



Characterisation of Case Studies

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

Basque Country

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

The business structure of the dairy cattle sector in the Basque Country is characterized by being comprised of a large number of small farms. In order to provide themselves with financial and technical expertise, the farmers set up cooperatives, leading to the Management Centres: LORRA, in the province of Bizkaia, ABELUR and LURGINTZA, in the province of Gipuzkoa and ABERE, in the province of Álava. These non-profit cooperatives are responsible for assisting farmers on administrative, economic and technical issues.

Other important stakeholders that define the current AKIS structure (Figure 1) are listed below:

- AZTI -- <https://www.azti.es/en/>
- IPARLAT -- <http://www.iparlat.com/en/>
- NEIKER -- <http://www.neiker.eus/?lang=en>
- KAIKU FOOD CORP. -- <http://www.kaiku.es/index.php?lang=es>
- HAZI -- <https://www.hazi.eus/es/>



Figure 1 – AKIS structure in the Basque Country Region

Indeed, the image of the islands for tourism benefits and is connected from dairy operations and tourists actively visit rural areas just to see the hortensia (*Hydrangea macrophylla*) hedges, particularly during blooming season. Other dysservices include gastronomy and cultural heritages that are of particular importance to Azorean locals, tourists from the continent and Azorean emigrants and their descendants that frequently visit the island. Overall, dairy farming provides a very good image of the islands that is recognized by all the players in the field.

Description and key figures

The Basque Country is an autonomous community located at the eastern end of the Cantabrian coast. The Basque Country borders are Cantabria and the Burgos province to the west, the Bay of Biscay to the north, France (Nouvelle-Aquitaine) and Navarre to the east and La Rioja (the Ebro River) to the south. It covers an area of 7,234 km² and its position makes it the nexus of the European Atlantic axis. It has a population of over 2 million people, with a density of over 300 inhabitants per square kilometre. It includes the Basque provinces of Álava, Vizcaya, and Guipúzcoa (Figure 2). Vitoria-Gasteiz, in the province of Álava, is the capital and where the Basque Parliament and the headquarters of the Basque Government are located. The High Court of Justice of the Basque Country has its headquarters in the city of Bilbao, located in Vizcaya. Whilst Vitoria-Gasteiz is the largest municipality in area, with 277 km², almost half of the 2,155,546 inhabitants of the Basque Country live in Greater Bilbao, Bilbao's metropolitan area.



Figure 2 – Administrative division of the Basque Country region

The steeply mountainous terrain in the region connects two great mountain ranges: the Pyrenees and the Cantabrian Mountains. The mountain chain that links these ranges (Aralar, Aizkorri-Urkilla-Elgea, Urkiola, Gorbeia and Sierra Salvada) divides the region into two distinct watersheds: the Atlantic and the Mediterranean. This chain is modest in altitude and is only higher than 1500 m above sea level at a few points very close to the coast, at a maximum distance of about 50-60 km. The Basque mountains form the watershed and also mark the distinct climatic areas of the Basque Country: The northern valleys, in Vizcaya and Guipuzcoa and also the valley of Ayala in Alava, are part of Green Spain, where the oceanic climate is predominant (Basque Government, 2009). The south part of the territory, however, presents Mediterranean climate conditions with a transition zone between both climates (Figure 3).



Figure 3: Climate division of the Basque Country Region; Oceanic climate (yellow), transitional zone (light green) and Mediterranean climate (dark green).

The valleys in the Atlantic watershed are therefore very narrow and steeply sloping. This situation was identified as a weakness for dairy farmers, due to the scarcity in land availability. The mean annual temperature in this watershed is 14-15°C, the annual precipitation is between 1200-2500 mm, with 200 rainy days, and the number of frost days is well below 20. In contrast, the Mediterranean watershed comprises a series of lower sloping basins that flow into the river Ebro. The mean annual temperature is 11-12°C in the Mediterranean watershed, the annual precipitation ranges between 800-450 mm, and the number of frost days is above 40 (Euskalmet, 2014).

The interaction between climatic, geological and topographical conditions in the Basque Country has resulted in a large natural diversity of soils. In the Atlantic watershed, the humid climate and the topographical variations are the most important factors differentiating the soils. Thus, the soils suffer very intense leaching of base cations, and on steep terrain the profiles tend to be rather shallow and poorly developed. This complex interaction has resulted in the Atlantic watershed having mostly acidic, rather shallow soils that are very prone to erosion. However, in the Mediterranean watershed, where the climate is drier, calcium carbonate is not leached from the soil and therefore most of the soils are calcareous (Gartzia-Bengoetxea & Arias-Gonzalez, 2015).

