

Common data pool on sustainability standards and competitiveness

MATS Deliverable 3.4



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www.sustainable-agri-trade.eu

Summary

In D3.4 a common data pool on sustainability standards and competitiveness has been created.

The focus countries are Germany, France, Italy, USA, Brazil, Argentina and South Africa. Moreover, for dairy, Zimbabwe and Algeria have been investigated. For beef, Morocco, Namibia, Kenya and Finland were also covered in the analysis of working conditions.

Competitiveness has been studied with the internationally recognized approach of “typical farm”, using a model farm representing the most common farm type for a specific product in a specific country or region. Details about the method are described as well as the characteristics of the typical farms (size, annual production, number of labour units, hectares cultivated).

Following this approach, production costs (labour costs - in terms of family labour and paid labour -, wages, prices), subsidies and cattle returns are reported. Moreover, import & export has been focused: the top five import-export destinations (for dairy and beef products) have been analysed in terms of quantities for the main commodities. Additionally, an in-depth cross-country analysis on import and export relationships has been addressed: trade between each country and all the others has been described.

Trade tariffs have been expressed (when available) as percentage in the trade flows for the main products and classified according to duty type (effectively applied tariffs, bound tariffs, most favoured nations tariffs, etc.).

Social sustainability has been investigated with reference to some SDGs strictly linked with the case studies on which this deliverable is based on. In particular, the social aspect is a primary focus in Case Study (CS) 10, 11 and 13, which fall within the action area of SDGs no. 1, 2, 3, 6. Case Study no. 3, focuses more on the environmental component (SDGs no. 13 and 15).

Given the complexity of the topic, SDGs have been translated to the more operational disclosures of the GRI Standards -Global Reporting Initiative Standards- which represent global best practice for reporting publicly on a

range of economic, environmental and social impacts. A summary table with the translation of the used SDG into the GRI system is also provided.

In particular, in order to investigate the level of national compliance with labor rights and the consistency between national legislations and the market dynamics, a challenging work on existing legislation on labour standardization has been carried out, for each engaged country. The result is an excel database, which enables to compare different countries and to understand the dynamics of the trade mechanism through the partner network. The main sections of this database are working time, paid leaves, occupational health and safety, social welfare, payments and trade rights. The sources of this information are the main official government websites and available public databases.

Environmental sustainability has been investigated with the support of Agribenchmark beef (CS10 - beef) and IFCN (CS13 - dairy). As for dairy, single countries have been taken into account and a certain number of typical farms have been studied, in terms of emissions (kg CO₂) per 100 kg of milk produced. As for beef, the approach using typical farms was not feasible, so reference has been done to data provided by literature. In particular, FAO and its publications has been privileged as sources. The limits which have been encountered - and that must be considered in drive conclusions starting from this data - are related to the lack of information as regards to specific countries and to the inhomogeneity of data itself, in terms of unit of measurements, approaches and year of investigation

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Introduction

To analyse different Case Studies involving different products in different countries and in different continents, it was necessary to build a *common data pool* to source necessary data to describe and support the case study analysis. The data pool is a sum of different sources including raw data and elaboration to standardize the data and to enable comparison across countries and sectors.

This common data pool consists of two main parts:

- Data pool related *to sustainability standards* (environment and labour conditions).
- Data pool related *to competitiveness*.

In this way, all three aspects of sustainability were covered and analysed. The creation of data pool has been a challenging exercise, both for the lack of information on some specific topics. In fact, on one hand, competitiveness can be addressed thanks to international public database (FAO, COMTRADE EU Commission sources etc.) and private (IFCN, Agribenchmark Beef). More difficult is to have access to data related to sustainability standards (environment and labor conditions) they are dealing with very specific fields that have been sometimes neglected by literature, with regards to specific Countries (e.g., in some African regions).

Moreover, sustainability standards data that can be found in papers are often expressed in different units of measurement. This creates a certain incompatibility and difficulties in performing comparisons. One example for all, can be emissions related to beef, that can be found as expressed in CO₂-eq/kg of live weight or CO₂-eq/kg of meat or CO₂-eq/kg of protein. This is why papers (mostly reviews) and literature sources where Authors attempted conversions to reach uniformity have been privileged. But also following this approach, covering all the information for all the focus Countries was not always possible. This is why in some cases, different data with different units of measurement have been expressed for the same topic/item and region. This inconsistency is sometimes linked to an upstream motivation: non-homogeneity of models/methods of investigation. This creates an additional obstacle in guaranteeing quality of data when attempting to convert it in a common expression form.

Another issue in some Countries is to be able to collect up-dated information, in many cases, when present, data are old and refers to previous decades. This, again, contributes to the difficulty of performing comparisons.

Regarding sustainability standards related to labour, the collection of legislative material when available, is organized following very different structures, it was therefore necessary to make an initial categorisation of the available information. In particular, the most difficult challenge in the part concerning the social analysis of working conditions was to try to make the indicators used in the different case studies more practice oriented. This was done by relying on the GRI system, which provides a highly specific and detailed set of “disclosures”. This effort made possible to translate qualitative data into classes that could be compared across the different case studies.

Although the data on working conditions are strictly related to legislation and do not include some real circumstances and exceptions, it was deemed to be an efficient indicator and in line with the requirement of indicator 8.8.2 “Level of national compliance with labour rights (freedom of association and collective bargaining) based on International Labour Organization (ILO) textual sources and national legislation, by sex and migrant status”.

All these challenging elements will be addressed in the elaboration of the case studies in trying to standardize the available information and fill the gaps when data are not available.

Data pool on competitiveness

In this part of the deliverable different data sets related to competitiveness have been collected. In particular data related to competitiveness in dairy and beef sector at farm level (production costs, products prices, labour cost, subsidies) and at international level (import export, trade tariffs). The focus is on countries related to Case Study 10 and 13 involving nine countries in the dairy sector (Italy, Germany, France, Algeria, Zimbabwe, South Africa, Argentina, Brazil, USA) and nine countries in the beef sector (Italy, Germany, France, Namibia, Morocco, South Africa, Argentina, Brazil, USA). To explore farm competitiveness at farm level The typical farm approach was used. To explore national competitiveness data, international data sources have been used.

The typical farm approach

A **typical farm**³ is a model farm representing the most common farm type for a specific product in a specific country or region. The necessary technical and economic data to define a typical farm are collected by farmers and local experts. The typical farms are fully comparable as the same standard rules are used. Still, the number of typical farms does not allow statistically significant conclusions. This is a tool used to estimate the total cost of production per unit (i.e., euro/kg of milk, euro/ton wheat etc.).

The approach was developed in various contexts, differentiated by industry:

- the *International Farm Comparison Network* (IFCN), for dairy farms;
- the Agri-benchmark networks, for beef and sheep, cereals, fruits and vegetables, and wine;
- the *InterPig network* for pig meat;
- the *International Poultry Production* (IPP) cost analysis performed by the Wageningen University and Research Centre.

³ Source: https://agriculture.ec.europa.eu/system/files/2019-12/ext-study-farmer-costs-fulltext_2014_en_0.pdf

Two clusters can be identified in terms of methodological approach: on the one hand, the IFCN and *agri-benchmark* networks, on the other hand the InterPig and IPP networks. In the description of the methodology, the differences will be highlighted.

General structure of the approach

The IFCN and *Agri-benchmark* networks are composed of country experts, who work in association with focus groups composed of local experts (so-called panel groups), according to a shared methodology. The major objective of these networks is to generate independent, worldwide knowledge on the costs of production and of revenues at farm-level. In order to achieve such knowledge, the central research centres, IFCN Dairy Research Centre, the *Thünen* Institute, AHDB and WUR-DLO, have developed a reference methodology for the calculation of production costs. The methodology details the steps which need to be taken by the national experts consulted when defining a typical farm.

Selection of regions and locations (*step 1*)

The first stage of the typical farm approach is the selection of the *geographical areas* where the typical farms are located. This step is carried out by the national experts using national statistics. Before establishing a typical farm, the experts have to understand the spatial distribution of the production. The region which produces the largest proportion of the national production should be identified and all main productive regions of the country should be included.

The process must be based on a defined reference unit. A number of units, each characterised by peculiar advantages and disadvantages, could serve as indicators - for instance the beef cattle density per 100 ha of agricultural land, the share of dairy farms per km², or the amount of wheat/apple/wine in 1,000 tons per region. The rationale of the indicators is explained here for wheat:

- wheat production per region. This indicator can be misleading if the regions differ substantially in size, causing large regions to appear more relevant than small ones, regardless of wheat density (higher relative importance of wheat production). The same reasoning applies when the regional share of total wheat production is set as an indicator.

- wheat production per ha of arable land. This perspective is closer to agriculture since the indicator excludes non-agricultural land and areas with other crops. However, a region with a very small share of agricultural land and only a few large, wheat-producing farms will be categorized as very important, whereas areas with extensive agricultural land and a higher diversity of products will appear less important.
- wheat production per km². This is a measure for absolute density that considers the different size of the regions, avoiding the disadvantages of the agricultural land perspective. However, it does not measure the relative importance of wheat production compared to other farming systems. This might be misleading when a region is relatively small and surrounded by non-wheat producing areas. Note that a substantial difference exists between productive regions and political regions: the former, in fact, are characterised by natural and bio-climatic conditions, rather than political boundaries.

Definition of the relevant farm population (*step 2*)

Having identified the pertinent regions, it is necessary to establish whether the entire farm population is relevant to the analysis. *Agri-benchmark* and IFCN focus on those farms generating a high share of total income. The rationale is to select farms that are able to generate at least 50% of farmers' income (farms dependent on agricultural income) or to feed at least one person/family. The objective of the analysis must also be considered in the selection process. The selection criteria differ when concentrating on the economic situation of smallholder farms in wheat/beef/dairy production or when tackling international competitiveness.

The next stage concerns the selection of a limited number of farm(s), that differ in terms of production system(s). They should be drawn from the cluster previously selected. For the most important production systems for the typical farm network, it has to be checked if different systems cause differences in the database.

This step in the typical farm approach is best done by the country's experts, on the basis of the available literature and statistical analyses, and/or with the support of local advisors. A stepwise procedure is used, starting with a rather rough classification that will be gradually refined.

Definition of the structure and size of the typical farm (*step 3*)

After defining the relevant types of typical farms and their respective production systems, a decision is taken regarding the size of each typical farm. Their position within the total farm population should be well specified by detailing the number of farms in the population that are larger, smaller, or which fall in the same size category of each typical farm. This task can be accomplished by making use of data about the farm population (which will usually not be available at the level of detail required) or using representative random samples, which provide key indicators to measure the frequency of certain farm types and sizes (like the Farm Accountancy Data Network of the EU). A list of the issues that need to be addressed when defining the size of a typical farm and collecting data is provided below. As time and resources are usually limited, it is not always possible to reflect all farm sizes and production systems in a region. Based on the experience of *Agri-benchmark* and IFCN, the following recommendations are offered.

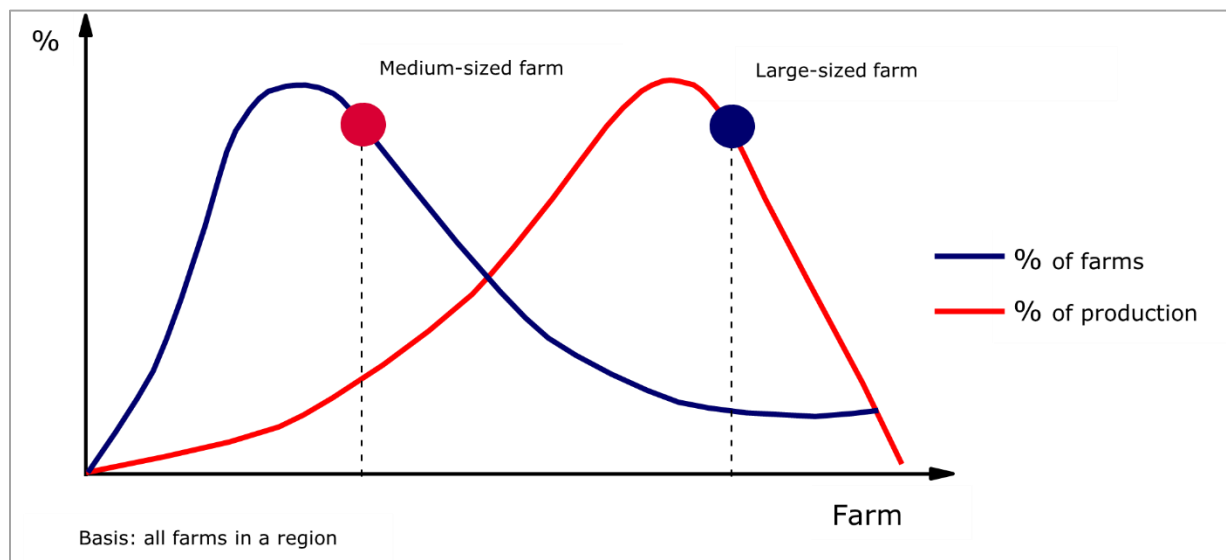
- In a region with minor differences in terms of production systems (for example in the Paris Basin region in France, or in Ireland, for dairy), two farms with the same production system but differing in size should be chosen. One farm should be of moderate size (usually slightly above average), the other farm should be large size and should belong to the approximately 20% of the largest farms of the whole population. Given the typical distribution of farm size classes (various small-sized enterprises with a relatively little share of production, and few large farms with a relatively high share of production, see figure 3.1) this enables the inclusion of a large number of farms and a major share of production in the analysis. Furthermore, it shows size effects: smaller farms could be affected more by specific regulations than large ones, or vice versa.
- Where possible, *Agri-benchmark* and IFCN use regional statistics about farm size distribution to ease the definition of appropriate farm sizes. Obviously, the availability of reliable statistical data is a precondition.
- In a region where (a) size differences are either not pronounced or appear irrelevant and (b) there are significant differences between production systems (e.g., intensive and low-input systems), two farms

of about the same size should be chosen, reflecting the different systems.

- The typical farm should have an average management level.
- In order to explore the potentials of a region/country, it is strongly recommended to add one large farm with top management to the set of farms. The technical standards of these top farms provide insight in which technical efficiency level can be reached when the limitations caused by average management are eliminated.

The quality of management is measured in terms of profitability. Farms with an average-level management should show an average level of profit, whereas top-management farms should rank in the upper 10% of large farms. When profit data are not available, gross margin or the physical productivity per unit of land are used as a proxy.

GRAPH 1 FARM SIZE DISTRIBUTION AND SELECTION OF TYPICAL FARM SIZES



SOURCE: DEBLITZ AND ZIMMER, 2005

The question of how many typical farm models are required to represent the production of a specific product of a given country is frequently asked. In quantitative terms, there is no general answer to this question. Two farms are defined as the standard: one average farm and one large farm, both with average management, and eventually a third farm with top management. Beyond this general rule, the number of farms required per country mainly depends on:

- the diversity of production systems including natural conditions, economic conditions, and infrastructure conditions. If production systems are very diverse, an increase in the number of typical farms is required;
- the diversity of farm size structure and its increase usually requires an increase in the number of typical farms;
- the size of the country, since smaller countries usually require less farm types, while larger countries with a great variety of farming systems might be subdivided into different regions;
- the spatial level of analysis, because fewer farms are required for international networks (usually 2 to 4 farms per country. For exceptions see previous point;
- the type of analysis performed. The number of required farms will increase when more adjustments have to be analysed;
- the financial feasibility, i.e., the resources needed to establish and maintain a network of typical farms in a country.

Experience so far has revealed that establishing a national network of typical farms in each country is the most effective method of generating information on a larger number of farms, and by doing so, to get a more detailed picture of both production systems and production costs.

It should however be underlined, that the limited number of typical farms per country does not allow to draw statistically significant conclusions. The results should therefore always be treated with care.

When statistics and resources to define typical farms are not available, a list of minimum criteria applicable to all products covered is made, to guide the first steps in determining a typical farm:

- select the region of the greatest importance for wheat, beef, sheep, dairy, pigs, broilers, apples, wine production in terms of tradable volume produced;
- within the region identified, select the production system with the highest share in regional production of the product to be analysed;
- select the farm size that produces the highest share of the product to be analysed within the production system identified;

- clarify as much as possible the location of the typical farm on the distribution function.

Data collection and assessment criteria (step 4)

Data collection is done with the support of local advisors and farmers who know the region, the farms and the production systems. Both *Agri-benchmark* and IFCN use the so-called expert panels, consisting of the responsible scientist, an advisor and from one to six farmers. The panel holds a round table meeting, where all required farm data are collected based on a standard questionnaire, available in several languages. The rationale of the method is a confrontation that creates a consensus on each figure, to properly describe how a typical farm looks like. The most frequent question raised during a panel discussion is: '*can this figure be considered typical for the type of farm we want to describe?*'. The aim of the analysis distinguishes different intensity levels of farmers' participation, listed and described below:

- a "pre-panel" with only 1 or 2 farmers, appears to be sufficient for *status quo* analysis of economic performance and production costs. Often, it is also possible to base the typical farm data on individual farm data. However, it is necessary (a) to identify and correct the particularities of individual farm data (to transform the latter into typical farm data), and (b) to perform farm visits to 2 to 3 farms with characteristics similar to the typical farm;
- a "full panel" with 4 to 6 farmers is required when farm adjustments to changes in the framework conditions or farm strategies are to be discussed and defined. The main reason is that more management options can be captured with a larger group. For this purpose, the data and the analysis derived from the pre-panel can be used as a basis for discussion.

An essential requirement for the farmers involved is that they must themselves run agricultural enterprises which are similar to the envisaged typical farm.

The collected data are computed by the analytical tools employed in *Agri-benchmark* and IFCN analyses, and results are returned to both the panel and the advisor. This process is repeated until the panel agrees on the results obtained, and a typical farm model is obtained.

In a final step, the results have to be compared with results from other economic analysis, i.e. by comparing the whole-farm profit of the typical farms with representative survey results. Such cross-checking assures that calculations and the typical farm selection procedures are aligned with other scientific results.

The *Agri-benchmark*, IFCN, selected for this study calculate the costs of production and express them in € per weight unit (kg, tons) of product.

Typical farms characteristics

The following graphs are describing the typical farms characteristics in terms of:

- farm size,
- annual production,
- number of labour units,
- hectares cultivated.

The typical farms used for the following analysis are the following:

TABLE 1 DAIRY TYPICAL FARM (N° OF COWS/FARM)

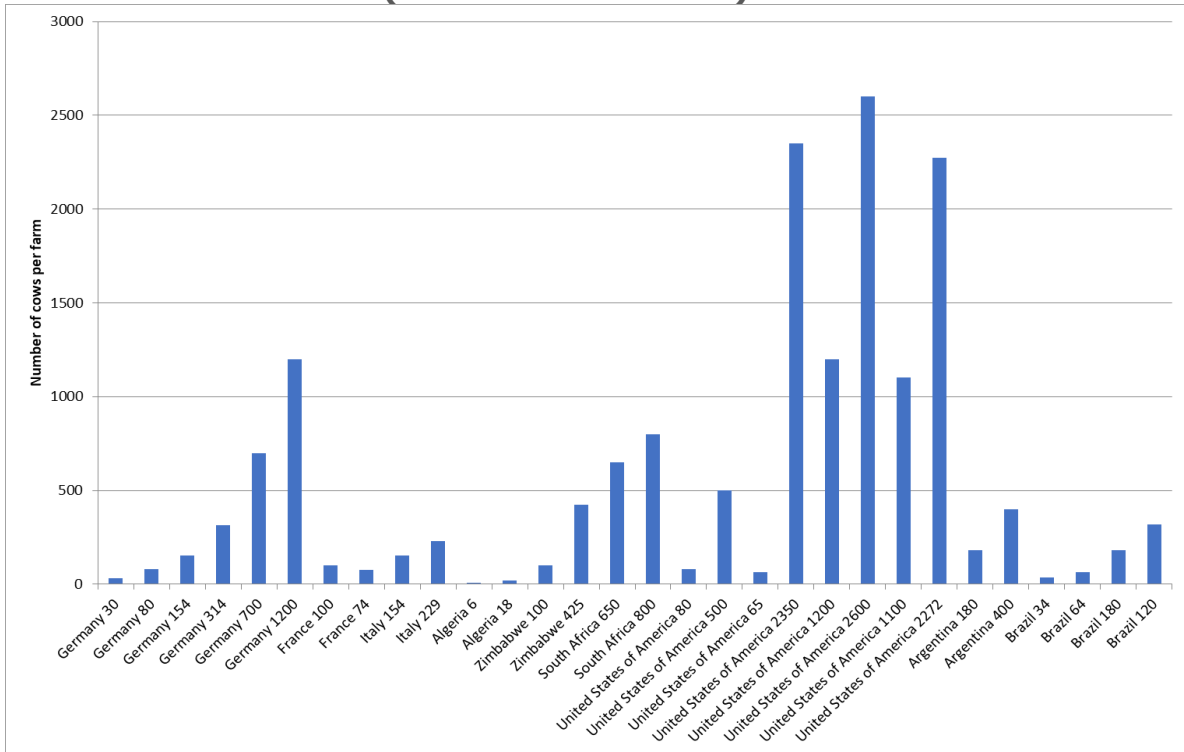
Country	Germany						France		Italy		Algeria		Zimbabwe		South Africa		United States of America						Argentina		Brazil					
Farm Size	30	80	154	314	700	1200	100	74	154	229	6	18	100	425	650	800	80	500	65	2350	1200	2600	1100	2272	180	400	34	64	180	120

TABLE 2 BEEF TYPICAL FARM (N° OF COWS/FARM)

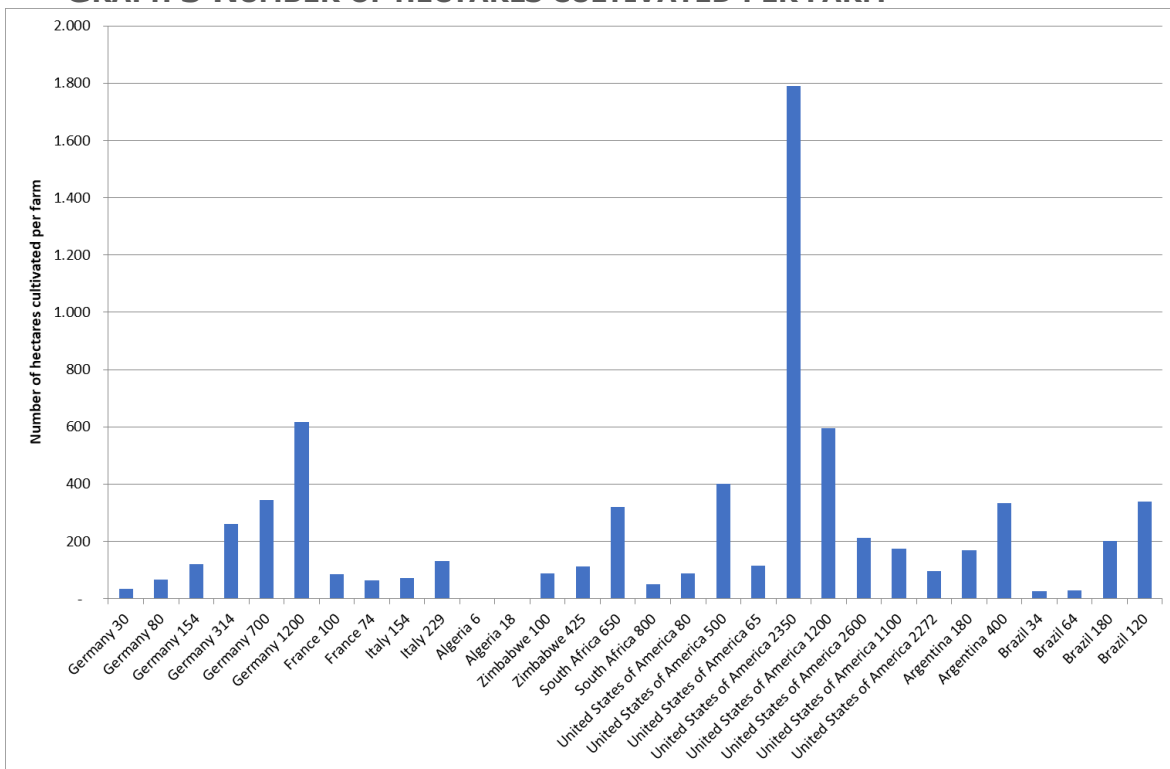
Country	Germany							France			Italy		USA		Argentina						Brazil						Morocco				South Africa		Namibia			
Farm size	260	280	285	380	525	560	4700	75	60	200	910	2660	8000	75000	900	380	630	750	1450	26000	35	60	240	300	500	800	1750	5000	1	14	36	280	3000	75000	600	25000

Dairy sector

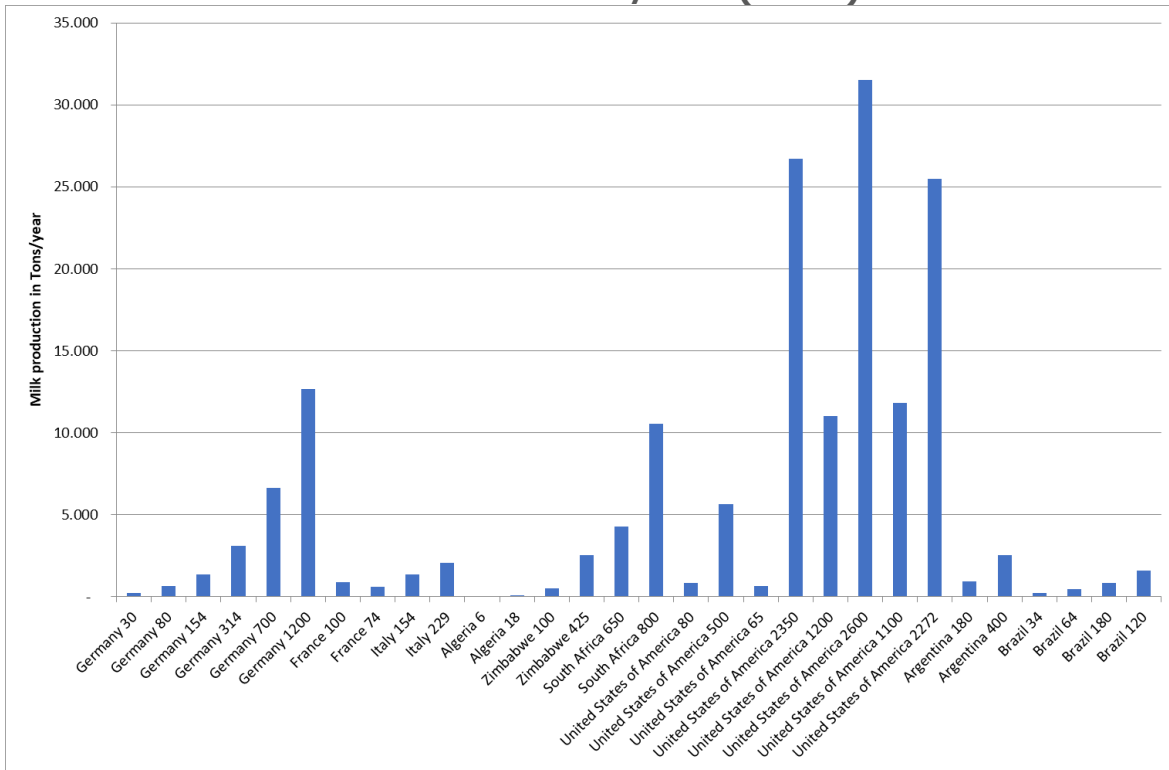
GRAPH 2 FARM SIZE (N° OF COWS PER FARM)



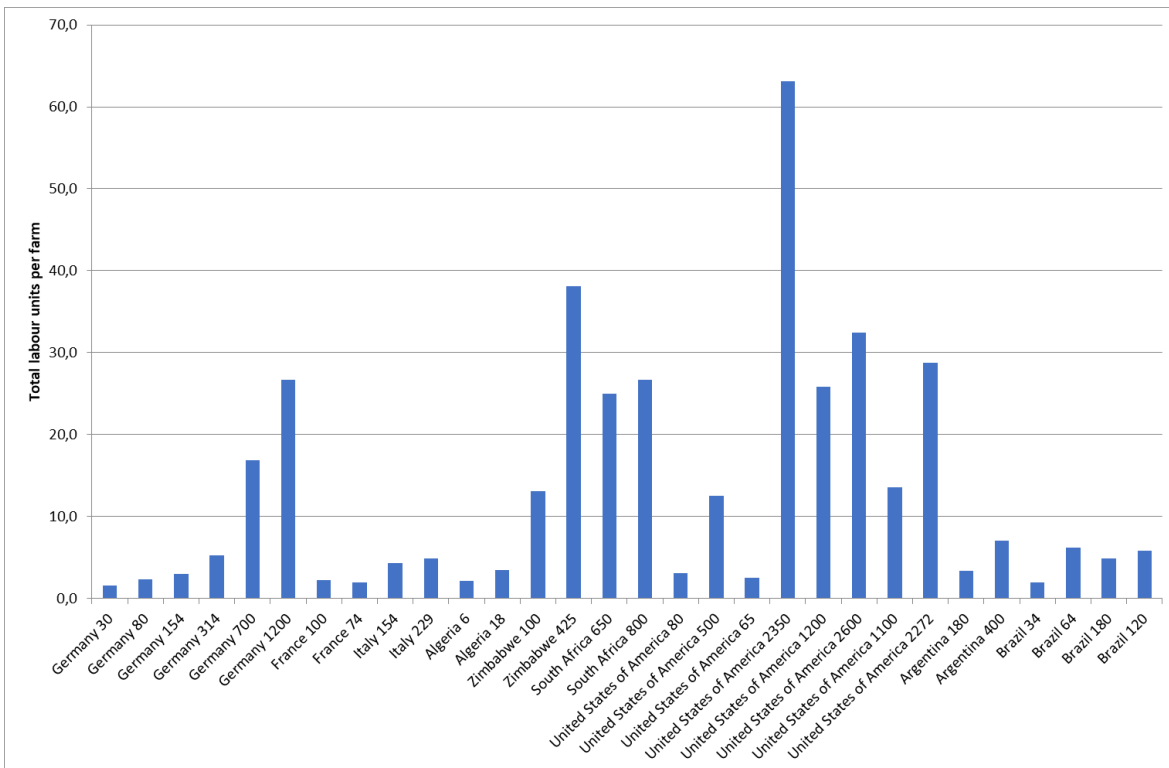
GRAPH 3 NUMBER OF HECTARES CULTIVATED PER FARM



GRAPH 4 MILK PRODUCTION IN TONS/YEAR (2022)

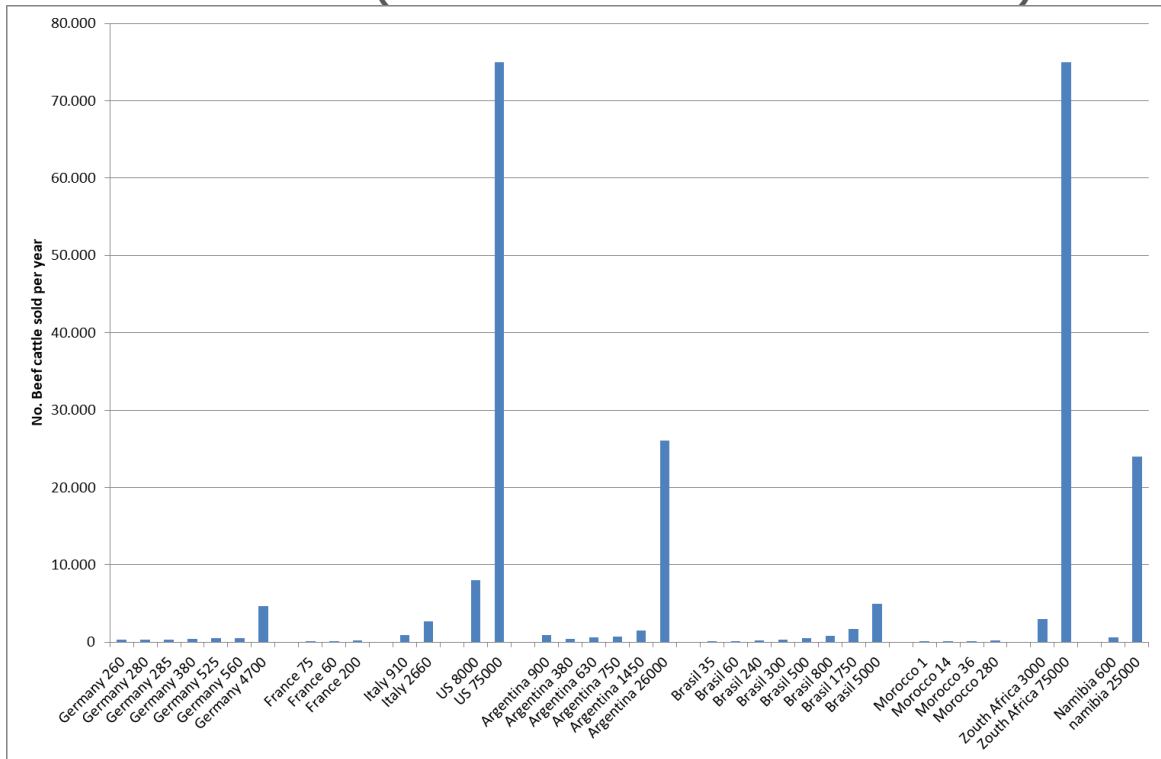


GRAPH 5 NUMBER OF LABOUR UNITS PER DAIRY FARM

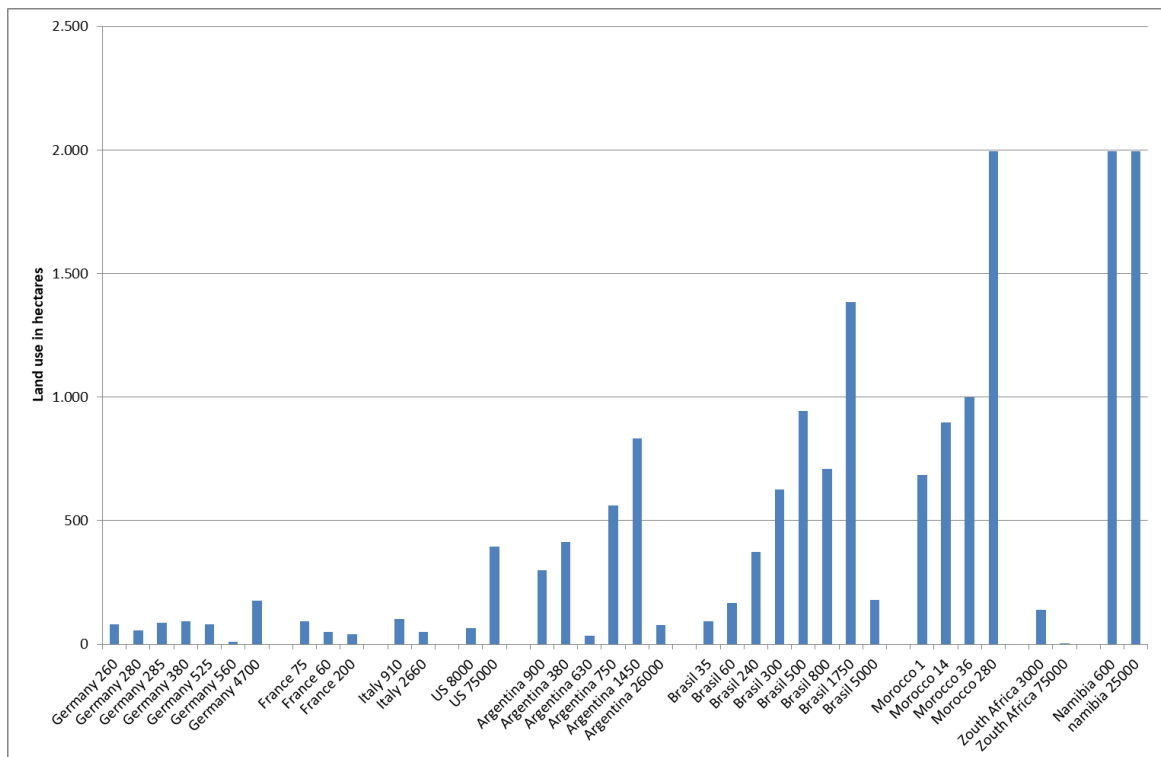


Beef sector

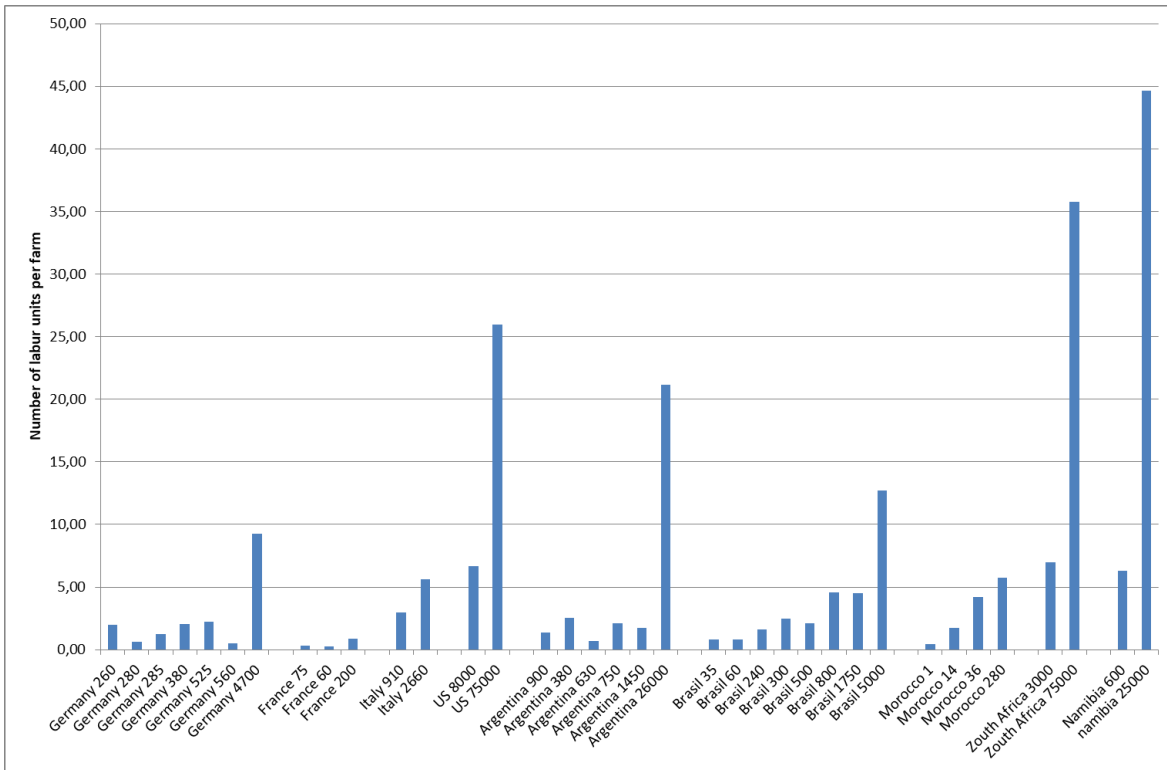
GRAPH 6 FARM SIZE (NUMBER CATTLE SOLD PER FARM PER YEAR)



GRAPH 7 LAND USED IN BEEF FARMS (HA)



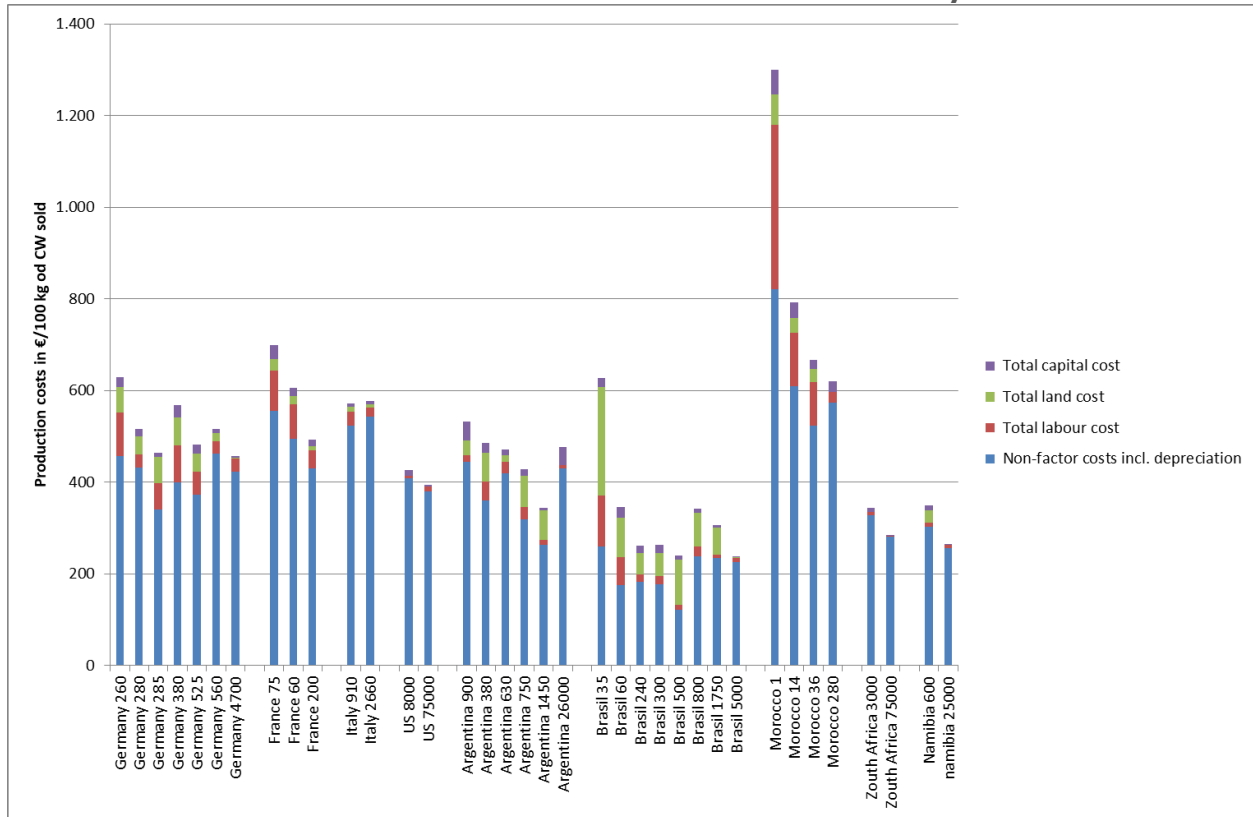
GRAPH 8 NUMBER OF LABOUR UNITS PER BEEF FARM



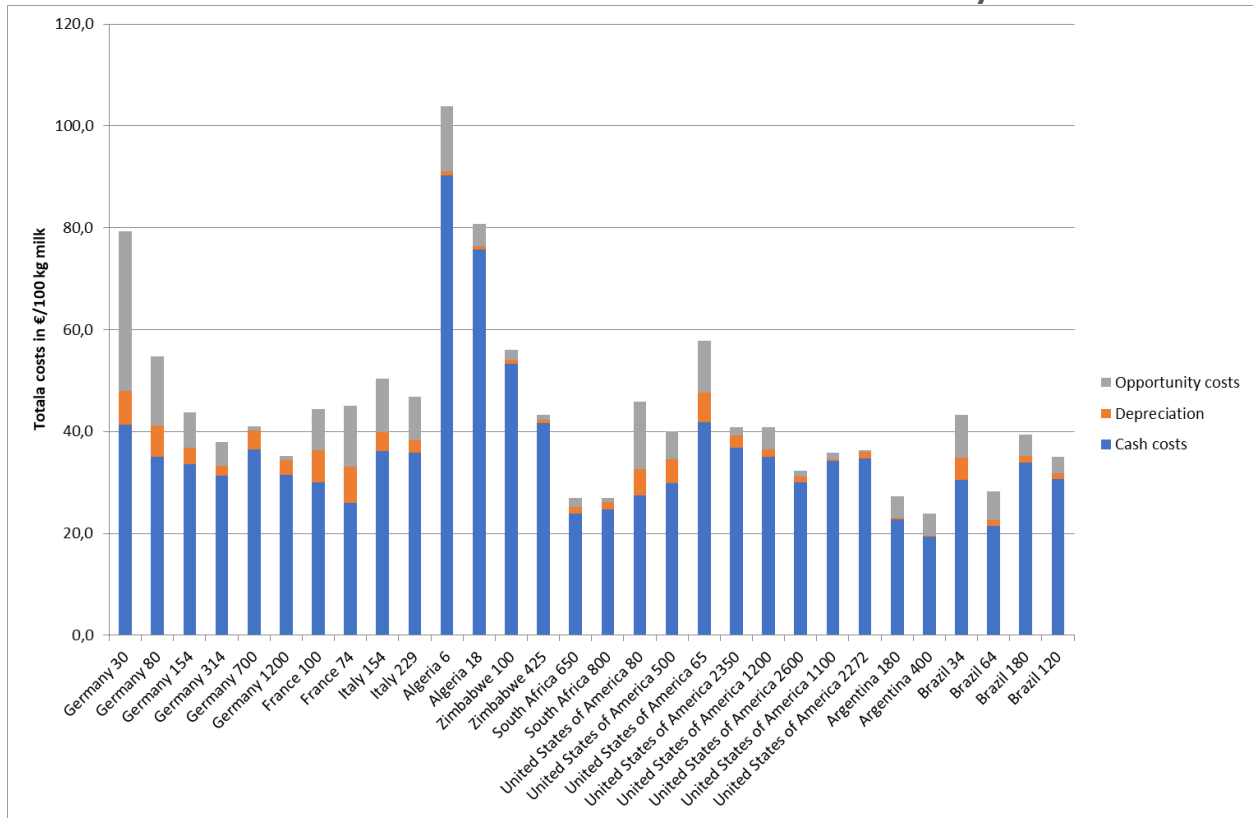
Production costs

In this paragraph, the graphs summarise production costs in 2021 in both dairy and beef farms.

