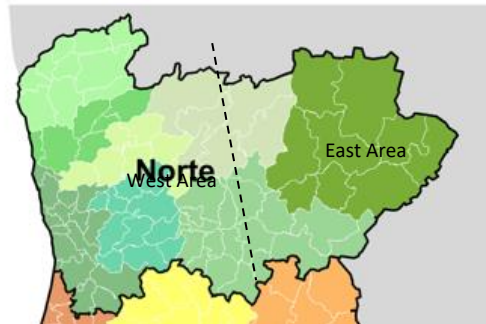


Figure 1. Portuguese North region (NUTS II - PT11). Different degrees of coloring represent different NUTS III units (adapted from INE, 2015)

Portuguese North region has a population of 3.7 million inhabitants (2018), representing approximately 35% of total Portuguese resident population. The west area is more densely populated (113 to 849 inhabitants per km², depending on the NUTS III) than the east area (23 to 55 inhabitants per km²). The distribution of the population by class of age shows a greater proportion on the class “> 65 years old” in the east area (ca. 30 % of the total population, compared to 20% in the west area) and a smaller percentage on the class “15 – 65 years old” (ca. 60% in the east, against 68% in the west) (Pordata, 2019). In 2013, the mean age of the North region farmers was 63 years, nevertheless one of the lowest values in mainland Portugal (GPP, 2016).

In 2018, active population in the North region was 1.83 million people, with an average unemployment rate of 7.3%; although, unemployment is higher in the young people (ca. 20% in the class of age “< 25 years old”).

The coastal area is predominantly urban and heavily industrialised, whereas in the inland area the primary sector still plays an important role. The region is characterised by traditional sector industries (e.g. textiles, clothing, footwear and metallurgy), but also encompasses medium- and high-tech sectors, in particular industrial equipment, automotive components, pharmaceuticals, precision equipment, communication equipment and computers. In 2013, economic activities in the secondary sector (manufacturing and construction) accounted for about 30.5 % of regional gross value added, which was the highest figure among all Portuguese regions. In 2016, the Norte region had the lowest GDP per capita in Portugal (EUR 15 200 as against the national average of EUR 17 900). https://research4committees.blog/2019/03/14/economic-social-and-territorial-situation-of-portugal/#_ftn1.

The share of active population by the primary, industry and services sectors is of 5.6, 34.1 and 60.3%; the average income in the same sectors, in 2018, was 848, 920 and 1 038 euros per month (Pordata, 2019). In 2017, the percentage of the region total population at-risk-of-poverty (after social transfers) was 18.6 %, being higher than the national value of 17.3% (INE, 2019).

The North Region has a total surface of 21 286 km² accounting for 23.1% of Portugal’s total surface area. This surface is distributed by the following uses: 7% of artificialized territories, 29% for agriculture (including grasslands), 38% for forestry, 23% of natural bushlands and 2% for other uses.

Arable land with annual crops represents one-third of the agricultural area (ca. 188 000 ha) (Alves, 2015). Maize forage is main crop for dairy production and occupies 36 000 ha, which is the agricultural area estimated for milk production in the region (official data not available).

In 2017, there was a total of 97 000 dairy cows (36% of Portuguese total) plus 74 000 replacement heads, in a total of 315 000 bovine heads in the region. The regional dairy herd is predominantly located in the west area. Bovines are the most important animals in the region. In addition to the bovines there are 61 000 swine heads, 283 000 sheep and 82 000 goat heads (INE 2018).

Main economic issues in the territory

The still low labor productivity.

Low level of specialization of the active population.

Main social issues in the territory

The demographic evolution (ageing and low birth rate) of the region.

The need to conciliate the professional and family life and the socio-professional role of the women in the society.

The low organizational level of the public sector services, lack of planning, poor management of the investments programs and the delay to take decisions. (Political issue?)

Main environmental issues in the territory

Pollution of water bodies by agricultural nitrates are a problem. The first cause of this issue is the intensive vegetable production and followed by the dairy farming.

Climate changes impacts on the agricultural ecosystems.

Main agricultural issues in the territory

Lack of an efficient Research, Development and Innovation system that can give answers to the main problems of the regional agriculture.

Small size of the holdings which in consequence leads to the intensification of the activities.

The lack of interest of the young generations to be farmers.

Main dairy farming systems in the territory

Dairy farming in the North Portuguese region is almost exclusively based on an intensive zero-grazing system based on two forage crops per year for silage making: maize and a winter crop consisting of annual ryegrass or a mixture of cereals with annual ryegrass. These crops reach high annual forage yields, typically 20-24 plus 7-9 t DM ha⁻¹ on the maize and on the winter crop, respectively.