The climatic conditions and soil type resulted in very distinctive forest landscapes in the Atlantic and Mediterranean watersheds. The mountains of the Mediterranean watershed were originally covered mainly by *Pinus sylvestris* and *Quercus* spp., although *Corylus*, *Buxus* and *Acer* were also present. In the southern part of the Basque Country, *Quercus ilex-coccifera* dominated.

However, in the Atlantic watershed, the main genera are *Fagus*, *Quercus* (*Q. robur* and *Q. petarea*), *Fraxinus*, *Betula* and *Tilia*, with the presence of *Alnus* and *Salix* in wet soils (Gartzia-Bengoetxea & Arias-Gonzalez, 2015).

Main economic issues in the territory

The Basque Country ranks first in Spain in term of per capita income, with a nominal gross domestic product (GDP) per capita (adjusted to purchasing power parity, PPP) being 22% higher than that of the European Union and 30% higher than Spain's average in 2016, and at €34,400 in 2015. Industrial activities were traditionally centred on steel and shipbuilding, mainly due to the rich iron ore resources found during the 19th century around Bilbao. The Estuary of Bilbao was the centre of industrial revolution during the 19th and the first half of the 20th century. These activities decayed during the economic crisis of the 1970s and 1980s, giving ground for the development of the service sector and new technologies.

Today, the strongest industrial sectors of the Basque Country's economy are machine tool, present in the valleys of Vizcaya and Guipúzcoa; aeronautics in Vitoria-Gasteiz; and energy, in Bilbao. The main companies in the Basque Country are: BBVA bank, Iberdrola Energy Company (both of them have their headquarters in Bilbao), Mondragón Cooperative Corporation, the largest cooperative in the world, Gamesa, wind turbine producer and CAF rolling stock producer. The Basque Autonomous Community ranked above other communities in Spain in terms of resilience in the face of the economic crisis, going on to become a beacon and a subject of study in Europe (Eurostat, 2018).

Main social issues in the territory

The main social issue in the Basque Country is the evolution of the population pyramid (Figure 4). The mean age of the population is 46 years in 2019. The ageing of the population was identified as focus of lack of generational replacement.

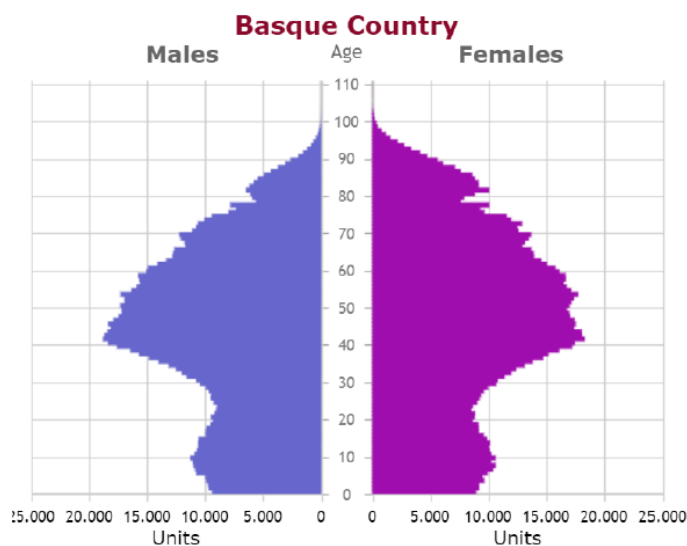


Figure 4: population pyramid of Basque Country in 2019. Source: Eustat 2019.

The stagnation and aging of the Basque population leads to an increase in the rate of economic dependence that evolves from 28.7% to 44.9%. In other words, if in 2010 there were 3.5 people of working age for each person aged 65 or over, in the year 2030 there will be only 2.2 people.

The number of children per woman in the future presents a slightly increasing evolution both in Spain and in Basque Country, but in both cases very far from the 2.1 children per woman that is considered as the demographic replacement rate. The average age of the mother to the first child, in the case of Basque country, remains constant in 32.3 years from 2009 to 2019 (Eustat, 2019).