GRAPH 9 BEEF PRODUCTION TOTAL COSTS IN 2021 IN €/100 KG CW SOLD



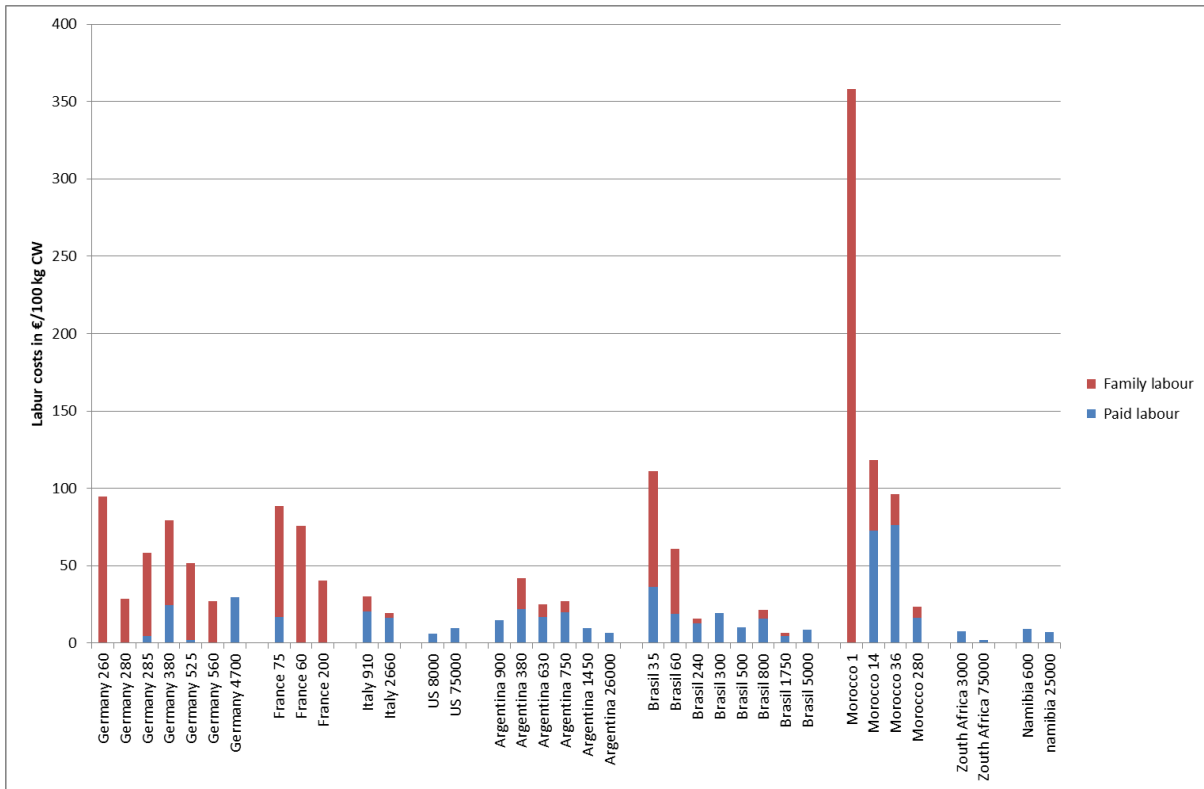
GRAPH 10 MILK PRODUCTION TOTAL COSTS IN 2021 IN €/100 KG MILK



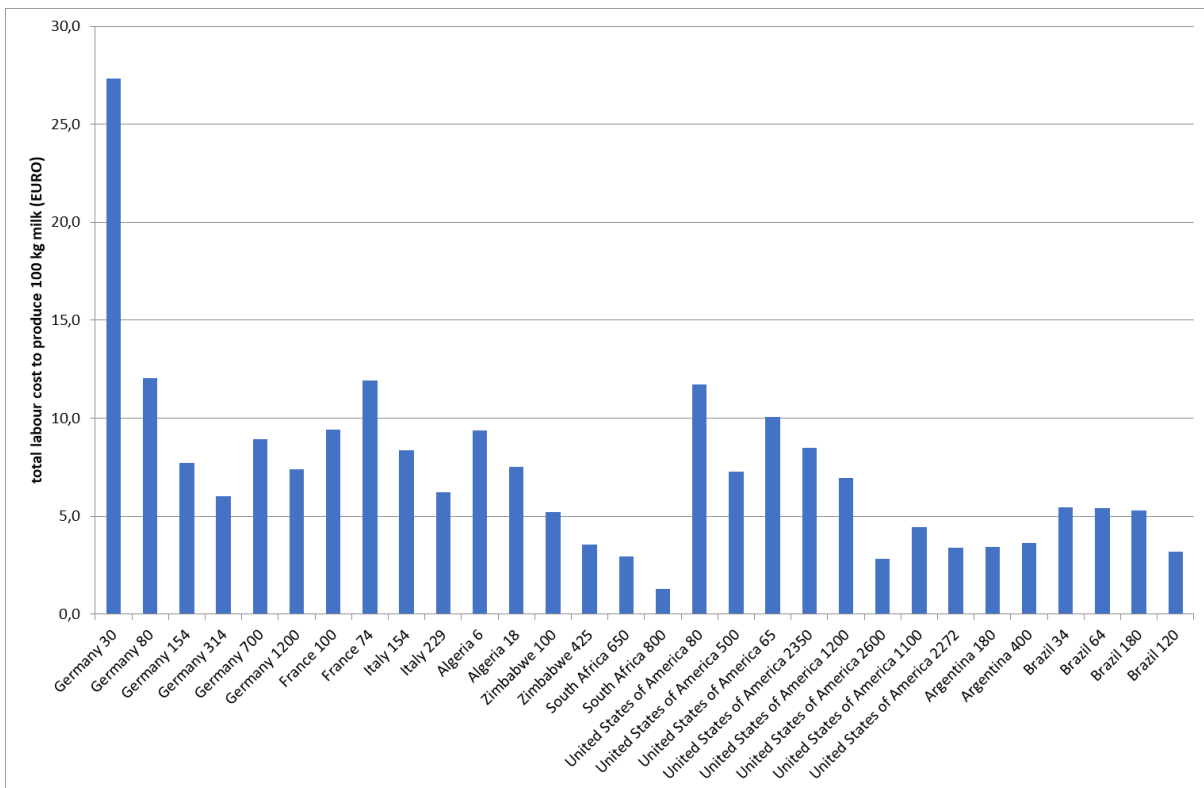
Labour costs

In the following section, labour costs in 2021 in both dairy and beef farms have been summarized with several graphs.

GRAPH 11 LABOUR COSTS IN BEEF FARMS 2021



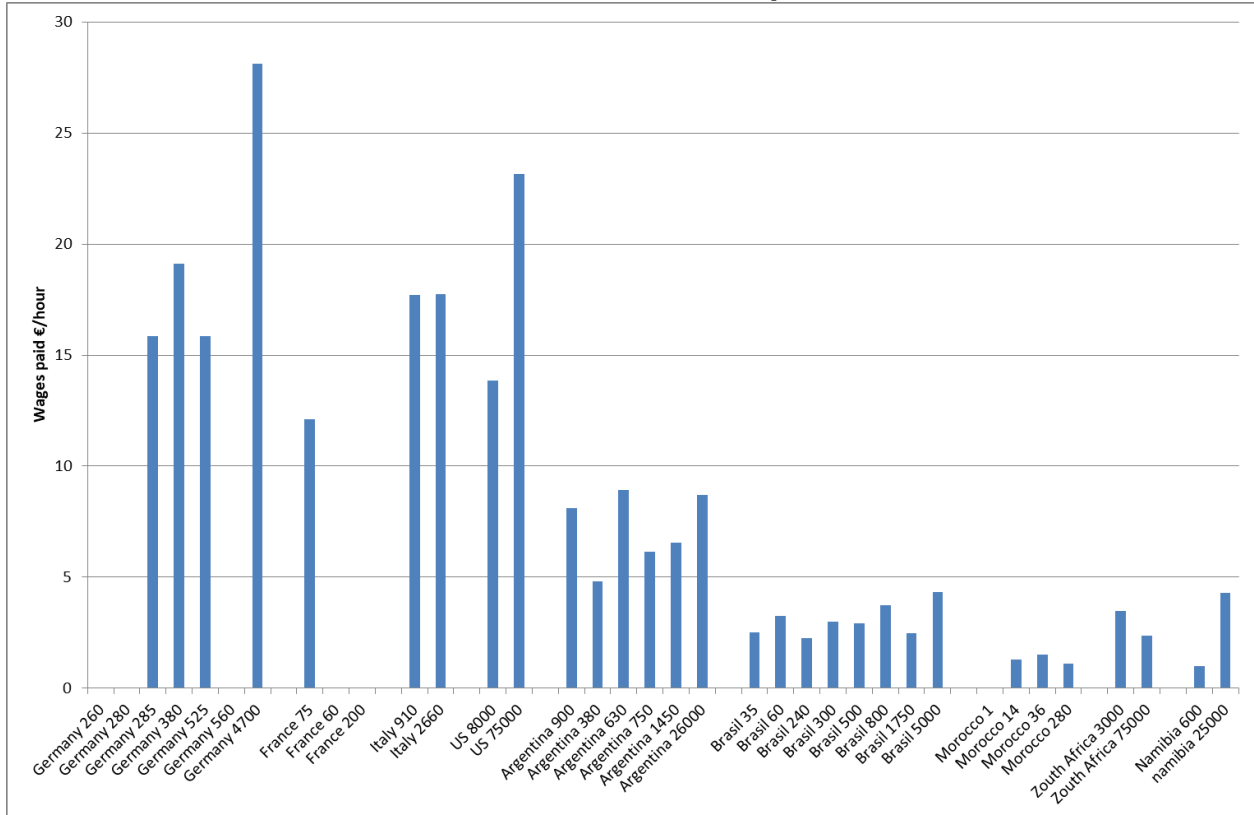
GRAPH 12 LABOUR COSTS IN DAIRY FARMS 2021 IN €/100 KG MILK



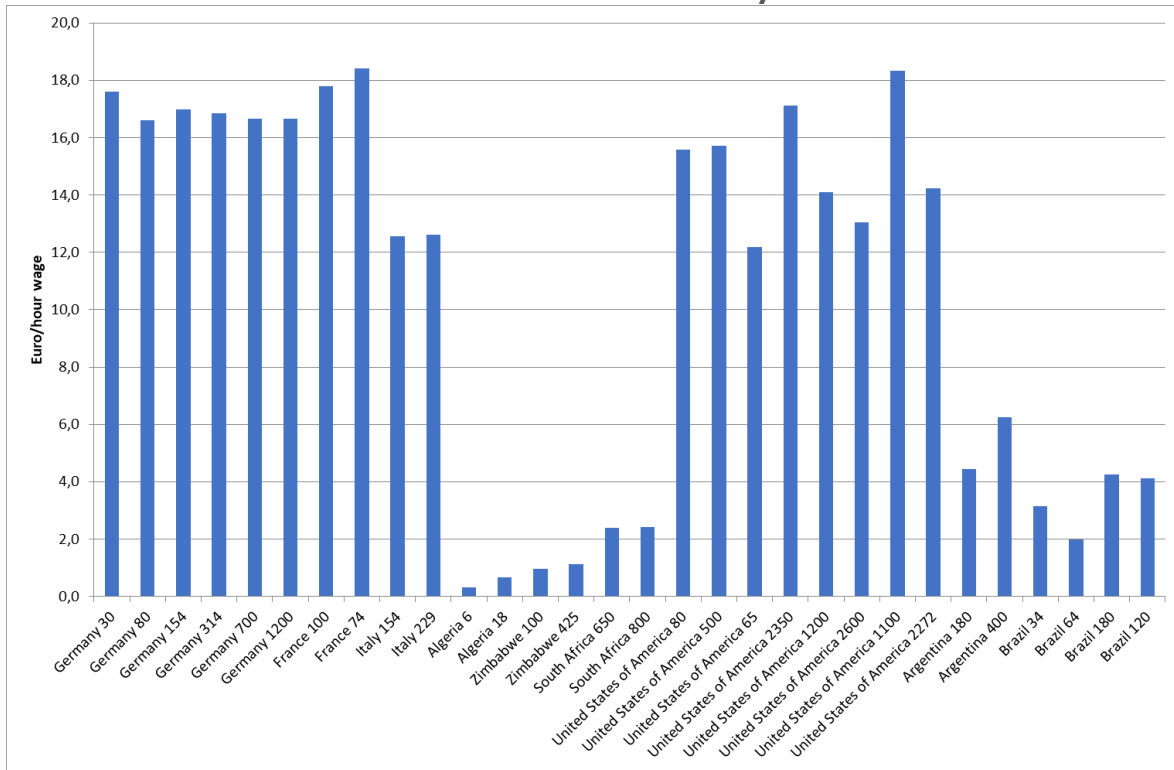
Wages

The following graphs summarise the wages paid in 2021 on both dairy and beef farms.

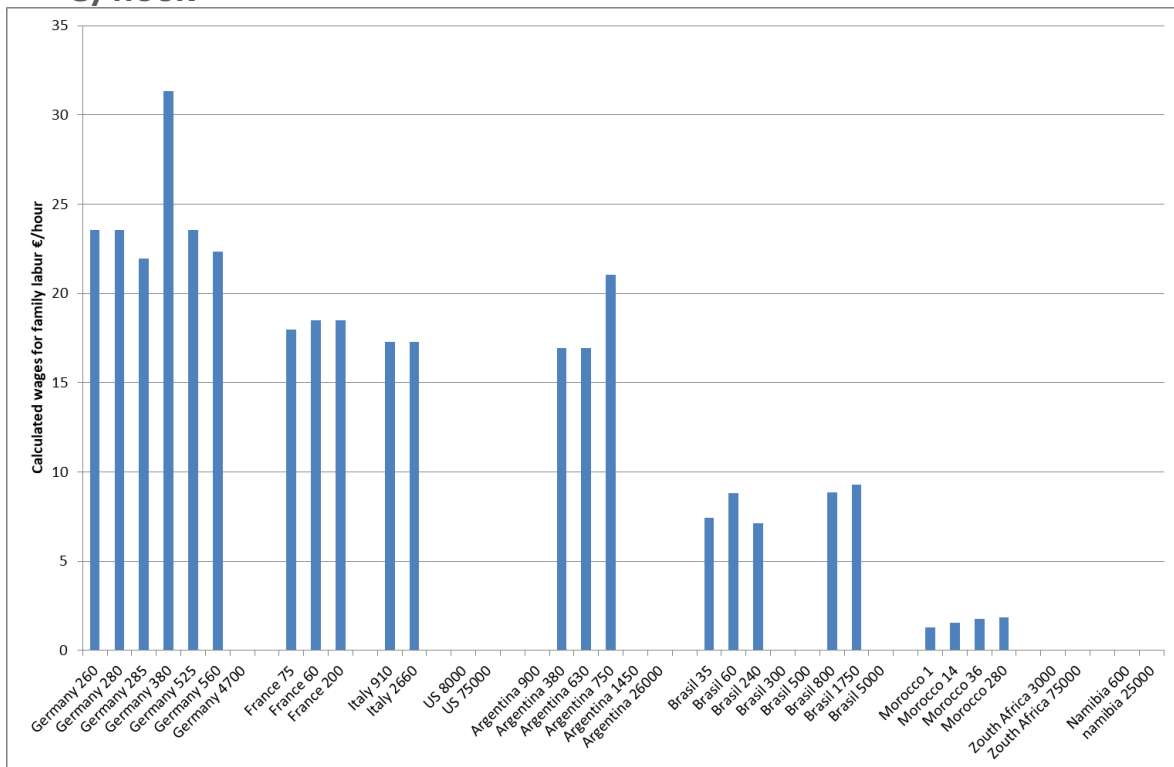
GRAPH 13 WAGES PAID IN BEEF FARMS IN €/HOUR



GRAPH 14 WAGES PAID IN DAIRY FARMS IN €/HOUR



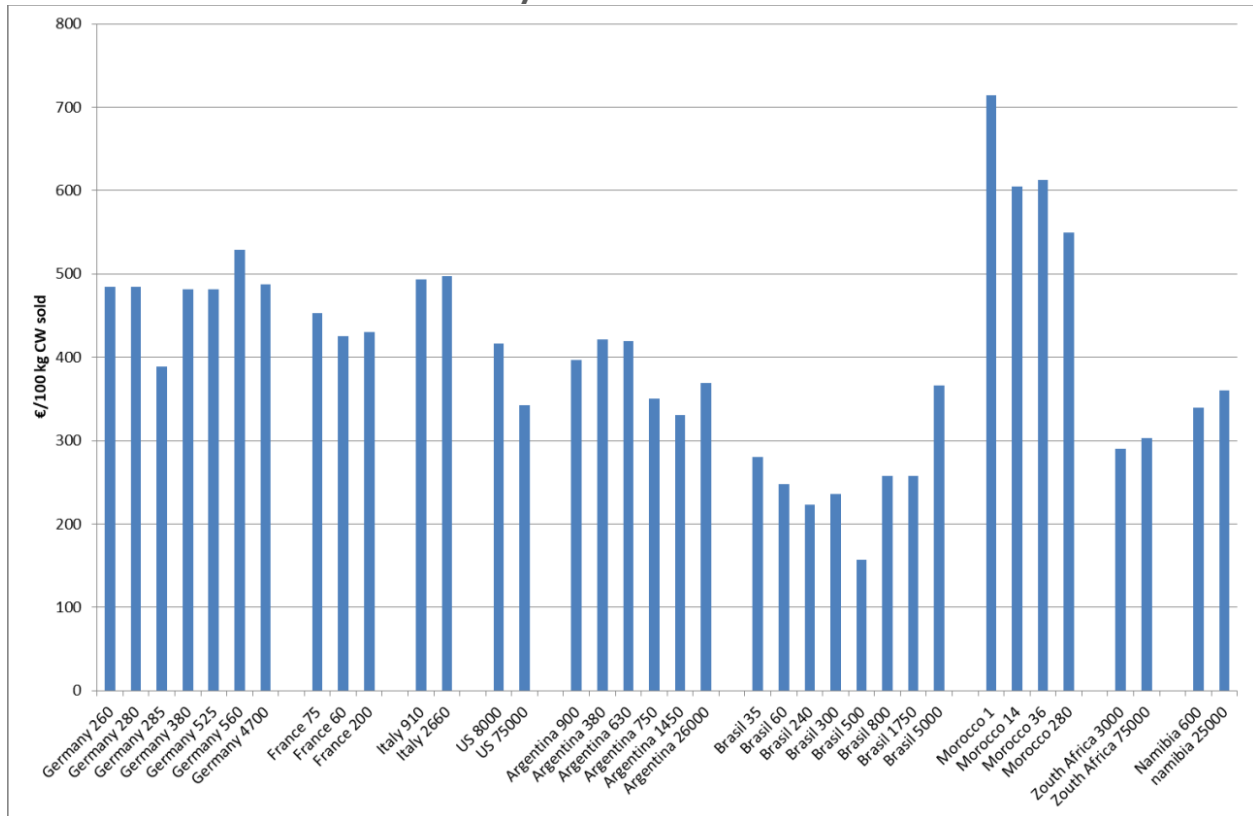
GRAPH 15 CALCULATED WAGES FOR FAMILY LABOUR IN BEEF FARMS IN €/HOUR



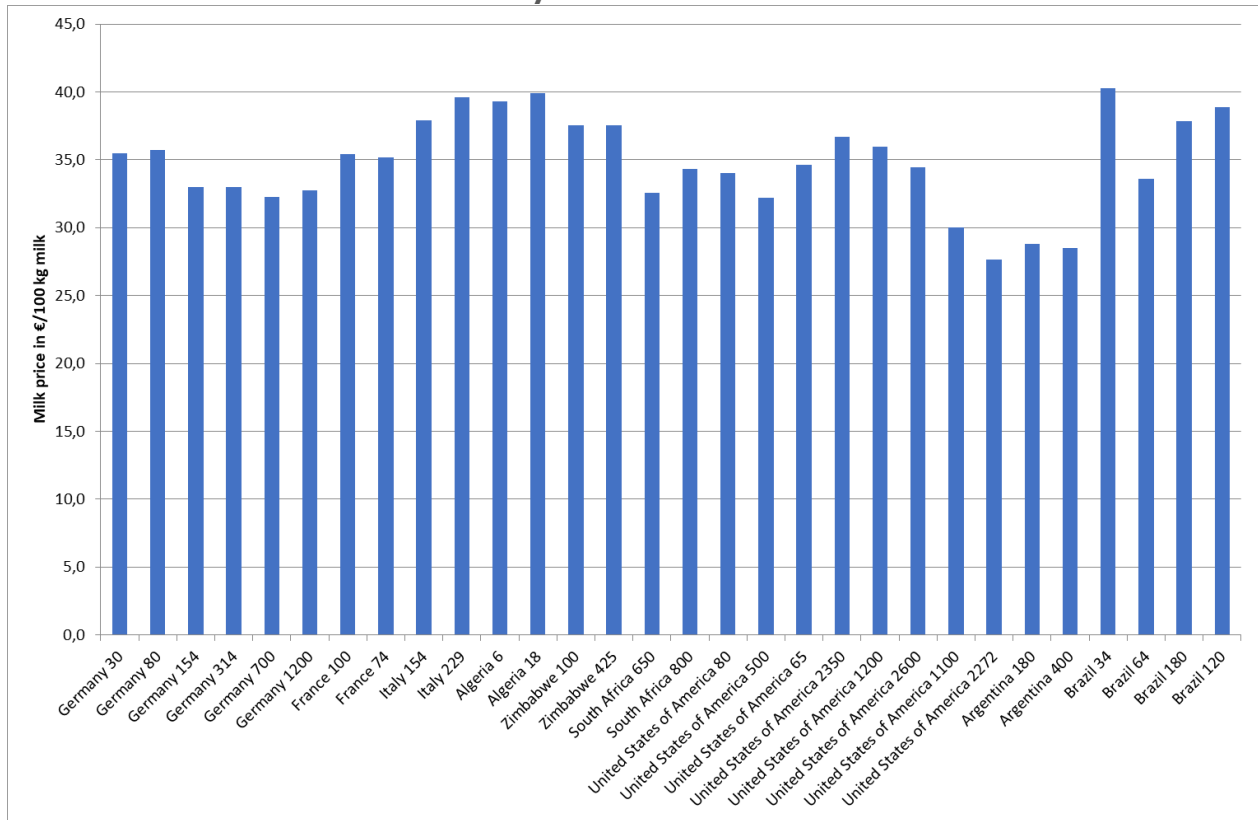
Prices

In this section, graphs summarise the perceived prices in 2021 on dairy and beef farms.

GRAPH 16 BEEF PRICE IN €/100 KG CW SOLD



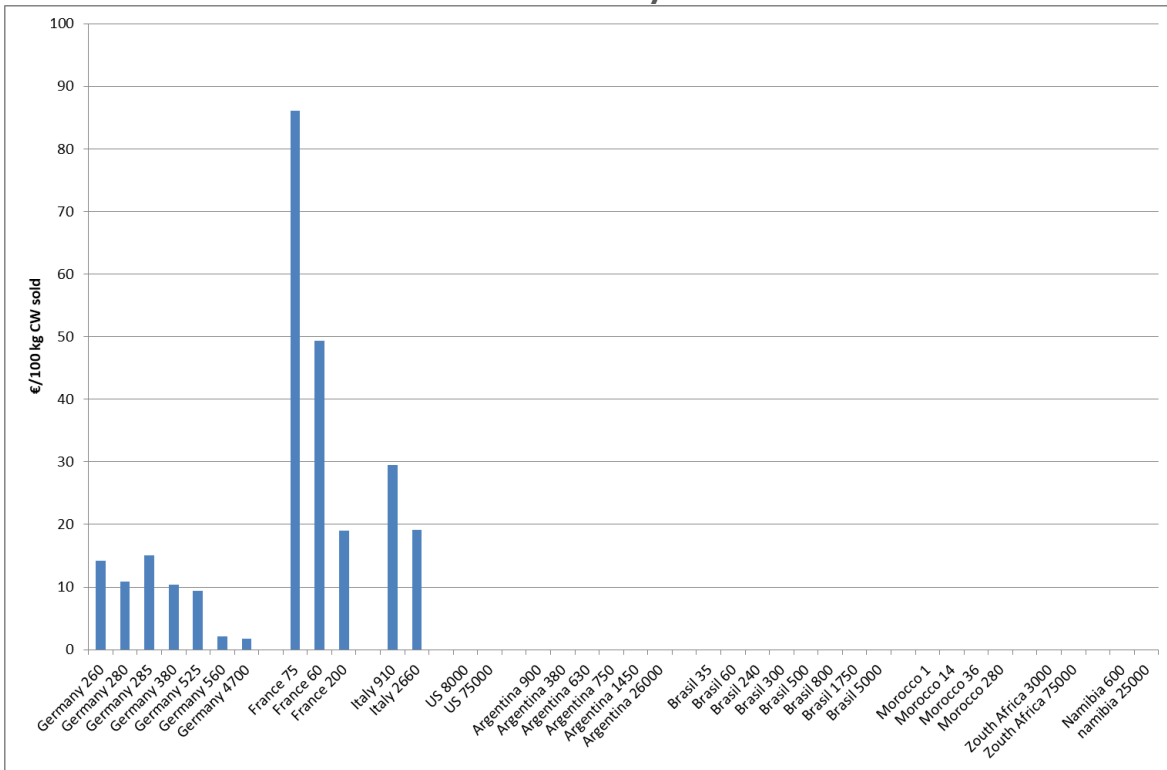
GRAPH 17 MILK PRICE IN €/100 KG MILK



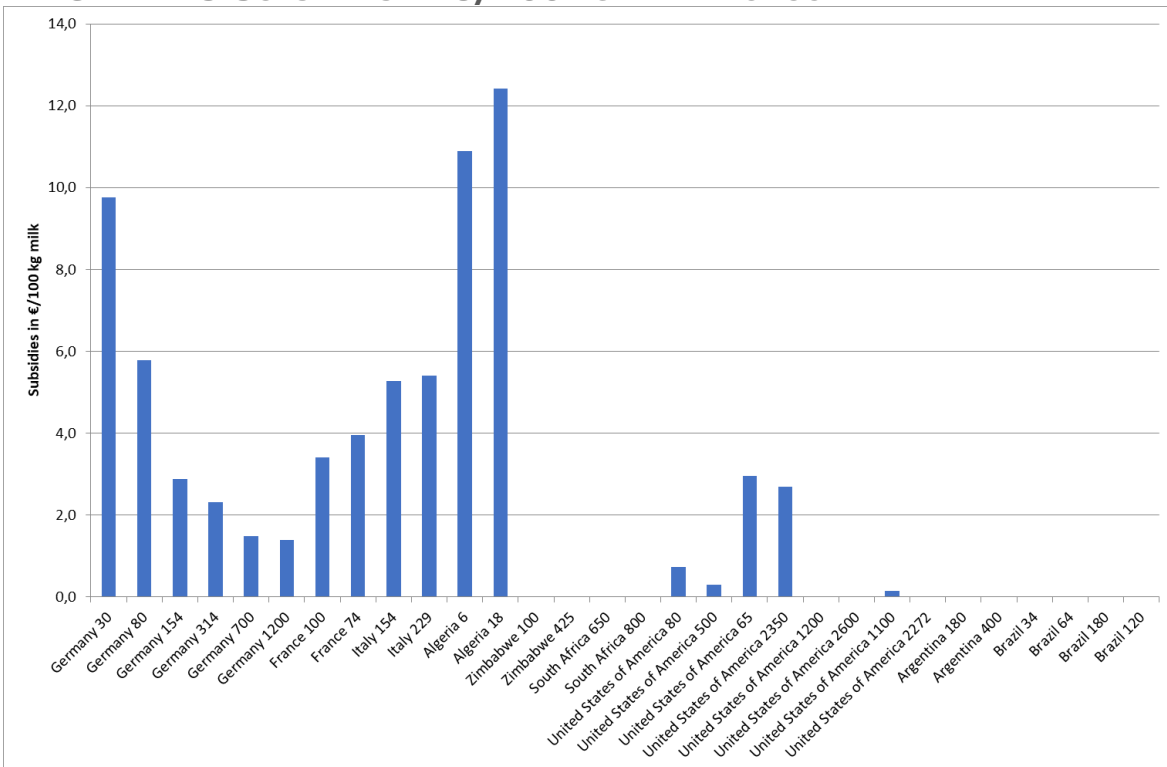
Subsidies

In this subsection, the graphs summarise the subsidies in 2021 on dairy and beef farms.

GRAPH 18 DECOUPLED PAYMENTS IN €/100 KG OF CW SOLD FOR BEEF



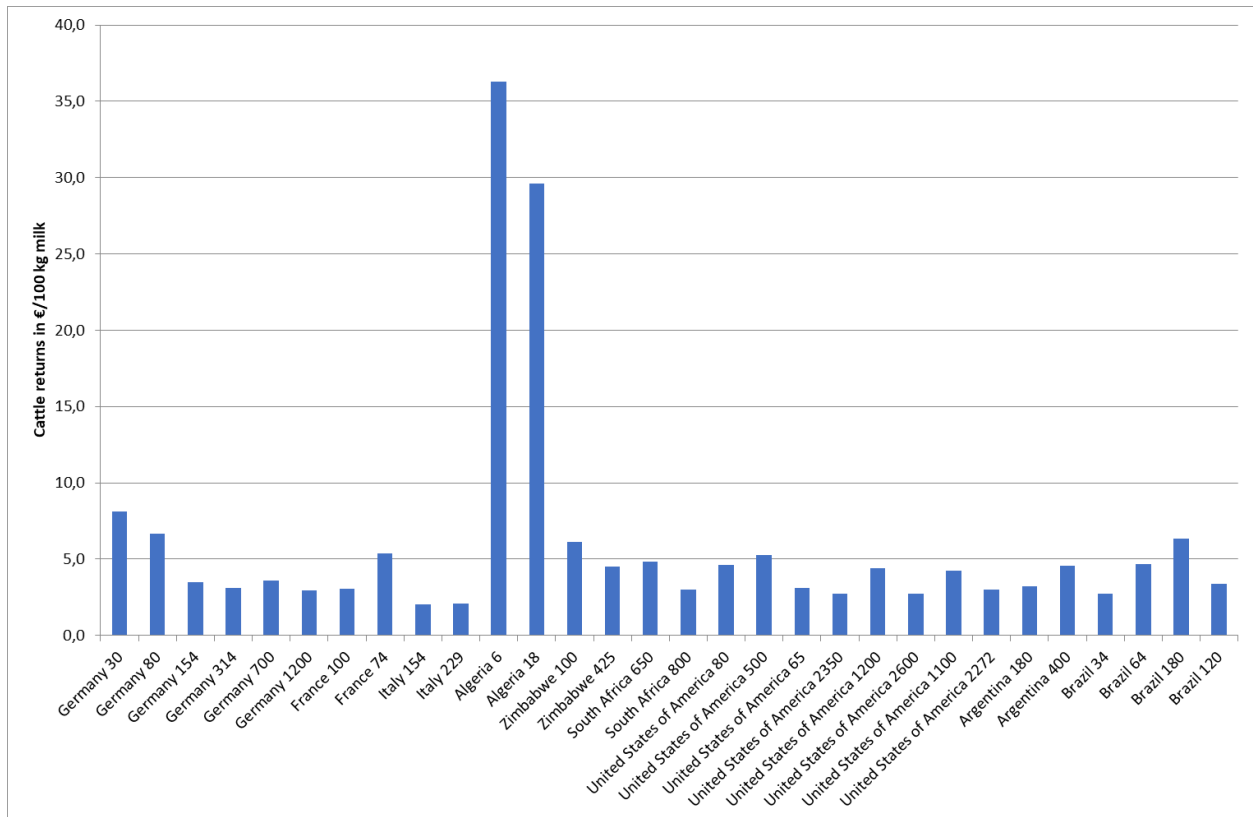
GRAPH 19 SUBSIDIES IN €/100 KG MILK PRODUCED



Cattle returns

In this part, the graphs summarise the cattle returns in 2021 on dairy and beef farms.

GRAPH 20 CATTLE RETURNS IN DAIRY FARMS IN €/100 KG MILK PRODUCED



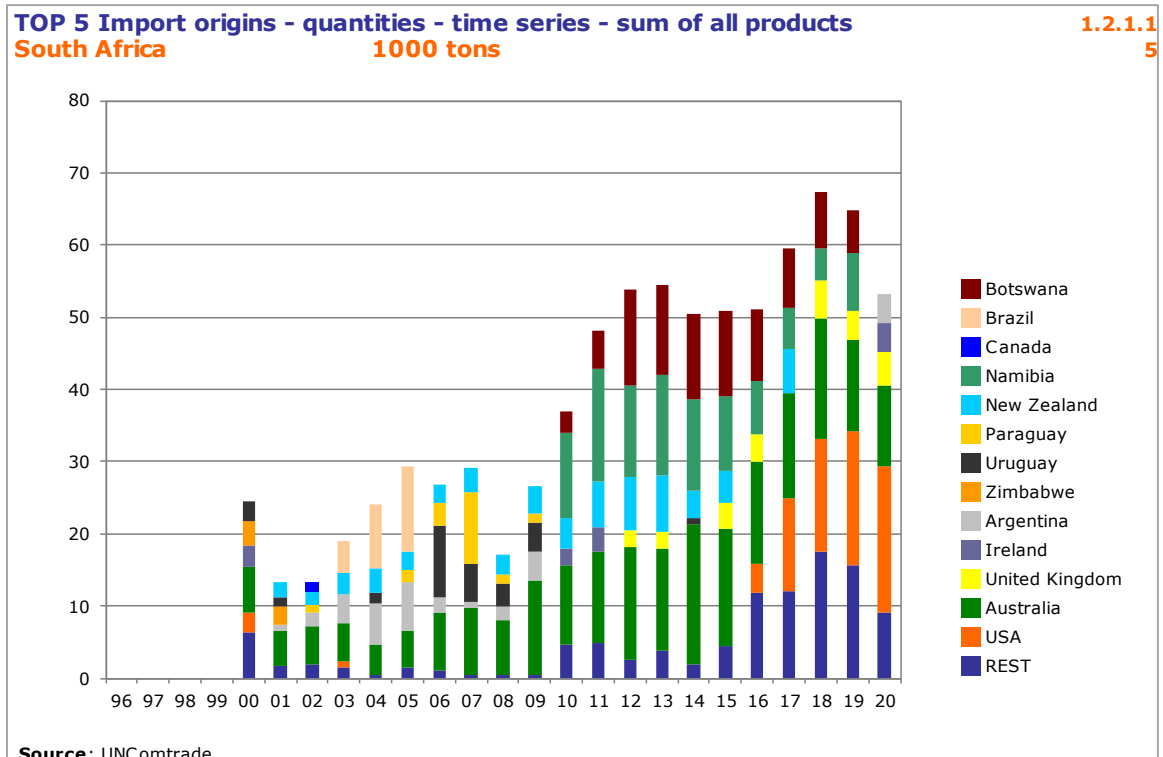
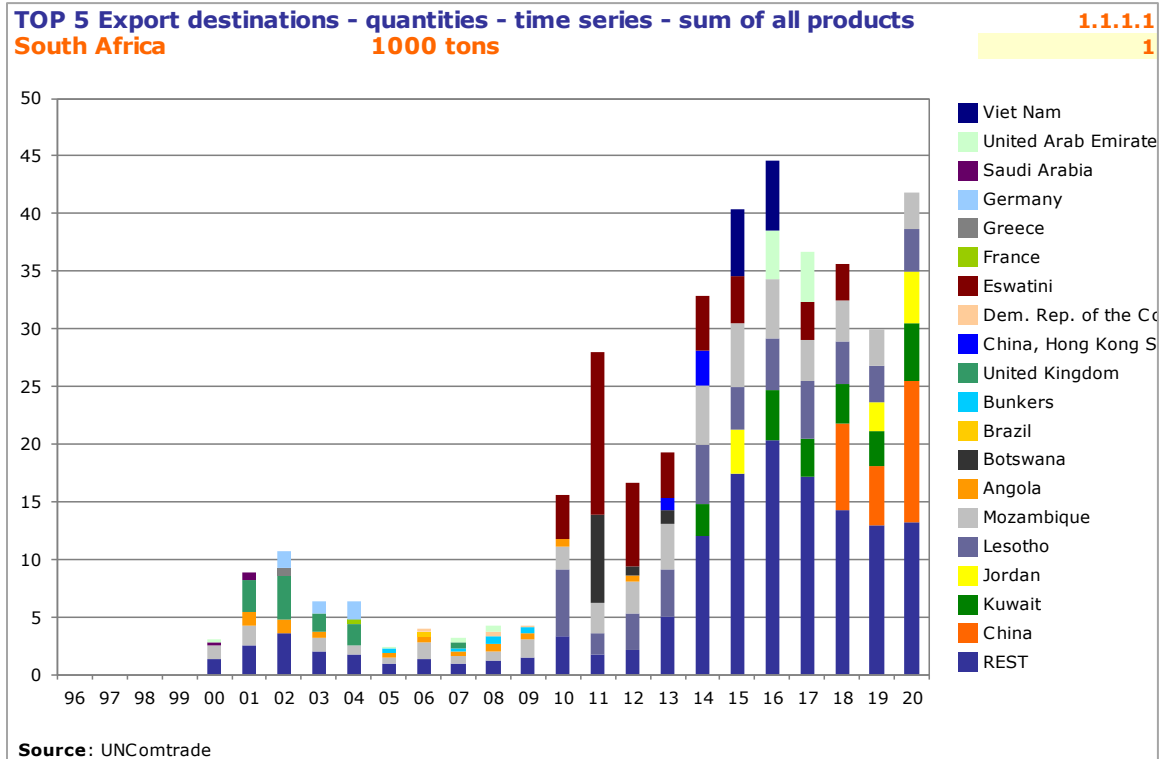
Import & export - beef

This chapter report the *top five import-export destinations* for dairy and beef products of the countries investigated in beef and dairy sector. The graphs are reporting the import-export quantity for the main commodities.

South Africa

The following graphs show the *South Africa's* main export & import partners.