Cows are fed with a total mix ratio (TMR) and kept “indoors” all around the year generally parked in covered and cemented cattle sheds where they are in semi-freedoms. The high forage yielding potential and the use of concentrate feed allow animal stocking rates of 4 to 6 LSU ha⁻¹ (including replacement herd). Cows’ replacement rates are very high reaching in many farms values over 30%. The storage capacity of liquid manure varies between 4 and 7 months. Slurry spreading to fields is mainly done twice a year just before the sowing of each crop, although application to the winter crop in February (top-dressed) has increased markedly in recent years. In addition to the slurry applied, often the crops receive mineral fertilizers at levels which may represent an extra annual input of 100-150 kg N ha⁻¹. Use of mineral phosphorus fertilizers is null in the majority of the farms and amounts of mineral N applied is decreasing as a result of technical advice and information campaigns. Meanwhile, this cropping system shows large surplus of nutrients in farm-gate balances (Fangueiro et al., 2008) and may generate large N losses, particularly by nitrate leaching (Trindade et al., 1997).

New challenges for dairy sector sustainability in North Portugal

Date of the Workshop: 25 September 2019

Type of participants	Number of participants
Cooperative sector ¹	4
Universities/High Schools ²	2
Agrifood industry (Dairy processing and commerce) ³	1
Municipalities/local communities and administrations ⁴	3
Natural official offices ⁵	1
Media ⁶	1
TOTAL	12

Analysis

STRENGTHS	WEAKNESSES
<p><u>Economic</u></p> <ul style="list-style-type: none"> • Existence of a dairy farms industry cluster (e.g. technical knowledge, services associated with the dairy sector) • Modernization of companies (high technical capacity achieved) • Well-dimensioned industry that allows economies of scale • Well-dimensioned dairy farms (medium and large scale) • Low costs associated with milk collection and transportation (short distances from dairy farms to cooperatives and processors; efficient milk collection system) • Guaranteed production flow with counter current price • Certification of dairy farms for animal welfare • Existence of EU aid packages • Producers easily adopt new technologies <p><u>Social</u></p> <ul style="list-style-type: none"> • Resilience of dairy farms (dairy farms are owned by families) • Producer's commitment, and dedication • Milk as food or constituent of many processed foods • Social relevance of the activity (e.g. fairs and animal contests) • Milk image as a natural and a basic food product (including yoghurt and cheese) • Existence of a school milk program <p><u>Environmental</u></p> <ul style="list-style-type: none"> • Close consumer production (reduced shipping) • The sector collects information that allows monitoring nutritional and prophylactic efficiency (e.g. urea, antibiotics, productive, reproductive and genealogical information) • Rural landscape preservation • Forage area prevents fires <p><u>Agricultural</u></p> <ul style="list-style-type: none"> • Milk with great quality control (food safety) and total traceability • Good quality genetic animals • Geographic location (favourable edaphoclimatic conditions with high productivity, that sustain a maize silage based diet) • Forages with high nutritional quality (less concentrate will be needed) • Existence of information sharing platforms (dairy contrast, productive, reproductive and genealogical information) • Close attention to animal health and welfare issues to avoid negative impacts on output 	<p><u>Economic</u></p> <ul style="list-style-type: none"> • Low and volatile milk prices at production • Instability of public policies (lack of coherence of policies between ministries and uncertainty in the future) • Heavy dependency on the import of feeds (especially protein-rich feed) for feed compounds • Cost of the production factors and very high initial investment • Oversizing of agrarian equipment <p><u>Social</u></p> <ul style="list-style-type: none"> • Unattractive quality of life • Age stratum of producers • Manure management (Image: odors and transport) • Reduction of milk consumption in nature (higher in low age strata) • Dairy farms in urban areas • Lack of communication between production and consumer <p><u>Environmental</u></p> <ul style="list-style-type: none"> • Difficult of manure management (high animal load and poor stocking capacity) • Transport cost of imported milk not reflected in its carbon footprint • Difficulty in complying with the nitrates' directive • High water consumption (inefficient cleaning and watering techniques) • Poor management in water consumption <p><u>Agricultural</u></p> <ul style="list-style-type: none"> • Constraints in agricultural land area availability • Agricultural land divided into fragmented plots • Inexistence of feed protein sources of national origin • Low cow longevity • Administrative burden • Maize silage-based diet vs. chemical composition of milk (saturated fat) • Statistical information related with the milk sector is siloed and difficult to access