Main environmental issues in the territory

Basque environmental policy has a proven track record dating back over 30 years and during that time, there has been significant private and public endeavour and high stakes have been involved to drive the country towards sustainable environmental development. The current situation of the main environmental issues in the Basque Country is summarised below (Basque government, 2015):

Climate change: Between 1990 and 2011, greenhouse gas (GHG) emissions dropped by 3%, with a steady downward trend since 2007. Specifically, the total CO₂ emissions from fuel fell by 18% in the Basque Country in the period 2000-2018. In that same period, the GDP rose by 25% and energy consumption by 4%. That implies greater efficiency of the Basque socio-economic sectors (lower energy intensity) and greater environmental efficiency of energy consumption (cleaner energy).

Air Quality: In recent decades, air quality in general has improved significantly and the poor air quality index has been reduced to less than one day a year. Between 1990 and 2010, sulphur oxide (SO_x) emissions were reduced by 71%, nitrogen oxides (NO_x) by 1%, and non-methane volatile organic compounds (NMVOCs) by 13%.

Water Quality: During recent years, the quality of the water bodies of our rivers has steadily improved. On the other hand, the water quality of our beaches has gone from 44% deficient/poor state in 1985 to 11% in 2012. During that same period, the population percentage with satisfactory quality water for consumption rose from 80% to 96%.

Soil Quality: The number of hectares of contaminated soil recovered for new uses has continued to increase and exceeded a total of 600 hectares. This has meant an average of nearly 100 hectares recovered each year during the last 10 years. Between 2000 and 2012, the number of sites tested came to 1312, 524 of which were recovered. We can conclude that with the prevention measures in place and the land recovery carried out, the quality of the soil resource is gradually improving.

Biodiversity: The protection of the terrestrial biome has doubled. In 2000, the Basque Country has nearly 12% of its territory protected. The initial steps for the Basque Country to join the Natura 2000 network were taken in 1997, 2000 and 2003, where 6 Special Protection Areas of Birds (SPA) and 52 areas were proposed to be designated as Sites of Community Importance (SCI). Those places were referred to the European Commission which approved them and designated those sites belonging to the Basque Country as Sites of Community Importance (SCIs) corresponding to the Mediterranean and Atlantic bio-geographic regions. Those decisions of the European Commission have been updated over the years and currently 20.3% of the surface area of the Basque Country is part of the Natura 2000 Network. Eighteen per cent of the different habitats identified have a clearly favourable status. As regards to the rest, 35% have a general poor conservation state, while the general state of the habitat in 47% of the cases have diverse assessments of rank, surface area occupied, structure and specific functions and/or future prospect.

Society and the environment: Basque grassroots perception of the main environmental problems has varied over time shifting from giving priority to water contamination and the destruction of the landscape in 2001, to highlighting air pollution and climate change as main concerns currently. Furthermore, industry has progressively lost ground in grassroots perception as the main cause of environmental pollution, dropping from 63% in 2001 to 53% in 2018, and it is the citizenry itself that recognises its greater role. Finally, it is noteworthy that 36% of the population in 2001 perceived that the environment had improved during recent years and that percentage had increased to 56% by 2018.

Main agricultural issues in the territory

The 54% of the Basque Country is covered in forest. This represents 397,223 hectares, one of the highest rates in the countries of the European Union. Pine plantations represent an important part of these forest mass (about 130,000 hectares in total). In the recent years, plantations of pines are being affected by several pathogens. Dothistroma needle blight (DNB), caused by *Dothistroma septosporum* and *Dothistroma pini*, and brown spot needle blight (BSNB), caused by *Lecanosticta acicola*, are some of the most serious and damaging foliar diseases of pines. Big efforts have been made to control the plague by the Basque government. Experimental studies are being carried out with cuprous oxide treatments and other alternatives. For the moment no viable solution has been found (Neiker, 2019).

Wolves population rising is an emerging concern between livestock farmers. The wolves' entrances from the west of the territory are causing deaths between the extensive cattle. The governments of the autonomous region compensate farmers for livestock damage after verification by wardens.

The abandonment of farmland due to lack of generational change and the poor profits is another of the problems facing the rural world. It causes a change in the soil use and structure and the presence of invasive aloctone species is rising. *Cortaderia selloana*, *Carpobrotus edulis*, *Cirsium eriophorum* or *Fatsia japonica* are examples of species with fast growing presence in the territory.