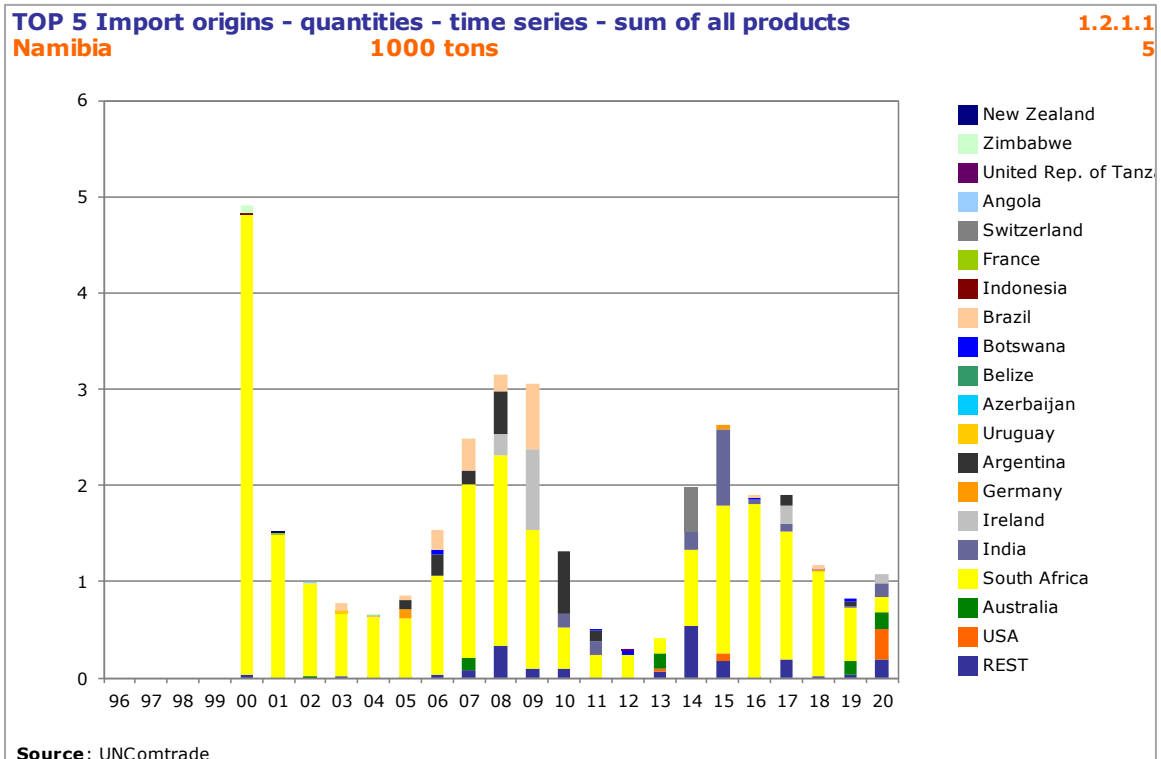
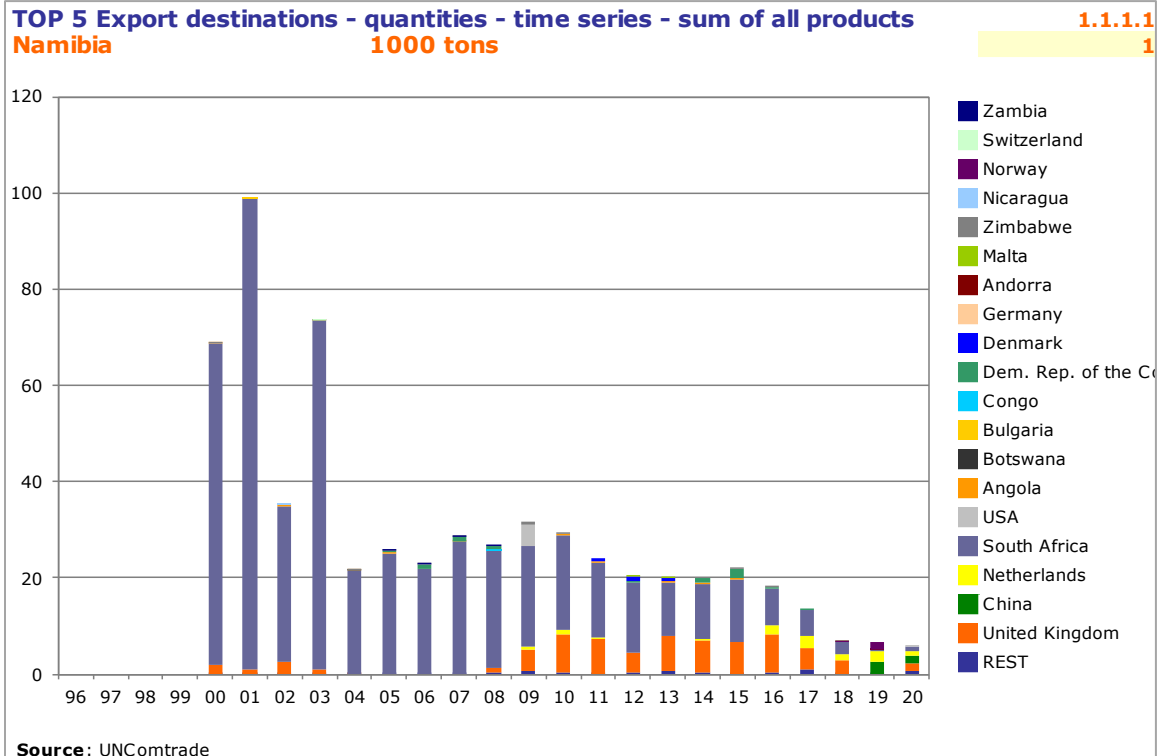
GRAPH 21 SOUTH AFRICA – EXPORT & IMPORT



Namibia

The following graphs show the *Namibia's* main export & import partners.

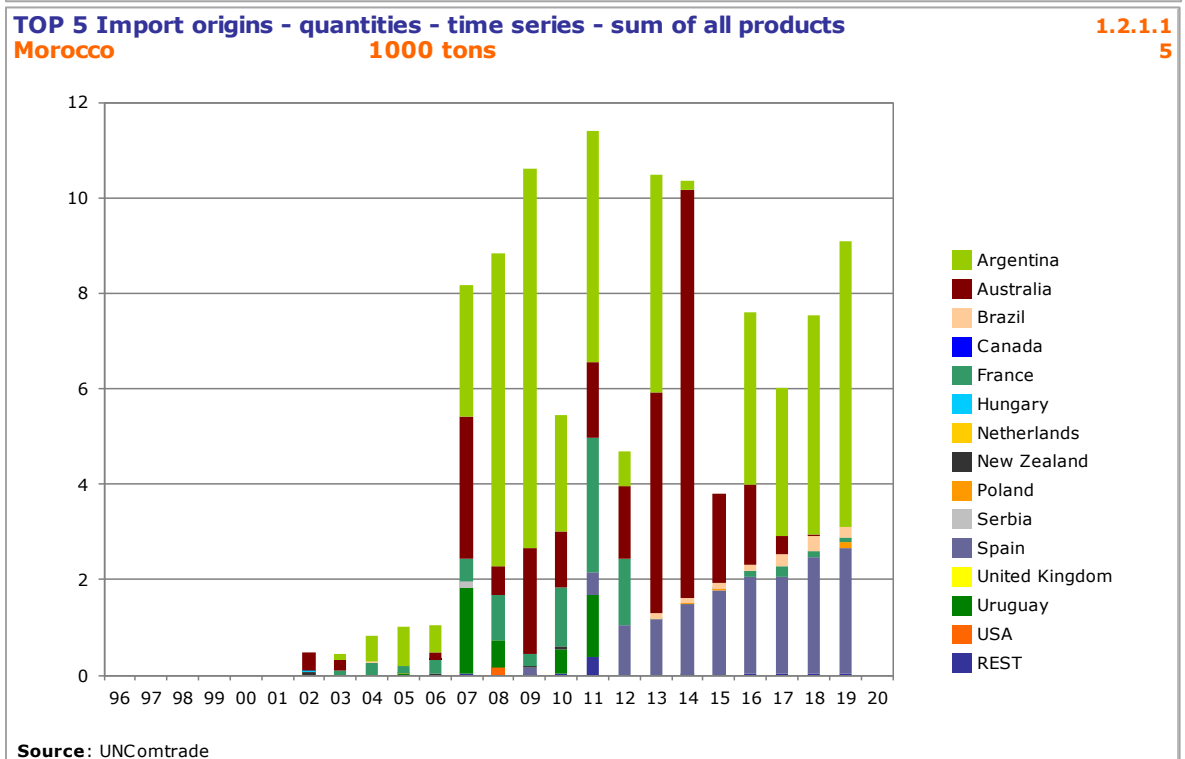
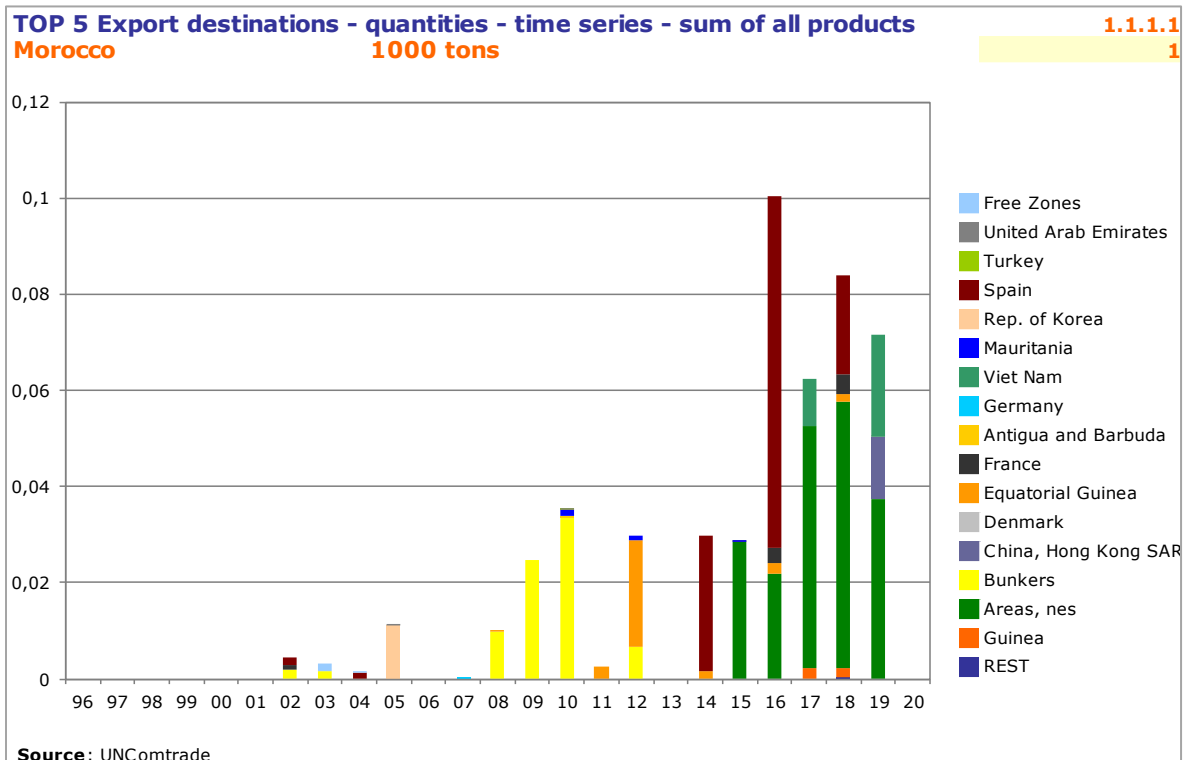
GRAPH 22 NAMIBIA - EXPORT



Morocco

The following graphs show that *Morocco's* main export and imports partners.

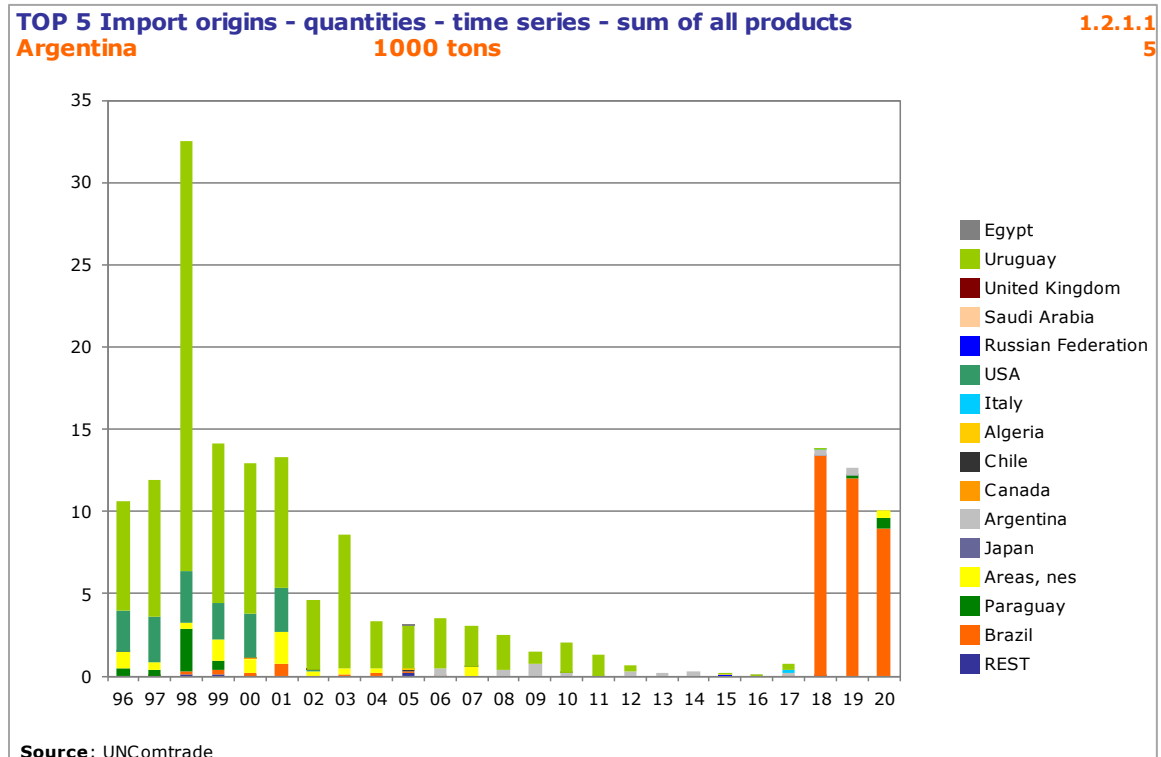
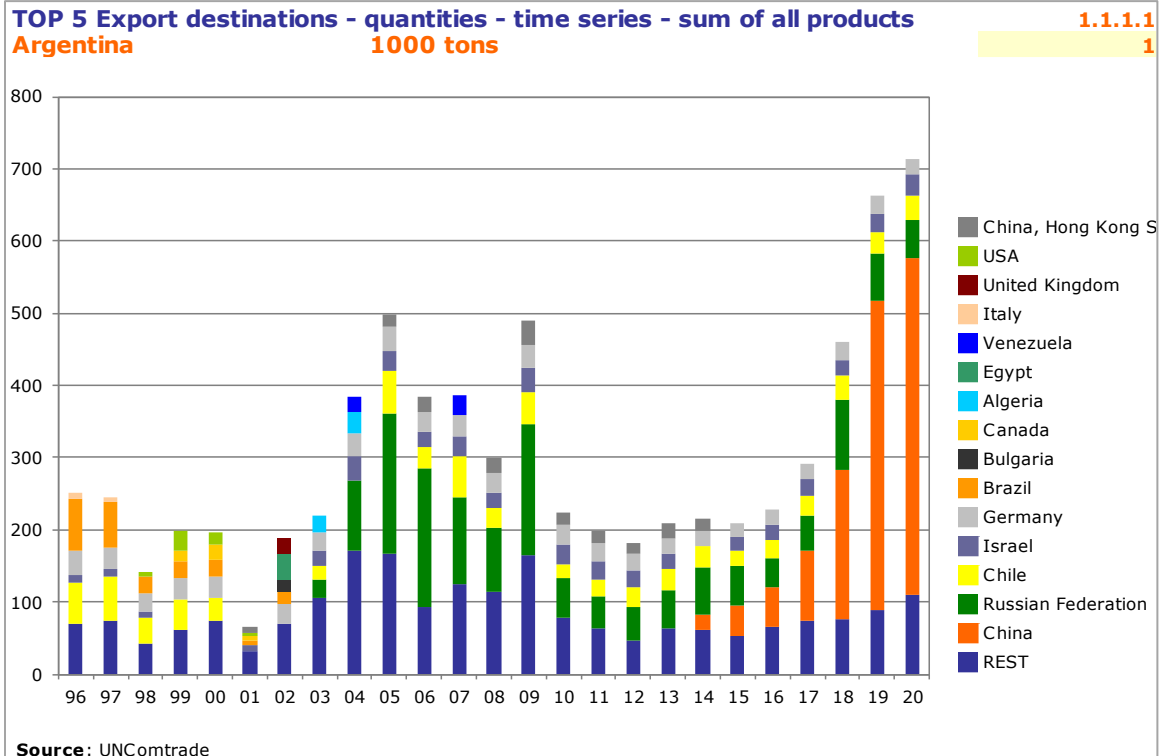
GRAPH 23 MOROCCO – EXPORT & IMPORT



Argentina

The following graphs show the *Argentina's* main export & import partners.

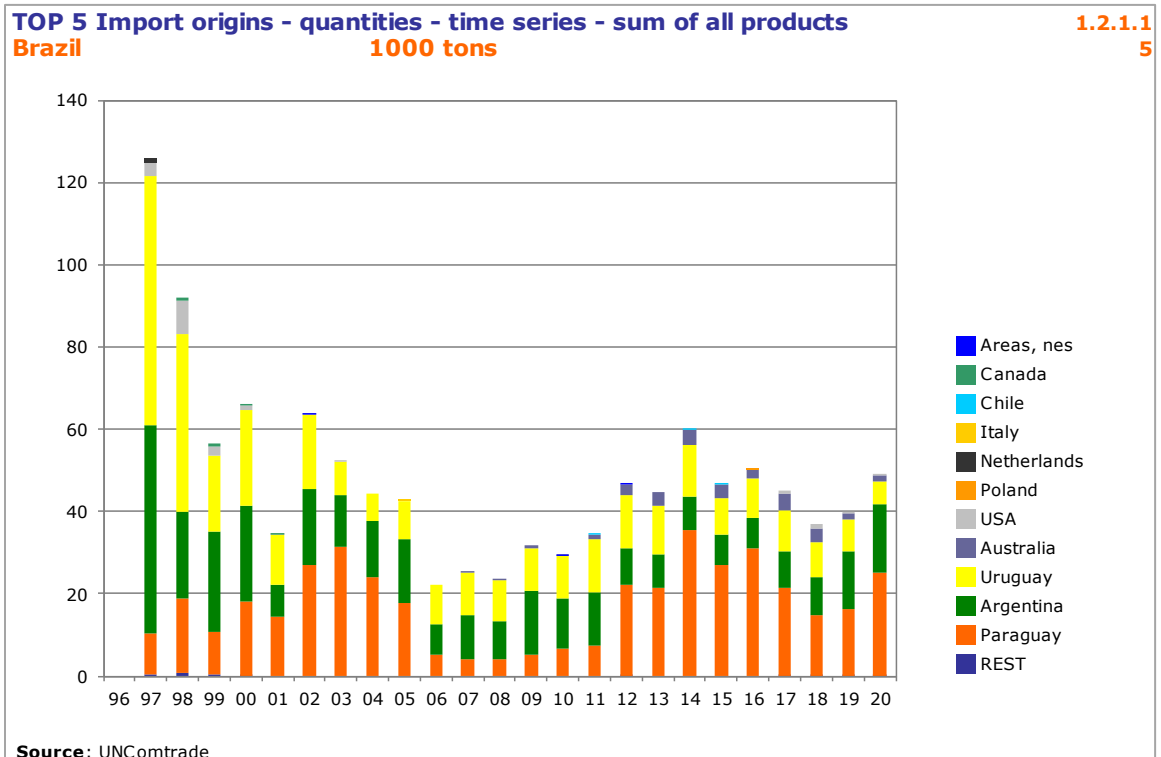
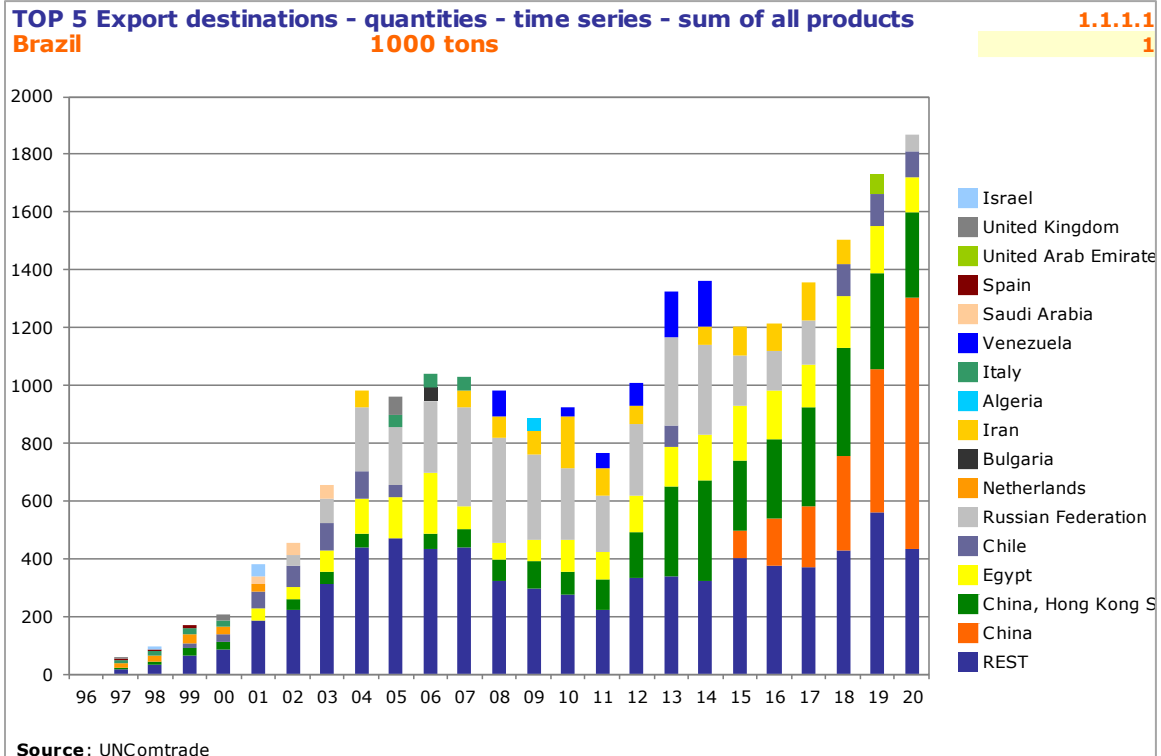
GRAPH 24 ARGENTINA - EXPORT & IMPORT



Brazil

The following graphs show the *Brazil's* main export & import partners.

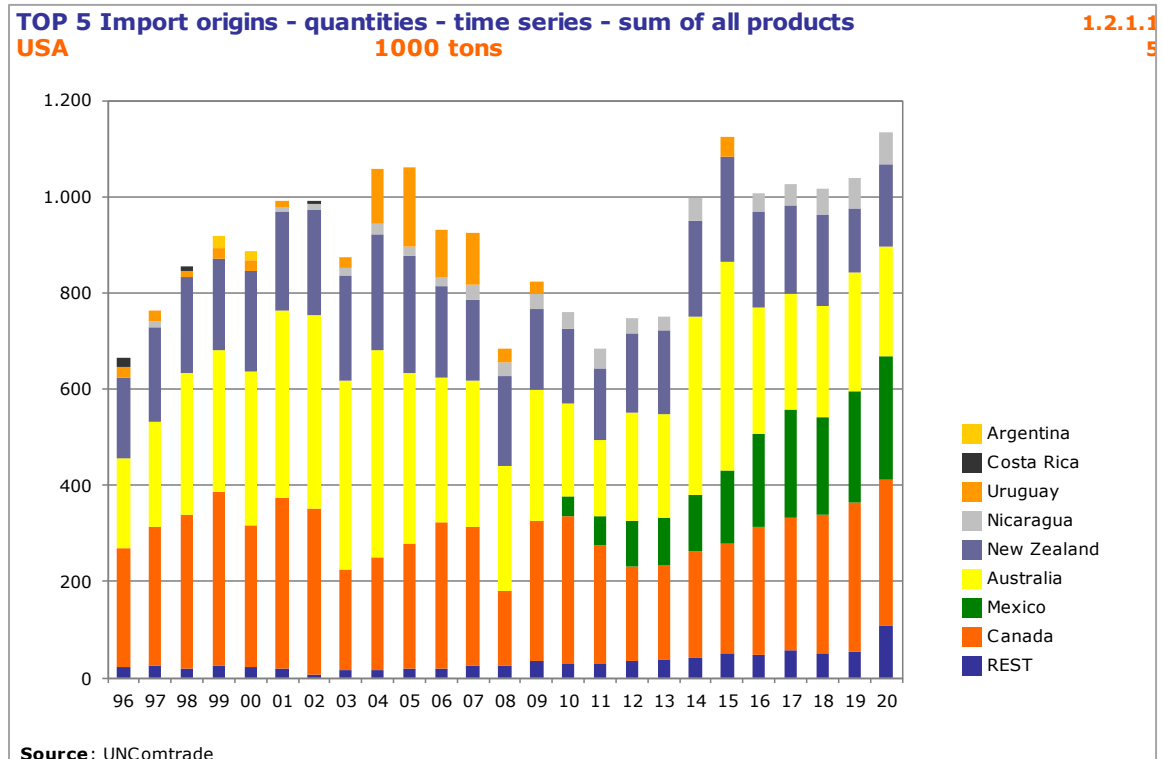
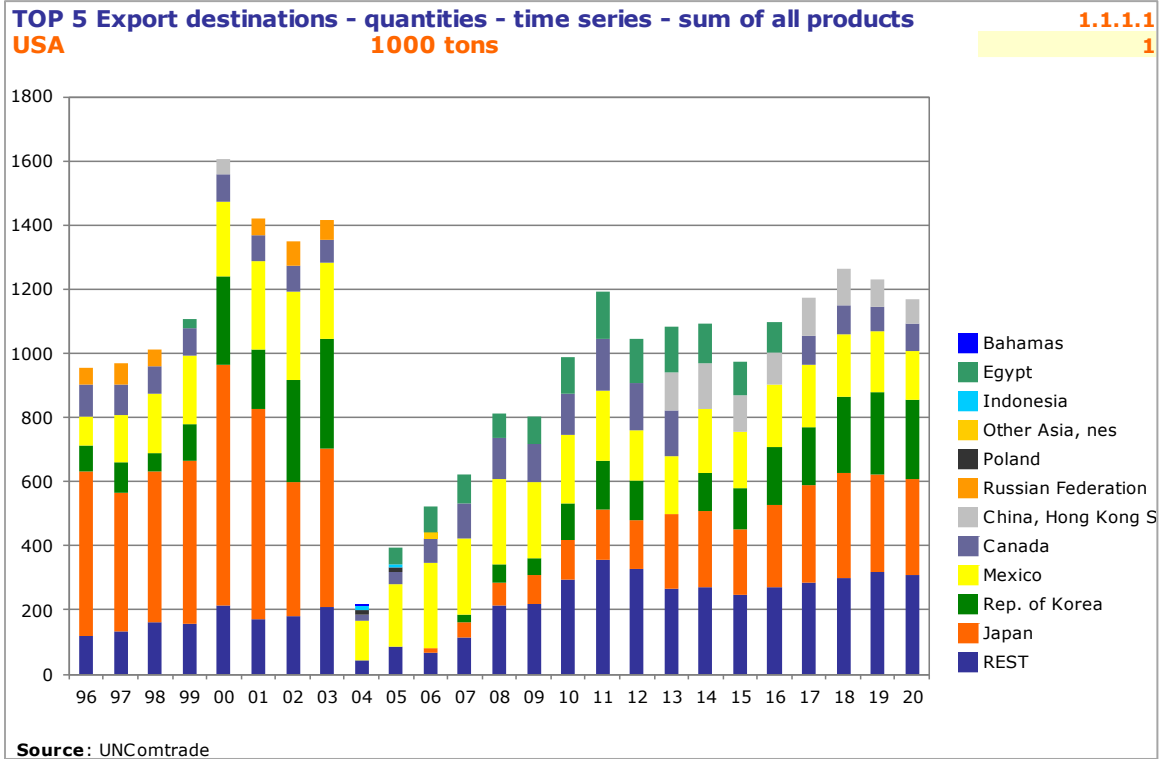
GRAPH 25 BRAZIL - EXPORT & IMPORT



USA

The following graphs show the *USA's* main export & import partners.

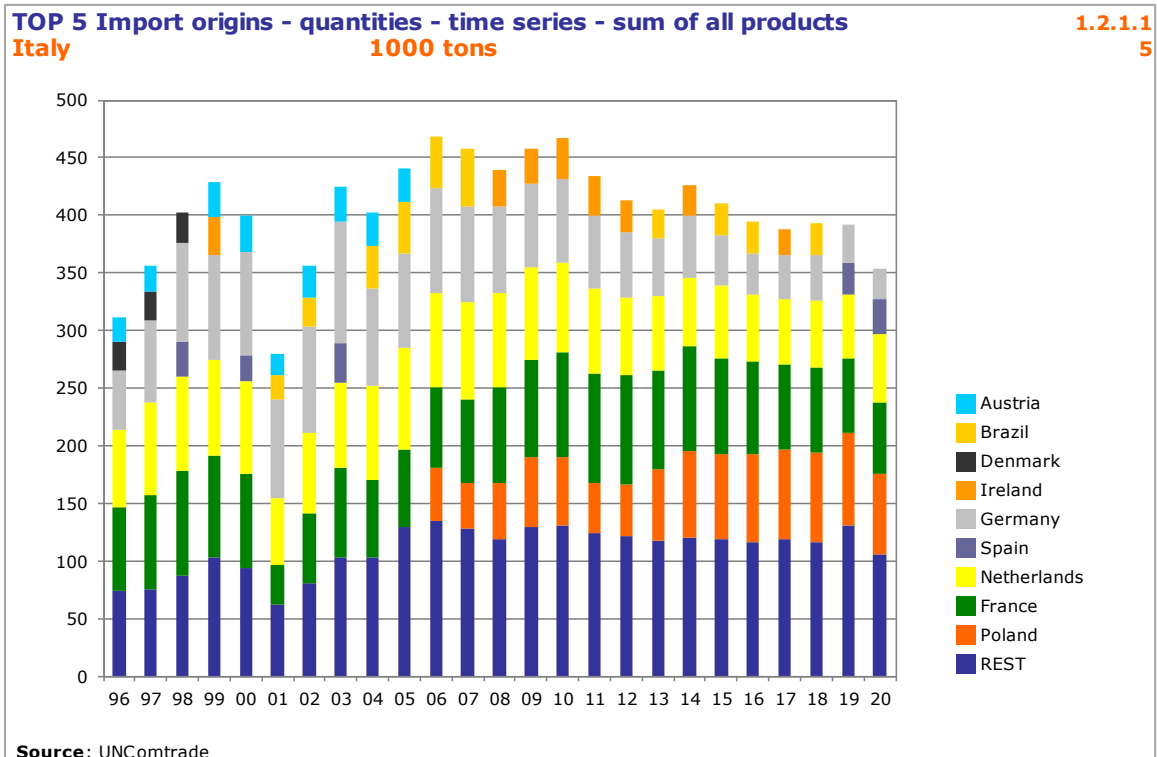
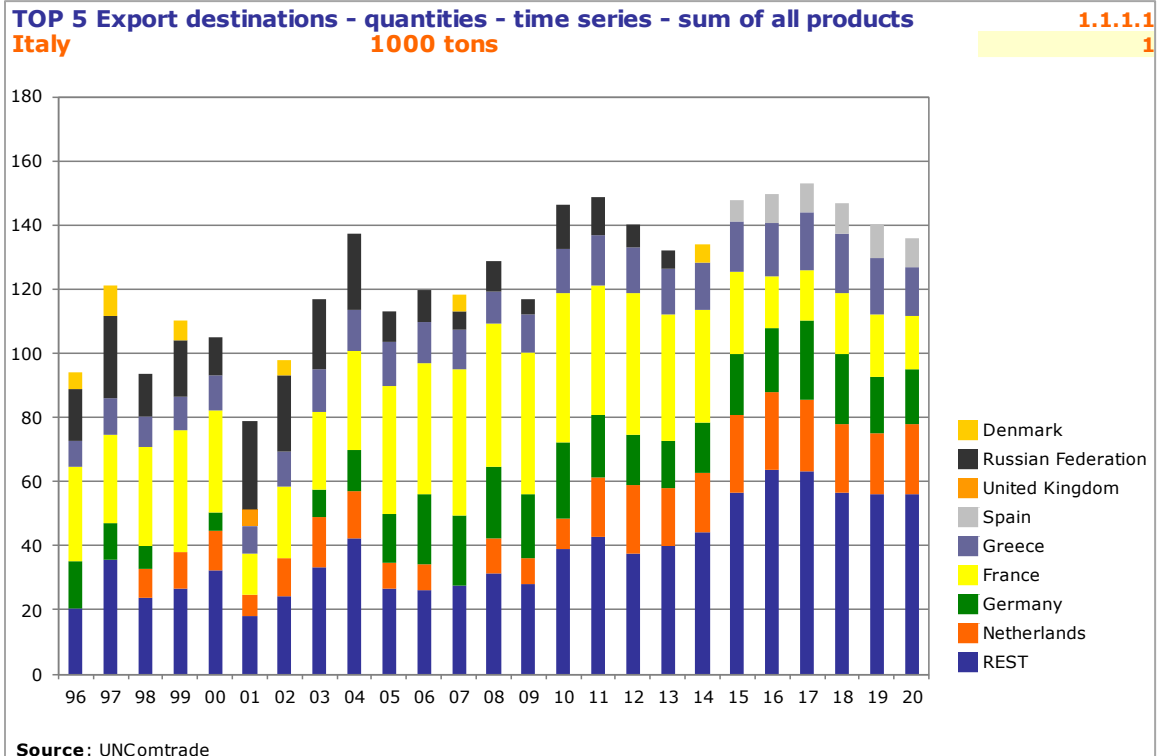
GRAPH 26 USA - EXPORT & IMPORT



Italy

The following graphs show the *Italy's* main export & import partners.

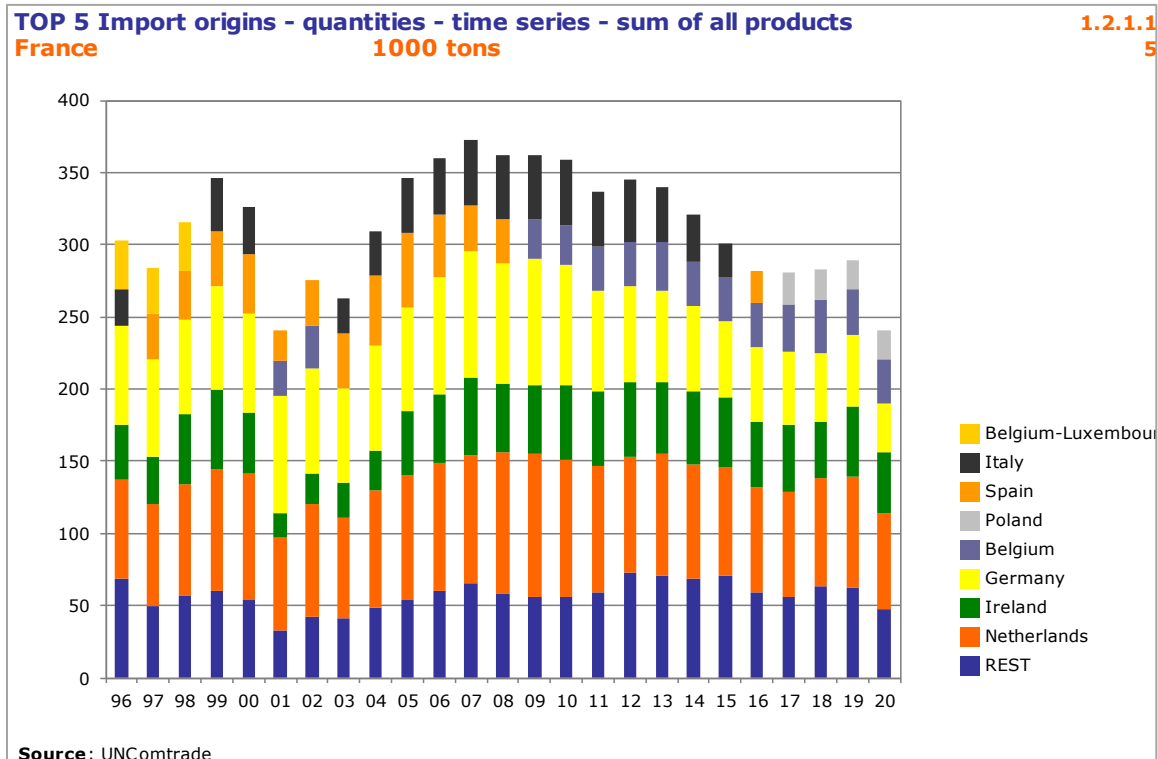
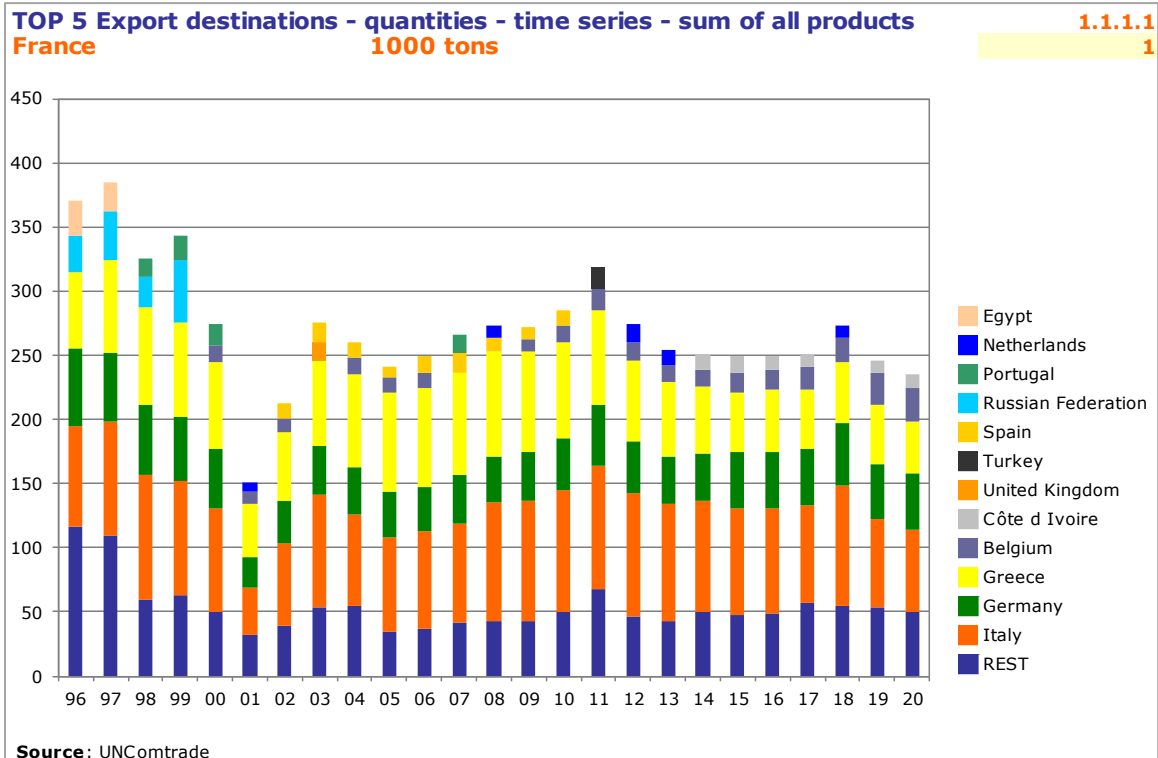
GRAPH 27 ITALY - EXPORT & IMPORT



France

The following graphs show the *France's* main export & import partners.

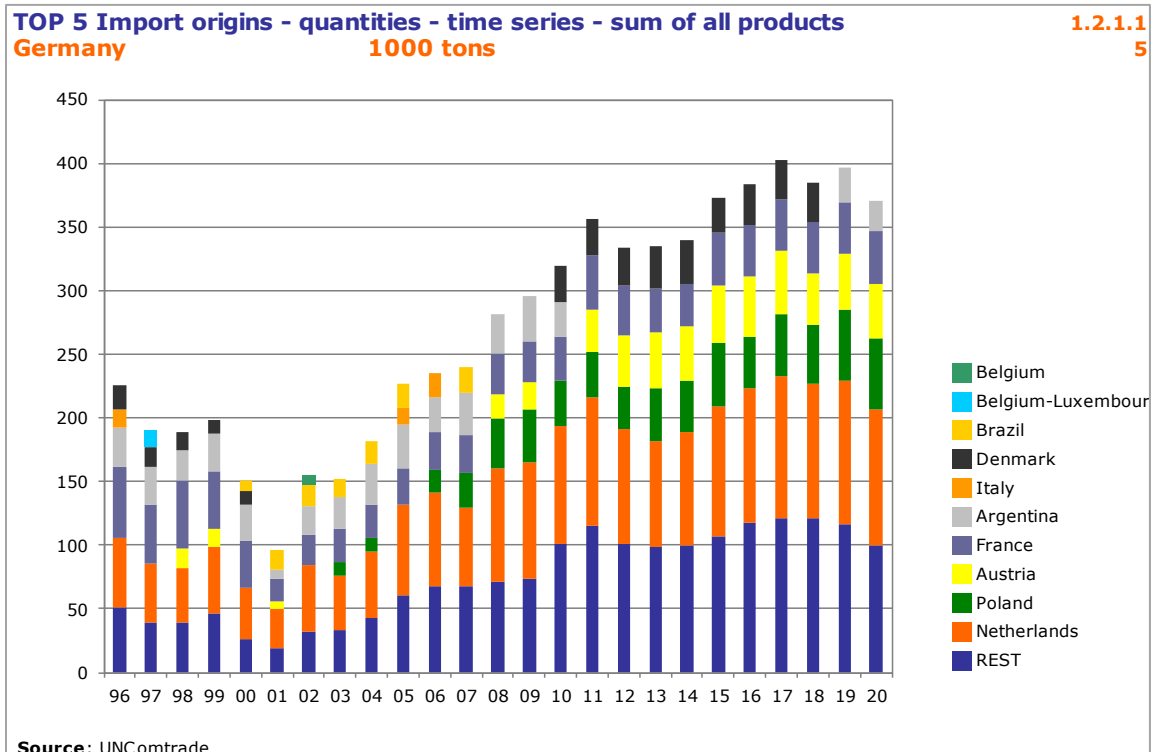
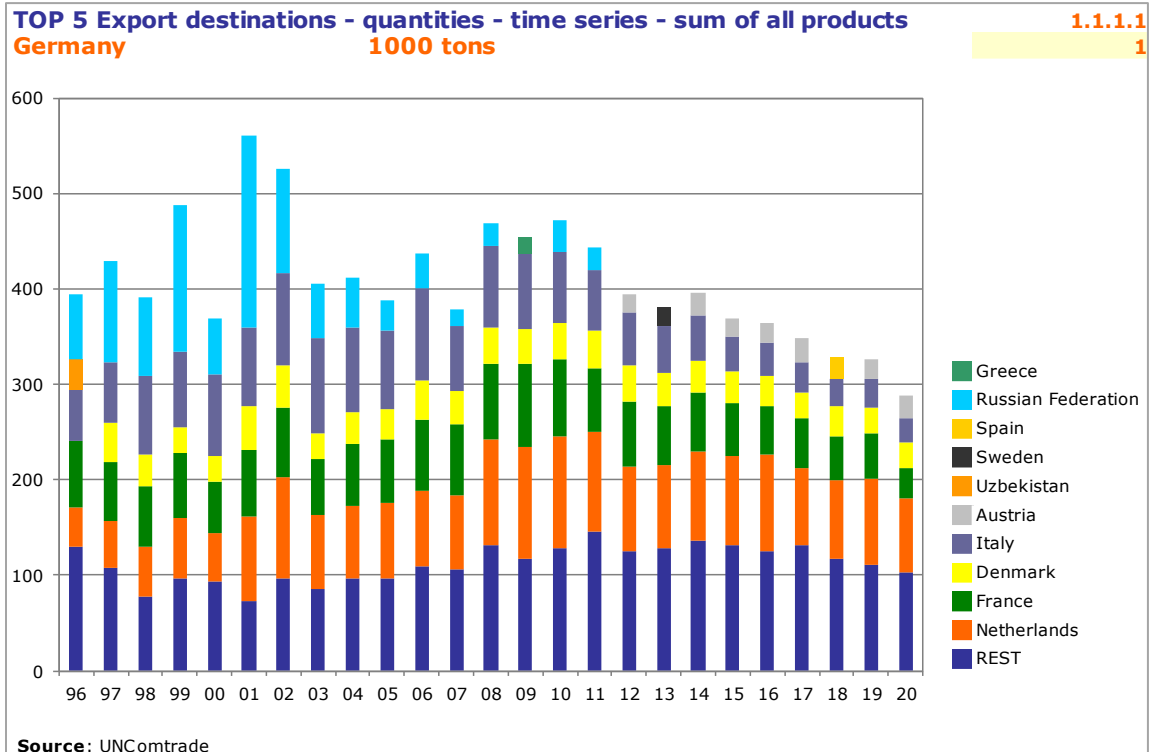
GRAPH 28 FRANCE - EXPORT & IMPORT



Germany

The following graphs show the *Germany's* main export & import partners.