OPPORTUNITIES	THREATS
<p><u>Economic</u></p> <ul style="list-style-type: none"> • Deficit trade balance (improvement of industry trade strategy, accompanied by national policies to promote national products) • Global consumption of fresh and processed dairy products is expected to increase • Organization in a cooperative model (economy of scale) allowing the possibility of purchasing inputs at a lower per-unit cost • Restructuring of the cooperative sector in order to avoid competition and duplication of services and adapt to the new requirements • Creation of services companies (private and cooperatives) to share equipment <p><u>Social</u></p> <ul style="list-style-type: none"> • Develop a professional communication strategy that demystify and change milk status in human diet (from production to the consumer) • Circular economy (valorisation and utilization of effluent in vineyards and forest and also as energy source) (economic, environmental and agricultural impacts, as well) • Education for Citizenship (school subject) • Awareness the consumer to the rural activities (open-door dairy farms) • Improve the communication within the dairy sector and between dairy production and consumer • More technical training of producers to optimize management strategies (e.g. mastitis prophylaxis) <p><u>Environmental</u></p> <ul style="list-style-type: none"> • Apply in the dairy sector strategies to mitigate the carbon footprint of the milk product • Certification of dairy farms and dairy products in terms of environmental footprint • Stimulating the ethical milk production according to consumer's expectations • Introducing measures to reduce water consumption • Introducing measures to reduce fertilizers and agrochemicals usage • Support local consumption (avoid environmental costs with transportation) <p><u>Agricultural</u></p> <ul style="list-style-type: none"> • Agriculture precision (drip irrigation, sensors,) and feeding precision • Optimization of diets, considering the specificity of each farm and the environment • Valorisation of other products from dairy production (meat, manure) • Certification of dairy farms • Relocation of the rearing of heifers • Introducing management practices to reduce the consumption of antibiotics (economic, environmental and social impacts, as well) 	<p><u>Economic</u></p> <ul style="list-style-type: none"> • Concentration of industry and distribution • Unfair competition with other countries which have less stringent criteria in the milk quality control markets • Commodity import dependence (e.g. soybean, maize) <p><u>Social</u></p> <ul style="list-style-type: none"> • Market uncertainties and policy • Social media campaigns against animal production and milk consumption (animal welfare, environment, human health issues) • Existence of organized pressure groups (e.g. PETA, ...) <p><u>Environmental</u></p> <ul style="list-style-type: none"> • Adverse climate changes • Restrictions on the use of agrochemicals • Restrictions on water consumption <p><u>Agricultural</u></p> <ul style="list-style-type: none"> • Less-innovative dairy industry and low commercial aggressiveness • Urbanization of rural space

List of issues

Economic

1. Low and volatile milk prices at production
 - a. Open market with more favorable production policies
 - b. Concentration of industry and distribution
 - c. Price pay by the consumer not indexed to the price pay to the producers
 - d. Almost the producers sell unprocessed milk
2. Agricultural sector instability (lack of coherence of policies between ministries)
 - a. The agricultural sector is under different ministries with lack of coherence
 - b. Negative perception of livestock production and milk consumption
3. Commodity import dependence and its price volatility
 - a. The industry of feed compounds use almost exclusively imported maize, wheat, soybeans and rapeseed
 - b. Low availability of local produced grains and by-products
4. Cost of the production factors and very high initial investment
 - a. High costs of production factors (e.g. fuel, electricity, feeds and fertilizers)
 - b. Dairy farmers acquire individual heavy machinery and equipment, economically inadequate to farm size

Social

1. Unattractive quality of life – the work in farm is based on family labour and is heavy work and socially unrecognized
2. Age stratum of producers high
3. Shortage of agricultural workers
4. Manure management
 - a. Negative image about odors and transportation in the public roads
 - b. Neighbours have the perception that farm manure and organic fertilizers are “dirty” and have unpleasant odors
 - c. In this region, urban areas expanded to rural areas

Environmental

1. Difficult of manure management (high animal load and poor stocking capacity)
2. Widespread concern for environmental issues, particularly mitigation of climate change, water and air pollution, and the depletion of natural resources, including soils
3. Difficulty in complying with the nitrate's directive

Agricultural

1. Land constraints
 - a. Availability and price - urban pressure
 - b. Agricultural land divided into fragmented parcels
2. Low cow longevity
3. Administrative burden (too much paper work and slow)
4. The dairy sector as no innovative products
 - a. All the farms produce the same type of milk
 - b. Inexistence of on farm dairy products (direct sales of butter, cheese, yogourts, ice cream,...)