Main dairy farming systems in the territory

Farms (cattle, sheep, goat, horses, pigs, poultry) are overall small-sized. Agricultural land (mostly range from 5 to 30 ha) is usually spread in several small plots. Pluriactivity is another main feature of the agricultural sector, as it is usual to combine livestock (different species and aptitudes) and agricultural production (small scale), and even with work in the industry or services. Nonetheless, dairy cattle production is particularly different as it is the main sector in which animals are raised in highly specialized farms. Dairy activity is currently concentrated in three main areas from The Basque Country: Karrantza Harana in the west (Bizkaia province), Asteasu-Aia in the east (Gipuzkoa province) and Aramaio and Aiara in Araba province (Figure 5).

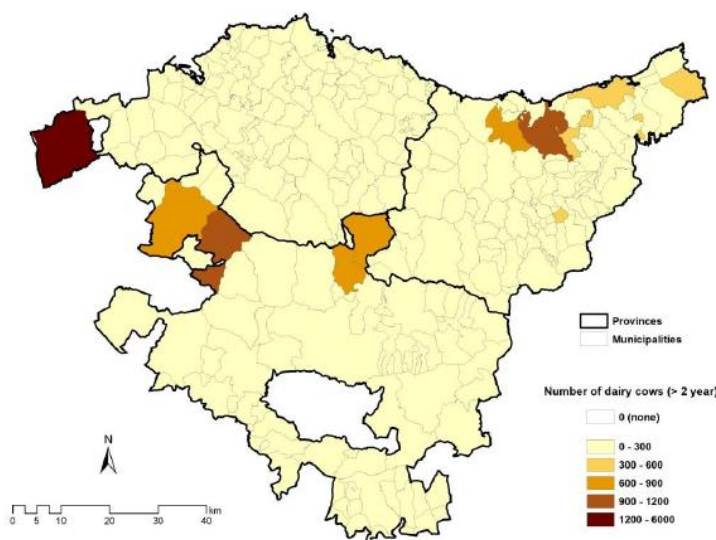


Figure 5: Distribution of dairy cattle (>2 years) in the Basque Country. 2018. Source: NEIKER, from data provided by the Statistical Entity of Economic Development and Infrastructure Department of the Basque Government.

Socio-economic data of the Basque dairy sector show that around 1,500 people are directly employed in the sector. This employment contributes to set population in the rural areas of The Basque Country, which is positively considered in terms of social benefits (maintenance of social activity, local services, landscape, cultural heritage,...). The economic impact of dairy cattle sector reached 60 million € in 2015, which accounted for 12% of the regional Gross Agricultural Product (GAP). There are currently 330 dairy farms and 10 dairy plants operating in the territory (FEGA, 2018). According to data reported by FEGA (Spanish Agrarian Guarantee Fund), the volume of milk production in The Basque Country has historically represented 2 to 4% of the national production (Figure 6). More than 95% of the milk produced in The Basque Country is delivered to regional industries, whereas the remaining milk is sold to national companies. KAIKU S. Coop (www.cooperativakaiku.es/cast/) and IPARLAT S.A. (www.iparlat.com) are the main regional dairy collectors and processors, which handle more than 75% of the milk produced. Raw milk is mainly (> 90%) processed as UHT milk. Fresh (pasteurized) milk production and consumption is still scarce. Butter and yoghurts are the main milk-derived products. Despite punctual farms are currently producing cow milk derived cheese, the volume of this product is still negligible in the market.

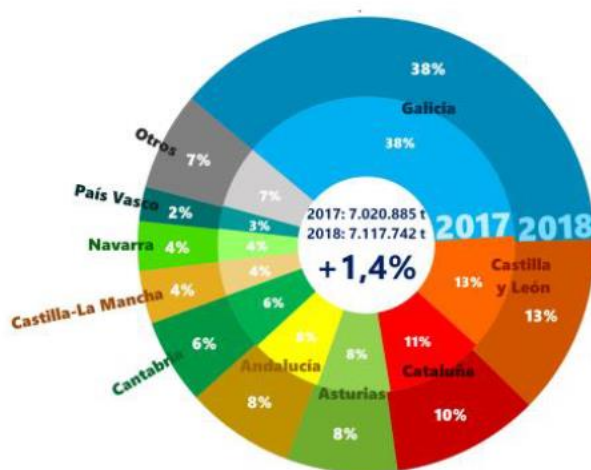


Figure 6: Milk deliveries by region 2017 vs 2018. Source: Fega Data.