GRAPH 29 GERMANY - EXPORT & IMPORT



Import & export – dairy

The following tables show the import and export information of each country with the other project partners. In particular, UNCOMTRADE data have been examined for dairy tariffs.

If the cell reads 'no data', it is to be interpreted that no data were recorded or that there is no significant relationship between the two countries. Unfortunately, no distinction is made at system level.

Dairy in Europe

TABLE 3 EUROPE IMPORT (DAIRY)

		IMPORT 2020 / 2021 (t)																	
		Europe				America				Africa									
		GERMANY		FRANCE		ITALY		ARGENTINA		BRAZIL		U.S.A.		SOUTH AFRICA		ZIMBABWE		ALGERIA	
		2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Europe	GERMANY																		
	Butter and ghee			5.042	4.820	3.754	2.042	no data	no data	no data	no data	0,18	4	no data	no data	no data	no data	no data	no data
	Cheese			5.521	137.423	71.874	79.720	no data	no data	0,28	0,34	171	161	no data	no data	no data	no data	no data	no data
	Whole Milk Powder			139.850	5.056	6	121	0,39	1	0,34	1	no data	0,05	no data	no data	no data	no data	no data	no data
	FRANCE																		
	Butter and Ghee	11.315	10.294			232	128	no data	0,01	no data	no data	27	361	no data	no data	no data	no data	no data	no data
	Cheese	89.718	114.014			102.010	115.208	no data	no data	1	0,12	517	108	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	4.544	5.864			479	553	no data	no data	0,004	no data	no data	0,02	no data	0,01	no data	no data	no data	no data
	ITALY																		
	Butter and Ghee	8.378	9.771	5.856	8.901			no data	no data	no data	no data	0,30	no data	no data	no data	no data	no data	no data	no data
	Cheese	227.467	240.212	40.737	40.006			no data	no data	no data	no data	3	3	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	7.910	9.242	7.672	8.093			no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data

Source: UN COMTRADE

TABLE 4 EUROPE EXPORT (DAIRY)

		EXPORT 2020 / 2021 (t)																	
		Europe						America						Africa					
		GERMANY		FRANCE		ITALY		ARGENTINA		BRAZIL		U.S.A.		SOUTH AFRICA		ZIMBABWE		ALGERIA	
		2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Europe	GERMANY																		
	Butter and ghee			14.930	11.825	9.141	10.705	no data	6	1	no data	519	380	2	1	no data	no data	23	no data
	Cheese			96.554	101.768	235.724	242.370	15	17	126	99	6.702	7.047	1.328	1.732	no data	no data	3.045	1.537
	Whole Milk Powder			4.949	5.577	8.186	9.016	no data	2	no data	no data	15	5	546	534	no data	no data	564	616
	FRANCE																		
	Butter and Ghee	5.356	4.653			5.962	8.161	no data	3	400	251	1.641	2.221	33	24	no data	no data	796	52
	Cheese	133.226	133.572			38.186	38.144	58	48	747	843	20.439	21.312	521	580	no data	0,01	1.328	557
	Whole Milk Powder	6.557	8.837			6.557	7.609	no data	no data	no data	no data	9	15	38	226	no data	no data	11.177	5.403
	ITALY																		
	Butter and Ghee	3.921	2.698	229	166			no data	no data	30	24	106	70	3	2	no data	no data	no data	no data
	Cheese	75.880	77.402	101.562	115.004			14	20	362	438	31.252	37.409	551	602	no data	no data	no data	no data
	Whole Milk Powder	26	51	791	802			no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data

Source: UN COMTRADE

Dairy in America

TABLE 5 AMERICA IMPORT (DAIRY)

		IMPORT 2020 / 2021 (t)																	
		ARGENTINA						BRAZIL						U.S.A.					
America	ARGENTINA																		
	Butter and Ghee	no data	no data	no data	no data	no data	no data												
	Cheese	23	11	37	72	14	20	403	523	4	0	no data	no data	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	0,06	2	no data	no data	no data	no data	no data	no data	no data	6	no data	no data	no data	no data	no data	no data	no data	no data
	BRAZIL																		
	Butter and Ghee	no data	no data	379	300	25	28	1.561	4.284										
	Cheese	118	93	718	904	393	406	19.255	22.597	31	53	no data	no data	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	no data	no data	no data	no data	no data	no data	52.450	22.103	720	212	no data	no data	no data	no data	no data	no data	no data	no data
	U.S.A.																		
	Butter and Ghee	454	245	1.358	1.850	78	58.264	16	12	121	135	no data	no data	no data	no data	no data	no data	no data	no data
	Cheese	2.763	3.693	11.271	11.853	23.540	29.586.624	1.649	607	219	220	no data	no data	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	3	5	no data	no data	no data	no data	no data	no data	4	1	no data	no data	no data	no data	no data	no data	no data	no data

Source: UN COMTRADE

TABLE 6 AMERICA EXPORT (DAIRY)

		EXPORT 2020 / 2021 (t)																								
America	ARGENTINA																									
	Butter and Ghee	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	1.462	2.359	no data	no data	no data	no data	no data	no data	no data	no data
	Cheese	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	19.057	22.775	3.044	730	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	52.596	21.748	no data	no data	no data	no data	no data	no data	66.446	99.866
	BRAZIL																									
	Butter and Ghee	1	0,29	0,11	0,10	0,10	0,11	9	41	16	19	0,01	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cheese	2	1	1	0,16	1	1	457	619	520	596	0,01	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	6	6	4	5	0,04	2	1	no data	26	8	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	1.000	5.232
	U.S.A.																									
	Butter and Ghee	no data	no data	116	499	1	3	no data	8	0,15	6	1	286	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cheese	451	420	495	248	11	10	6	no data	93	81	13	75	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	no data	no data	no data	21	2	no data	no data	no data	176	164	27	54	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	2.273	2.934

Source: UN COMTRADE

Dairy in Africa

The search for data on the African continent returned few results, as the tables show.

TABLE 7 AFRICA IMPORT (DAIRY)

		IMPORT 2020 / 2021 (t)																								
Africa	SOUTH AFRICA																									
	Butter and Ghee	0,001	no data	30	no data	2	no data	no data	no data	no data	no data	no data	no data	no data	no data	0,01	no data	no data	no data	no data	no data	no data	no data	no data	no data	
	Cheese	1.590	no data	591	no data	557	no data	no data	no data	no data	no data	no data	no data	no data	no data	10	no data	no data	no data	no data	no data	no data	no data	no data	no data	
	Whole Milk Powder	737	no data	25	no data	114	no data	60	no data	no data	no data	no data	no data	no data	0	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	
	ZIMBABWE																									
	Butter and Ghee	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	31	no data	no data	no data	no data	no data	no data	no data	no data	no data	
	Cheese	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	224	no data	no data	no data	no data	no data	no data	no data	no data	no data	
	Whole Milk Powder	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	689	no data	no data	no data	no data	no data	no data	no data	no data	no data	
	ALGERIA																									
	Butter and Ghee	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cheese	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data

Source: UN COMTRADE

TABLE 8 AFRICA EXPORT (DAIRY)

		EXPORT 2020 / 2021 (t)																			
Africa	SOUTH AFRICA																				
	Butter and Ghee	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	50	no data	no data	no data
	Cheese	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	0,01	no data				647	no data	0,002	no data
	Whole Milk Powder	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	519	no data	no data	no data
	ZIMBABWE																				
	Butter and Ghee	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cheese	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	ALGERIA																				
	Butter and Ghee	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Cheese	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
	Whole Milk Powder	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data

Source: UN COMTRADE

Trade tariffs

Dairy

Argentina

The Table 9 shows the average rates (as a percentage) of the rate recorded by the country report (Argentina) in the trade flows with the different partner countries.

TABLE 9 ARGENTINA TARIFFS

Duty type and items	Argentina	Brazil	France	Germany	Italy	South Africa	United States	Zimbabwe
AHS - Effectively applied tariffs								
<i>Cheese and curd.</i>	0%	0%	19%	19%	18%		16%	
<i>Milk and cream, concentrated or containing added s</i>	0%	0%	28%	24%			24%	
<i>Milk and cream, not concentrated nor containing ad</i>	0%	0%						
<i>Whey, whether or not concentrated or containing ad</i>	0%	0%	28%	14%			21%	
BND - Bound tariffs								
<i>Cheese and curd.</i>	35%	35%	35%	35%	35%		35%	
<i>Milk and cream, concentrated or containing added s</i>	35%	35%	35%	35%			35%	
<i>Milk and cream, not concentrated nor containing ad</i>	35%	35%						
<i>Whey, whether or not concentrated or containing ad</i>	35%	35%	35%	35%			35%	
MFN - Most favoured nations tariffs								
<i>Cheese and curd.</i>	19%	20%	19%	19%	18%		16%	
<i>Milk and cream, concentrated or containing added s</i>	28%	28%	28%	24%			24%	
<i>Milk and cream, not concentrated nor containing ad</i>	13%	13%						
<i>Whey, whether or not concentrated or containing ad</i>	14%	21%	28%	14%			21%	
PRF - Preferential tariffs								
<i>Cheese and curd.</i>		0%						
<i>Milk and cream, concentrated or containing added s</i>		0%						
<i>Milk and cream, not concentrated nor containing ad</i>		0%						
<i>Whey, whether or not concentrated or containing ad</i>		0%						

Source: WITS-<https://wits.worldbank.org/>

Brazil

The Table 10 shows the average rates (as a percentage) of the rate recorded by the country report (Brazil) in the trade flows with the different partner countries.

TABLE 10 BRAZIL TARIFFS

Duty type and items	Argentina	Brazil	France	Germany	Italy	South Africa	United States	Zimbabwe
AHS - Effectively applied tariffs								
Buttermilk, curdled milk and cream, yogurt, kephir	0%							
Cheese and curd.	0%		19%	19%	19%		22%	
Milk and cream, concentrated or containing added s	0%						26%	
Whey, whether or not concentrated or containing ad	0%		28%	14%			21%	
BND - Bound tariffs								
Buttermilk, curdled milk and cream, yogurt, kephir	35%							
Cheese and curd.	48%		53%	52%	48%		52%	
Milk and cream, concentrated or containing added s	47%						47%	
Whey, whether or not concentrated or containing ad	35%		35%	35%			35%	
MFN - Most favoured nations tariffs								
Buttermilk, curdled milk and cream, yogurt, kephir	16%							
Cheese and curd.	19%		19%	19%	19%		22%	
Milk and cream, concentrated or containing added s	26%						26%	
Whey, whether or not concentrated or containing ad	21%		28%	14%			21%	
PRF - Preferential tariffs								
Buttermilk, curdled milk and cream, yogurt, kephir	0%							
Cheese and curd.	0%							
Milk and cream, concentrated or containing added s	0%							
Whey, whether or not concentrated or containing ad	0%							

Source: WITS-<https://wits.worldbank.org/>

Morocco

The Table 11 shows the average rates (as a percentage) of the rate recorded by the country report (Morocco) in the trade flows with the different partner countries.

TABLE 11 MOROCCO TARIFFS

Duty type and items	Argentina	Brazil	France	Germany	Italy	South Africa	United States	Zimbabwe
AHS - Effectively applied tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			10%	10%				
<i>Cheese and curd.</i>	15%		1%	1%	0%		0%	
<i>Milk and cream, concentrated or containing added s</i>			22%	34%	7%		0%	
<i>Milk and cream, not concentrated nor containing ad</i>			4%	0%	0%			
<i>Whey, whether or not concentrated or containing ad</i>			0%	0%	0%		0%	
BND - Bound tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			87%	87%				
<i>Cheese and curd.</i>	58%		77%	76%	76%	76%	76%	
<i>Milk and cream, concentrated or containing added s</i>			87%	87%	87%		87%	
<i>Milk and cream, not concentrated nor containing ad</i>			87%	87%	87%			
<i>Whey, whether or not concentrated or containing ad</i>			87%	87%	87%		87%	
MFN - Most favoured nations tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			97%	100%				
<i>Cheese and curd.</i>	17%		35%	36%	31%		34%	
<i>Milk and cream, concentrated or containing added s</i>			67%	81%	67%		92%	
<i>Milk and cream, not concentrated nor containing ad</i>			75%	50%	50%			
<i>Whey, whether or not concentrated or containing ad</i>			3%	3%	3%		3%	
PRF - Preferential tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			10%	10%				
<i>Cheese and curd.</i>			1%	1%	0%		0%	
<i>Milk and cream, concentrated or containing added s</i>			22%	34%	7%		0%	
<i>Milk and cream, not concentrated nor containing ad</i>			4%	0%	0%			
<i>Whey, whether or not concentrated or containing ad</i>			0%	0%	0%		0%	

Source: WITS-<https://wits.worldbank.org/>

Namibia

Table 12 shows the average rates (as a percentage) of the rate recorded by the country report (Namibia) in the trade flows with the different partner countries.

TABLE 12 NAMIBIA TARIFFS

Duty type and items	Argentina	Brazil	France	Germany	Italy	South Africa	United States	Zimbabwe
AHS - Effectively applied tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			0%	0%		0%		
<i>Cheese and curd.</i>						0%		
<i>Milk and cream, concentrated or containing added s</i>						0%		0%
<i>Milk and cream, not concentrated nor containing ad</i>				0%		0%		0%
<i>Whey, whether or not concentrated or containing ad</i>						0%		
BND - Bound tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			96%	96%		96%		
<i>Cheese and curd.</i>			95%	95%	95%	95%	95%	
<i>Milk and cream, concentrated or containing added s</i>				96%		96%	96%	96%
<i>Milk and cream, not concentrated nor containing ad</i>				96%		96%		96%
<i>Whey, whether or not concentrated or containing ad</i>						96%		
MFN - Most favoured nations tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			0%	0%		0%		
<i>Cheese and curd.</i>								
<i>Milk and cream, concentrated or containing added s</i>								
<i>Milk and cream, not concentrated nor containing ad</i>				0%		0%		0%
<i>Whey, whether or not concentrated or containing ad</i>								
PRF - Preferential tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>						0%		
<i>Cheese and curd.</i>						0%		
<i>Milk and cream, concentrated or containing added s</i>						0%		0%
<i>Milk and cream, not concentrated nor containing ad</i>						0%		
<i>Whey, whether or not concentrated or containing ad</i>						0%		

Source: WITS-<https://wits.worldbank.org/>

South Africa

Table 13 shows the average rates (as a percentage) of the rate recorded by the country report (South Africa) in the trade flows with the different partner countries.

TABLE 13 SOUTH AFRICA TARIFFS

Duty type and items	Argentina	Brazil	France	Germany	Italy	South Africa	United States	Zimbabwe
AHS - Effectively applied tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			0%	0%	0%			
<i>Cheese and curd.</i>								
<i>Milk and cream, concentrated or containing added s</i>								
<i>Milk and cream, not concentrated nor containing ad</i>		0%	0%	0%			0%	0%
<i>Whey, whether or not concentrated or containing ad</i>			0%	0%				0%
BND - Bound tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			96%	96%	96%		96%	
<i>Cheese and curd.</i>			95%	95%	95%		95%	
<i>Milk and cream, concentrated or containing added s</i>	96%	96%	96%	96%	96%		96%	
<i>Milk and cream, not concentrated nor containing ad</i>		96%	96%	96%			96%	96%
<i>Whey, whether or not concentrated or containing ad</i>		96%	96%	96%			96%	96%
MFN - Most favoured nations tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			0%	0%				
<i>Cheese and curd.</i>								
<i>Milk and cream, concentrated or containing added s</i>								
<i>Milk and cream, not concentrated nor containing ad</i>		0%	0%	0%			0%	0%
<i>Whey, whether or not concentrated or containing ad</i>								
PRF - Preferential tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>			0%	0%	0%			
<i>Whey, whether or not concentrated or containing ad</i>			0%	0%				0%

Source: WITS-<https://wits.worldbank.org/>

The United States of America

Table 14 shows the average rates (as a percentage) of the rate recorded by the country report (U.S.A.) in the trade flows with the different partner countries.

TABLE 14 U.S.A. TARIFFS

Duty type and items	Argentina	Brazil	France	Germany	Italy	South Africa	United States	Zimbabwe
AHS - Effectively applied tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>		19%	19%	19%		0%		
<i>Cheese and curd.</i>	12%	11%	12%	12%	12%			
<i>Milk and cream, concentrated or containing added s</i>		18%		18%	18%	0%		
<i>Milk and cream, not concentrated nor containing ad</i>								
<i>Whey, whether or not concentrated or containing ad</i>			12%	13%	12%			
BND - Bound tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>		19%	19%	19%		19%		
<i>Cheese and curd.</i>	12%	12%	12%	12%	12%			
<i>Milk and cream, concentrated or containing added s</i>		18%		18%	18%	18%		
<i>Milk and cream, not concentrated nor containing ad</i>								
<i>Whey, whether or not concentrated or containing ad</i>			12%	13%	12%			
MFN - Most favoured nations tariffs								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>		19%	19%	19%		19%		
<i>Cheese and curd.</i>	12%	12%	12%	12%	12%			
<i>Milk and cream, concentrated or containing added s</i>		18%		18%	18%	18%		
<i>Milk and cream, not concentrated nor containing ad</i>								
<i>Whey, whether or not concentrated or containing ad</i>			12%	12%	12%			
PRF								
<i>Buttermilk, curdled milk and cream, yogurt, kephir</i>						0%		
<i>Cheese and curd.</i>	11%	11%						
<i>Milk and cream, concentrated or containing added s</i>						0%		

Source: WITS-<https://wits.worldbank.org/>

Beef

Argentina

The Table 15 shows the average rates (as a percentage) of the rate recorded by the country report (Argentina) in the trade flows with the different partner countries.

TABLE 15 ARGENTINA (BEEF) TARIFFS

Countries	Argentina	Brazil	France	Germany	Italy	Morocco	Namibia	South Africa	United States
AHS									
<i>Meat of bovine animals, fresh or chilled.</i>	0%								
<i>Meat of bovine animals, frozen.</i>	0%	0%							
BND									
<i>Meat of bovine animals, fresh or chilled.</i>	35%								
<i>Meat of bovine animals, frozen.</i>	35%	35%							
MFN									
<i>Meat of bovine animals, fresh or chilled.</i>	12%								
<i>Meat of bovine animals, frozen.</i>	11%	12%							
PRF									
<i>Meat of bovine animals, fresh or chilled.</i>		0%							
<i>Meat of bovine animals, frozen.</i>		0%							

Source: WITS-<https://wits.worldbank.org/>

Brazil

Table 16 shows the average rates (as a percentage) of the rate recorded by the country report (Brazil) in the trade flows with the different partner countries.

TABLE 16 BRAZIL (BEEF) TARIFFS

Countries	Argentina	Brazil	France	Germany	Italy	Morocco	Namibia	South Africa	United States
AHS - Effectively applied tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>	0%								
<i>Meat of bovine animals, frozen.</i>	0%								11%
BND - Bound tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>	55%								
<i>Meat of bovine animals, frozen.</i>	55%								55%
MFN - Most favoured nations tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>	11%								
<i>Meat of bovine animals, frozen.</i>	11%								11%
PRF - Preferential tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>	0%								
<i>Meat of bovine animals, frozen.</i>	0%								

Source: WITS-<https://wits.worldbank.org/>

Morocco

Table 17 shows the average rates (as a percentage) of the rate recorded by the country report (Morocco) in the trade flows with the different partner countries.

TABLE 17 MOROCCO (BEEF) TARIFFS

Countries	Argentina	Brazil	France	Germany	Italy	Morocco	Namibia	South Africa	United States
AHS - Effectively applied tariffs									
<i>Meat of bovine animals, frozen.</i>		0%	0%						175%
BND - Bound tariffs									
<i>Meat of bovine animals, frozen.</i>		239%	239%						239%
MFN - Most favoured nations tariffs									
<i>Meat of bovine animals, frozen.</i>		0%	0%						0%
PRF - Preferential tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>			0%	0%	0%				
<i>Meat of bovine animals, frozen.</i>			0%	0%	0%				150%

Source: WITS-<https://wits.worldbank.org/>

Namibia

Table 18 shows the average rates (as a percentage) of the rate recorded by the country report (Namibia) in the trade flows with the different partner countries.

TABLE 18 NAMIBIA (BEEF) TARIFFS

Countries	Argentina	Brazil	France	Germany	Italy	Morocco	Namibia	South Africa	United States
AHS - Effectively applied tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>									
<i>Meat of bovine animals, frozen.</i>									
BND - Bound tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>				160%				160%	
<i>Meat of bovine animals, frozen.</i>				0%					
MFN - Most favoured nations tariffs									
<i>Meat of bovine animals, frozen.</i>									
PRF - Preferential tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>									
<i>Meat of bovine animals, frozen.</i>									

Source: WITS-<https://wits.worldbank.org/>

South Africa:

Table 19 shows the average rates (as a percentage) of the rate recorded by the country report (South Africa) in the trade flows with the different partner countries.

TABLE 19 SOUTH AFRICA (BEEF) TARIFFS



Countries	Argentina	Brazil	France	Germany	Italy	Morocco	Namibia	South Africa	United States
AHS - Effectively applied tariffs									
<i>Meat of bovine animals, frozen.</i>									
BND - Bound tariffs									
<i>Meat of bovine animals, frozen.</i>	160%	160%							
MFN - Most favoured nations tariffs									
<i>Meat of bovine animals, frozen.</i>									
PRF - Preferential tariffs									
<i>Meat of bovine animals, fresh or chilled.</i>									
<i>Meat of bovine animals, frozen.</i>									

Source: WITS-<https://wits.worldbank.org/>

No available data for tariffs in U.S.A.

Data pool on environmental and social sustainability of trade

The MATS project closely links trade with the concept of sustainability in its most comprehensive sense. Making trade more sustainable means fulfilling as comprehensively and across the board as possible the three macro areas of sustainability: economic, environmental and social. It is necessary to remember that each component must be satisfied, otherwise sustainability does not exist. The case studies on which this deliverable is based have been associated with the following SDGs, as they deal with topics related to the sustainability goals.

Case Study N.º 3	Case Study N.º10	Case Study N.º11	Case Study N.º13
<i>Trade, sustainability and environmental linkages in Finnish dairy production</i>	<i>Beef and policy coherence for sustainable development</i>	<i>Private standards and sustainable trade</i>	<i>Dairy production, standards and competitiveness in global markets</i>
			

To emphasise the role of the SDGs in the case studies, reference is also made to *Table 2* of the [D2.4 of the project](#), which highlights for each Goal the indicators chosen to create greater comparability between the different case studies analysed by partner Countries. The indicators selected represent the dimensions of sustainable development and are subject to variations depending on the case study. The social aspect is a primary focus in three of the four case studies covered in this paper (CS 10/11/13), which in fact fall within the action area of Goals n.º 1, 2, 3, 6. The social aspect was also partially analysed for case study n.º 3, which focuses more on the environmental component (goals n.º13 and 15).

TABLE 20 MATS D2.4

	SDG #	MULTI-COUNTRY TRADE FOCUS				NATIONAL PRODUCTION FOCUS							PRODUCTION OUTCOMES FOCUS				#
		CS4	CS10	CS14	CS15	CS1	CS2	CS6	CS7	CS8	CS11	CS12	CS13	CS3	CS5	CS9	
Social dimension																	
Ownership rights	5.a.1			X				X		X	X	X					5
Social Protection	1.3.1							X	X	X	X						5
Discrimination	10.3.1	X				X			X						X		4
Unemployment rates	8.5.2	X			X		X		X			X				X	6
Human rights (Child labour, forced labour)	8.7.1	X															1
	8.3.1		X	X	X		X	X	X			X				X	8
Working conditions	8.8.2		X	X			X	X	X		X	X					8
Human dimension																	
Poverty rates	1.1.1		X	X	X	X		X	X	X		X			X	X	11
Access to basic services	1.4.1	X							X	X							3
Food security and nutrition (e.g., famine, nutrition, food quality)	2.1.1					X			X	X				X			4
	2.1.2				X				X					X			3
	2.2.2					X								X			2
	3.9.1									X							1
Health	3.9.2	X								X							2
	3.8.1																0
Economy and Markets																	
Volume traded	17.11.1	X	X	X	X	X			X		X	X	X				9
Prices (unit value, distortions...)	2.c.1							X							X		2
Income creation	8.5.1						X							X			2
	2.3.2		X		X	X	X	X	X		X	X	X	X	X		10
Subsidies & tariff lines	12.c.1									X							1
	10.a.1																0
	2.3.1	X		X			X	X		X	X	X	X			X	9
Production	2.4.1	X		X			X	X	X					X			5
	12.3.1					X	X						X	X			4
Value added (GDP)	8.1.1				X												1
	8.2.1																0
Natural capital																	
Exposure to extreme climatic events	13.1.1	X															1
Access to environment-friendly technology	17.7.1						X		X							X	3
	6.4.1																0
Natural resource use	6.4.2	X		X									X				3
	7.2.1																0
	8.4.1		X	X	X			X				X	X				6
GHG emissions	13.2.2		X	X					X				X				4
Water-related ecosystems	6.6.1			X									X				1
Landscape changes	11.3.1			X				X	X								3
	15.1.1	X							X								2
Water pollution	3.9.2	X															1
	6.3.2	X															1
Soil erosion	15.3.1							X									1
Policy, governance & regulations																	
Legal Framework	5.1.1	X			X			X	X	X	X	X					7
	2.a.1		X			X	X					X		X	X		6
	2.a.2	X	X			X	X					X			X		7
Public revenues and expenditure (agriculture sector, essential services, pro-poor, and conservation/ biodiversity)	2.b.1	X	X		X	X	X					X					7
	1.a.2				X		X		X	X							4
	1.b.1							X	X								2
	15.a.1					X					X						2

Source: Deliverable 2.4 MATS

Social sustainability

In an attempt to increase the sustainability of trade, it is necessary to assess more specifically the sustainability of production processes in the agri-food chain and it is essential not to neglect the component of positive and negative social impacts.

If the requirements of social sustainability are met, then trade will be more sustainable.

In order to achieve a more comprehensive understanding of sustainability in relation to agricultural trade, the social aspect actively participates in the product value chain.

A useful transverse *indicator* for analysing the human and social dimension is 8.8.2, which concerns working conditions.

Given the complexity of the topic, it was deemed insufficient to rely on a single indicator, or on a small pool of indicators that have a very strong theoretical basis but little applicability to individual case studies.

For this reason, it was deemed appropriate to make an effort to translate from the known *SDGs* to the more operational disclosures of the *GRI* system. The **GRI Standards** -*Global Reporting Initiative Standards*- represent global best practice for reporting publicly on a range of economic, environmental and social impacts. Sustainability reporting based on the Standards provides information about an organization's (in this case it is applied to Country legislation) positive or negative contributions to sustainable development.

These standards are characterised by being practice-oriented and have provided a guide for the compilation of a database enclosing working conditions in different countries.

The social impact analysis was based on the study of working conditions in the case study countries. This approach allows us to first investigate the efforts made by each state to promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro, small and medium-sized enterprises, including through access to

financial services (sub-objective 8.3 of SDGs), for example, by ensuring formal employment (indicator 8.3.1).

At the same time, it is crucial to protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment (sub goal 8.8).

In order to try to understand the level of national compliance with labour rights (freedom of association and collective bargaining, indicator 8.8.2) and the consistency between national legislations and the market dynamics, the choice fell to going to research for each state engaged in the case study the type of existing legislation regarding labour standardization.

For this purpose, a database was built to collect and compare different countries and understand the dynamics of the trade mechanism through the partner network.

Data were collected from the main official government websites and available public databases.

The tool used to construct the database is Excel. As the contracts in the respective countries were read and studied, additional sections and categories were added, and at the end, those not representative for this cross-sectional analysis were removed.

The data reported refer to the most up-to-date data available for collective bargaining agreements, and where these were not available or exhaustive, reference was made to the more generic national Labour Code. The States surveyed are Algeria, Argentina, Brazil, Finland, France, Germany, Kenya, Italy, Morocco, Namibia, South Africa, the United States of America, and Zimbabwe.

The database is divided into several parts, as following:

- General information
- Working time
- Education
- Paid leaves
- Occupational health and safety
- Social Welfare
- Payments

- Trade right
- Other regulation
- Forced and child

Each of these parts is divided into a multitude of sections that provide detailed information.

In each of the specific parts, crucial information was gathered to understand the negative and positive impacts of labour on social and marketing dynamics. This study made it possible to analyse similarities and differences that can make an exchange more 'convenient' (lower prices, but at what cost?) or more 'competitive' (importance of product and process quality, qualified personnel, etc.).

However, it is to be noted that although the analysis has attempted to achieve a high degree of detail, it is not possible to fully represent a world made up of exceptions, special cases and realities that very often differ from what is desired on paper (child labour, exploitation, undeclared work). Nevertheless, this work could be useful in defining the point at which the country protects its workers.

At the end of this section, it is possible to find a summary table with the translation of the used SDG into the GRI system.

General information

Collective bargaining is a constant in the legislation of the different partner countries, although in different ways. For example, collective agreements can be made at the organization, a particular site, the industry level, or at the national level in countries where this is the practice. Moreover, consultation has not always been possible, since in some cases they are not published, as is the case in Germany.

In most cases, contracts do not have an expiry date but are updated periodically. According to the *GRI 407-1 "Freedom of Association and Collective Bargaining (2016)"*, collective agreements can cover specific groups of workers, for example, those performing a specific activity or working at a specific location.

An organization is expected to respect the rights of workers to exercise freedom of association and collective bargaining. It is also expected to not benefit from or contribute to such violations through its business relationships (e.g., suppliers).

The column labelled *Links* shows the connections to the main sources used. The first choice always goes over collective agreements when present, which are supplemented with national standards when they do not cover precise aspects and replaced with labour codes when necessary.

Please, note that each time the cell reports "*not specified*", means that the particular information is not describe in the national/collective agreement but should be negotiated between the parties and included in the contract of employment.

TABLE 21 DATABASE, GENERAL INFORMATION

GENERAL INFORMATION				
List of SDG Indicators and GRI Disclosure			SDG Indicator 8.8.2 GRI Disclosure 407-1	
COUNTRY	NATIONAL AGREEMENT or collective labour agreement	LINK	Presence of collective agreements	DURATION
ALGERIA Dairy CS13	<i>Loi n° 90-11 du 21 Avril 1990</i> Relative aux relations de travail, modifiée et complétée	Link to Algeria	Yes	<i>Not specified</i>
ARGENTINA Dairy CS13 Beef CS10)	<i>Ley de Contrato de Trabajo</i>	Link to Argentina	Yes	<i>Not specified</i>
BRAZIL Dairy CS13 Beef CS10)	<i>Consolidação das Leis do Trabalho</i>	Link to Brazil	Yes, but usually they use a "Carteira de Trabalho e Previdência Social - CTPS	<i>Not specified</i>
FRANCE Dairy CS13 Beef CS10)	<i>"Convention Collective nationale proction agricole/CUMA du 15 Septembre 2020"</i>	Link to France	Yes	15/09/2020- indeterminate [Art 1.3]
GERMANY Dairy CS13 Beef CS10	Absence of a separate labour law code. Labour law is governed by several laws: <i>das Arbeitszeitgesetz (ArbZG); das Bundesurlaubsgesetz (BUrlG); das Entgeltfortzahlungsgesetz (EntgFG); das Teilzeit- und Befristungsgesetz (TzBfG); Das Bürgerliche Gesetzbuch (BGB), that regulates the notice period.</i>	das Arbeitszeitgesetz (ArbZG) - Law on working time das Bundesurlaubsgesetz (BUrlG) - Law on minimum leave for employees das Entgeltfortzahlungsgesetz (EntgFG) – Law on payment of remuneration on public holidays and in the event of sickness das Teilzeit- und Befristungsgesetz (TzBfG) – Law on part-time work and fixed-term contracts Das Bürgerliche Gesetzbuch (BGB) - civil code	Collective agreements between the employers' association/union and agreements between employer/works council are not available for consultation and are not national contracts.	Not specified. It depends on the document referenced
ITALY Dairy CS13 Beef CS10	<i>"Contratto collettivo nazionale di lavoro per gli operai agricoli e florovivaisti"</i>	Link to Italy	Yes	01/01/2018- 31/12/2021
MOROCCO Beef CS10	<i>Code du travail</i>	Link to Morocco	Yes	<i>Not specified</i>
NAMIBIA Beef CS10	<i>Labour Act</i>	Link to Namibia	Yes	<i>Not specified</i>
SOUTH AFRICA Dairy CS13 Beef CS10	<i>"Basic Conditions of Employment Act, nr 75 of 1997 and the Sectoral Determination 13: Farm Worker Sector "</i>	Link to South Africa	Yes	<i>Not specified</i>
U.S.A. Dairy CS13 Beef CS10	<i>Fair Labour Standards Act (FLSA) Wage and Hour Division (WHD)</i>	Link to USA	Yes, but only in certain sectors	No expiration date
ZIMBABWE Dairy CS13	<i>Labour Act (28:01)</i>	Link to Zimbabwe	Yes	<i>Not specified</i>
FINLAND Dairy CS3	<i>"Collective agreement for agricultural workers"</i>	Link to Finland	Yes	01/02/2020- 31/01/2022 With a continuation agreement for 01/02/2022- 31/01/2023
KENYA Avocado CS11	<i>Employment Act, 2007 Collective bargaining agreement (ex. Members of the Sisal Growers and employers' association (Kenya)- the Kenya plantation and agricultural WORKERS' UNION</i>	Link to Kenya	Yes	<i>Not specified</i>

Working time

The daily, weekly or monthly working hours vary widely depending on the type of contract and the country concerned. In some cases, the value entered refers to the hours defined by the national labour code, while in many other cases, the value from collective bargaining is given, which must always be equal to or better than the national value. The calculation of working hours per day is also significant with regard to the risk of accidents and the occurrence of work-related illnesses.

Typically, in most countries, working hours in the agricultural sector range from 7 to 9 a day. Daily working hours can reach a maximum of 10 hours, but in this case, it is considered overtime and paid with an increase in basic salary. Among the partner countries, Zimbabwe is the country with the greatest variation, with up to 10 hours of daily work as a rule.

The agricultural sector also has the particularity of providing, in many contractual cases, for the possibility of increasing daily working hours in periods of seasonality and workload, on condition that a maximum limit is not exceeded and with the guarantee of being able to compensate in a period of lower load.

TABLE 22 DATABASE, WORKING TIME.

WORKING TIME							
	SDG - Indicator 8.8.2 GRI - Disclosure 403-9			SDG - Indicator 8.8.2 GRI - Disclosure 401-2			
COUNTRY	WORKING TIME per week	WORKING TIME per day	Exceptions	WEEKLY BREAK	VACATION	NON-WORKING DAYS (No.)	NATIONAL HOLIDAYS (No.)
ALGERIA Dairy CS13	44 h. max 48 h.	Between 8 and 9 hours* *Depending on the type of contract	2000 h/year* *divided into periods according to the needs of region/activity	Fridays	30 days	Each Friday* *Depends on commercial needs	11 days (Observed according to the Islamic lunar calendar)
ARGENTINA Dairy CS13 Beef CS10)	40 h, max 48 h.	8 h./day	Overtime max 3 h/day, 30 h/month 200 h/ year.	35-hour weekly rest period starting at 1 p.m. on Saturdays	The employer must grant them between 1/10 and 30/04, as follows: > 5 years of service: 14 d. 5-10 years of service: 21 d. 10-20 years of service: 28 d. >20 years of service: 35 d.	Each Sunday (52 circa)	13 days
BRAZIL Dairy CS13 Beef CS10)	40 h. (6 days) or 44 h. (5 days)	7-8 h., depending on whether the employee works 5 or 6 d/week	Working day of 12 h. with 36 h. of continuous rest	11 h. between 2 working days. 24 h. which should coincide with Sunday	After each 12-month period of work: between 12 and 30 days, depends on the n° of absences (between 5 and 32)	Each Sunday (52 circa)	12 days
FRANCE Dairy CS13 Beef CS10)	35 h.	7 h./day Max 10 h./day	-	11 h. between 2 working days. 24 h. which	2.5 days for each month of actual work	Each Sunday (52 circa)	11 days

				should coincide with Sunday			
GERMANY Dairy CS13 Beef CS10	40 h. (5 days) or 48 h. (6 days) [ArbZG]	8 h./day; Max 10 h./day [ArbZG]	Longer daily working h. allowed for campaign period > 8 h. = reduction in working time in other periods. Max 48 h. per week [ArbZG]	11 h. between 2 working days. 24 h. which should coincide with Sunday	Between 20-24 days (depends on if the week is of 5 or 6 days) Full entitlement to paid leave is acquired after 6 months of employment [BUrlG]	Each Sunday (52 circa)	10 days (all federal States) + up to 3 additional days in some of the federal states [BUrlG]
ITALY Dairy CS13 Beef CS10	39 h.	6.3 h.	Max 85 h/year max 44 h/week	24 consecutive h. possibly Sunday	26 paid days/year	Each Sunday (52 circa)	13 days
MOROCCO Beef CS10	46 h., it depends on season and needs	Max 10 h./day	2,496 hours/years, it depends on needs	Weekly rest must be granted either on Friday, Saturday or Sunday, the day of the weekly market, for minimum 24 hours	1.5 days of actual work per month of service	Each Sunday (52 circa)	11 days
NAMIBIA Beef CS10	Max 45 h.	Max 9 h. (5 d/week) Max 8 h. (6d/week)	Max 10 h. of overtime/week and no more of 3 h./day	weekly interval of at least 36 continuous hours	4 consecutive weeks/years, but depends on the number of days worked per week	Each Sunday (52 circa)	12 days
SOUTH AFRICA Dairy CS13 Beef CS10	40 h.	8 h.	Maximum 45 hours/week, 9 hours/day (5 d./week) 8 hours/day (6d/week) Not more than 10 hours of overtime allowed in a week	36 consecutive hours (must include Sunday, exception can be defined by Collective Agreements); daily rest of 12 consecutive hours	21 paid days/year (one day for every 17 days worked or 1 hours for every 17 hours worked)	Each Sunday (52 circa)	12 days
U.S.A. Dairy CS13 Beef CS10	40 h.	8 h.	<i>*There is no limit on the number of hours employees 16 years or older may work in any workweek</i>	<i>Not specified</i>	14-25 days/year depending on the length of employment. Qualified employees may also donate leave to assist other employees through an extended absence. (Depends on the State)	Each Sunday (52 circa)	12
ZIMBABWE Dairy CS13	52 h.	10 h. circa	208 h/month	24 h. of rest each week, either on the same day of every week or on a day agreed by the employer and employee.	paid vacation leave shall accrue in terms of this section to an employee at the rate of one twelfth of his qualifying service in each year of employment, subject to a maximum accrual of ninety days' paid vacation leave [art 14A]	-	11 days
FINLAND Dairy CS3	40 h.	8 h.	Max 50h per week and 10 h./day for specific needs Individual agreements allow 55h and 11h	35 consecutive hours, usually Sundays	24 paid days/year (permanent contract)	Sundays and Saturdays, with exceptions based on productional reasons	8 days
KENYA Avocado CS11	46 h. (6 days)	-	for some type of workers, the weekly hours could be 56. (Week 6 days)	At least one rest day in every period of seven days.	21 days/year	Usually Sunday	10

Education

Education is a transversal concept that can cover many areas and modalities. For example, it is relevant to plan education on human rights and working conditions that must be guaranteed, to recognise and condemn the use of force, inhuman and degrading treatment, discrimination, identification and registration.

In some cases, it is explicit in the contract that employees can take additional leave to finish or continue their studies, even outside the work context and sphere.

Employee training represents an investment on the part of the employer who in this way has a qualified and more competitive workforce at his disposal.

In some states there is a professional training plan that is repeated on a cadenced basis with the aim of elevating the knowledge and skills of employees. One example is a periodic evaluation every two years as is the case in France and the possibility of advancing in professional "level". Regular performance and career development reviews can also enhance employee satisfaction, which correlates with improved organizational performance.

In order to guarantee the right of training and education, some guidelines for the employer must be assured at the regulatory level:

- recognition of all types of vocational training and instruction.
- paid educational leave provided by an organization for its employees.
- training or education pursued externally and paid for in whole or in part by an organization.
- training on specific topics.