Services and indicators used to measure them

Category	Description	Indicators	Specific dairy farming systems (if relevant)
Provisioning	<p>Milk and dairy products</p> <p>-The region produces about 2/3 of national dairy milk. This milk has high level of biosafety control (traceability) and quality.</p> <p><i>- This production is also important in terms of food security</i></p> <p><i>-The local labels have high recognition and acceptability by the national consumers.</i></p> <p>Meat – The dairy farms contribute to about 15% of total beef meat production and Portugal have only about 50% of auto provisioning meat beef</p>	<p>Milk: 0,7 x 10⁶ ton</p> <p>Dairy products (eq. milk): 0,5 x 10⁶ ton</p> <p>Meat: 15x 10³ ton</p>	Indoor system based on maize silage + concentrate
Rural vitality and socio-economic issues	<p>The dairy sector gives important contribution to the rural economy</p> <p>The dairy sector is vital to the existence of a group of companies and enterprises that ensure a large number of employees</p>	<p>Cooperatives, consultants, feed compounds manufactures, milk industry, equipment</p> <p>No indicators specific for the milk sector.</p>	
Environment	<p>Intensive production, based on the use of maize silage, animals with high productivity, and higher frequency of milking (fewer animals required for the same output), resulting in low intensity of GHG emissions (direct emissions per unit of milk or meat)</p> <p>Agricultural plots used to produce fodder are organized in a mosaic pattern with forest areas which helps to prevent fires and maintain high biodiversity levels</p> <p>High stocking rates and yields per forage hectare-Growing <i>maize</i> for <i>silage</i> allows a very high soil utilization efficiency</p>	<p>4-6 cows ha⁻¹</p> <p>Maize forage yield: 20-24 t DM ha⁻¹</p>	
Cultural heritage/Quality of life	<p>Fairs and animal contests – These events contribute to the dissemination of the rural activities to the society in general.</p>	<p>Relevant examples of agricultural festivals and events:</p> <p>Agro semana</p> <p>Agro Braga</p> <p>Agro Vouga</p> <p>Feira da Trofa</p>	

Dysservices and indicators used to measure them

Category	Description	Indicators	Specific dairy farming systems (if relevant)
Provisioning	Diets made with imported cereals and oilseed proteins – higher GEE due to the transport	GEE emission per t and km	
Rural vitality and socio-economic issues	High land price	40 to 70 000 € ha ⁻¹	
Environment	<p>Maize as monoculture</p> <p>Concentration of dairy farms, resulting in high quantities of slurry per unit of area</p> <p>Water uses for irrigation</p> <p>Pollution of groundwater– nitrification</p> <p>Odors and insects from manures</p> <p>Farms attract rodents.</p> <p>There is a constant uneasiness between farmers and urban populations living in rural areas.</p>	<p>Proliferation of weeds-resistance (e.g. <i>Cyperus esculentus</i>)</p> <p>There is an excess of slurry production in the region. Dairy farms have 20% excess of slurry (ca. 500 x 10³ m³ of slurry in excess in the north region)</p> <p>150-250 mm of irrigation water for the maize crop Extraction of groundwater is causing intrusion of saline sea water in the coastal plain.</p> <p>The dairy production plays a role in the Nitrate Vulnerable Zone defined in the coastal region (Esposende-Barcelos NVZ).</p> <p>Increasing number of complaints against farmers (no statistical data available)</p>	
Cultural heritage /Quality of life	Conflicts with urban populations due to odors and flies		

List of Innovative practices likely to improve sustainability and competitiveness of dairy farming

Communication

- Organization of events that highlight the central role that dairy farmers play in the society and the **contribution of dairy products to food supply and security** – Actually, cooperatives promote open days for children and teachers at dairy farms.
- Education in schools – Training programs on dairy farms in order to increase the **consumer's awareness of what a modern dairy farming activity consist** and in how it contributes to common services – intervention of policy makers is need.
- **Labelling and marketing strategies** (e.g., give information about health and welfare of cows)

Milk valorisation

- Direct remuneration of milk, **introducing new parameters for milk pricing, as indicators of good practices (e.g. indicators of animal welfare and health)** – Actually, a program of **certification of dairy farms by animal welfare** is running, which is expected to increase the confidence of consumers in milk production. By other side, an effort is made in order to reduce the utilisation of antibiotics.
- **The sector collects information that allows monitoring nutritional and prophylactic parameters (e.g. urea, antibiotics and BHB) that are increasingly used for improving dairy farming efficiency.**

Agricultural practices

- **Improvement of agricultural practices to achieve high quality of annual ryegrass silage** from the winter crop. Issues that are under improvement relate to: better varieties selection according to the forage intended use, sowing and harvest date; better conservation (silage and hay-silage) techniques.
- **Introduction of legumes in mixtures** with annual ryegrass produced in rotation with maize silage to improve forage crude protein content.
- **Improvement in management planning of crop fertilization** (reduction of mineral fertilizers application; slurry handling, storage and spread over fields in a timely way and using low ammonia emission techniques). Transfer of dairy manure in excess to other agricultural activities (greenhouse vegetable production, vineyards and fruits production).
- Improvement in the efficiency of **irrigation techniques** by using drip irrigation in the maize crop.
- Introduction of **technologies for heat stress control in dairy cows** and reduce impacts in cow milk productivity during the summer months.
- Monitoring and investments programs for **improving energy use efficiency** at the dairy farms.