The strong cooperative system, which joins dairy farming with milk collection and processing, is considered by different regional stakeholders (farmers, advisors, industry, administration,...) as one of the main strengths of the Basque dairy sector. For instance, as a result of this share of cooperatives, milk prices have historically remained steadier in this region than in the rest of Spain (Figure 8). Milk prices have ranged from 0.33 €/l (current price) to 0.38 €/l over the last 7 years. Despite the stability of milk price, the overall low milk price received by the farmers is considered as one of the main weakness of the sector, which is directly related to the low income rates at dairy farms. Additionally, this issue constitutes one of the main threats to guarantee a sustainable dairy farming activity in the future.

The scarce generational renewal of dairy farm owners/partners is another main weakness and threat to solve for the next years in The Basque Country. Dairy farmers are, on average, 53 years old. Despite efforts have been carried out from the different regional public bodies in order to encourage young people to join the dairy sector through GAZTENEK programme (education, training courses, economic incentives, technical and economical assessment, ...), it is still being difficult to attach new generations to the farms. The three main reasons of such difficulty can be summarized as: (i) the high economical investment required either for setting-up a new dairy farm or for modernizing an existing one; (ii) the above mentioned low price of the milk; and (iii) the huge amount of working hours required by the activity. On average, 2.3 working units (WU) are involved in the farms., where women were actively present in 27% of the farms. The increasing presence of women in

recent times is expected to be one of the main strengths of the Basque dairy sector for the next future.

The reduction of milk consumption at regional level is another challenge for the future. The drop of milk consumption was 34% over the last decade (milk consumption in 2015 was 70.7 milk kg per capita). Efforts are being done by the regional authorities to encourage citizens to consume regional milk and their derivatives.

Since the implementation of European milk quota system in 1986, dairy farmers tended to intensify their activity in The Basque Country. Intensification (fewer and larger farms, Holstein breed herds, TMR based nutrition, increasing number of automatic milking systems) process is still on-going in the region. The number of dairy farms decreased from 647 units in 2007 to 330 units in 2017, which led to reduce the regional dairy cow population from 28,000 to 25,500. In this sense, other factors like herd size (from 66 to 85 cows) or milk yield per cow (from 7,973 to 8,500 milk l/cow/y) increased in the same period (Figure 7). Milk production per annual dairy working unit (WU) also increased from 210,487 milk kg /WU in 2007 to 225,077 milk kg/WU in 2017.

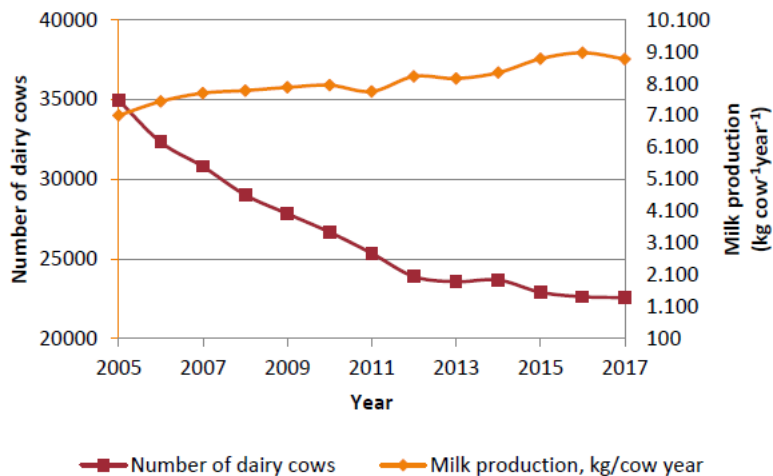


Figure 7: Evolution of milk production per cow and number of dairy cattle units in the Basque Country. Source: Data: Eustat, 2017. Neiker

As a result of this intensifying trend, the regional total milk production dropped from 215,000 tons in 2007 to 175,000 tons in 2017. Nonetheless, the regional milk production has slightly increased (\approx 2-3%) since the end of milk quota system in 2015 due to increasing herd sizes. The share of cows in farms of different sizes has also significantly changed during the last decade. The number of cows in the largest farms (> 100 cows) increased from 10.6% in 2007 to 18.0% in 2017. The same trend was observed in farms rearing 50 to 100 cows as the share rose from 21.6% to 35.0% in the same period. As a consequence, the ratio of cows in the smallest farms (< 20 cows) decreased from 30.7% to 16.0%.