TABLE 23 DATABASE, EDUCATION

EDUCATION			
	SDG Indicator 8.8.2 GRI: Disclosure 404-1 & Disclosure 404-3 % 403-5		SDG Indicator 8.8.2 GRI -Disclosure 404-1 Disclosure 404-2
COUNTRY	PROFESSIONAL DEVELOPMENT	LEVELS (NQF)	CONTINUING EDUCATION
ALGERIA Dairy CS13	Each employer is obliged to carry out training and further training for workers according to a programme which he submits to the participation committee for its opinion.	<i>Not specified</i>	Leave is provided to enable the employee to attend professional courses authorised by the employer and to take academic or professional examinations.
ARGENTINA Dairy CS13 Beef CS10)	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
BRAZIL Dairy CS13 Beef CS10)	<i>Not specified</i>	<i>Not specified</i>	Workers' Support Fund (FAT), financing of professional and technological training
FRANCE Dairy CS13 Beef CS10)	Organization of a professional interview to evaluate the evolution and prospects of each employee every 2 years. [Art 4.7]	6 (o 12) levels [Art 4]	<i>Compte Personnel de Formation</i> : credits for continuing education in the form of CPF hours. These credits are recorded in an individual account that follows the employee throughout his working life (even in the event of a job change or unemployment). 24 hours a year up to a maximum of 120 hours, and then 12 hours a year up to a maximum of 150 hours.
GERMANY Dairy CS13 Beef CS10	<i>Not specified</i>	<i>Not specified</i>	Employees can take educational leave for the purpose of their further training. The federal states have their own laws on educational leave which govern paid leave from work. You can use this for your own citizenship education, language courses or for your further vocational training. As for annual leave, you should agree on arrangements for educational leave with your employer at an early stage.
ITALY Dairy CS13 Beef CS10	<i>Not specified</i>	3 levels [Art 31]	200 paid hours/3 years (permanent)
MOROCCO Beef CS10	<i>Not specified</i>	<i>Not specified</i>	there are continuing education courses
NAMIBIA Beef CS10	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
SOUTH AFRICA Dairy CS13 Beef CS10	Not specified, may be negotiated between the parties and included in the contract of employment.	8 levels	Not specified, may be negotiated between the parties and included in the contract of employment.
U.S.A. Dairy CS13 Beef CS10	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
ZIMBABWE Dairy CS13	<i>Not specified</i>	10 levels	<i>Not specified</i>
FINLAND Dairy CS3	<i>Not specified</i>	<i>Not specified</i>	For professional education provided by the employer or outside of the workplace all required costs and income losses will be reimbursed.
KENYA Avocado CS11	In accordance with the Occupational Safety and Health Act 2007, it is the responsibility of an employer to provide instruction, training and supervision as is necessary to ensure health and safety at work of his workers.	<i>Not specified</i>	<i>Not specified</i>

Paid leaves

The number and type of leaves reserved for different categories of workers are among the most highly variable values in the countries analysed. This component is strongly influenced by the type of society in which it is contextualised.

The data collected within this database refer to the working conditions related to a full-time worker. This screening was done with the intention of ensuring sufficient homogeneity in the data, making them more comparable.

Given this premise, it is necessary to point out that many of the benefits are reserved exclusively for full-time employees and not for temporary or part-time workers.

According to GRI 401-2-3, some of these benefits are included in the welfare-related components that will be reported later, such as life insurance and health care. Among the benefits covered in this Disclosure there are leave, the following are the best known:

- marriage leave
- maternity and paternity leave
- Death of relatives
- Parental leave
- Leave for remedial course (cross indicator with “education” section)

All these benefits for full-time employees are a key factor in retaining employees.

Substantial differences can be observed particularly in the sections on maternity/paternity leave and parental leave. In fact, many countries have introduced legislation to provide parental leave with the aim of allowing employees to take leave and return to work in the same (or a comparable) position. The application of legislation varies according to interpretation by government, employers and employees.

Many women are discouraged from taking leave and returning to work by employer practices that affect their employment security, remuneration and career path, as many men are not encouraged to take the leave to which they are entitled. Equitable gender choice for maternity and paternity leave, and other leave entitlements, can lead to the greater recruitment and retention of qualified employees and it can also boost employee morale and

productivity. Men's uptake of paternity leave options can indicate the degree to which an organization encourages fathers to take such leave. Men taking advantage of leave entitlements positively impacts women to take such leave without prejudicing their career path. (*Source: GRI 401-3*)

TABLE 24 DATABASE, PAID LEAVES

PAID LEAVES							
	SDG indicator 8.8.2 GRI - Disclosure 401-2	SDG indicator 8.8.2 GRI - Disclosure 401-3		SDG indicator 8.8.2 GRI - Disclosure 401-2	SDG indicator 8.8.2 GRI Disclosure 401-3	SDG indicator 8.8.2 GRI - Disclosure 401-2 & 404-1	
COUNTRY	MARRIAGE LEAVE	MATERNITY LEAVE	PATERNITY LEAVE	DEATH OF RELATIVES	PARENTAL LEAVE	LEAVE FOR REMEDIAL COURSE	Others
ALGERIA Dairy CS13	3 days	Pre- and post-natal periods: 14 weeks' maternity leave. They may also benefit from facilities under the conditions laid down in the internal regulations of the employing organisation, as paid leave for breastfeeding.	2 days	3 days	Annual leave available, based on work done during an annual reference period (1.07/30.06)	Leave is provided to enable the employee to attend professional courses authorised by the employer and to take academic or professional examinations.	The employer may grant unpaid special leave of absence to employees who have an urgent need to be absent under the conditions laid down in the internal regulations.
ARGENTINA Dairy CS13 Beef CS10)	10 days	90 days paid maternity leave. A worker may choose to take 45 days leave before and 45 days after the birth. The mandatory leave to be taken before childbirth is min. 30 days, the remaining days can be added to the postnatal leave period. Maternity leave can be extended 3-6 months without pay.	2 days' paid leave for the birth of a child. The duration of the leave may be extended through collective bargaining.	3 days	The law does not provide for parental leave.	2 days for educational examinations and up to 10 days per year	<i>Not specified</i>
BRAZIL Dairy CS13 Beef CS10)	<i>Not specified</i>	From the 8 th month of pregnancy: 180 paid days. Adoption: same, but the n.° of days is gradually reduced as the age of the child increases.	20 days (also for adoption)	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
FRANCE Dairy CS13 Beef CS10)	<i>Not specified</i>	Depends on the n° of children → 16 weeks if one or two, 26 weeks for >3. multiple born : 2= 34 WEEKS; >2=46 WEEKS [Art 10.1]	11 consecutive days (18 if multiple births, 30 if the child is recovering) [Art 10.1]	3 days, 7 in case of death of a son [Art 10.2]	in case of illness of child/ren. 3 days/years if the child/ren is younger than 16 years. 5days/years is the child/ren is <1year or if the worker has 3 children under 16 (not paid)	no specific leave is provided	<i>Not specified</i>
GERMANY Dairy CS13 Beef CS10	<i>Not specified</i>	From 6 weeks before to 8 weeks after birth, extendable to 12 in the case of special replacement of the newborn. In this period the mother is awarded full salary, but a share is paid by health insurance. [MuSchG]	paternity leave is not provided, but parental leave can be taken.	2 days	3 years unpaid leave together to raise their child. The employment contract is suspended during parental leave. The application must be submitted to the employer no later than 7 weeks before the desired start of parental leave. Parents can take 24 months' parental leave between the 3rd and 8th year of the child's age. Parental leave after the 3rd year of the child must be registered at least 13	Refer to leave for study	<i>Not specified</i>

					<p>weeks in advance, parental leave before the 3rd year of the child only 7 weeks in advance. (not paid).</p> <p>For the first 12 or 14 months of parental leave, parents can apply for a parental allowance (around 60% of the net income). 12 months are granted, if only one parent takes the leave, 14 months are granted, if both parents split the time between them, min 2 month and max 12 month per parent.</p>		
ITALY Dairy CS13 Beef CS10	Not specified, may be negotiated between the parties and included in the contract of employment.	5 months, usually 2 before and 3 after (<i>"Testo unico delle disposizioni legislative in materia di tutela e sostegno della maternità e della paternità"</i> , d.lgs. 26.3.2001, n. 151)	10 paid days for the father (in case of birth or adoption or custody)	3 paid days each	in case of illness of child/ren - Cfr. art. 47 commi 1 e 2, d.lgs. 26 marzo 2001, n. 151 (Testo Unico delle disposizioni legislative in materia di tutela e sostegno della maternità e della paternità).	150 paid hours/3 years	<i>Not specified</i>
MOROCCO Beef CS10	4 days (only 2 paid)	14 weeks, the mother may abstain from returning to work after the end of her leave, by notifying her employer no later than 15 days before the end of the maternity leave period.	3 days	3 days (only 1 day is paid)	Not specified, depends on type of contract and agreements	<i>Not specified</i>	<i>Not specified</i>
NAMIBIA Beef CS10	<i>Not specified</i>	woman whit 6 months of continuous service: maternity leave of not less than 12 weeks. Entitled to start her maternity leave 4 weeks before the expected date of birth and 8 weeks of leave	<i>Not specified</i>	5 paid days each	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
SOUTH AFRICA Dairy CS13 Beef CS10	<i>Not specified</i>	4 consecutive months	10 days (parental leave)	<i>Not specified</i>	10 days + 3 days on request	<i>Not specified</i>	<i>Not specified</i>
U.S.A. Dairy CS13 Beef CS10	<i>Not specified</i>	The Family and Medical Leave Act entitles employees who have worked for the state for at least 12 months and for at least 1,250 hours during the previous twelve-month period, to 12 weeks of leave. You may take FMLA leave for the birth of a child and to bond with the newborn child, or for the placement of a child for adoption or foster care and to bond with that child. Men and women have the same right to take FMLA leave to bond with their child, but it must be taken within one year of the child's birth or placement and must be taken as a continuous block of leave unless the employer agrees to allow intermittent leave.		Provided for in the FMLA, but depends on each state	The Family and Medical Leave Act entitles employees who have worked for the state for at least 12 months and for at least 1,250 hours during the previous twelve-month period to 12 weeks of leave to care for an employee's parent, spouse, or minor/dependent child who has a serious health condition.	this specific leave is not foreseen	Employees are allowed leave with pay for jury duty or to perform other civil duties. Leave pay will be equal to full salary for the time involved. // Military training leave with pay is permitted to a maximum of 21 workdays in any one year. An employee entering military service, U.S. Peace Corps, or U.S. Public Health Service for active duty is entitled to leave of absence without pay. The employee

							will be restored to his or her position, or one of similar classification and salary, in state service if reinstatement is requested within 90 days after release from active duty.
ZIMBABWE Dairy CS13	special leave of 12 days, covering several reasons	Maternity leave shall be granted in terms of this section for a period of 98 days on full pay to a female employee who has served for at least one year. A female employee may proceed on maternity leave not earlier than the 45° day and not later than the 21° day prior to the expected date of delivery. Max 3 periods of maternity leave with respect to her total service to any one employer, with full salary [art 18]	special leave of 12 days, covering several reasons	special leave of 12 days, covering several reasons	special leave of 12 days, covering several reasons	special leave of 12 days, covering several reasons	
FINLAND Dairy CS3	Marriage anniversary or your 50th, 60th or 70th birthday each entitle one day	Maternity leave 105 days of which 30 days paid. (or 158 days divided between the parents as they see fit, not paid by the employer but social benefits received from the government)	54 days or 158 days divided between parents, not paid by the employer but social benefits received from government	1 day for funeral	in case of illness of children under the age of 10, 1-4 days of paid leave (sudden illness of elderly parent entitles a leave for making the required arrangements)	<i>Not specified</i>	<i>Not specified</i>
KENYA CS11	<i>Not specified</i>	3 months	Two weeks	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>

Occupational health and safety

Concerning *health in the workplace*, contracts refer to work illnesses and injury in the workplace as dangers to be prevented. To accomplish this, it is essential to understand which activities and factors the worker is exposed to and which pose risks in the short or long term.

Referring again to the GRI methodology, it is important to observe which States carry out prevention or compensation activities. The former includes short time working and high shift work. In some cases, there is also an increase in basic pay, sometimes exclusively in terms of compensation. The work-related hazards that pose a risk of ill health and of workplace injury (for example the heavy and harmful work) (*GRI 403-09* and *GRI 403-10*). To avoid this risk, the employer made different actions for prevents as a reduced working hours, high turnover or extra pay are the most frequently used 'solutions'. Only France, Namibia and Kenya leave the decision of the management of the harmful works to the relation between employee and employer. In all the other case the national/collective law require a system of prevention based on “planning activities, do, verify and correct”.

Usually a reduction in hours (and thus a higher staff turnover) is opted for, sometimes accompanied by the payment of an extra share on the basic salary. The aim is to expose the worker to as little danger as possible and to increase his or her compensation. In some countries, as is the situation in Italy, training courses are provided for all employees so that they can learn in more detail about the risks and possible behaviour.

TABLE 25 DATABASE, OCCUPATIONAL HEALTH AND SAFETY

OCCUPATIONAL HEALTH AND SAFETY				
	SDG - 8.8.2 GRI Disclosure 403-1-2-3-4-5-6-7-8-9-10	SDG - 8.8.2 GRI - Disclosure 202-2; GRI - Disclosure 403-1-2-3-4-5-6-7-8-9-10	SDG - 8.8.2 GRI - Disclosure 202-2; GRI - Disclosure 403-1-2-3-4-5-6-7-8-9-10	SDG - 8.8.2 GRI - Disclosure 202-2; GRI - Disclosure 403-1-2-3-4-5-6-7-8-9-10
COUNTRY	ILLNESS AND WORKPLACE INJURY (also work-related ill health)	PAY IN CASE OF ILLNESS	PAY IN CASE OF WORKPLACE INJURY	HEAVY AND HARMFUL WORK
ALGERIA Dairy CS13	Sick leave: employees must present relevant documents as proof of their illness.	Sick leave generally paid from the first day of illness.	Not specified, may be negotiated between the parties and included in the contract of employment.	Reductions in working hours are possible, depending on agreements between employer/ employee
ARGENTINA Dairy CS13 Beef CS10)	a worker's employment is secured for the duration of his sick leave. The minimum period of sick leave (paid + unpaid) is 15 months, while the maximum period is 24 months.	Fully paid sick leave of 3 months to one year, depending on the employee's seniority and family status. < 5 years of service: 3-6 months paid leave (if he has dependants). The period is extended to 6 months and 12 months respectively if the employee has more than 5 years' service and has dependants. If recovery does not take place, there is an additional period of up to 1 year (unpaid) but the job is kept. Employers are required to provide 100% of salary for up to three months to employees with <5 years of service; up to 6 months with at least 5 years of service.	Accident/total permanent disability: monthly allowance equal to 53 times the monthly basic income*a coefficient (the division of the number 65 by the age of the insured at the onset of disability). A constant attendance allowance of 2,000 pesos per month is also paid. Permanent partial disability: lump sum or monthly payments, depending on the degree of disability. - Disability between 50% and 66%: calculated amount of ARS 80,000, plus a full annuity that cannot be less than the disability percentage x ARS 180,000. - Disability < 50%: lump sum calculated as 53*base income*disability%*(65/age). Temporary disability: the worker receives monthly payments equal to the monthly income. (if variable salary: monthly allowance is equal to the average salary of the last 6 months). The first 10 d are paid by the employer. From the 11th day until recovery or certification of permanent disability, benefits are paid by ART (Employment Risk Insurer). In the event of death, dependants (widower, cohabitee, children under the age of 21) receive a survivor's pension equal to the total amount of the permanent disability pension that a deceased worker would have received, plus an additional allowance of ARS 120,000.	Reductions in working hours
BRAZIL Dairy CS13 Beef CS10)	An employee is eligible to receive sickness or disability compensation after 12 months of contributions to the social security plan (except temporary illness, which does not require a minimum contribution). The amount of compensation depends on whether the illness is temporary, long-term, or whether it is a per-	For a temporary illness, the beneficiary gets 50% of his or her monthly salary. If the illness/accident prevents the beneficiary from working for more than 15 days, he can get a benefit of 91% of his monthly salary. Workers, who due to work-related illnesses or accidents are no longer able to work, are entitled to disability benefits. These amount to 100 percent of the beneficiary's monthly salary and increase by an additional 25 percent if the beneficiary requires continuous care.		Jobs that may endanger the health or lives of workers are better paid, but the percentage is decided between the employee and employer; + 30% on basic pay

	manent disability.			
FRANCE Dairy CS13 Beef CS10	Compensation not specified [Art 10.3]	Compensation not specified [Art 10.3]	Compensation not specified [Art 10.3]	<i>Not specified</i>
GERMANY Dairy CS13 Beef CS10	Insurance payable by the employer. In case of illness or injury, the job role is assured for 6 weeks, renewable than others 6 weeks.	In the event of illness, you are insured through your employment and will continue to receive your salary for a maximum of 6 weeks. After this period, you receive a sick pay from the German health insurance you are a member of, for a maximum of 78 weeks. The sick pay varies between 70 - 90% of your net salary. [EntgFG]	Compensation not specified	Minimization rule to exposure and specific training on good prevention practices
ITALY Dairy CS13 Beef CS10	In case of illness or injury, the job role is assured for 180 days. In case of oncological pathology, the worker can ask for 6 months of non-paid leave from work after those 180 days. - In case of workplace injury, the job role is assured until complete recovery, but no longer than 12 months from the injury.	At least 80% of baseline pay	At least 80% of baseline pay	the turn rotations. time limits for carrying out harmful work. wage increases to be paid to workers for heavy work. [Art 67-68] training courses on the problems of health protection and ecological rehabilitation. The workers participating in the courses are entitled to 30h of paid leave, to be deducted from the 200 hours [Art 37] over a period of three years.
MOROCCO Beef CS10	In case of illness or accident, they must notify and justify it to the employer within 48h. Absence > 4 days, the employee must inform the employer of the probable duration of the absence (and certificate). [Art 271]	Unspecified remuneration. If absence due to illness or injury (but not due to work) exceeds 180 consecutive days in a 365-day period, or if the employee has become unfit to continue working, the employer may consider the employee to have resigned from work.	The employer must defer the granting of paid annual leave to an employee who has suffered an accident at work until the injury has been consolidated. Amounts paid to the victim by way of daily allowance are not taken into account when determining annual leave or leave allowance.	compensatory indemnities are provided for
NAMIBIA Beef CS10	not less than 30 working days, if the employee works five days a week min 36 working days, if the employee works 6 days a week An employee is entitled to 1 day of sick leave for every 26 days worked during the 1st year of employment	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
SOUTH AFRICA Dairy CS13 Beef CS10	The employees must notify as soon as possible in case of absence (illness); During every sick leave cycle of 36 months the employee will be entitled to an amount of paid sick leave equal to the number of days the employee would normally work during a period of six weeks. During the first 6 months of employment the	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>

	employee will be entitled to 1 day's paid sick leave for every 26 days worked.			
U.S.A. Dairy CS13 Beef CS10	The Family and Medical Leave Act entitles employees who have worked for the state for at least 12 months and for at least 1,250 hours during the previous twelve-month period to 12 weeks of leave as a result of the employee's serious health condition.	Full-time employees earn 1 day/month of sick leave.	Not specified, may be negotiated between the parties and included in the contract of employment.	The Act requires the inclusion in the regular rate of such extra premiums as nightshift differentials (whether they take the form of a percent of the base rate or an addition of so many cents per hour) and premiums paid for hazardous, arduous or dirty work. (FLSA)
ZIMBABWE Dairy CS13	<i>Not specified</i>	the employer must grant up to 90 days of sick leave with full pay. If necessary and justified, a further 90 days with half pay may be added. [art 14] For employment of at least one week but less than a month, the employee is entitled to 50% of base salary for 9 days.		It depends on the individual agreements between the parties, there may be reductions in hours or pay increases
FINLAND Dairy CS3	Illness or injury must be notified to the employer immediately. Paid leave for two days on personal notice after which a doctoral consultation is needed	For employment longer than one month, 100% of base salary for 28 days For longer than 3 years, 35 days For longer than 5 years, 42 days For longer than 10 years, 56 days		An extra pay of 52 cents/hour is paid for "dirty" work
KENYA CS11	<i>Not specified</i>	min. sick leave 7 days with full pay and then sick leave of 7 days with 1/2 pay for year	<i>Not specified</i>	<i>Not specified</i>

Social Welfare

Welfare is realised in different ways and has many facets that vary greatly depending on the country we are in. GRI 403-6 refers to the promotion of employers' health outside the purely work environment, for example by facilitating workers' access to extra-occupational health and medical services. Increasing health coverage, even making it universal as stipulated in SDG n.º 3, plays a key role in ensuring people's well-being, without which there can be no talk of social sustainability or even sustainability in the broader sense.

Welfare refers to all measures that are recognized at the National level and applied at the farm level to ensure and increase the wellbeing of the employee. as mentioned earlier in the section on education, in welfare a number of benefits are guaranteed which increase retention and, in the long term, the productivity and efficiency of the employee.

Highly variable, for example, is the type of policy inherent in retirement and minimum age. It is interesting here to note that in many countries where the minimum retirement age is relatively low, life expectancy is also extremely limited. We can observe this context particularly in African countries.

TABLE 26 DATABASE, SOCIAL WELFARE

SOCIAL WELFARE							
	GRI Disclosure 201-1; 401-2	GRI - Disclosure 201-1; 403-6	SDG: Indicator 8.8.2 GRI Disclosure 201-1; 401-2			GRI Disclosure 201-1; 401-2	GRI: Disclosure 201.3
COUNTRY	SOCIAL SERVICES	ADDITIONAL SERVICES AND INSURANCE	UNEMPLOYMENT BENEFITS	ANTICIPATION OF CARE TREATMENTS	SUPPLEMENTARY HEALTH CARE FUND	NATIONAL INTEGRATIVE WELFARE	RETIREMENT
ALGERIA Dairy CS13	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	Not specified in this law
ARGENTINA Dairy CS13 Beef CS10)	Health care plans exist for all employees and are financed through employer contributions and employee deductions, both a percentage of the employee's salary. Employers must obtain compulsory insurance that covers the employee's work-related death, illness or disability. Employers must conclude insurance contracts through authorised insurance companies.	The employer must also provide compulsory life insurance for its employees, payable by the employer through monthly contributions. Please note that applicable collective agreements may provide for additional insurance.	Unemployment benefits if the insured worker has at least 6 months of contributions in the 3 years prior to the onset of unemployment. Unemployment benefits can be granted from 2 to 12 months, depending on the number of contribution months and the amount decreases over time: Unemployment benefits are administered by the National Social Security Administration. Only employers contribute to the unemployment fund. Unemployed persons should not receive any other social security benefits. However, the unemployed person and his/her dependents receive social security medical benefits and family allowances and may continue their health insurance plan during the period of unemployment.	Early retirement is reserved for workers who have reached the age of 60 (55 for women) with at least 360 months of contributions. The early retirement pension is equal to 50% of the amount of the full pension a worker would have received if he or she had reached the required age.	The health system, administered by the National Social Security Administration, is financed by employee and employer contributions. The employer's contribution is 6% of the employee's salary, while the employee's contribution is 3% of salary. An additional 1.5% of the employee's salary is paid by the employee for each beneficiary family member covered by the health plan.	<i>Not specified</i>	Employees are entitled to collect a mandatory pension when they reach retirement age (65 years for men and 60 years for women) and have made contributions to this system for 30 years. Employers can only compel employees to retire when they reach 70 years old, and have made contributions to this system for 30 years.
BRAZIL Dairy CS13 Beef CS10)	<i>Not specified</i>	There are numerous unions and organizations that support full-time workers. The Brazilian Federation of Workers' Unions (Central Unica dos Trabalhadores) has established as one of its top priorities the protection of employees and the provision of medical policies for employees. However, most of the working population works without an employment contract, so they cannot avail	Any employee can apply for unemployment benefits as long as he/she has worked continuously for min. 6 months before losing employment.	<i>Not specified</i>	Each employee contributes to social security by paying taxes amounting to 8-11% of his or her monthly salary. The employer's contribution is 12%. The contribution of the self-employed during the first 3 years of their business is 10%. After that period, the contribution increases to 20% according to a base salary estimated by Social Security	<i>Not specified</i>	Men over 65 and women over 60 are entitled to receive a pension. In general, the amount of the pension represents to 70% of the beneficiary's average monthly salary and gradually increases every 12 months from 1% to the maximum of 100%

		themselves of the support of any organization					
FRANCE Dairy CS13 Beef CS10)	<p>Employees shall be subject, depending on their status:</p> <ul style="list-style-type: none"> - both the provisions of the National Agreement on Additional Social Protection in Agriculture and the creation of pension plans and any territorial plans agreements; - provisions of the national collective insurance agreement for engineers and farm managers for technicians, supervisors and managers. [Art 6.1] 	<p><i>Before 1 January 2002:</i> local collective agreements designating the supplementary pension schemes ARRCO and AGIRC.</p> <p><i>After 1 January 2002:</i> the company is required to contribute to the Alliance professionnelle Retraite AGIRC-ARRCO.</p>	An employer's contribution for unemployment insurance is 8% of the pre-tax of your monthly salary.	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<p><i>Employee's voluntary retirement:</i> 2 months' notice (if company seniority < 2 years, 1 month notice. Severance pay varies from 1 to 3 months depending on seniority)</p> <p><i>Retirement by the employer:</i> 2 months notice (retirement allowance equal to 1/4 of the monthly salary per year of service for the first 10 years; 1/3 monthly salary per year of seniority from the 11th year). Under 70 years: minimum age 67 years, or older to benefit the full pension. 3 months notice of employer and 1 response for employee. If the answer is no, retirement cannot take place for 1 year and the procedure is repeated every year until the age of 69. From the age of 70: The employer may retire an employee without his or her consent, subject to written notification.</p>
GERMANY Dairy CS13 Beef CS10	<p>Compulsory insurance system offering protection against general risks such as unemployment, illness, need for care, disability, accidents at work, occupational diseases.</p> <p>Employees and employers each pay 1/2 of the social security contributions. Only the employer pays the contributions to the statutory accident insurance. Contributions are automatically deducted from the wages or salary (together with income taxes, the main difference between the gross and net</p>	<p>The contribution rate is shared between employer and employee. For the worker, the contributions to be paid are roughly 20% of his gross earnings.</p> <p>The social security contributions amount to:</p> <p>Health insurance: 7.3 percent and on average an additional contribution rate of 0.9% of gross earnings</p> <p>Pension insurance: 9.3% of gross salary</p> <p>Unemployment insurance: 1.2% of gross earnings</p> <p>Long-term care insurance: 1,525 or 1,7 % of gross salary (it is a compulsory insurance covering the risks of the need for long-term care. Employees without children pay a higher contribution)</p>	<p>Eligibility for the allowance:</p> <ul style="list-style-type: none"> - a minimum of 12 months' contribution payment in the last 30 years before registration as unemployed; - registration with the Employment Agency as a job seeker; - availability of work and ability to pursue employment. <p>The duration of unemployment benefit varies according to the duration of the social security obligation in the last five years and the applicant's age.</p> <p>The allowance runs up to 60% of the last net salary and 67% with children.</p>	<i>Not specified</i>	In the case of insurance against accidents in agriculture, special contribution rates apply, which are mainly based on the area and income of the agricultural holding. Public accident insurance bodies regularly finance their expenditure from budget funds (taxes).	<i>Not specified</i>	The legal retirement age for persons born from 1964 onwards is 67 years. Early retirement is still possible in the case of serious disability or contributions paid for min 45 years. The more contributions are paid to the pension scheme, the higher the pension. Own education (up to 8 years), raising children (up to 3 years per child) or care of relatives are also taken into account as qualifying contributory time periods.

	income).						
ITALY Dairy CS13 Beef CS10	According to law, workers are entitled to the provision and insurance of means appropriate to their needs in the event of an accident, illness, invalidity and old age, involuntary unemployment.	Contributions due to "Agrifondo": 1% paid by the employer; 1% paid by the worker (who may decide to increase this quota); a share of severance pay (min 2% max 100%) variable depending on the membership in the fund of workers employed before 28.04.93 (before 2%; after 100%). [art 59]	To the national public unemployment benefit, the employer must add 10% of the baseline pay	<i>Not specified</i>	The Fund provides supplementary public assistance services for health, safety and social purposes, according to the provisions of the relevant regulation.	<i>Not specified</i>	67 years, regardless of contributions paid, or early retirement with minimum 42 years and 10 months (men) and 41 years and 10 months (women), regardless of age.
MOROCCO Beef CS10	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	The user company is responsible for insuring its employees against accidents at work and occupational diseases.	<i>Not specified</i>	retirement age set at 60 years
NAMIBIA Beef CS10	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
SOUTH AFRICA Dairy CS13 Beef CS10	<i>Not specified</i>	<i>Not specified</i>	Each employer contributes to the Unemployment Insurance Fund.	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
U.S.A. Dairy CS13 Beef CS10	Eligible employees and their families are covered by medical, dental, and vision insurance which covers pre-existing conditions. Eligible employees are provided with basic term life insurance and may purchase supplemental insurance. Eligible employees receive basic Long-Term Disability (LTD) coverage.	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	Public Employees' Retirement System (PERS). Employees hired on or after March 1, 2002, choose between PERS Plan 2 or PERS Plan 3. PERS Plan 2 is a defined benefit plan. This means an individual's retirement benefit is defined by a formula. The formula is: 2% X service credit years X average final compensation (AFC). PERS Plan 3 has two different components. A defined benefit component similar to PERS Plan 2 except it uses one percent in the formula and a defined contribution component.
ZIMBABWE Dairy CS13	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	An employee who reaches the age of sixty years may be required by the employer to retire.
FINLAND Dairy CS3	<i>Not specified</i>	Employer implements social arrangements according to the life insurance contract agreed	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>

		upon between the employers and employees' unions					
KENYA Avocado CS11	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	Normal age: 60 years for (men and women); Earlier retirement: 55 years, at the discretion of either the employee or the employer.

Overtimes, holiday working periods and nocturnal working periods

This table provides information on overtime and related remuneration.

TABLE 27 DATABASE, OVERTIMES AND EXTRA-PAY

OVERTIMES, HOLIDAY WORKING PERIODS AND NOCTURNAL WORKING PERIOD						
SDGs – Indicator 8.8.2 & 1.1.1 GRI - Disclosure 201-1						
COUNTRY	OVERTIME	HOLIDAY WORKING HOURS	NOCTURNAL WORKING HOURS	OVERTIME IN HOLIDAY WORKING DAYS	NOCTURNAL WORKING HOURS IN HOLIDAY WORKING DAYS	BUSINNES TRIP
ALGERIA Dairy CS13	Min. additional remuneration +50% of normal hourly wage	The worker is entitled to compensatory rest of equal duration and of equal duration and shall benefit from the right to overtime pay.	The rules and conditions of night work are determined by collective agreements. The employer is not entitled to use female staff for night work	The worker is entitled to compensatory rest of equal duration and of equal duration and shall benefit from the right to overtime pay.	Worker entitled to compensatory rest of equal duration and of equal duration and shall benefit from the right to overtime pay. The employer is not entitled to use female staff for night work	Reimbursement of expenses is paid by the employer.
ARGENTINA Dairy CS13 Beef CS10)	a rate of 50% of the normal pay	100% of the normal pay	reduce working hours	100% of the normal pay	100% of the normal pay	Depends on agreements between employer and employee
BRAZIL Dairy CS13 Beef CS10)	Overtime is paid at a premium of 50%	Overtime in holidays is paid at a premium of 100%	Nocturnal working hours is paid at a premium of 20%	Overtime in holidays is paid at a premium of 100%	Overtime in holidays is paid at a premium of 100%	<i>Not specified</i>
FRANCE Dairy CS13 Beef CS10)	The hourly amount paid to the employee is increased by 25% for the first 8 hours and 50% for the following hours. Alternatively, the employee recovers hours with a 25% bonus. <i>[National Agreement]</i>	<i>Not specified</i>	night worker: at least twice a week, three hours of work per day from 21:00 to 06:00; 270 or more hours of work within 12 consecutive months between 21:00 and 6:00 --> increase of 20%; [Art 8.2]	<i>Not specified</i>	<i>Not specified</i>	Journey " work - work " included in working time= actual working time (paid) Higher than normal "work-to-work" journey outside working time= financial compensation (1/2 pay/h *travel time exceeding normal commuting time at home-to-work). Overnight transfer: the employer provides accommodation and catering. (distance allowance= 5 times the guaranteed minimum per night away). Personal vehicle: kilometre allowance. [Art 8.1]
GERMANY Dairy CS13 Beef CS10	There are no legal provisions governing the arrangements and the overtime bonus, which are governed by collective agreements and employment contracts. Overtime can be compensated with permits or wage supplements.	Employees working on Sundays or public holidays are entitled to a replacement day of rest: - for Sunday work within two weeks, - for public holidays within eight weeks, - 15 Sundays per year must remain non-working, - Replacement rest days	8 hours, maximum 10hours/day only if an average of 8h/night is not exceeded for an entire month.	There are no legal provisions governing the arrangements and the overtime bonus, which are governed by collective agreements and employment contracts. Overtime can be compensated with permits or wage supplements.	<i>Not specified</i>	<i>Not specified</i>

		<p>must be granted after a rest period of 11 hours.</p> <p>- Rules derogating from the framework collective agreement:</p> <p>Holiday work can be paid for or compensated by leave within 3 months.</p> <p>On the days preceding Christmas and New Year's Eve, regular working hours end at 12:00.</p>				
ITALY Dairy CS13 Beef CS10	paid with +25% of base salary (Quantity: Maximum of 3 hours/day or maximum 18/week – Max. 300 h./year)	paid +35% of base salary (on Sunday and National holidays) - Exception: if in standard recurring shift: only +10%	paid with +40% of base salary (from 8 pm to 6 am) - Exception: if in standard recurring shift: only +10%	paid with +40% of base salary	paid with +45% of base salary	governed by provincial contracts
MOROCCO Beef CS10	25% increase	is equal to 26% of the remuneration for the 26 days of actual work immediately preceding the holiday for a fee.	+ 50% increase	is equal to 26% of the remuneration for the 26 days of actual work immediately preceding the holiday for a fee.	is equal to 26% of the remuneration for the 26 days of actual work immediately preceding the holiday for a fee.	Governed by contracts and agreement
NAMIBIA Beef CS10	Max 10 hours in a week, paid 1.5 times the base pay	paid twice the basic pay	Additional payment of 6% of the employee's basic hourly wage for each hour worked by that employee between 8pm-7am.	paid twice the basic pay	paid twice the basic pay	To be paid by the employer, specified in individual contracts
SOUTH AFRICA Dairy CS13 Beef CS10	paid 1.5 times the employee's normal wage. The employees can also accept to receive paid time off.	An employee who occasionally works on Sunday (or during a public holiday): double pay; ordinarily works on Sunday: 1.5 normal pay // ordinary pay for any public holiday that falls on a working day;	between 18h-6h the work must be compensated by payment of an allowance or by a reduction of working hours and transport must be available. Compensated at least 10% of ordinary wage	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
U.S.A. Dairy CS13 Beef CS10	Overtime pays at a rate not less than 1.5 times the regular rate of pay is required after 40 hours of work in a workweek (max 48h) (FLSA)	The premium rate must be at least 1.5 times the rate established in good faith for like work performed in non-overtime hours on other days.	The Act requires the inclusion in the regular rate of such extra premiums as nightshift differentials (whether they take the form of a percent of the base rate or an addition of so many cents per hour) (FLSA)	Overtime paid at a rate min than 1.5 times the regular rate of pay	The Act requires the inclusion in the regular rate of such extra premiums as nightshift differentials (whether they take the form of a percent of the base rate or an addition of so many cents per hour) (FLSA)	Travel that is all in a day's work, however, is considered hours worked and must be paid.
ZIMBABWE Dairy CS13	Overtime at x1.5 the employee's current wage for the time worked in excess of the ordinary monthly hours of work. Overtime worked on a day off x2 the employee's current wage	The employer shall remunerate an employee who is required to work on a public holiday for every hour or part of an hour of work at two and a half times the current hourly wage of the employee, regardless of whether such work is conducted during or outside the employee's ordinary working hours for the day of the week on which the public holiday falls	<i>Not specified</i>	paid not less than twice his current remuneration for that day [art 14C]	<i>Not specified</i>	<i>Not specified</i>
FINLAND Dairy CS3	+50% for the first 2 hours of daily overtime, +100% for the rest for weekly overtime, +50% on the first 8 hours, +100% for the rest	paid with +100% of base salary on Sundays and national holidays	paid with +20% of base salary (between 22-05)	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
KENYA Avocado	150% of basic wage	200% of basic wage	No premium payment for night work. Normal	200% of basic wage	No premium payment for night work.	Employers must pay

CS11			<p>working hours at night cannot exceed 60 hours per week and overtime of 24 hours is allowed in a period of 2 consecutive weeks. The total working time, inclusive of overtime, may not exceed 144 hours for night workers.</p>		<p>Normal working hours at night cannot exceed 60 hours per week and overtime of 24 hours is allowed in a period of 2 consecutive weeks. The total working time, inclusive of overtime, may not exceed 144 hours for night workers.</p>	
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Payments

Information on remuneration and other benefits is set out in the table below. This indicator is of particular importance since it simultaneously satisfies both indicator 8.8.2, on working conditions, and indicator 1.1, on poverty.