Land use parameters also point out the same intensifying trend. Milk production per hectare of fodder area enhanced from 18.4 to 24.3 milk tons/ha, whereas the number of dairy livestock units (LU) per hectare also increased from 2.70 to 2.98 LU/ha. Intensification is also detected by nutritional factors such as the increasing demand of concentrates over the last decade. Mean annual concentrate intake at regional level increased from 2,726 kg/cow/y in 2007 to 2,836 kg/cow/y in 2017. Nonetheless, milking herds from the largest farms may annually consume even up to 4,500–5,500 kg/cow/y. The share of purchased feed in the diets increased slightly during the same period (from 75 to 77% of the diets). Grazing, which is practiced from March to October, is mainly oriented to young cattle (heifers, and occasionally dry cows). Few farmers graze with milking cows. Finally, the increasing number of automatic milking robots in the farms (data not available) also shows that intensification is still running in the Basque Country.

Nutritional costs account for 50% of the mean milk price received by the farmers (data from 2013 to 2018). Nonetheless, it is remarkable that these costs may even reach up to 58% of milk price in those farms in which forage autonomy is low (forage production < 25% of cattle requirement). Home-grown forages may represent up to 35% of feed intake in milking cows. Fodder area mainly comprises grasslands (permanent, ploughed as needed or in rotation with maize) as they account for more than 90% of the land. Grasslands are mostly destined to grass silage or hay production in order to feed confined cattle at the stalls (grass silage for milking cows, grass hay for young cattle). The remaining agricultural plots are usually destined to maize production for silage. Alfalfa production is still very scarce in the region. Farmers own about 40-50% of their fodder area, which means that the remaining land surface must be taken in rent. Because of the high prices of grasslands in The Basque Country (12,950 €/ha), renting is currently the main way to increase the land availability. Fodder area is mainly fertilized with dairy cattle slurry, which is mostly applied in spring (April/May) and autumn (September/October). The use of mineral fertilization has decreased during the last years. The splash plate method and band spreaders are the commonest application methods although umbilical systems and injectors may be also found. There are currently different strategies running in the region to handle the exceeding slurry in a cooperative way (slurry distribution trucks, commonly managed covered storage tank). The next challenge for Basque dairy farmers will be the adaptation to national RD 980/2017, which will regulate in the next future the requirements for the correct slurry application.

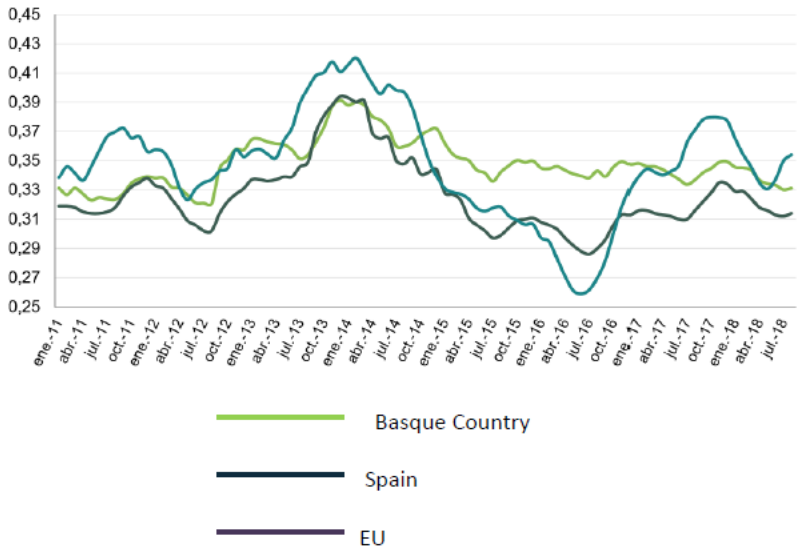


Figure 8: Milk price paid to farmers (€/L). Source: Behatoki number 180, 2018. HAZI Fundazioa. Eusko Jaurlaritza

Finally, it is remarkable that from recent years onwards, organic milk production is increasing in the region. There are currently five organic farms, which yearly produce 490 milk tons. Organic farms produce pasteurized milk, different types of cheese and natural yoghurts, which are sold by direct sales either at the farm or in local fairs (markets) or small shops. Milk and dairy products labelling will have to show their origin of production and processing based on the recent national regulation (RD1181/2018).