TABLE 28 DATABASE, PAYMENTS

PAYMENTS								
SDGs 1 - Indicator 1.1.1 & 8.8.2 Disclosure 201-1					SDGs 1 - Indicator 1.1.1 GRI Disclosure 401-1			
COUNTRY	INTERRUPTIONS	PAYMENT KIND	TOOLS AND EQUIPMENT	MINIMUM PAY	EXTRA-PAY	LONG SERVICE BONUS	REIMBURSEMENT FOR EXPENSES	SEVERANCE PAY
ALGERIA Dairy CS13	<i>Not specified</i>	Exclusively monetary	Provided by the employer	20,000 Algerian dinars (136.99 EURO) (monthly)	<i>Not specified</i>	<i>Not specified</i>	Expense reimbursements are paid	Paid per month for each year of work, Max. 15 months.
ARGENTINA Dairy CS13 Beef CS10	Depends on agreements between employer and employee	Allowed as part (max 20%) of remuneration. Wages must be paid in cash according to the legislation	Depends on agreements between employer and employee	16.875 AR \$ (203.42 Euro) (monthly)	13 th salary	Depends on agreements between employer and employee	Depends on agreements between employer and employee	<i>dismissal without just cause:</i> 1 month's basic pay for each full year of service (and any fraction exceeding 3 months); <i>employer dismisses an employee for a reason not attributable to the worker</i> , entitled to 1/2 of the monthly salary for each year of service. *Payment limited by law for companies where collective agreements apply.
BRAZIL Dairy CS13 Beef CS10	The duration of the work may be extended for the time required up to a max. of 2 h. for the number of days necessary to make up the lost time provided that 10 hours per day are not exceeded, for a maximum of 45 d/y	<i>Not specified</i>	Provided by the employer	1.212 R\$ (0.22 EURO) (Per hour)	Two bonus for year, in November and December	<i>Not specified</i>	Yes	<i>Dismissal for just cause</i> = no severance pay is due to the employee, he/she only has to pay the accrued entitlements of the employee during the period of employment. <i>Dismissal without just cause</i> = the employer must pay the employee, in addition to the payment of accrued entitlements and as a penalty for dismissal without just cause, an amount equal to 40% of what the employer has paid into the employee's severance pay fund ("FGTS") during the employee's employment.
FRANCE Dairy CS13 Beef CS10	<i>not specified</i>	payments in kind possible (food, accommodation, equipment, vehicle) and must appear in the paycheck [Art 5.2.2]	Provided by the employer	From 10,15 to 20,70 euro/hour, according to the level of specialization of the job [Art 5.1]	Not intended for this sector.	established during the verification of the professional path (every 6 years). [Art 4.7.2]	Yes	It may not be less than: - 1/4 of the monthly salary per year of service for the first 10 years; - 1/3 monthly salary per year of service from the 11th year.
GERMANY Dairy CS13 Beef CS10	<i>Not specified</i>	<i>Not specified</i>	Provided by the employer	Minimum gross wage of at least 12 €/hour.	Christmas bonuses, holiday bonuses and anniversary bonuses are possible, but it depends on collective agreements and company	<i>Not specified</i>	Yes	A severance payment is not mandatory if a justified reason and proper notice are given for the termination. However, the employer should provide a severance payment for terminations caused by operational changes if they have agreed to it in a social plan with the works council. There are no rules for the amount of severance. Typically, a 1/2 month of the employee's regular wage for every year they were in the company applies. However, the amounts can be up to 2 months of the salary for every employment year.

					contracts.			
ITALY Dairy CS13 Beef CS10	If the daily activities are interrupted due to force majeure, the rest of the hours are paid only if the worker is asked to stay in the farm, at disposal.	<i>Not specified</i>	Provided by the employer	From 874,65 euro to 1286,25-euro according to the level of specialization of the job (monthly)	"tredicesima" (at the end of the year, each employee receive an extra-pay equal to the pay of December) and "quattordicesima" (at the end of April, each employee receive an extra-pay equal to a monthly pay)	Each 2 years, the monthly pay is increased of 8.99-11.62 euros, according to the level of specialization of the worker, for a maximum of 5 bonuses	yes	- 1/3 monthly salary per year of service from the 11th year.
MOROCCO Beef CS10	In case of a collective interruption of work due to accidental causes or force majeure, the daily working time can be extended by way of recuperation. -max 30 hours/year - max 1 hour/day - total working time 10 hour/day	Depends on the agreements, but in agricultural activities, benefits in kind are not considered for the calculation of the statutory minimum wage. [art 357]	Provided by the employer	The legal minimum wage for a day's work is set at 88.58 Dirhams. (8.07 EUR)	<i>Not specified</i>	Each employee is entitled to a seniority bonus, the amount of which is set at: - 5% of the salary paid, after 2 years of service; - 10% of the salary paid after 5 years of service - 15% of the salary paid after 12 years of service - 20% of the salary paid, after 20 years of service; - 25% of the salary paid, after 25 years of service. (Period of service, continuous or not, in the same company or with the same employer) [Art 350]	yes	Severance pay is calculated on the basis of the average wages received in the 52 weeks preceding the termination of the contract.
NAMIBIA Beef CS10	<i>Not specified</i>	allowable, to be defined with the employer	to be defined with the employer	table with requirements and methods for calculating the minimum wage (art 10)	<i>Not specified</i>	<i>Not specified</i>	Depends on agreements between employer and employee	the employer must pay redundancy compensation to an employee who has completed 12 months of continuous service; amounting to at least 1 week's pay for each year of continuous service with the employer
SOUTH AFRICA Dairy CS13 Beef CS10	<i>Not specified</i>	Can't be more than 10% each of the wage for food and accommodation	<i>Not specified</i>	RAND 23.19/ hours (1.27 EURO/hour)	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	1 week's severance pay for every year of service.
U.S.A. Dairy CS13 Beef CS10	<i>Not specified</i>	Where payments are made to employees in the form of goods or facilities which are regarded as	<i>Not specified</i>	\$7.25 per hour effective (6.92euro/h). In cases where an employee is subject to both state and federal minimum wage laws, the	These benefits are generally a matter of agreement between an employer and an employee	These benefits are generally a matter of agreement between an employer and an employee	<i>Not specified</i>	Not foreseen by law, but usually agreed between actors, also thanks to the help of the Employee Benefits Security Administration (EBSA)

		part of wages, the reasonable cost to the employer or the fair value of such goods or of furnishing such facilities must be included in the regular rate.		employee is entitled to the higher minimum wage. (FLSA)				
ZIMBABWE Dairy CS13	<i>Not specified</i>	Remuneration in kind is only allowed in certain sectors and cannot fully replace remuneration in cash. [12A]	<i>Not specified</i>	Since the 1st of June 2022, the minimum wages payable is determined by converting the applicable US\$ at the auction rate prevailing on the 23rd day of the month for which remuneration is due to the employees. (Min depends on grade, the min is 71.926 ZW\$)	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	Employee with > 5 years of continuous service is entitled to a "bonus" equal to or greater than the amount obtained by multiplying the contractually agreed % of his current monthly salary at the time of termination by the number of years of continuous service. The bonus does not apply to an employee who is entitled to compensation from a private pension scheme.
FINLAND Dairy CS3	<i>Not specified</i>	<i>Not specified</i>	Tools and equipment for working safety are provided by the employer	9,20 euro / hour	<i>Not specified</i>	On December 1st an extra pay for number of years served: 5-9y = 140e 10-15y = 190e 16-19y = 260e 20y or more = 345e	<i>Not specified</i>	Severance period applied, if the period is not respected, full pay for those days will be reimbursed
KENYA Avocado CS11	<i>Not specified</i>	Possible	Basic working tools provided to workers who have completed the probationary period. If an employee is not provided with tools and he/she uses his/her own tools shall be entitled to a monthly allowance	15120 KES/Month (113.684 USD/Month)	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>

Working relationship

TABLE 29 DATABASE, WORKING RELATIONSHIP

WORKING RELATIONSHIP			
	SDG: Indicator 8.8.2 GRI: Disclosure 402-1	SDG: Indicator 8.8.2 GRI: Disclosure 402-1	
COUNTRY	PROBATIONARY PERIOD	FIRING	DISMISS
ALGERIA Dairy CS13	6 month (12 months for hight qualified work)	The written contract is not mandatory. Oral agreements between employers and employees are legally allowed. In case of early termination of the contract, the employee may be entitled to compensation. This is generally paid in cash and is given in the event of sudden dismissal provided the employee is not dismissed for misconduct.	Notice period under the conditions set out in the collective agreement.
ARGENTINA Dairy CS13 Beef CS10)	Maximum 3 months	15 days written notice to the probationary employee; 1 month in advance, if the employee has worked up to 5 years; 2 months in advance, if the employee has worked for more than 5 years. He may not give notice provided if he pays an indemnity equal to 15 days' salary, plus 1- or 2-months' salary.	15-day notice to employer.
BRAZIL Dairy CS13 Beef CS10)	Max 90 days	notice of 30 days or more if the contract specifies. If the employer fires an employee without a valid reason, he must pay a penalty.	notice of 30 days or more if the contract specifies.
FRANCE Dairy CS13 Beef CS10)	two months renewable, for a maximum of 4 months total [Art 7.2]	1 month if the worker has < than 2 years of presence. 2 months if the workers have more than 2 years of presence. [Art 9.1]	One month notice [Art. 9.1]
GERMANY Dairy CS13 Beef CS10	Trial period is not mandatory, but it is very common. Duration approximately from 1 to 6 months. Both the employer and the employee may terminate the employment relationship without giving any reasons, but with 2 weeks of notice [BGB]	Ordinary termination: notice period varies according to the length of employment: 0- 6 mths employment: 2 weeks 0.5 - 2 years: 4 wks to 15. or end of month 2 - 5 yrs: 1 mth to end of mth 5 - 8 yr: 3 mths to end of mth 8 - 10 yrs: 4 mths to end of mth 10 - 12 yrs: 5 mths to end of mth >12 yrs: 6 mths to end of mth Extraordinary termination: immediate, from the moment of communication. Termination agreement: agreement between employee and employer Note: workers' representatives (member of the works council) are under special protection. Their contract cannot be ordinarily terminated.	4 weeks
ITALY Dairy CS13 Beef CS10	14, 20, 16 days (according to the level of specialization of the job)	Dismissal may be for just cause (with immediate resolution of the report without notice obligation) or justified reason (2 months' notice) [Art. 74]	Without notice for resignation with just cause and with one month's notice in other cases [Art 76]
MOROCCO Beef CS10	1.5 months (renewable once)	Notice of dismissal provided for, specified in contracts and collective agreements.	The notice period depends on the employment contract and collective bargaining, but cannot be less than 8 days [art 13]
NAMIBIA Beef CS10	not specified, depends on the contract and agreements	1 day, if the worker has been employed for < 4 weeks 1 week, if the worker has been employed for > 4 but < 1 year; 1 month, if the worker has been employed for > 1 year.	1 day, if the worker has been employed for < 4 weeks 1 week, if the worker has been employed for > 4 but < 1 year; 1 month, if the worker has been employed for > 1 year.
SOUTH AFRICA Dairy CS13 Beef CS10	Not specified, may be negotiated between the parties and included in the contract of employment.	Notice: one week before if the employee has been employed for 6 months or less. // 2 weeks for 6 months<workers< 1 year // 4 weeks for workers > 1 year	Just cause or justified reason; Notice: one week before if the employee has been employed for 6 months or less. // 2 weeks for 6 months<workers< 1 year // 4 weeks for workers > 1 year
U.S.A. Dairy CS13 Beef CS10	It depends on the state and the contract, usually ranging from 3 to 6 months	The At Will contract gives an employee the right to fire employees at any time, while Just Cause contracts require that employers must have a valid reason in order to fire the employee.	The At Will contract gives an employee the right to leave at any time, while Just Cause contracts require that employee must have a valid reason and give notice in advance.
ZIMBABWE Dairy CS13	3 months	3 months of notice [art12]	4 months of notice [art12]
FINLAND Dairy CS3	Max 6 months	Dismissal may be for just cause (as outlined in employment law chapter 7 2§) or required for economic reasons (chapter 7 3§)	Dismissal periods for different lengths of employment if

		Dismissal periods for different lengths of employment	resignation by the employee
KENYA Avocado CS11	6 months (max 12) 60 days in collective agreement	6 days in trial period. 1 month if the relation was 1-2 years. 2 months if the relation was 3-5 year 3 months if the relation was > 5 year An employee declared redundant shall be entitled to 21 days' pay for each completed year of service.	7 days in trial period. 1 month if the relation was 1-2 years. 2 months if the relation was 3-5 year 3 months if the relation was > 5 year

Trade right

This section contains data on union rights guaranteed at the contractual level and made explicit.

In some cases, reference is made to internal agreements between employer and union members.

TABLE 30 DATABASE, TRADE UNION RIGHTS

TRADE UNION WRIGHT			
COUNTRY	FARM WORKERS' REPRESENTATIVES	MEETINGS IN THE COMPANY	UNION PERMITS
ALGERIA Dairy CS13	<p>from 10 to 50 employees: 1 union delegate from 51 to 100 employees: 2 union delegates from 151 to 400: 4 union delegates; from 401 to 1000: 6 union delegates; more than 1000 employees: an additional representative every 500 employees</p>	<p>The employer shall provide the participation committee and the staff delegates with the necessary means to hold their meetings and to carry out secretarial work.</p>	<p>Leave is provided to enable the employee to perform trade union or staff representation tasks, on the basis of accordance with legal or contractual provisions. Staff representatives are entitled to monthly credit of 10 hours paid by the employer as working time, for the exercise of their mandate, except during annual leave.</p>
ARGENTINA Dairy CS13 Beef CS10)	<p>from 20 to 50 employees: 1 union delegate from 51 to 150 employees: 2 union delegates more than 101 employees: an additional representative every 100 employees</p>	<p>recognised the right to assemble, but the terms are specified in collective agreements</p>	<p><i>Not specified</i></p>
BRAZIL Dairy CS13 Beef CS10)	<p>Representative Commission - companies 200-3000 employees = 3 members - companies 3,000-5,000 = 5 members - companies > 5,000 employees = 7 members.</p>	<p><i>Not specified</i></p>	<p><i>Not specified</i></p>
FRANCE Dairy CS13 Beef CS10)	<p><i>Economic and Social Committee</i>: elections organized in companies with more than 11 employees. From 11 to 20, if no employee applies within 30 days of notification, the employer is not required to organise elections. If major has the obligation to organize elections. [Art 2.5]</p>	<p>The members of each trade union section may meet once a month within the premises of the company, outside working hours, in accordance with arrangements to be determined by mutual agreement with the employer, without prejudice to special rights granted to staff representatives by the Labour Code.</p>	<p>Request by the workers 3 days in advance: time necessary to carry out their trade union mission outside the company and to attend to the various commissions. Employees called upon to carry out trade union functions benefit from leave for economic, social, environmental and trade union training (max 18 days/years). Unpaid, subject to recovery hours (paid with regular fee) within 3 months [Art 2.1]</p>
GERMANY Dairy CS13 Beef CS10)	<p>The representation of employees is regulated by the Works Constitution Act. For the appointment or election of a workers' representative (the works council), the company in question must have at least five employees aged 18 or over. [Betriebsverfassungsgesetz]. The number of representatives in the works council increases with increasing number of employees 5 - 20 employees: 1 representative 21 - 50 employees: 3 representatives 51 - 100 employees: 5 representatives and so on Members of the work council are under special protection. Their contract cannot be ordinarily terminated.</p>	<p><i>Not specified</i></p>	<p><i>Not specified</i></p>
ITALY Dairy CS13 Beef CS10)	<p>In farms with >5 farm workers 1 delegate will be elected. Farms with >75 agricultural workers will be elected a second delegate.</p>	<p>Workers have the right to meet in the company during the working hours (maximum 13 hours/year's paid regularly) and</p>	<p>Union member workers must have granted paid leave (11 hours per month may be</p>

		outside working hours	accumulated within a maximum period of 4 months); For corporate delegated workers: 4-hour monthly permits, cumulative within the four-month period.
MOROCCO Beef CS10	<ul style="list-style-type: none"> - 10-25 wage earners= 1 full delegate and 1 alternate delegate; - 26- 50 salaried employees= 2 full delegates and 2 alternate delegates [art 433] - 51- 100 employees= 3 full and 3 alternate delegates - 101- 250 employees= 5 full and 5 alternate delegates - 251- 500 employees= 7 full and 7 alternate delegates - 501-1000 employees= 9 full and 9 alternate delegates; For each additional group of 500 employees, there is one full and one alternate delegate.	Workers have the right to meet in the company	<i>Not specified</i>
NAMIBIA Beef CS10	<ul style="list-style-type: none"> 1 representative with > 5 workers; 2 representatives with > 25 workers; 3 representatives with > 50 workers; 4 representatives with > 100 workers + 1 representative every 100 workers 	Possibility of organising meetings on work premises, outside and inside working hours (subject to employer's authorisation)	Planned but depend on collective agreement
SOUTH AFRICA Dairy CS13 Beef CS10	<i>Not specified</i>	<i>Not specified</i>	<i>Not specified</i>
U.S.A. Dairy CS13 Beef CS10	<i>Not specified</i>	The Bill of Rights guarantees union members equal rights to nominate candidates for union office, to vote in union elections or referendums, and to attend union meetings and participate in the deliberations and voting upon the business of such meetings	The Bill of Rights guarantees union members equal rights to nominate candidates for union office, to vote in union elections or referendums, and to attend union meetings and participate in the deliberations and voting upon the business of such meetings
ZIMBABWE Dairy CS13	<i>Not specified</i>	<i>Not specified</i>	special leave of 12 days, covering several reasons
FINLAND Dairy CS3	Elected delegate representing unionized workers at the workplace	<i>Not specified</i>	Employers and employees have the right to choose to join unions
KENYA Avocado CS11	<i>Not specified</i>	With the consent of the employer	<i>Not specified</i>

Other regulation

TABLE 31 DATABASE, OTHER REGULATIONS

OTHER REGULATIONS		
COUNTRY	INDIVIDUAL DISPUTES	COLLECTIVE DISPUTES
ALGERIA Dairy CS13	Conciliation mechanisms and modalities specified in collective bargaining	Conciliation mechanisms and modalities specified in collective bargaining
ARGENTINA Dairy CS13 Beef CS10	Existence of the Compulsory Labour Conciliation Service (SECLC)	Existence of the Compulsory Labour Conciliation Service (SECLC)
BRAZIL Dairy CS13 Beef CS10	If the parties (employer and employee) do not reach the agreement directly, the dispute is referred to the respective territorial tribunal	Collective disputes that cannot be resolved within the company can be submitted to the Conciliation Commission
FRANCE Dairy CS13 Beef CS10	<i>Not specified</i>	Collective disputes that cannot be resolved within the company can be submitted to the Conciliation Commission, with possible recourse to both the arbitration procedure and the mediation procedure. [Art 1.6]
GERMANY Dairy CS13 Beef CS10	<i>Not specified</i>	<i>Not specified</i>
ITALY Dairy CS13 Beef CS10	If the parties (employer and employee) do not reach the agreement directly, the dispute is referred to the respective territorial trade unions (within 15 days of the request of one of the parties) [Art 89]	Within 15 days of the notification of one of the parties, the contracting organizations must intervene to examine and resolve the collective disputes arising for the application of laws, CCNL and provincial employment contracts. [Art 90]
MOROCCO Beef CS10	Labour inspectors are responsible for conciliation attempts in individual labour disputes. (art 532)	Collective labour disputes are settled in accordance with the conciliation and arbitration procedure provided for this purpose (art 551)
NAMIBIA Beef CS10	- attempt at conciliation - appeal to the arbitration court - labour commissioner	- attempt at conciliation - appeal to the arbitration court - labour commissioner
SOUTH AFRICA Dairy CS13 Beef CS10	<i>Not specified</i>	<i>Not specified</i>
U.S.A. Dairy CS13 Beef CS10	<i>Not specified</i>	<i>Not specified</i>
ZIMBABWE Dairy CS13	First attempt at conciliation or, if agreed by the parties, referring to arbitration. If a resolution is reached, the labour officer must record the agreement in writing. If no agreement is reached within 30 days, a certificate of non-resolution is issued to the parties of the dispute or unfair labour practice.	
FINLAND Dairy CS3	If the parties (employer and employee) do not reach the agreement directly, the dispute is referred to the elected farm workers representative	If agreements are still not reached, they will be referred to collective parties
KENYA Avocado CS11	the aggrieved party may complain to the labour officer or lodge a complaint or suit in the Industrial Court.	the aggrieved party may complain to the labour officer or lodge a complaint or suit in the Industrial Court.



Forced and child labour




TABLE 32 DATABASE, FORCED LABOUR AND CHILD LABOUR

Forced and child labour		
	SDG Indicator 8.7.1 & 8.8.2 GRI Disclosure 405-1; 406-1; 409-1	SDG Indicator 8.7.1 GRI Disclosure 408-1
COUNTRY	FORCED LABOUR	CHILD LABOUR
ALGERIA Dairy CS13	<i>Not specified</i>	+16 years (except apprenticeship) Legal guardian's authorisation required <19 may not do night work
ARGENTINA Dairy CS13 Beef CS10)	<i>Not specified</i>	Prohibited at <14 years of age (allowed if they work with the family and do not perform dangerous tasks) Between 14 and 18 can work if parents/guardians know about it
BRAZIL Dairy CS13 Beef CS10)	Not allowed	Brazil Prohibited to <16 years Granted to +14 years old for apprenticeships Prohibited. Following inspection, entitled to 3 instalments of unemployment insurance
FRANCE Dairy CS13 Beef CS10)	<i>Not specified</i>	If <18 cannot do jobs that endanger safety, health and development Nothing
GERMANY Dairy CS13 Beef CS10)	Not allowed	Minimum 15 years In the agricultural sector +17
ITALY Dairy CS13 Beef CS10)	<i>Not specified</i>	Must have completed compulsory schooling Apprenticeship only for +17
MOROCCO Beef CS10)	Not allowed	Forbidden to <15 years Between 15 and 18 only with permission of the labour inspector
NAMIBIA Beef CS10)	Not allowed	Forbidden to <14 years Between 14 and 16 cannot work between 8 p.m. and 7 a.m. Cannot in mining, construction/demolition, transformation and distribution of electricity, activities that endanger health
SOUTH AFRICA Dairy CS13 Beef CS10)	Not allowed	Forbidden for under 15 years
U.S.A. Dairy CS13 Beef CS10)	<i>Not specified</i>	USA Minimum age 16 for agricultural occupations. However, +14, with training certificate or if an apprentice, may perform some hazardous occupations in agriculture. Minimum age 18 for hazardous occupations in general. 12-13 can work in a business if a parent also works there.
ZIMBABWE Dairy CS13)	Not allowed, except in public emergencies or at the request of the court	Forbidden for under 16 years
FINLAND Dairy CS3)	<i>Not specified</i>	Forbidden for under 15 years
KENYA Avocado CS11)	It is not considered forced: -military service -civil service -conviction in a court of law -in case of war or calamity -minor communal service	Kenya Subject to authorisation by an officer. Denied if it forces the child to stay away from the family; where alcohol is sold; as a tour guide Not considered forced: -military service -civilian duty -conviction in a court of law -in case of war or calamity -minor communal service

To conclude this section, a table summarising the main linkages between the reference SDGs and the GRI system is provided.

TABLE 33 SDGs TO GRI STANDARDS

SDGs	Sub goal	Indicator	GRI		Disclosure
	1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day	1.1.1 Proportion of the population living below the international poverty line by sex, age, employment status and geographical location (urban/rural)	201	Economic performance	1 - Direct economic value generated and distributed <i>Economic value distributed: operating costs, employee wages and benefits, payments to providers of capital, payments to government by country, and community investments;</i>
	1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, new-borns, work-injury victims and the poor and the vulnerable			3 - Defined benefit plan obligations and other retirement plans <i>If the plan's liabilities are met by the organization's general resources, the estimated value of those liabilities.</i> <i>If a separate fund exists to pay the plan's pension liabilities:</i> <ul style="list-style-type: none"> - the extent to which the scheme's liabilities are estimated to be covered by the assets that have been set aside to meet them; - the basis on which that estimate has been arrived at; - when that estimate was made. <i>If a fund set up to pay the plan's pension liabilities is not fully covered, explain the strategy, if any, adopted by the employer to work towards full coverage, and the timescale, if any, by which the employer hopes to achieve full coverage.</i> <i>Percentage of salary contributed by employee or employer.</i> <i>Level of participation in retirement plans, such as participation in mandatory or voluntary schemes, regional, or country-based schemes, or those with financial impact.</i>
	2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	2.3.2 Average income of small-scale food producers, by sex and indigenous status	201	Economic performance	1 - Direct economic value generated and distributed <i>Economic value distributed: operating costs, employee wages and benefits, payments to providers of capital, payments to government by country, and community investments;</i>
	5.1 End all forms of discrimination against all women and girls everywhere	5.1.1 Whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination on the basis of sex	406	Non-discrimination	1 - Incidents of discrimination and corrective actions taken
	5.a Undertake reforms to give women equal rights to economic resources,	5.a.1 (a) Proportion of total agricultural population	409	Forced or Compulsory	1 - Operations and suppliers at significant risk for incidents of forced or compulsory labour

		<p>as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws</p>		<p>with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure</p>		<p>Labour</p>	<p><i>Operations and suppliers considered to have significant risk for incidents of forced or compulsory labour. Measures taken by the organization in the reporting period intended to contribute to the elimination of all forms of forced or compulsory labour.</i></p>
	<p>8.3</p>	<p>Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services</p>	<p>8.3.1</p>	<p>Proportion of informal employment in total employment, by sector and sex</p>	<p>409</p>	<p>Forced or Compulsory Labour</p>	<p>1 - Operations and suppliers at significant risk for incidents of forced or compulsory labour <i>Operations and suppliers considered to have significant risk for incidents of forced or compulsory labour. Measures taken by the organization in the reporting period intended to contribute to the elimination of all forms of forced or compulsory labour.</i></p>
					<p>408</p>	<p>Child labour</p>	<p>1 - Operations and suppliers at significant risk for incidents of child labor.</p>
	<p>8.8</p>	<p>Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment</p>	<p>8.8.2</p>	<p>Level of national compliance with labour rights (freedom of association and collective bargaining) based on International Labour Organization (ILO) textual sources and national legislation, by sex and migrant status</p>	<p>403</p>	<p>Occupational Health and Safety</p>	<p>1 - Occupational health and safety management system <i>A statement of whether an occupational health and safety management system has been implemented. A description of the scope of workers, activities, and workplaces covered by the occupational health and safety management system, and an explanation of whether and, if so, why any workers, activities, or workplaces are not covered.</i></p> <p>2 - Hazard identification, risk assessment, and incident investigation <i>A description of the processes used to identify work-related hazards and assess risks on a routine and non-routine basis, and to apply the hierarchy of controls in order to eliminate hazards and minimize risks. A description of the policies and processes for workers to remove themselves from work situations that they believe could cause injury or ill health, and an explanation of how workers are protected against reprisals.</i></p> <p>3 - Occupational health services <i>A description of the occupational health services' functions that contribute to the identification and elimination of hazards and minimization of risks, and an explanation of how the organization ensures the quality of these services and facilitates workers' access to them</i></p> <p>4 - Worker participation, consultation, and communication on occupational health and safety <i>A description of the processes for worker participation and consultation in the development, implementation, and evaluation of the occupational health and safety management system, and for providing access to and communicating relevant information on occupational health and safety to workers.</i></p> <p>5 - Worker training on occupational health and safety <i>A description of any occupational health and safety training provided to workers, including generic training as well as training on specific work-related hazards, hazardous activities, or hazardous situations.</i></p> <p>6 - Promotion of worker health <i>An explanation of how the organization facilitates workers' access to non-occupational medical and healthcare services, and the scope of access provided. A description of any voluntary health promotion services and programs</i></p>

						<p><i>offered to workers to address major non-work-related health risks, including the specific health risks addressed, and how the organization facilitates workers' access to these services and programs.</i></p> <p>7 - Prevention and mitigation of occupational health and safety impacts directly linked by business relationships. <i>A description of the organization's approach to preventing or mitigating significant negative occupational health and safety impacts that are directly linked to its operations, products, or services by its business relationships, and the related hazards and risks.</i></p> <p>8 - Workers covered by an occupational health and safety management system <i>If the organization has implemented an occupational health and safety management system based on legal requirements and/or recognized standards/guidelines:</i></p> <ul style="list-style-type: none"> - the n° and % of all employees and workers who are not employees but whose work and/or workplace is controlled by the organization, who are covered by such a system; - the n° and % of all employees and workers who are not employees but whose work and/or workplace is controlled by the organization, who are covered by such a system that has been internally audited; - the n° and % of all employees and workers who are not employees but whose work and/or workplace is controlled by the organization, who are covered by such a system that has been audited or certified by an external party. <p><i>Whether and, if so, why any workers have been excluded from this disclosure, including the types of workers excluded.</i> <i>Any contextual information necessary to understand how the data have been compiled, such as any standards, methodologies, and assumptions used.</i></p> <p>9 - Work-related injuries</p> <p>10 - Work-related ill health</p>
				407	Freedom of Association and Collective Bargaining	<p>1 - Operations and suppliers in which the right to freedom of association and collective bargaining may be at risk <i>Operations and suppliers in which workers' rights to exercise freedom of association or collective bargaining may be violated or at significant risk.</i></p>

Environmental sustainability

The in-depth study of environmental sustainability issues was carried out thanks to the participation in the activities of two organisations highly specialised in the sectors investigated by the case studies:

- [Agribenchmark beef](#) was involved in case study n.º 10: “Beef and policy coherence for sustainable development”.
- [IFCN](#) was involved in case study n.º13 “Dairy production, standards and competitiveness in global markets”.

The study carried out brought to light some information about the real impact of these production.

Dairy production, standards and competitiveness in global markets (CS #13)

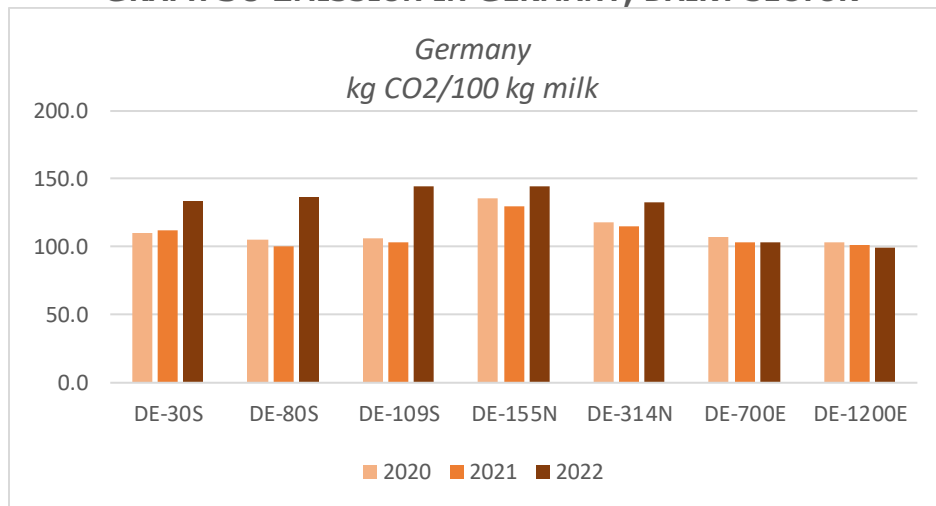
Germany

For Germany, a total of seven typical farms were analysed.

TABLE 34 EMISSION IN GERMANY, DAIRY SECTOR (IFCN)

GERMANY									
			DE-30S	DE-80S	DE-109S	DE-155N	DE-314N	DE-700E	DE-1200E
Total CO2 emissions for milk	2020	kg CO2/100 kg milk	110.7	105.7	106.2	135.5	117.8	107.0	103.8
	2021	kg CO2/100 kg milk	112.4	100.9	103.8	129.8	115.5	103.7	100.9
	2022	kg CO2/100 kg milk	133.7	137.0	144.2	145.0	133.3	103.6	99.8

GRAPH 30 EMISSION IN GERMANY, DAIRY SECTOR



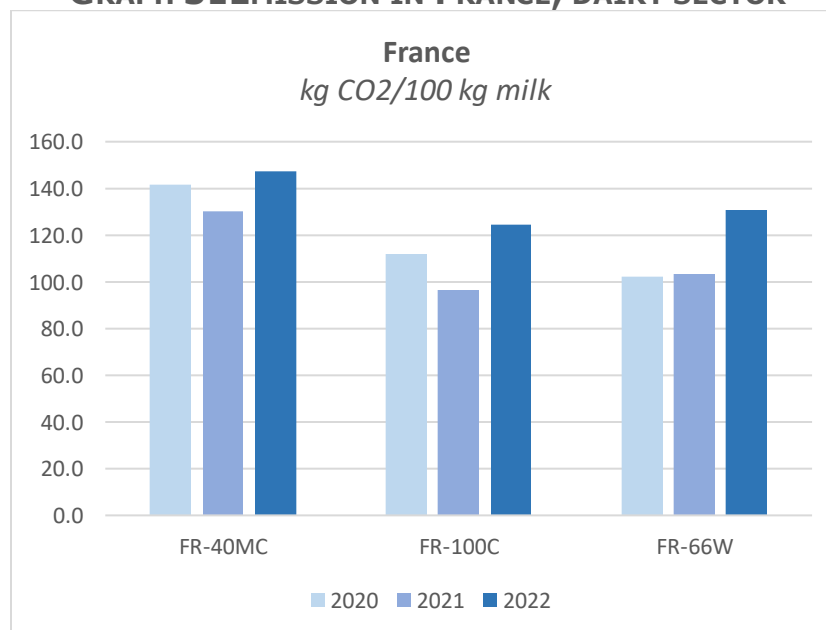
France

For France, a total of three typical farms were analysed.

TABLE 35 EMISSION IN FRANCE, DAIRY SECTOR (IFCN)

FRANCE					
			FR-40MC	FR-100C	FR-66W
Total CO ₂ emissions for milk	2020	kg CO ₂ /100 kg milk	141.3	111.8	102.5
	2021	kg CO ₂ /100 kg milk	130.4	96.7	103.3
	2022	kg CO ₂ /100 kg milk	147.1	124.7	131.0

GRAPH 31 EMISSION IN FRANCE, DAIRY SECTOR



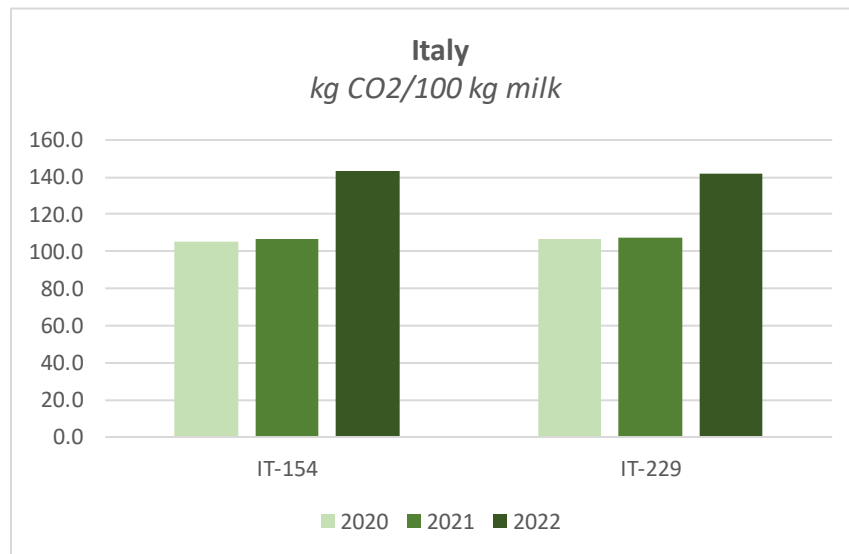
Italy

For Italy, a total of two typical farms were analysed.

TABLE 36 EMISSION IN ITALY, DAIRY SECTOR (IFCN)

ITALY				
Total CO2 emissions for milk			FR-40MC	FR-100C
	2020	kg CO2/100 kg milk	105.2	106.7
	2021	kg CO2/100 kg milk	106.5	107.6
	2022	kg CO2/100 kg milk	143.0	142.1

GRAPH 32 EMISSION IN ITALY, DAIRY SECTOR

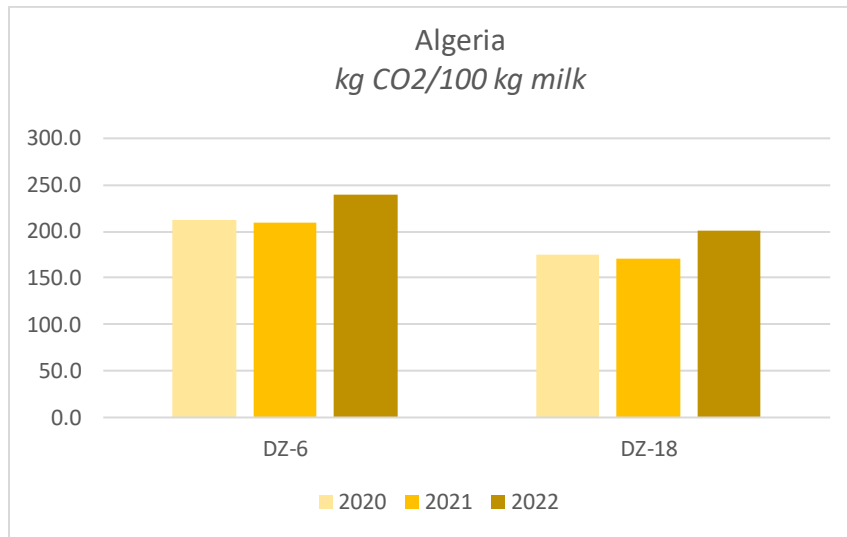


Algeria

TABLE 37 EMISSION IN ALGERIA, DAIRY SECTOR (IFCN)

ALGERIA				
Total CO2 emissions for milk			DZ-6	DZ-18
	2020	kg CO2/100 kg milk	212.1	174.7
	2021	kg CO2/100 kg milk	209.4	170.9
	2022	kg CO2/100 kg milk	239.9	200.6

GRAPH 33 EMISSION IN ALGERIA, DAIRY SECTOR

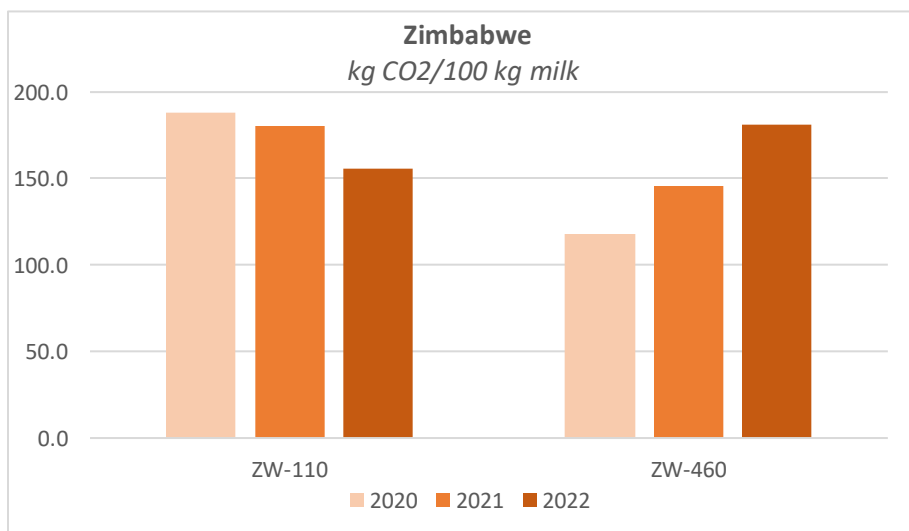


Zimbabwe

TABLE 38 EMISSION IN ZIMBABWE, DAIRY SECTOR

ZIMBABWE				
			ZW-110	ZW-460
Total CO ₂ emissions for milk	2020	kg CO ₂ /100 kg milk	188.4	117.7
	2021	kg CO ₂ /100 kg milk	180.8	146.0
	2022	kg CO ₂ /100 kg milk	156.0	181.2

GRAPH 34 EMISSION IN ZIMBABWE, DAIRY SECTOR

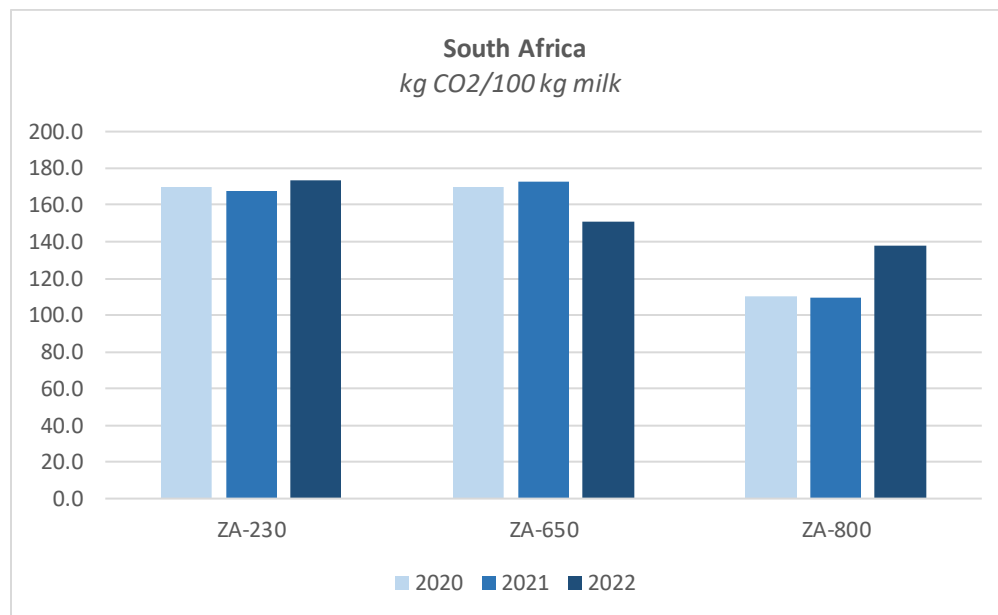


South Africa

TABLE 39 EMISSION IN SOUTH AFRICA, DAIRY SECTOR

SOUTH AFRICA					
			ZA-230	ZA-650	ZA-800
Total CO2 emissions for milk	2020	kg CO2/100 kg milk	169.8	170.1	110.3
	2021	kg CO2/100 kg milk	167.8	173.1	109.6
	2022	kg CO2/100 kg milk	173.5	150.8	138.2

GRAPH 35 EMISSION IN SOUTH AFRICA, DAIRY SECTOR

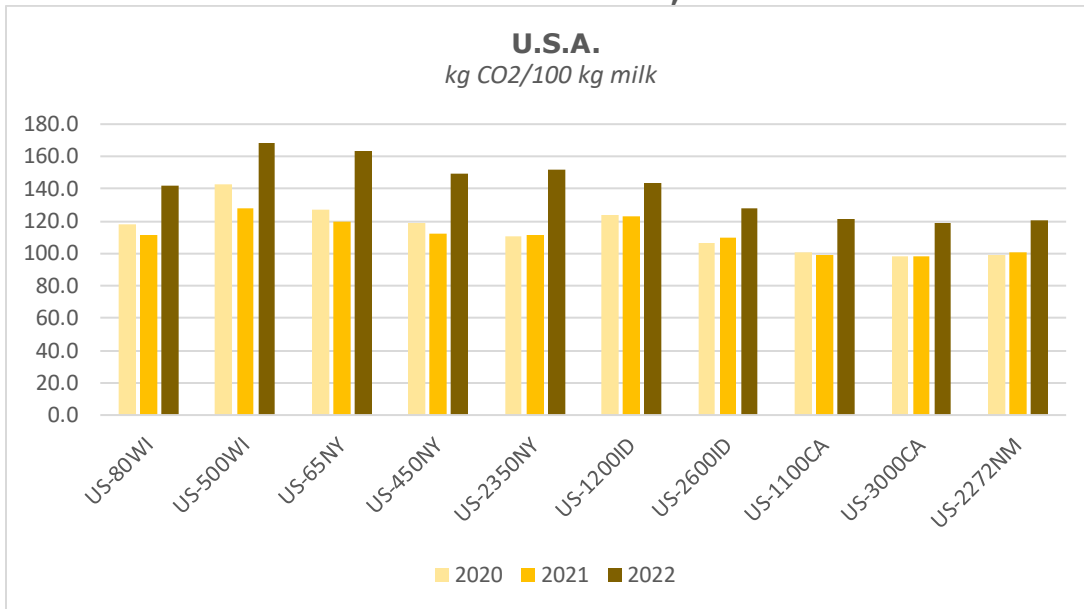


United States of America

TABLE 40 EMISSION IN U.S.A., DAIRY SECTOR

United States of America											
	US-80WI	US-500WI	US-65NY	US-450NY	US-2350NY	US-1200ID	US-2600ID	US-1100CA	US-3000CA	US-2272NM	
Total CO2 emissions for milk kg CO2/100 kg milk	2020	117.8	142.5	127.3	119.2	110.3	123.5	106.6	100.5	97.8	99.3
	2021	111.5	127.7	119.7	112.3	111.3	123.2	109.8	99.4	98.6	101.0
	2022	142.1	168.6	163.4	149.6	151.5	143.3	127.7	121.0	119.1	120.5

TABLE 41 EMISSION IN U.S.A., DAIRY SECTOR



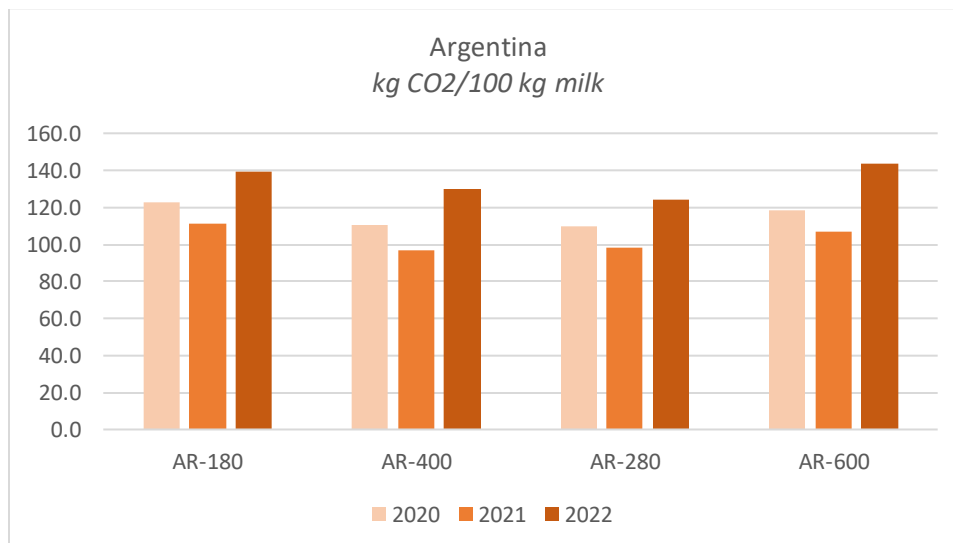
Argentina

For Argentina, a total of seven typical farms were analysed.

TABLE 42 EMISSION IN ARGENTINA, DAIRY SECTOR (IFCN)

Argentina						
			AR-180	AR-400	AR-280	AR-600
Total CO ₂ emissions for milk	2020	kg CO ₂ /100 kg milk	122.7	110.1	109.8	118.6
	2021	kg CO ₂ /100 kg milk	111.3	96.9	98.3	106.9
	2022	kg CO ₂ /100 kg milk	139.2	129.6	124.4	143.7

GRAPH 36 EMISSION IN ARGENTINA, DAIRY SECTOR

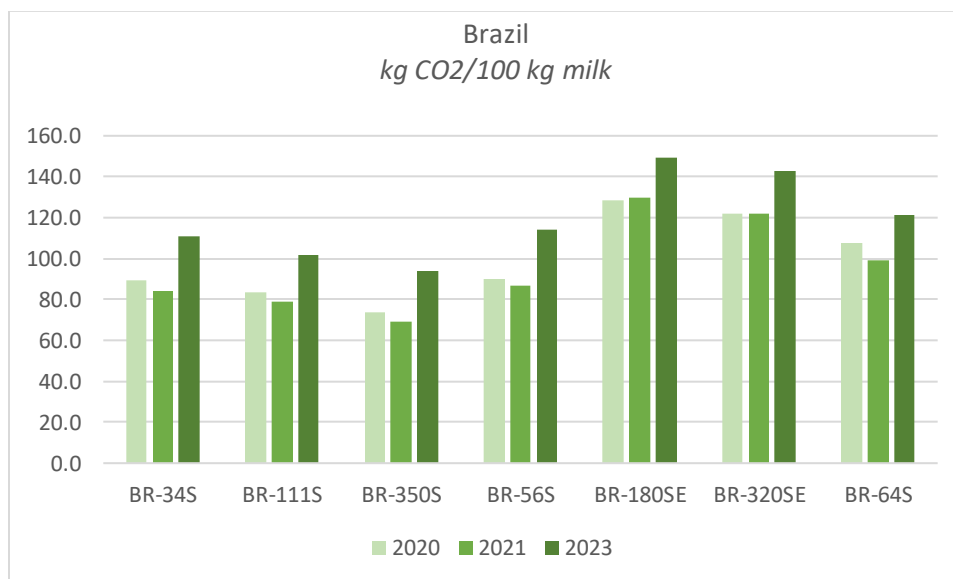


Brazil

TABLE 43 EMISSION IN BRAZIL, DAIRY SECTOR (IFCN)

BRAZIL									
Total CO2 emissions for milk			BR-34S	BR-111S	BR-350S	BR-56S	BR-180SE	BR-320SE	BR-64S
	2020	kg CO2/100 kg milk	89.3	83.7	73.9	89.8	128.2	121.9	107.6
	2021	kg CO2/100 kg milk	84.3	78.8	69.2	86.9	129.8	121.7	99.1
	2022	kg CO2/100 kg milk	110.9	101.8	93.8	113.9	149.5	142.6	121.2

GRAPH 37 EMISSION IN BRAZIL, DAIRY SECTOR (IFCN)



Emission of beef production (CS #10)

Beef sector GHG emissions

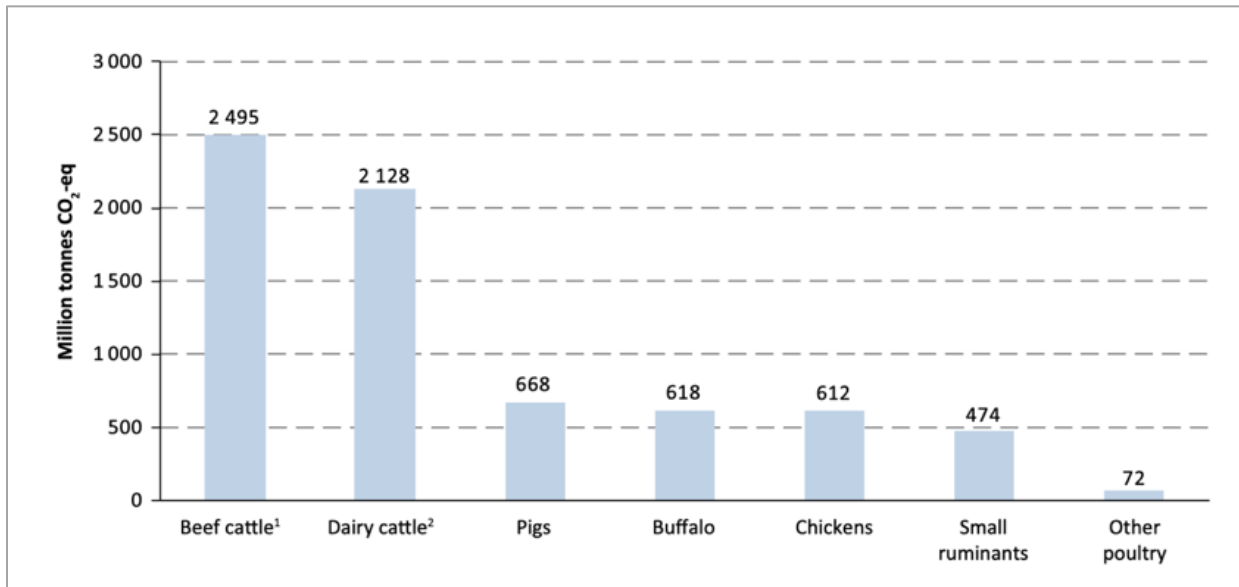
Global overview of dynamics

To draw a global overview of the emissions linked to agri-food system and – in particular – to beef, reference is done to the FAO report, *Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities* (FAO, 2013), which still represents one of the most comprehensive estimate of livestock's contribution to global warming (as well as the sector's potential to help tackle the problem). To complete and to update the framework reference is also done to other and more recent FAO/FAOSTAT reports (FAO, 2016; FAO 2019; FAOSTAT 2000-2020): the patterns of GHG emissions (e.g., Proportions among species/commodities as for the global impact) have not changed, while the absolute values of GHG emissions can have slightly changed. This can be explained partially to a slight change in emissions and partially to a constant finetuning of assessment/estimate tools.

The **livestock sector** plays an important role in climate change, with GHG emissions along livestock supply chains estimated at **7.1 gigatonnes CO₂-eq per annum, representing 14.5% of all human-induced emissions.**

Cattle (beef and milk) are the main contributor to the agri-food sector's emissions with about 4.6 gigatonnes CO₂-eq, **representing 65% of sector emissions.** Beef cattle (producing meat and non-edible outputs) and dairy cattle (producing both meat and milk, in addition to non-edible outputs) generate similar amounts of GHG emissions (beef slightly more). Pigs, poultry, buffaloes and small ruminants have much lower emission levels, with each representing between 7 and 10% of sector emissions (Graph 38).

GRAPH 38 GLOBAL ESTIMATES OF EMISSIONS BY SPECIES* (FAO, 2013) - GHG EMISSION VALUES ARE COMPUTED IN GLEAM - GLOBAL LIVESTOCK ENVIRONMENT ASSESSMENT MODEL



*Includes emissions attributed to edible products and to other goods and services, such as draught power and wool

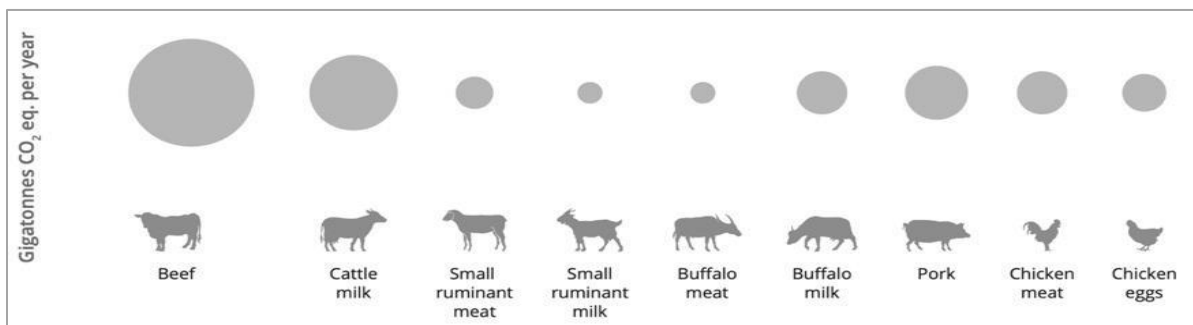
1 Producing meat and non-edible outputs

2 Producing milk and meat as well as non-edible outputs

Source: [GLEAM](#)

Beef is the commodity with highest total emissions and emission intensities: it contributes 2.9 gigatonnes CO₂-eq, or 41%, and cattle milk 1.4 gigatonnes CO₂-eq, or 20%, of total sector emissions. They are followed by pig meat, with 0.7 gigatonnes CO₂-eq, or 9% of emissions, buffalo milk and meat (8%), chicken meat and eggs (8%), and small ruminant milk and meat (6%). The rest are emissions from other poultry species and non-edible products. Graph 39 describes this pattern of proportions in a visual way.

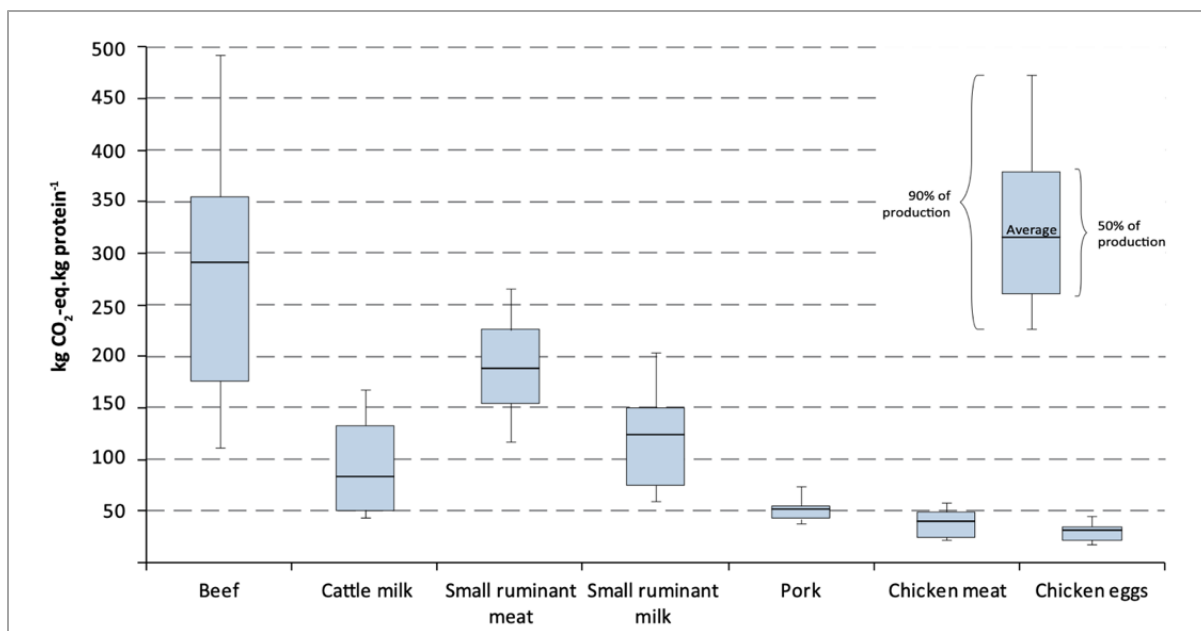
GRAPH 39 TOTAL EMISSIONS BY COMMODITY



Source: GLEAM 2 – FAO, 2019

When emissions are expressed on a per protein basis, beef is the commodity with the highest emission intensity (amount of GHGs emitted per unit of output produced), with an average of over 300 kg CO₂-eq per kg of protein; followed by meat and milk from small ruminants, with averages of 165 and 112 kg CO₂-eq per kg of protein, respectively. Cow milk, chicken products and pork have lower global average emission intensities, all below 100 kg CO₂-eq per kg of edible protein (Graph 40).

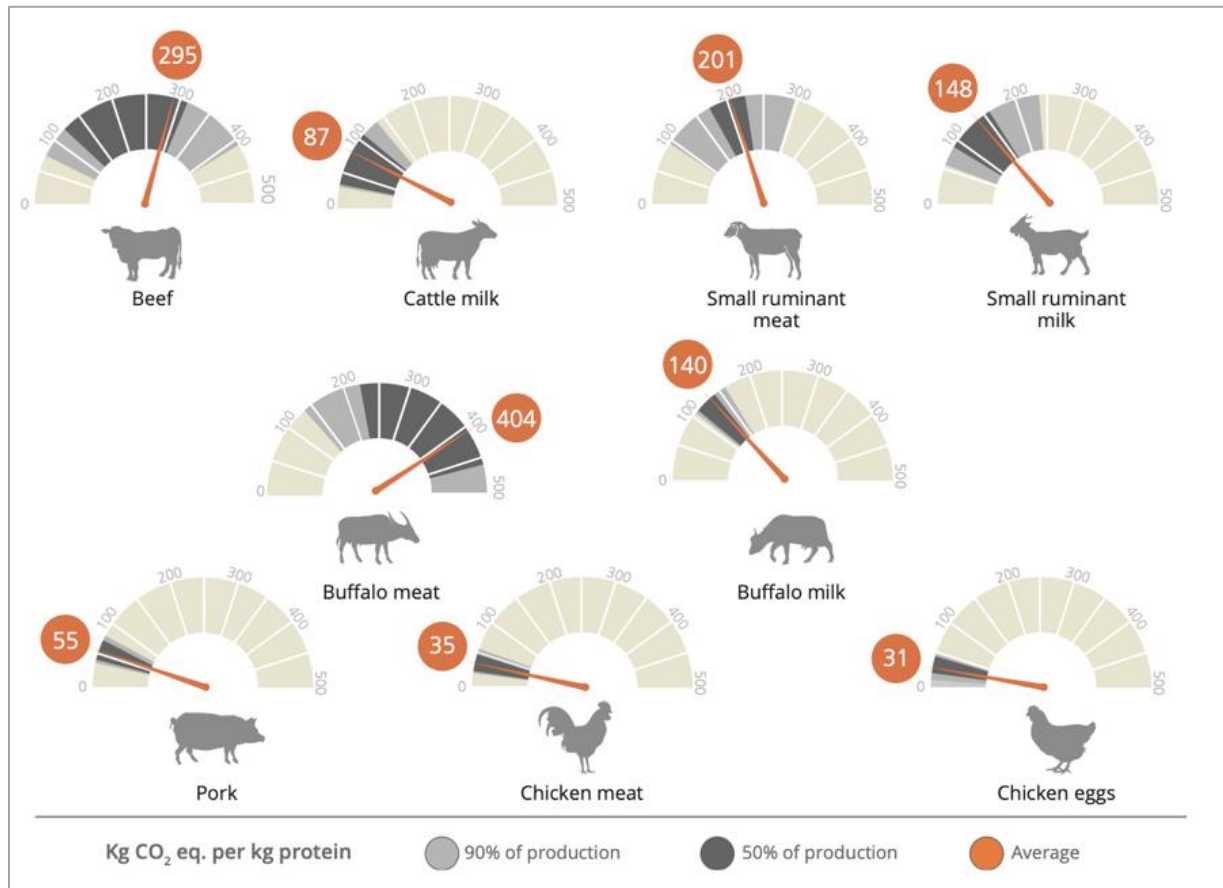
GRAPH 40 GLOBAL EMISSION INTENSITY BY COMMODITY (FAO, 2013) - GHG EMISSION VALUES ARE COMPUTED IN GLEM - GLOBAL LIVESTOCK ENVIRONMENT ASSESSMENT MODEL



Source: [GLEM](#)

Figure 1 describes this pattern in a visual way: as above anticipated, absolute values in Figure 1 (FAO, 2019) slightly differ from values in Graph 40 (FAO, 2013) because they changed during the years, partially due to concrete evolution of the emissions and partially to an evolution of estimate tools. Conversely, patterns are constant.

FIGURE 1 EMISSION INTENSITY PER SPECIES (EXPRESSED IN CO₂ EQ.) BY COMMODITY



Source: [GLEM 2](#) – FAO, 2019

Graph 40 and Figure 1 also display the variability of the intensity of emissions which is particularly high in beef. This variability depends on the different level of efficiency of production systems in different areas of the world.

From a geographical perspective, regional emissions and production profiles vary widely (Graph 41). Differences are explained by the respective shares of ruminants (higher emissions) or monogastrics in total livestock production, and by differences in emission intensities for each product and production system (efficiency), between regions. In Graph 41, focus can be done on beef (dark blue portions).

Latin America and the Caribbean (LAC) have the highest level of emissions (almost 1.3 gigatonnes CO₂-eq), driven by an important production of specialized beef. Although at reduced pace in recent years, ongoing land-use

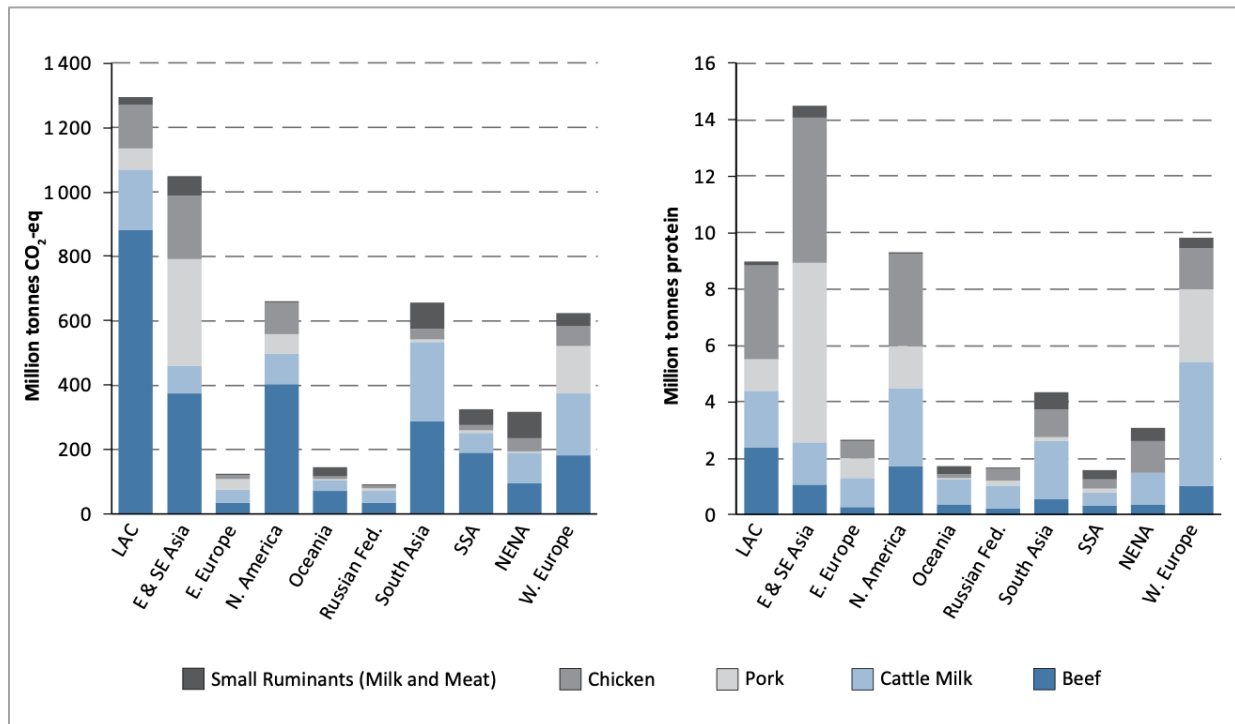
change contributes to high CO₂ emissions in the region, due to the expansion of both pasture and cropland for feed production (one third of all the emissions. Another third is linked to enteric CH₄ emissions (Graph 42).

With the highest livestock production and relatively high emission intensities for its beef and pork, East Asia has the second highest level of emissions (more than 1 gigatonnes CO₂-eq).

North America and Western Europe have similar GHG emission totals (over 0.6 gigatonnes CO₂-eq) and also fairly similar levels of protein output. However, emission patterns are different. In North America, almost two-thirds of emissions originate from beef production which has high emission intensities. In contrast, beef in Western Europe mainly comes from dairy herds with much lower emission intensities. In North America, emission intensities for chicken, pork and milk are lower than in Western Europe because the region generally relies on feed with lower emission intensity.

South Asia's total sector emissions are at the same level as North America and Western Europe, but its protein production is half what is produced in those areas. Ruminants contribute a large share due to their high emission intensity. For the same reason, emissions in sub-Saharan Africa (SSA) are large, despite a low protein output.

GRAPH 41 LIVESTOCK GHG EMISSIONS AND LIVESTOCK PRODUCTION, BY COMMODITY AND REGIONS (FAO, 2013)



LAC= Latin America and Caribbean; SSA= Sub-Saharan Africa; NENA= Near East and North Africa region
 Source: GLEAM

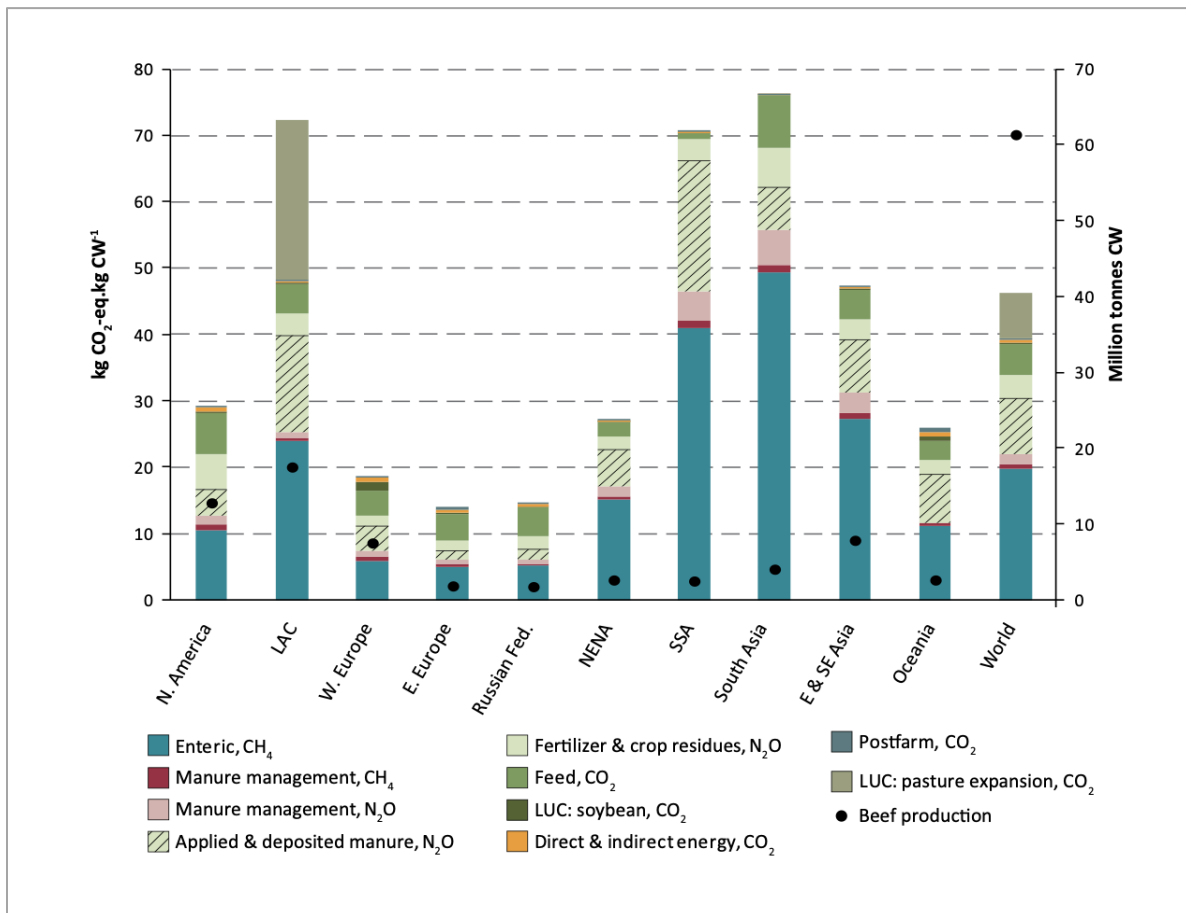
Focusing to beef, Graph 42 shows the proportion of different sources of GHG emissions with reference to intensity (emissions per kilogram of carcass weight - kg CO₂-eq.kg CW⁻¹) in different regions. Reference is also done to regional beef production (·).

Across regions, enteric emissions of CH₄ represents from one third to a half of emissions intensity. NO₂ deriving from manure management/application varies from one sixth to one third (Latin America and the Caribbean, sub-Saharan Africa).

Emission intensities for beef are highest in South Asia, sub-Saharan Africa, Latin America and the Caribbean, and East and Southeast Asia. Higher emissions are largely caused by low feed digestibility (leading to higher enteric and manure emissions), poorer animal husbandry and lower slaughter weights (slow growth rates leading to more emissions per kg of meat produced) and higher age at slaughter (longer life leading to more emissions). In Latin America and the Caribbean, one-third of the emissions (24 kg CO₂-eq/kg carcass weight) from beef production is estimated to come from pas-

ture expansion into forested areas. This estimate is to be taken with caution, given the numerous methodological and data uncertainties affecting land-use change emissions estimates (FAO, 2013). In Europe, about 80% of the beef is produced from dairy animals (surplus calves and culled cows), resulting in lower emission intensities.

GRAPH 42 REGIONAL VARIATION IN BEEF PRODUCTION AND GHG EMISSIONS INTENSITIES (FAO, 2013)



CW: carcass weight
Source: GLEAM

Anyway, when considering the global GHG emissions as a whole (Graph 43), this proportion (CO₂ from pasture expansion/GHG emissions) drops to one sixth, confirming that pasture expansion is a critical source of emissions in specific regions.

GRAPH 43 GLOBAL EMISSIONS FROM BEEF SUPPLY CHAIN, BY CATEGORY OF EMISSIONS (FAO, 2013)

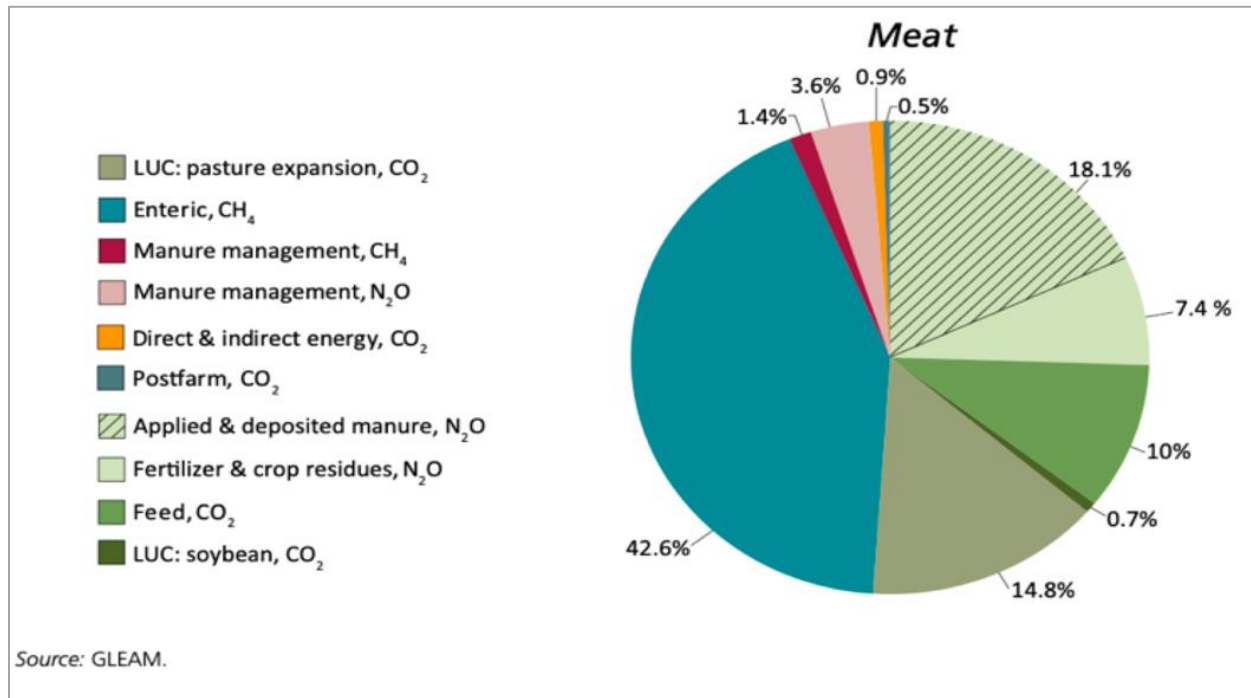


TABLE 44 GLOBAL PRODUCTION, EMISSIONS AND EMISSION INTENSITY FOR CATTLE MILK AND BEEF (FAO, 2013)

Herd	System	Production (Million tonnes)		Emissions (Million tonnes CO ₂ -eq)		Emission intensity (kg CO ₂ -eq/kg product)	
		Milk ¹	Meat ²	Milk	Meat	Milk ¹	Meat ²
Dairy	Grazing	77.6	4.8	227.2	104.3	2.9 ³	21.9 ³
	Mixed	430.9	22.0	1 104.3	381.9	2.6 ³	17.4 ³
	Total dairy	508.6	26.8	1 331.1	486.2	2.6³	18.2³
Specialized beef	Grazing		8.6		875.4		102.2 ³
	Mixed		26.0		1 462.8		56.2 ³
	Total beef		34.6		2 338.4		67.6³
Post-harvest emissions ⁴				87.6	12.4		
Totals		508.6	61.4	1 419.1	2 836.8	2.8⁵	46.2⁵

Note:

Grassland-based (or grazing) systems: Livestock production systems in which more than 10% of the dry matter fed to animals is farm-produced and in which annual average stocking rates are less than ten livestock units per ha of agricultural land

Mixed systems: Livestock production systems in which more than 10% of the dry matter fed to livestock comes from crop by-products and/or stubble or more than 10% of the value of production comes from non-livestock farming activities

1 Product: FPCM

2 Product: carcass weight (CW)

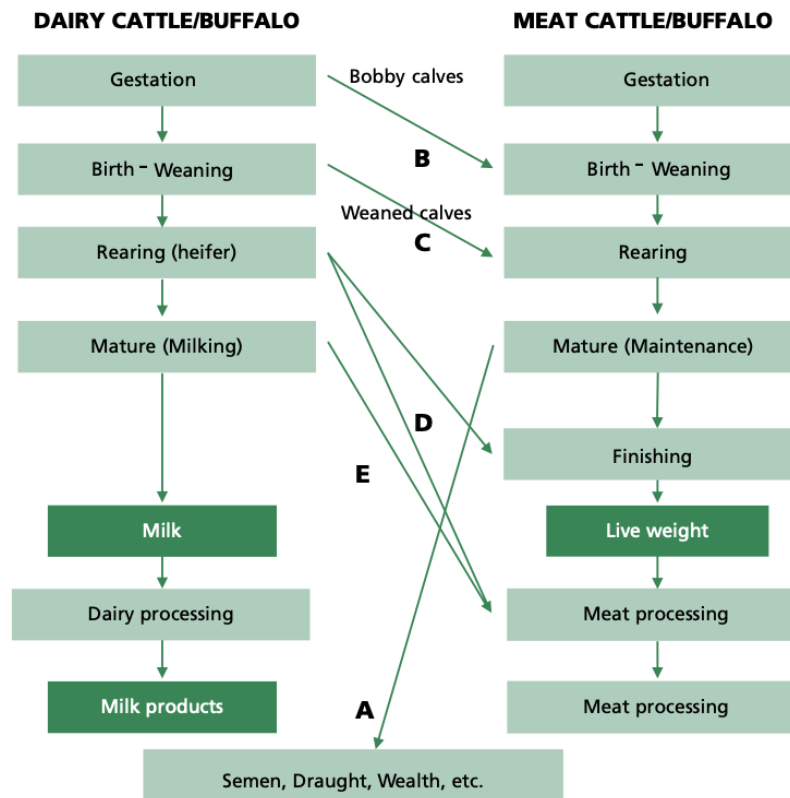
3 Does not include post-harvest emissions

4 Computed at commodity and country level

5 Includes post-harvest emissions

An interesting comparison to focus on is the milk vs beef commodity (Table 44), most of all in terms of emission intensity (kg CO₂-eq/kg milk or meat). In fact, emission intensity of 1 kg of meat coming from dairy beef is 18.2 kg CO₂-eq (blue frame) while emission intensity of 1 kg of meat coming from specialized beef is 67.6 kg CO₂-eq (red frame). This apparently peculiar difference among those two types of production is actually intrinsic: emissions coming from meat from dairy cattle are shared by emissions coming from milk produced by the same cattle. Figure 1 shows the contribution of dairy sector to beef production. Moreover, meat coming from dairy cattle in Countries specialized for dairy production mostly derives from animals which are slaughtered at 4-6 months of age and reared in barns, while cattle specialized for beef production have a longer life cycle (up to 24 months) and they are often reared in pasture and therefore they have a less efficient Feed Conversion Rate.

FIGURE 2 CONCEPTUAL MODEL OF LARGE RUMINANT DAIRY AND BEEF PRODUCTION SYSTEMS SHOWING THE DIFFERENT LIFE STAGES, RELATIONSHIPS BETWEEN THE SYSTEMS AND OUTPUTS



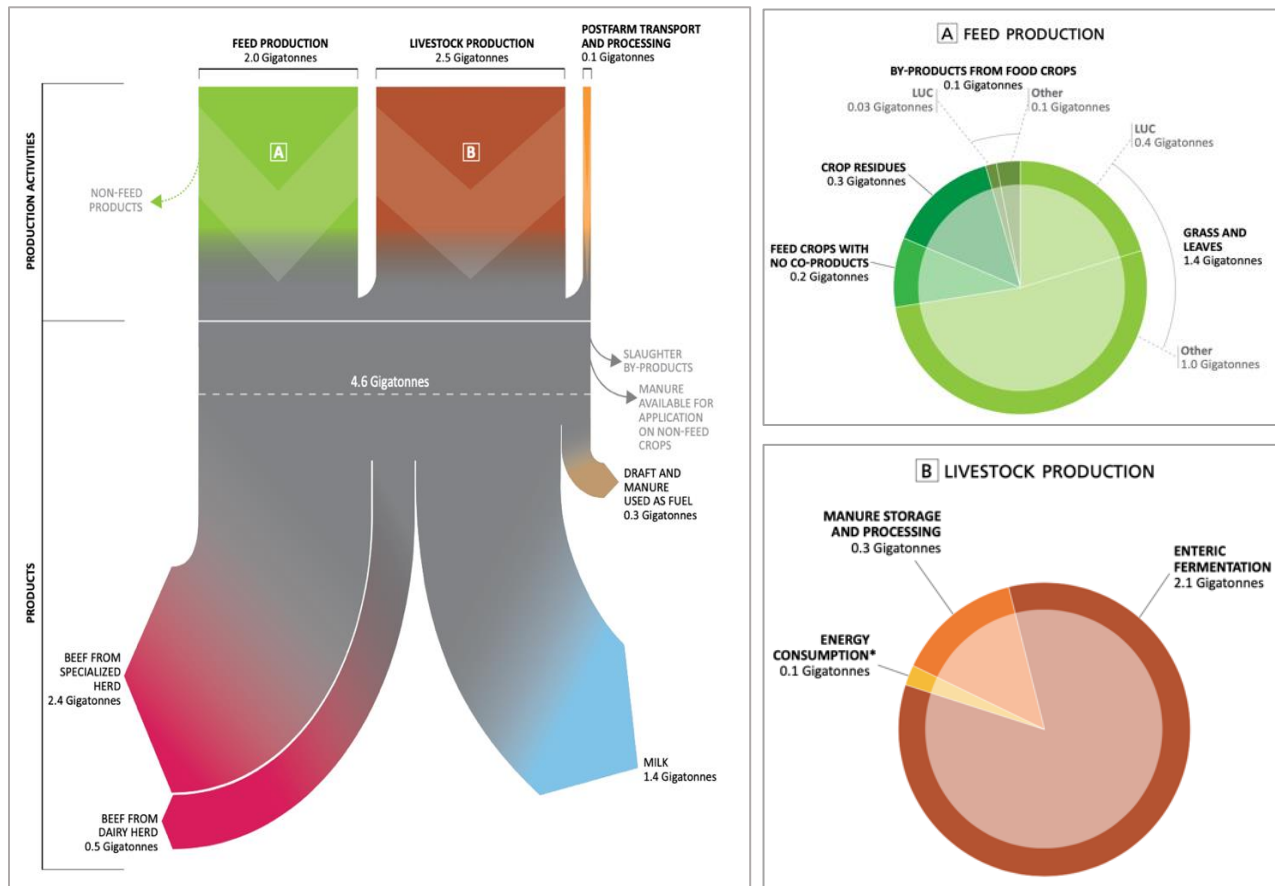
FAO. 2016. *Environmental performance of large ruminant supply chains: Guidelines for assessment*. Livestock Environmental Assessment and Performance Partnership. FAO, Rome, Italy.

An incisive overview at global level of flow emissions in cattle supply chain is provided by Figure 2. Some general mechanisms are clearly displayed.

With a perspective focused on production activities, the total emissions of the cattle supply chain (4.6 gigatonnes) derive for 54% from livestock production (2.5 gigatonnes), for nearly 44% from feed production (2.0 gigatonnes) and the remaining quota (2%) derive from post-farm transport and processing (0.1 gigatonnes). This shows “where” theoretically operate (in terms of step of productive chain) when trying to mitigate GHG emissions. It must be notes that these “environmental” lever points could not correspond to “social” lever points, able to impact effectively on human welfare. In fact, post-farm transport and processing activities, even if affecting only marginally GHG emissions, are crucial in a welfare perspective.

Focusing on products, beef from specialized herd impacts for 2.4 on 4.6 gigatonnes (52%), while beef from dairy herd impacts for 0.5 gigatonnes (11%) and milk impacts for 30% and draft/manure used as fuel 7%. The difference between the impact of beef from specialized herd and beef from dairy herd can be explained one again with the fact that the emissions of the latter is shared with milk production, mitigating the final effect.

FIGURE 3 GLOBAL FLOW EMISSIONS IN CATTLE SUPPLY CHAIN, BY PRODUCTION ACTIVITIES AND PRODUCTS (FAO, 2013)



*Embedded energy related to the manufacture of on-farm buildings and equipment is included in this category.
 Source: GLEAM.

Global overview of trends

Considering the total anthropogenic GHG emissions, the agri-food systems as a whole account for one-third. Those agri-food emissions are generated within the farm gate, from crop and livestock production activities, by land-use change, for instance deforestation and peatland drainage to make room for agriculture and in pre- and post-production processes, such as food

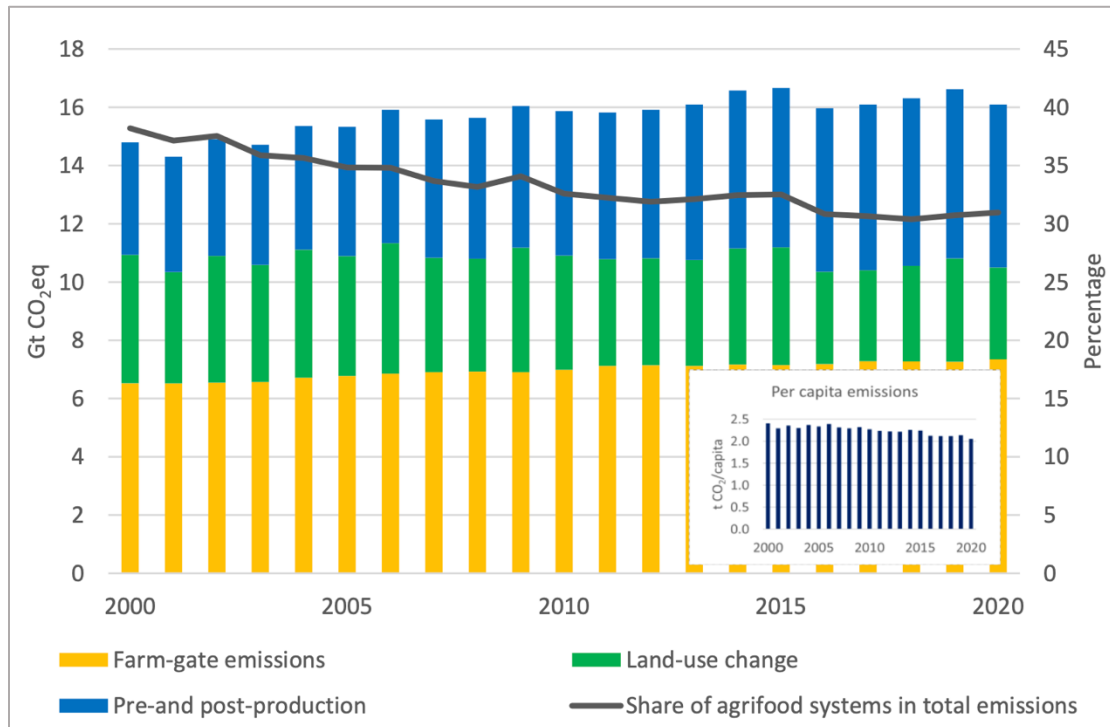
manufacturing, retail, household consumption and food disposal (FAOSTAT 2000-2020).

Globally, the farm gate in 2020 represented nearly half of total agri-food systems emissions, pre- and post-production processes contributed one-third and land-use change one-fifth (FAOSTAT 2000-2020).

In 2020, global annual anthropogenic GHG emissions reached 52 Gt CO₂eq, down 4% from 54 Gt CO₂eq in 2019 – reflecting a well-documented reduction in economic activities due to the COVID-19 pandemic. They were nonetheless 34% higher than in 2000. At the same time, emissions from agri-food systems were 16 Gt CO₂eq in 2020, down 3% from 2019, but 9% higher than in 2000.

The share of agri-food systems in total emissions in 2020 (31%) confirmed the downward trend from the levels of 2000 (38%), a consequence of agri-food systems emissions growing significantly more slowly than the rest of the economy, dominated by fossil fuels combustion for energy use. In fact, non-food emissions grew nearly 50% since 2000. Agri-food systems emissions per capita likewise decreased over the period, from 2.4 t CO₂eq/cap to 2.0 t CO₂eq/cap (FAOSTAT 2000-2020, Graph 44).