New challenges for dairy sector sustainability in Basque Country

Date of the Workshop: 28th of May 2019

Type of participants	Number of participants
Farmers	5
Technicians/technical support	4
Agrifood industry	2
Municipalities/local communities and administrations	1
Parks/natural official office	
Universities/agricultural highschoools	5
NGO	
Others (Farmers Union)	2
TOTAL	19

SWOT Analysis

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> - Cooperativism - Animal health / Genetic improvements - Gender equality - Technology 	<ul style="list-style-type: none"> - Generational replacement - Land availability - Proper management of slurries - Profitability
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> - Technology - Product labelling - Genetic improvement - Collaboration between sector agents 	<ul style="list-style-type: none"> - Milk price - Market tendencies - Generational replacement - Production costs

List of issues ranked by importance (percentage of the attendants who voted the issue)

1. Low generational replacement rate (85%)
2. Strong network of cooperatives (85%)
3. Technological opportunities (85%)
4. Milk price volatility (80%)
5. Overall good herd health and genetic improvement (70%)
6. Reducing milk consumption at regional level (60%)
7. Low economic profitability (40%)
8. Limited access to new farmland (40%)
9. Improvements required in slurry management (40%)

Services and dysservices and indicators used to measure them

Category	Description	Indicators
Provisioning, Rural vitality and socio-economic issues, Environment, Cultural heritage and quality of life,...	Describe one service or dysservice	Percentage of the attendants who voted the issue
SERVICES		
Provisioning	Milk supply	85%
Rural vitality and socio-economic issues	Rural economic revitalization	60%
Rural vitality and socio-economic issues	Maintaining the population in rural areas	50%
Rural vitality and socio-economic issues	Social activity	50%
DYSSERVICES		
Rural vitality and socio-economic issues	Difficulties in attracting new employment	70%
Environment	Air/Water pollution	60%
Environment	Plastic waste production	50%
Health	Antibiotic resistances	50%
Environment	Nutrient surplus	40%

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

Innovative practices	Factors that prevent the adoption	Types of farms that have developed these practices or that are interesting regarding these innovative practices
Enhancing services		
The education of children, teenagers and young adults on the importance of protecting a rural environment	People mostly live in highly industrialized areas.	There are individual farms running visits for schools (8-16 years old) are welcome in order to show them what a dairy farm is. There is an initiative launched by one regional farmer union in which families can visit dairy farms on weekends (https://ongietorribaserrira.com/)
Improving farmers' overall training/skills (nutrition, technologies, farm management, etc)	Farmers do not have too much time to improve their skills.	Farmers involved in the largest milk cooperative (KAIKU S. Coop) are trained by specific courses (nutrition, management, etc). Some farmers participate in training courses which are organised by HAZI Fundazioa (Foundation of the Basque Government for rural, coastal and food development): nutrition, health, management, etc
To strengthen a support network from Administration bodies to provide farmers the resources that they need to focus their activity just at farm level	Regional agricultural GDP is low and investment for this kind of solutions is reduced	
The improvement of life conditions at dairy farms by fitting timetables and tasks, allowing longer holidays periods, etc)	Farms are mostly family business (2-3 workers, no more)	Farms run by partners instead of family business. Some farms participate in a substitution service for summer holidays, in which young farmers (even students of dairying activity) work in different farms for 2-3 months.
Searching of added-value uses for the by-products (slurry, milk whey, etc) produced at dairy farms	The mean age of dairy farmers is above 50 years, which reduces the possibilities of setting-up new strategies.	Organic farms (6) Larger conventional dairy farms which are led by farmers who are motivated in searching added-value products.
Promoting the consumption of local milk-derived products	There is not a real social awareness.	Organic and conventional farms which produce added-value products would be interested in promoting the consumption of new products. Some local administrations are encouraging these actions such as: http://openlab.enkarterrialde.eus/
Reducing dysservices		
To encourage the interactions between farmers	Farmers do not have too much time to interact between them.	Overall, all type of farmers (organic, small-sized family farms, largest conventional farms) are more and more interested in social networks (whatsapp, ...)
To promote the use of recyclable/compostable packages	High investment is required	Organic farmers are usually concerned. Also, conventional farmers run by young generations are interested on it.
To promote low emission slurry management practices	High investment is required	Farmers, who work in a collaborative way (sharing machinery, ...) or biggest farm have incorporated this type of strategy in their farms. Anyway, farmers are overall more and more receptive to this kind of technology due to legal requirements.

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