GRAPH 44 GLOBAL AGRI-FOOD SYSTEM EMISSIONS BY COMPONENT AND INDICATOR



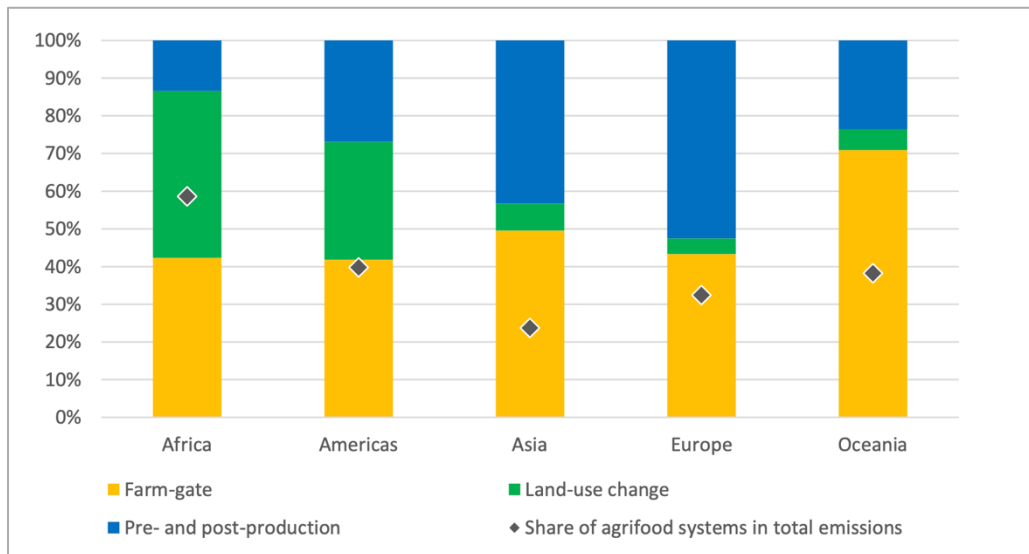
FAO. 2022. Emissions totals. In: *FAO*. Rome. Cited October 2022. <https://www.fao.org/faostat/en/#data/GT> and
 FAO. 2022. Emissions shares. In: *FAO*. Rome. Cited October 2022. <https://www.fao.org/faostat/en/#data/EM>

In 2020, Africa had the largest share of agri-food systems in total emissions (59%), consistently with the predominance of agriculture in most economies of the region. The shares were much lower in the Americas (40%), Oceania (38%) and Europe (32%) and lowest in Asia (23%), reflecting the economic efficiency of more intensive mixed and modern production systems (Graph 45).

The relative role of the three components in total emissions from agri-food systems varies across regions, reflecting structural differences in production and distribution systems around the world (Graph 45). Emissions in Africa and the Americas had significant land-use change components (1.2–1.3 Gt CO₂eq), respectively 44% and 31% of the total agri-food systems emissions, reflecting the extensive nature of agriculture in both regions and its impact on surrounding ecosystems. Conversely, significant pre- and post- production emissions were observed in Asia (43%, or 2.9 Gt CO₂eq) and especially in Europe (53% or 1.0 Gt CO₂eq), where this component was in fact the largest contributor. Emissions produced within the farm gate remained the

dominant component of agri-food systems emissions in Oceania (71%), Asia (50%) and the Americas (42%).

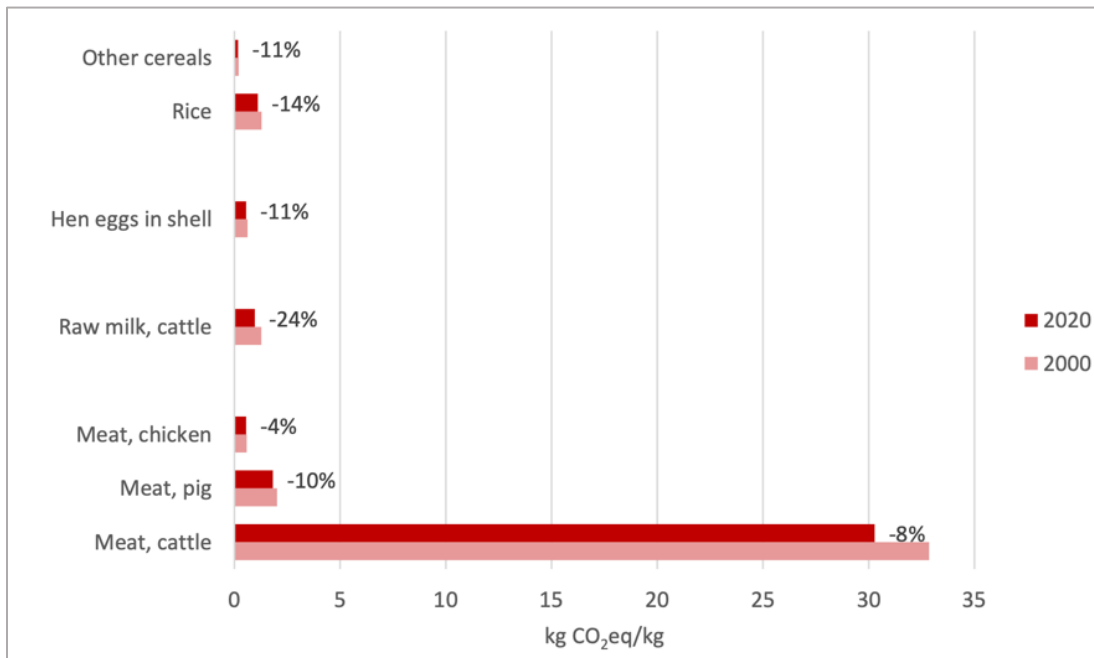
GRAPH 45 REGIONAL AGRI-FOOD SYSTEMS EMISSIONS AND SHARE IN TOTAL EMISSIONS IN 2020 (FAOSTAT, 2000-2020)



FAO. 2022. Emissions totals. In: *FAO*. Rome. Cited October 2022. <https://www.fao.org/faostat/en/#data/GT> and
 FAO. 2022. Emissions shares. In: *FAO*. Rome. Cited October 2022. <https://www.fao.org/faostat/en/#data/EM>

The variation of farm-gate emission intensity from 2000 to 2020 is displayed in Graph 46. In 2020, farm-gate emissions by kg of beef were 32 kg CO₂eq/kg, a high value that is largely due to methane production by ruminant fermentation. Indeed, the emissions intensities of monogastric animals were much smaller: nearly 2 kg CO₂eq/kg for pork and less than 1 kg CO₂eq/kg for chicken. The global emissions intensity of cow milk was 1 kg CO₂eq per kg of milk. The global emissions intensities of cereals were 1 kg CO₂eq/kg for rice and 0.2 kg CO₂eq/kg for other cereals. The GHG intensity of hen eggs was 0.6 kg CO₂eq/kg. Farm-gate emissions intensities had a marked long-term declining trend since 2000 across all commodities, with the largest reduction computed for cow milk (-24%) and rice (-14%) (Graph 46). Such reductions reflect increases in crop and livestock production efficiency over time, often achieved through economies of scale.

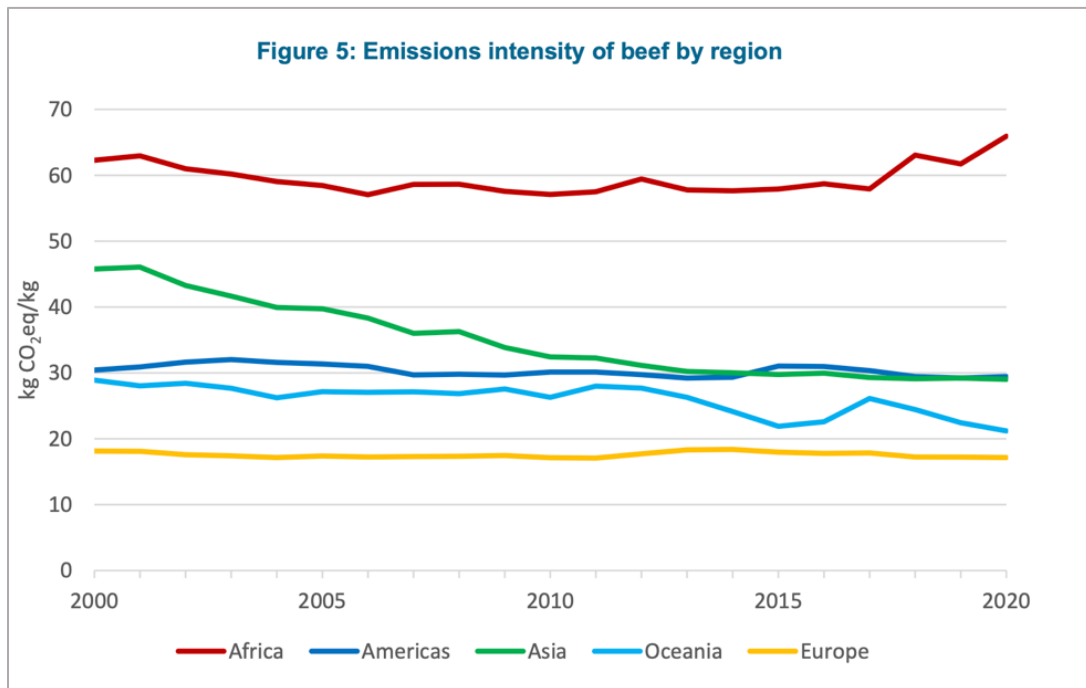
GRAPH 46 GLOBAL EMISSIONS INTENSITIES (2000-2020) AND % CHANGE



FAO. 2022. Emissions intensities. In: *FAO*. Rome. Cited October 2022 <https://www.fao.org/faostat/en/#data/EI>

Focusing on beef production, Graph 47 shows the trend of emissions intensity in different regions from 2000 to 2020. The 2020 emissions intensity of beef was highest in Africa (66 kg CO₂eq/kg), followed by the Americas and Asia (29 kg CO₂eq/kg in both regions), Oceania (21 kg CO₂eq/kg) and Europe (17 kg CO₂eq/kg). Between 2000 and 2020, most regions exhibited a downward trend in the emissions intensity of beef. The largest reductions were found in Asia and Oceania (-37% and -27%, respectively) whereas Europe and the Americas showed smaller reductions in the 3–5% range. Africa was the only region with an increase (6%).

GRAPH 47 EMISSIONS INTENSITY OF BEEF BY REGION, FROM 2000 TO 2020



FAO. 2022. Emissions intensities. In: *FAO*. Rome. Cited October 2022. <https://www.fao.org/faostat/en/#data/EI>

Geographical focus

In the following paragraphs the emissions related to beef production in 9 Countries will be considered.

Focus Countries are:

- Germany
- France
- Italy
- USA
- Brazil
- Argentina
- Morocco
- South Africa
- Namibia

Data are grouped in tables according to the reference.

In the comment related to each Country/Region the lowest and the higher values reported in references are pointed out. On some occasions, it has been necessary to express different values, according to different measurement units, which are one of the critical issues of emissions (e.g. kg CO₂-eq/kg of meat, kg CO₂-eq/kg of live weight, kg CO₂-eq/kg of protein).

For certain Countries data are not easily available.

Legenda:

- BFM: Bone Free Meat
- System Boundary: segment of the production process (start and finish) that is taken into account in a certain study. E.g. From cradle to farm gate.
- Allocation: distribution of GHG emissions to different products occurring in multi-outputs productions
- LW: Live Weight

Germany

In Germany, according to authors and to reference years, the emissions of beef sector vary from 13.6 kg CO₂-eq/kg of meat (Reinhardt G et al., 2020) to 26.9 kg CO₂-eq/kg of bone free meat (Mieleitner J at al., 2012).

Clune et al., 2017

Reference	Year of study	Report type	kg CO ₂ -eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
Lesschen, J. P., M. van den Berg, H. J. Westhoek, H. P. Witzke and O. Oenema (2011). "Greenhouse gas emission profiles of European livestock sectors." <i>Animal Feed Science and Technology</i> 166-167(0): 16-28.	2011	Journal	24.30	MITERRA-Europe model
Mieleitner, J., M. Alig, F. Grandl, T. Nemecek and G. r. Gaillard (2012). Environmental impact of beef – role of slaughtering, meat processing and transport. 8th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2012). Saint Malo, France. Rennes.	2012	Conference	26.93	

Reference	Classification	System Boundaries	Functional Unit (FU)	GhG Emissions (kg CO ₂ e / FU)	Allocation
Zehetmeier, M., Baudracco, J., Hoffmann, H. & Heißenhuber, A. 2012. Does increasing milk yield per cow reduce greenhouse gas emissions? A system approach. <i>Animal</i> , 6: 154–66. doi:10.1017/S1751731111001467	Comparison dairy + beef combined system	cradle to farm gate but it is a bovine system including milk and beef system	kg meat	Milk: 0.98 – 1.35; Beef: 5.6 – 14.6 Milk: 0.89 – 1.06; Beef: 10.8 – 16.2	None: GHG emissions are allocated all to milk Economic: GHG emissions occurring during dairy cow production and heifer rearing are allocated to milk according to their economic value

Reinhardt G, Gärtner S, Wagner T, Environmental footprints of food products and dishes in Germany, Institute For Energy and Environmental Research (IFEU), Heidelberg, 2020 - <https://www.ifeu.de/fileadmin/uploads/Reinhardt-Gaertner-Wagner-2020-Environmental-footprints-of-food-products-and-dishes-in-Germany-ifeu-2020.pdf>

TABLE 45 CO₂ FOOTPRINTS OF SELECTED MEAT AND MEAT SUBSTITUTE PRODUCTS "AT THE SUPERMARKET CHECKOUT" IN GERMANY IN KILOGRAMS OF CO₂ EQUIVALENTS PER KILOGRAM OF FOOD. REFERENCE YEAR: 2019.

No.	Foodstuff	CO ₂ footprint [kg CO ₂ eq / kg food]
1	Beef, average ³	13.6
2	Beef (organic) ³	21.7
3	Beef patty, frozen	9.0
4	Minced beef ⁴	9.2
5	Minced beef (organic) ⁴	15.1
6	Chicken, average	5.5
7	Chicken, frozen	5.7
8	Chicken, nuggets	3.3
9	Chicken, sausage slices	2.9
10	Fish, aquaculture	5.1
11	Fish, wild-catch, bulk good, frozen	2.4
12	Fish, wild-catch, fresh	4.0
13	Fish, wild-catch, speciality, frozen	10.0
14	Game meat, deer ⁵	11.5
15	Lupine flour	0.4

³ Both conventional beef (11 to >30 kg CO₂-eq / kg food) and organic beef (16 to >30 kg CO₂-eq / kg food) show wide ranges, with organic beef tending to perform slightly worse.

⁴ Processed meat such as minced meat has lower CO₂ footprint than fine meat; the range is also smaller: 7 to 26 CO₂-eq / kg food for conventional beef mince.

France

In France, according to authors and to reference years, the emissions of beef sector vary from 17.4 kg CO₂-eq/kg of meat (Dollé J et al., 2012) to 40.0 kg CO₂-eq/kg of bone free meat (Nguyen TTH at al., 2012).

Parallely, Veysset et al. (2010) focusing on the region of Charlerois report footprint as kg CO₂e per kg Live Weight, indicating the range 14.3-18.3.

<i>Clune et al., 2017</i>				
Reference	Year of study	Report type	kg CO ₂ -eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
Dollé, J. B., A. Gac, V. Manneville, S. Moreau and E. Lorinquer (2012). Life cycle assessment on dairy and beef cattle farms in France. 8th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2012). Saint Malo, France. Rennes.	2012	Conference	17.35	
Salou, T., S. Espagnol, A. Gac, P. Ponchant, A. I. Tocqueville, V. Colomb and H. M. G. v. d. Werf (2014). Life Cycle Assessment of French livestock products: Results of the AGRIBALYSE® program. Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector. San Francisco: 1154-1162.	2014	Conference	20.20	mean AGRIBALYSE®
Salou, T., S. Espagnol, A. Gac, P. Ponchant, A. I. Tocqueville, V. Colomb and H. M. G. v. d. Werf (2014). Life Cycle Assessment of French livestock products: Results of the AGRIBALYSE® program. Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector. San Francisco: 1154-1162.	2014	Conference	21.05	mediunAGRIBALYSE®
Lesschen, J. P., M. van den Berg, H. J. Westhoek, H. P. Witzke and O. Oenema (2011). "Greenhouse gas emission profiles of European livestock sectors." <i>Animal Feed Science and Technology</i> 166–167(0): 16-28.	2011	Journal	23.80	MITERRA-Europe model
Salou, T., S. Espagnol, A. Gac, P. Ponchant, A. I. Tocqueville, V. Colomb and H. M. G. v. d. Werf (2014). Life Cycle Assessment of French livestock products: Results of the AGRIBALYSE® program. Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector. San Francisco: 1154-1162.	2014	Conference	24.04	biophysical, mean AGRIBALYSE®
Salou, T., S. Espagnol, A. Gac, P. Ponchant, A. I. Tocqueville, V. Colomb and H. M. G. v. d. Werf (2014). Life Cycle Assessment of French livestock products: Results of the AGRIBALYSE® program. Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector. San Francisco: 1154-1162.	2014	Conference	24.25	biophysical, mean AGRIBALYSE®
Dollé, J. B., A. Gac, V. Manneville, S. Moreau and E. Lorinquer (2012). Life cycle assessment on dairy and beef cattle farms in France. 8th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2012). Saint Malo, France. Rennes.	2012	Conference	27.41	calf to beef steers 30 months old
Dollé, J. B., A. Gac, V. Manneville, S. Moreau and E. Lorinquer (2012). Life cycle assessment on dairy and beef cattle farms in France. 8th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2012). Saint Malo, France. Rennes.	2012	Conference	28.01	calf to beef young bulls 17 months old

Veysset, P., M. Lherm and D. Bébin (2010). "Energy consumption, greenhouse gas emissions and economic performance assessments in French Charolais suckler cattle farms: Model-based analysis and forecasts." <i>Agricultural Systems</i> 103(1): 41-50.	2010	Journal	29.50	
Dollé, J. B., A. Gac, V. Manneville, S. Moreau and E. Lorinquer (2012). Life cycle assessment on dairy and beef cattle farms in France. 8th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2012). Saint Malo, France. Rennes.	2012	Conference	30.44	calf to weanling 9-10 months old
Veysset, P., M. Lherm and D. Bébin (2010). "Energy consumption, greenhouse gas emissions and economic performance assessments in French Charolais suckler cattle farms: Model-based analysis and forecasts." <i>Agricultural Systems</i> 103(1): 41-50.	2010	Journal	37.76	conventional
Nguyen, T. T. H., H. M. G. van der Werf, M. Eugène, P. Veysset, J. Devun, G. Chesneau and M. Doreau (2012). "Effects of type of ration and allocation methods on the environmental impacts of beef-production systems." <i>Livestock Science</i> 145(1-3): 239-251.	2010	Journal	38.85	Ext suckler, fibre, O3f
Nguyen, T. T. H., H. M. G. van der Werf, M. Eugène, P. Veysset, J. Devun, G. Chesneau and M. Doreau (2012). "Effects of type of ration and allocation methods on the environmental impacts of beef-production systems." <i>Livestock Science</i> 145(1-3): 239-251.	2010	Journal	39.28	O3f Ext suckler, fibre
Nguyen, T. T. H., H. M. G. van der Werf, M. Eugène, P. Veysset, J. Devun, G. Chesneau and M. Doreau (2012). "Effects of type of ration and allocation methods on the environmental impacts of beef-production systems." <i>Livestock Science</i> 145(1-3): 239-251.	2010	Journal	39.86	Ext suckler, maize,
Nguyen, T. T. H., H. M. G. van der Werf, M. Eugène, P. Veysset, J. Devun, G. Chesneau and M. Doreau (2012). "Effects of type of ration and allocation methods on the environmental impacts of beef-production systems." <i>Livestock Science</i> 145(1-3): 239-251.	2010	Journal	40.00	Ext suckler, maize

Reference	Classification	System Boundaries	Functional Unit (FU)	GhG Emissions (kg CO2e / FU)	Allocation
Nguyen, T.T.H., van der Werf, H.M.G., Eugène, M., Veysset, P., Devun, J., Chesneau, G. & Doreau, M. 2012. <i>Effects of type of ration and allocation methods on the environmental impacts of beef-production systems. Livestock Science</i> , 145: 239-251. doi:10.1016/j.livsci.2012.02.010	Case study	cradle to farm gate	kg carcass (farm gate); kg LWG (live weight gain)	27.0 / 27.9	live weight; protein; economic

Reference	Method/Boundaries/ Allocation	Management/Spatial scale	Footprint kg CO2e per kg LW	Notes
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Veysset, P.; Lherm, M.; Bébin, D. Energy consumption, greenhouse gas emissions and economic performance assessments in French Charolais suckler cattle farms: Model-based analysis and forecasts. <i>Agri. Syst.</i> 2010, 103, 41–50.	IPCC Tier 2/cradle to farm gate/not specified	Conventional/study	14.3-18.3	Range in emissions for 5 beef production systems. May be suitable as a regional average, however allocation of dairy emissions is not specified.
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Italy

In Italy, according to authors and to reference years, the emissions of beef sector vary from 15.3 kg CO₂-eq/kg of bone free meat (Benatti L et al., 2012) to 27.3 kg CO₂-eq/kg of bone free meat (Lesschen JP at al., 2011).

For organic production, Vitali A et al. (2018) reports 24.47 CO₂-eq/kg meat.

Taking into account the emissions kg of Live Weight, the value goes from 15 to 26 CO₂eq/kg live weight (Bragaglio et al, 2020): in this case variations mostly depends on the farming system (and allocation).

Finally, to explore another unit of measurement (kg CO₂eq/kg of protein), Zucali et al., 2017 reports the emission value of some productions in Lombardy region. In particular, beef from specialized systems has an emission of 80 kg CO₂-eq/kg of protein while beef from dairy production reaches 85 kg CO₂-eq/kg of protein (Sandrucci A and Trevisi E, 2022. Produzioni Animali, EdiSES Università)

<i>Clune et al., 2017</i>				
Reference	Year of study	Report type	kg CO ₂ -eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2013	EPD	15.30	3. - a calf white meat for coop in italy white meat produced by italian breeders respecting the values of coop

Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2013	EPD	18.20	1. adult beef (beef and scot-tona) for coop in italy meat of adult cattle breeders produced by italian respecting the values of coop
Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2013	EPD	23.10	
Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2013	EPD	24.70	5 - adult cattle grazing in ireland - industry standard meat of adult bovine irish produced by kepák
Lesschen, J. P., M. van den Berg, H. J. Westhoek, H. P. Witzke and O. Oenema (2011). "Greenhouse gas emission profiles of European livestock sectors." Animal Feed Science and Technology 166–167(0): 16-28.	2011	Journal	27.30	MITERRA-Europe model

Summary of the study on the carbon footprint of New Zealand sheepmeat and beef, 2022, Meat Industry Association, New Zealand. <https://beeflambnz.com/knowledge-hub/PDF/summary-study-carbon-footprint-new-zealand-sheepmeat-and-beef.pdf>

Reference	Boundary	Farm type	Farm	Processing	Post-processing	Total Footprint
			CO2eq/kg meat			
Vitali A, Grossi G, Martino G, Bernabucci U, Nardone A, Lacetera L, 2018, Carbon footprint of organic beef meat from farm to fork: a case study of short supply chain. Journal of the Science Food and Agriculture, https://doi.org/10.1002/jsfa.9098	up to food consumption	organic beef	20.98	1.27	2.22	24.47

Bragaglio et al., 2020

Cradle-to-farm gate life cycle (Functional unit: 1 kg of live weight) global warming potential (GWP, kg CO2 eq/kg live weight) of four beef production systems before and after the economic allocation of the ecosystem services (mean ± SE).

-Podolian System (Pod): local Podolian cattle breed, they maintained cows and calves on pasture in the first phase and then finished beef animals in confinement

-Specialized Extensive system (SpEx): specialized beef breeds, they maintained cows and calves on pasture in the first phase and then finished beef animals in confinement

-Cow-calf Intensive system (CoCaI): specialized beef breeds with cows and calves constantly kept in confinement

-Fattening system (Fat): specialized beef breed imported calves fed with concentrate based diets

Table 3. Cradle-to-farm gate life cycle * global warming potential (GWP), acidification potential (AP), eutrophication potential (EP), and land occupation (LO) of four beef production systems before and after the economic allocation of the ecosystem services (mean \pm SE).

	Pod		SpEx		CoCaI		Fat		Significance		
	Before Allocation	After Allocation	Before Allocation	After Allocation	Before Allocation	After Allocation	Before Allocation	After Allocation	Production System (PS)	Allocation (A)	PS \times A
GWP, kg CO ₂ -eq	26.30 \pm 1.65	14.92 \pm 1.58	25.41 \pm 1.58	23.12 \pm 1.58	21.94 \pm 1.87	20.32 \pm 1.87	17.62 \pm 1.71	17.62 \pm 1.71	0.0029	0.0027	0.0049

United States of America

In USA, according to authors, to reference years and to system boundaries, the emissions of beef sector vary from 22.30 to 41.73 CO₂eq/kg meat (Gerber PJ et al., 2013).

Focusing on the Upper Midwest, Pelletier et al. (2010) report that feed lot finished beef emissions are 19.2 kg CO₂-eq/kg Live Weight, while pasture finished beef emissions are 14.8 kg CO₂-eq/kg Live Weight.

Clune et al., 2017					
Region	Reference	Year of study	Report type	kg CO ₂ -eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
Nth America	Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci and G. Tempio (2013). Tackling climate change through livestock, A global assessment of emissions and mitigation opportunities. Rome, Food and Agriculture Organization of the United Nations (FAO).	2013	Report	41.73	
USA	Stackhouse-Lawson, K. R., C. A. Rotz, J. W. Oltjen and F. M. Mitloehner (2012). "Carbon footprint and ammonia emissions of California beef production systems." Journal of Animal Science 90(12): 4641-4655.	2012	Journal	22.30	A partial life cycle assessment (LCA) was conducted using the Integrated Farm System Model (IFSM)
USA	Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2013	EPD	23.10	pasture
USA	Dunkley, C. S. and K. D. Dunkley (2013). "REVIEW - Greenhouse Gas Emissions from Livestock and Poultry, Agric Food Anal Bacteriol , 2013." Agric. Food Anal. Bacteriol 3:17-29.	2013	Journal	23.41	
USA	Stackhouse-Lawson, K. R., C. A. Rotz, J. W. Oltjen and F. M. Mitloehner (2012). "Carbon footprint and ammonia emissions of California beef production systems." Journal of Animal Science 90(12): 4641-4655.	2012	Journal	25.61	partial life cycle assessment (LCA) conducted using the Integrated Farm System Model (IFSM)
USA Mid-West	Johnson, D., H. Phetteplace, A. Seidl, U. Schneider and B. McCarl (2003). Management Variations for U.S. Beef Production Systems: Effects on Greenhouse Gas Emissions and China. 3rd International Methane and Nitrous Oxide Mitigation Conference, Beijing, China,, China Coal Information Institute.	2003	Report	26.82	feedlot
USA Mid-West	Pelletier, N., R. Pirog and R. Rasmussen (2010). "Comparative life cycle environmental impacts of three beef production strategies in the Upper Midwestern United States." Agricultural Systems 103(6): 380-	2010	Journal	39.61	pasture finished

	389.				
USA Mid-West	Pelletier, N., R. Pirog and R. Rasmussen (2010). "Comparative life cycle environmental impacts of three beef production strategies in the Upper Midwestern United States." <i>Agricultural Systems</i> 103(6): 380-389.	2010	Journal	30.53	feedlot finished

Reference	Classification	System Boundaries	Functional Unit (FU)	GhG Emissions (kg CO2e / FU)	Allocation
Battagliese, T., Andrade, J., Schulze, I., Uhlman, B. & Barcan, C. 2013. More Sustainable Beef Optimization Project. Phase 1 Final Report. BASF.	National sector	cradle to grave	1 lb consumed, boneless beef	23.6 (kg/lb)	
Capper, J.L., Cady, R.A. & Bauman, D.E. 2009. The environmental impact of dairy production : 1944 compared with 2007. <i>Journal of Animal Science</i> . 87: 2160-7. doi:10.2527/jas.2009-1781	Comparison	cradle to grave	kg LW	Conv: 15.2 Grass finished: 26 Natural: 18	mass and economic
Capper, J.L. 2011. The environmental impact of beef production in the United States: 1977 compared with 2007. <i>Journal of Animal Science</i> , 89: 4249-61. doi:10.2527/jas.2010-3784	Comparison	cradle to grave	kg of HCW beef	17.95	biological causality (dairy to beef)
Dudley, Q.M., Liska, A.J., Watson, A.K. & Erickson, G.E. 2014. Uncertainties in life cycle greenhouse gas emissions from U.S. beef cattle. <i>Journal of Cleaner Production</i> , 75: 31-39. doi:10.1016/j.jclepro.2014.03.087	Regional assessment	cradle to farm gate (cow-calf background feedlot)	kg LW	8 - 8.3	mass

FAO, 2016, *Environmental performance of large ruminant supply chains: Guidelines for assessment – Region Upper Midwest United States*

Reference	Classification	System Boundaries	Functional Unit (FU)	GhG Emissions (kg CO2e / FU)	Allocation	Soil Carbon /Sequestration	LuC / iLuC	Land use/ occupation	Impact categories
Pelletier, N., Pirog, R. & Rasmussen, R. 2010. Comparative life cycle environmental impacts of three beef production strategies in the Upper Midwestern United States. <i>Agricultural Systems</i> , 103: 380-389. doi:10.1016/j.agsy.2010.03.009	Comparison	cradle to farm gate	kg LW	Feed lot finished: 19.2, Pasture finished: 14.8	No cow/calf allocation. Bio-physical properties (ratios)	constant assumed	not mentioned	ecological footprint was used instead of land occupation	

Desjardins et al., 2012 - **USA - Mid-West**

Reference	Method/Boundaries/	Management/Spacial	ΔSOC	ΔSOC	Footprint	Notes
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	Allocation	scale	from LMC	from LUC	kg CO2e per kg Live Weight	
Pelletier, N.; Pirog, R.; Rasmussen, R. Comparative life cycle environmental impacts of three beef production strategies in the Upper Mid-western United States. <i>Agri. Syst.</i> 2010, 103, 380–389.	IPCC Tier 1 and 2/cradle to farm gate/chemical energy of co-products	Feedlot finished/ study	eq	0	14.8	Inclusion of carbon sequestration associated with LMC reduces carbon footprint to 13.6 and 11 kg CO2e per kg LW for feedlot and pasture finished beef
		Pasture finished/ study			19.2	
Johnson, D.E.; Phetteplace, H.W.; Seidl, A.F.; Schneider, U.A.; McCarl, B.A. Management Variations for U.S. Beef Production Systems: Effects on Greenhouse Gas Emissions and Profitability. In <i>Proceedings of the 3rd International Methane and Nitrous Oxide Mitigation Conference</i> , Beijing, China, 17–21 November 2003; China Coal Information Institute: Beijing, China, 2003; pp. 953–961.	IPCC Tier 1 + literature survey/cradle to farm gate/none	Conventional cow-calf to feedlot/study	x	0	13.0	Also provided are emissions estimates associated with 5 alternative production scenarios.

Summary of the study on the carbon footprint of New Zealand sheepmeat and beef, 2022, Meat Industry Association, New Zealand. <https://beeflambnz.com/knowledge-hub/PDF/summary-study-carbon-footprint-new-zealand-sheepmeat-and-beef.pdf>

Reference	Boundary	Farm type	Farm	Processing	Post-processing	Total Footprint
Kelly Twomey Sanders and Michael E Webber 2014 <i>Environ. Res. Lett.</i> 9 044011. https://iopscience.iop.org/article/10.1088/1748-9326/9/4/044011/pdf	up to food consumption	/	27	0.39	3.43	30.82
Asem-Hiablie S, Battagliese T, Stackhouse-Lawson KR, Alan Rotz C (2019). A life cycle assessment of the environmental impacts of a beef system in the USA. <i>International Journal of Life Cycle Assessment</i> , 24(3), 441-455. https://doi.org/10.1007/s11367-018-1464-6	grave	pasture + feedlot	30.67*	0.59*	3.84*	35.10*

*data was adjusted to a meat equating to

40% of Live Weight						
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Latin America and Caribbean

The beef sector of Latin America and Caribbean considered as a whole, according to Gerber PJ et al. (2013) produces from 49 to 69 CO₂-eq/kg meat (Gerber PJ et al., 2013).

Some data referring to single Countries are also available.

Clune at al., 2017				
Reference	Year of study	Report type	kg CO ₂ -eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci and G. Tempio (2013). Tackling climate change through livestock, A global assessment of emissions and mitigation opportunities. Rome, Food and Agriculture Organization of the United Nations (FAO).	2013	Report	69.06	
Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci and G. Tempio (2013). Tackling climate change through livestock, A global assessment of emissions and mitigation opportunities. Rome, Food and Agriculture Organization of the United Nations (FAO).	2013	Report	48.92	

Argentina

In Argentina, according to authors and to reference years, , the emissions of beef sector vary from 22 (González AD at al., 2011) to 35 CO₂-eq/kg meat (Benatti L et al., 2015).

Clune at al., 2017				
Reference	Year of study	Report type	kg CO ₂ -eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
González, A. D., B. Frostell and A. Carlsson-Kanyama (2011). "Protein efficiency per unit energy and per unit greenhouse gas emissions: Potential contribution of diet choices to climate change mitigation." Food Policy 36(5): 562-570.	2011	Journal	22.00	
Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2013	EPD	28.80	

Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2015	EPD	35.00	feedlot
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Brazil

In Brazil, according to authors, to reference years, to system boundaries and to farming efficiency, the emissions of beef sector vary from 9.2 (Dick, M at al., 2014) to 64 CO₂-eq/kg meat (Mieleitner J et al., 2012).

Considering the emissions kg of Live Weight, the value goes from 14 to 22 CO₂-eq/kg live weight (Cederberg C et al, 2011).

Clune at al., 2017				
Reference	Year of study	Report type	kg CO ₂ -eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
Schroeder, R., L. K. Aguiar and R. Baines (2012). "Carbon Footprint in Meat Production and Supply Chains." Journal of Food Science and Engineering 2: 652-665.	2012	Journal	25.40	
Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2014	EPD	29.00	feedlot
Kamali, F. P., M. P. M. Meuwissen and A. G. J. M. O. Lansink (2014). Evaluation of beef sustainability in conventional, organic, and mixed crop-beef supply chains. Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector. San Francisco: 619-627.	2014	Conference	30.03	mixed
Cederberg, C., U. M. Persson, K. Neovius, S. Molander and R. Clift (2011). "Including Carbon Emissions from Deforestation in the Carbon Footprint of Brazilian Beef." Environmental Science & Technology 45(5): 1773-1779.	2011	Journal	30.23	
Kamali, F. P., M. P. M. Meuwissen and A. G. J. M. O. Lansink (2014). Evaluation of beef sustainability in conventional, organic, and mixed crop-beef supply chains. Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector. San Francisco: 619-627.	2014	Conference	33.12	organic
Kamali, F. P., M. P. M. Meuwissen and A. G. J. M. O. Lansink (2014). Evaluation of beef sustainability in conventional, organic, and mixed crop-beef supply chains. Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector. San Francisco: 619-627.	2014	Conference	33.74	conventional
Benatti, L., B. Biolatti, S. Cinotti, C. Federici, C. Montanari, Kees, d. Roest, D. Rama, N. Brina, S. Daga, V. Mazzini, M. Zuchi, M. Marino and S. Pignatelli (2013). The sustainability of beef to coop market. Italy, coop.	2013	EPD	34.10	feedlot

Cederberg, C., Meyer, D. & Flysjö, A., (2009), Life Cycle Inventory of greenhouse gas emissions and use of land and energy of Brazilian beef exported to Europe, SIK-Rapport 792, accessed 13/02/2015 from http://www.konkurrensverket.se/globalassets/upphandling/hallbarhet/life-cycle-inventory-of-greenhouse-gas-emissions-and-use-of-land-and-energy-in-brazilian-beef-production-sik-2009792.pdf	2009	Report	40.29	
Hallström, E., E. Rööf and P. Börjesson (2014). "Sustainable meat consumption: A quantitative analysis of nutritional intake, greenhouse gas emissions and land use from a Swedish perspective." Food Policy 47(0): 81-90.	2014	Journal	41.00	
Schroeder, R., L. K. Aguiar and R. Baines (2012). "Carbon Footprint in Meat Production and Supply Chains." Journal of Food Science and Engineering 2: 652-665.	2012	Journal	45.17	
Cederberg, C., U. M. Persson, K. Neovius, S. Molander and R. Clift (2011). "Including Carbon Emissions from Deforestation in the Carbon Footprint of Brazilian Beef." Environmental Science & Technology 45(5): 1773-1779.	2011	Journal	46.95	
Blonk, H., A. Kool, B. Luske and S. d. Waart (2008). Environmental effects of protein-rich food products in the Netherlands Consequences of animal protein substitutes Gouda, Blonk Milieuvadvis.	2008	Report	58.33	
Mieleitner, J., M. Alig, F. Grandl, T. Nemecek and G. r. Gaillard (2012). Environmental impact of beef – role of slaughtering, meat processing and transport. 8th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2012). Saint Malo, France. Rennes.	2012	Conference	64.00	

Reference	Classification	System Boundaries	Functional Unit (FU)	GhG Emissions (kg CO2e / FU)	Allocation
Dick, M., Abreu da Silva, M. & Dewes, H. 2014. Life cycle assessment of beef cattle production in two typical grassland systems of southern Brazil. Journal of Cleaner Production 1-9. doi:10.1016/j.jclepro.2014.01.080	Case study	cradle to farm gate	kg LW	22.5 (extensive); 9.2 (improved)	not needed - single product (LWG)

Reference	Method/Boundaries/ Allocation	Management/Spatial scale	Footprint kg CO2e per kg LW	Notes
Cederberg, C.; Persson, U.M.; Neovius, K.; Molander, S.; Clift, R. Including carbon emissions from deforestation in the carbon footprint of Brazilian beef. Environ. Sci. Tech. 2011, 45, 1773-1779.	IPCC Tier 1 + literature survey/ cradle to farm gate / primary product based	Conventional/national	14.3	Spatial attribution of emissions from LUC have a significant impact on emissions, and range from 22 to 370 kg CO2e per kg LW. Value given is at the national scale, amortized over 20 years. Values have been converted from kg CO2e per kg carcass weight.
		Conventional/national	22.4	

Sudaharian Africa

The beef sector of Sudaharian Africa considered as a whole, according to Gerber PJ et al. (2013) produces 100.72 CO2-eq/kg meat.

Clune et al., 2017				
Reference	Year of study	Report type	kg CO2-eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci and G. Tempio (2013). Tackling climate change through livestock, A global assessment of emissions and mitigation opportunities. Rome, Food and Agriculture Organization of the United Nations (FAO).	2013	Report	100.72	

South Africa

For this Country no data are available as for total emissions by beef sector, expressed as CO2-eq per kg of meat or protein or live weight.

Du Toit et al. (2013) reports CH4 emissions which are the larger contribution to GHG emission in ruminant (and beef) sector. The authors take into account separately commercial feed cattle and communal beef cattle. Using for example the animal class of "bulls" as a point of comparison, the Methane Emission Factor of the commercial sector is 113 CH4 kg/head/year, while in the communal sector the Methane Emission Factor of bulls is 84 CH4 kg/head/year.

TABLE 46 METHANE EMISSION FACTORS FOR COMMERCIAL BEEF CATTLE

Animal class	Weight (kg)	MEF _{enteric} (kg/h/year)	MEF _{manure} (kg/h/year)
Bulls	733	113	0.022
Cows	475	92.6	0.018
Heifers	365	75.9	0.016
Oxen	430	89.4	0.018
Young oxen	193	51.6	0.012
Calves	190	51.6	0.012

MEF: methane emissions factor; kg/h/year: kg/head/year.

TABLE 47 METHANE EMISSION FACTORS FOR COMMUNAL BEEF CATTLE

Animal class	Weight (kg)	MEF _{enteric} (kg/h/year)	MEF _{manure} (kg/h/year)
Bulls	462	83.8	0.017
Cows	360	73.1	0.015
Heifers	292	62.5	0.013
Oxen	344	72.6	0.015
Young oxen	154	41.6	0.010
Calves	152	40.9	0.010

The main represented commercial cattle category in South African is dairy cattle (almost 3,000,000 heads). A smaller quota is represented by beef reared in feedlots (almost 600,000 heads). The enteric fermentation emission factor of this latter category is 59 kg CH₄ per head per year, considering 2010-2017 (National GHG Inventory Report South Africa, 2017).

Namibia

For this Country no data are available as for total emissions by beef sector, expressed as CO₂-eq per kg of meat or protein or live weight.

In the National GHG Inventory Report 2000-2012 (NIR 2) aggregated emission estimates from enteric fermentation (EF) and manure management (MM) from year 2000 to 2012 are presented and expressed in Gigagrams CO₂-eq: the value goes from 4164 (EF) and 350 (MM) in 2000 to 5170 (EF) and 508

(MM) in 2012. The trend shows a certain slight fluctuation until 2010 while in 2011 1st 2012 a clear increase is displayed.

CH4 emissions largely represent the main contribution to GHG coming from livestock. In 2012, out of 265 million kg CO2-eq coming from CH4 produced in Agriculture, Forestry and Other Land Use, 254.2 million kg CO2-eq came from Livestock. Out of these, 220 million kg CO2-eq came from enteric fermentation of cattle and 8.8 million kg CO2-eq came from manure management of cattle.

North Africa

The beef sector of North Africa considered as a whole, according to Gerber PJ et al. (2013) produces 40 CO2-eq/kg meat.

Clune et al., 2017				
Reference	Year of study	Report type	kg CO2-eq/kg produce, BFM after conversion	Notes (conventional farming assumed unless stated):
Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci and G. Tempio (2013). Tackling climate change through livestock, A global assessment of emissions and mitigation opportunities. Rome, Food and Agriculture Organization of the United Nations (FAO).	2013	Report	40.29	

Morocco

The Climate Chance Observatory team, in “Moroccan society’s uneven response to the proliferation of waste” (Climate Chance - global observatory on non-state climate action, 2016) reports that in Morocco, in 2012, GHG emissions related to agriculture were 21.3% of total emissions, citing as source World Bank, (2017), based on data from the Ministry of the Environment (2016).

The same authors report Morocco’s GHG emissions in kilotons CO₂-eq (source: UNFCCC), which go from 40,000 (in 1994) to 100,000 (in 2012), just to have a figure of the order of magnitude.

A previous document (First National Communication United Nations Framework Convention on Climate Change, 2001), reporting data from 1994, identified as 25% the contribution of agriculture to total Morocco emissions, with a value of 12,000 kilotons CO₂-eq.

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4. Du Toit CJL, Meissner HH, Van Niekerk WA, 2013. Direct methane and nitrous oxide emissions of South African dairy and beef cattle. *South African Journal of Animal Science* 2013, 43 (No.3)
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8. Gerber PJ, Steinfeld H, Henderson B, Mottet A, Opio C, Dijkman J, Falucci A & Tempio G, 2013. *Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities.* Food and Agriculture Organization of the United Nations (FAO), Rome - <https://www.fao.org/3/i3437e/i3437e.pdf>
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