

World trade analysis of cork products in the Iberian Peninsula: an economic characterization of a forestry industry

Jorge Sierra-Pérez^{1,2}, Jesús Boschmonart-Rives^{1,3}, Xavier Gabarrell^{1,4}

1 Sostenipra (ICTA - IRTA - Inèdit Innovació SL): Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona (UAB), 08193 – Cerdanyola del Vallès (Bellaterra), Barcelona, Spain.

2 Centro Universitario de la Defensa. Ctra. de Huesca s/n, 50.090, Zaragoza, Spain

3 Inèdit Innovació, S.L. Parc de Recerca de la Universitat Autònoma de Barcelona (UAB), 08193 – Cerdanyola del Vallès (Bellaterra), Barcelona, Spain

4 Department of Chemical Engineering (XBR), Universitat Autònoma de Barcelona (UAB), 08193 – Cerdanyola del Vallès (Bellaterra), Barcelona, Spain

* Corresponding Author:

Phone: + 34 976739836.

Fax: +34 976739824

E-mail: jsierra@unizar.es

Abstract

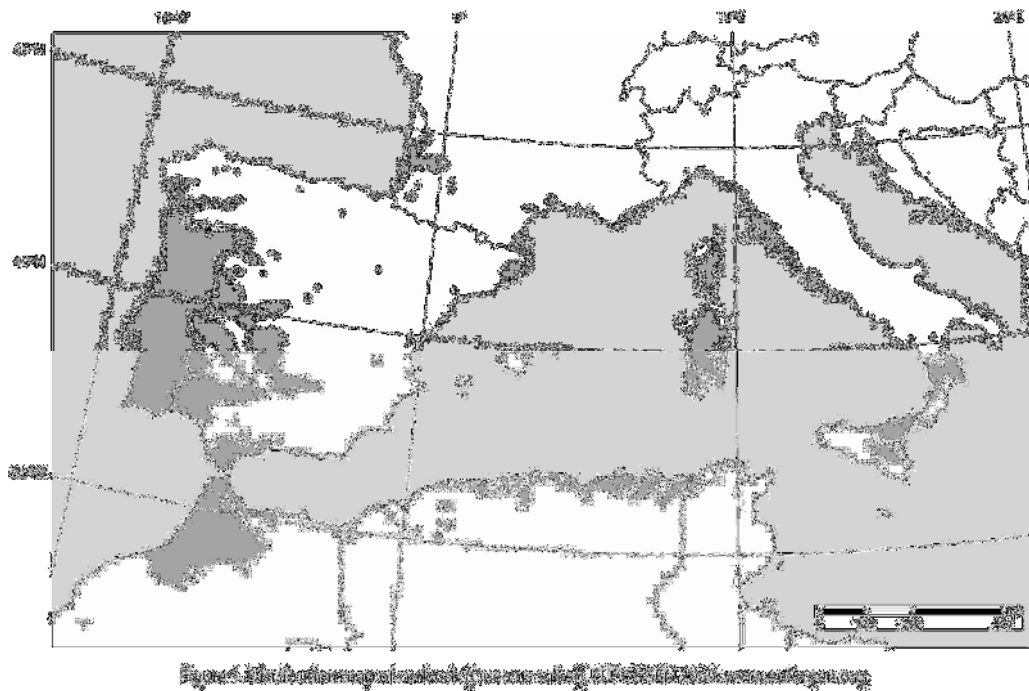
Cork oak forest grows endemically in the coastal regions of the western Mediterranean basin, especially in the Iberian Peninsula. The cork agro-forestry systems play a key role in ecological processes, and the extraction of the outer bark, the cork, can be extracted sustainably without damaging the tree or affecting biodiversity. Due to the significant properties of the cork, an important forestry and industrial structure has been developed around the most valuable goods. This paper describes the current global trade patterns in the Iberian Peninsula, where Portugal and Spain are world leaders, concentrating most of the cork trade flows with the rest of the world; but there are clear differences between the sectors within the Iberian Peninsula. The aim of the study was to identify these differences and to characterize each sector analysed from an economic approach. The main difference between sectors lies in the characteristics of the production chain and indeed, in the capacity to generate wealth from the raw cork. Portugal is mainly producer and processor of raw cork into products with high added value. Spain bases its cork sector on the raw material and cork half-manufactured, not being able to use fully the potential that cork provides; except for Catalonia, who is the world leader in champagne stoppers market. In order to encourage the development of the entire cork sector, it has to be produced the strengthening of every link of supply chain through the installation of companies, the employment generation and therefore, the development of rural areas. Moreover, this industry has to establish its own development strategies for the future, increasing the investment in R&D and innovation due to the opportunities identified: the potential for diversification beyond the wine market, the improvement potential for forest management and the enhancing of sustainability and the eco-efficiency in every link of the cork chain industry.

Key words

Cork industry; international trade; Iberian Peninsula; cork supply chain; natural resource economics; Research and development, sustainability

1. Introduction

Cork oak (*Quercus suber*) forests are one of the best examples of balanced conservation and development in the world. They play a key role in ecological processes such as water retention, soil conservation, and carbon storage (Rives et al., 2013b). The cork oak tree is a long-life species (250- 350 years) with an outer bark, the cork, characterized by its elasticity, impermeability and good thermal insulator (Pereira, 2007). The extraction of cork is a sustainable process because it does not damage the tree and after that, a new bark regrows. This process occurs every 9-14 years, depending on the area, until the tree is about 200 years old (Pereira and Tomé, 2004). The cork oak forests are distributed in the coastal regions of the western Mediterranean basin, including Algeria, France, Italy, Morocco, Portugal, Spain, Tunisia, the islands of Corsica, Sardinia and Sicily (Figure 1). The most extensive forests are concentrated on the Iberian Peninsula, located in the south of Europe and it is made up of Portugal and Spain, representing 34% and 27% of the world cork oak forests, respectively (Table 1).



The cork production is the most important source of revenue in cork oak agroforestry (Borges, 1997), and it is considered the key element in the preservation of these systems (Campos et al, 2008b). The Iberian Peninsula hosts the highest rates of global extraction of cork, more than 80% (Table 1). Regarding Magreb (Morocco, Algeria and Tunisia), represents an important area of cork oak forest but yet with a low exploitation level. In both Portugal and Spain around 90% of their cork oak forests are privately owned (Zapata, 2002), and cork stripping continues to be the primary cork oak management goal. Therefore, the nearly total lack of natural regeneration of cork oak indicates that in the long term is at risk and this has caused a subsequent stagnation or a decrease of the quantity and quality of cork to commercialize. Moreover, several studies have been analysed about specific techniques that help to restore the cork oak woodlands in an active way especially when managing natural regeneration is not sufficient (Aronson, 2009). Within this context, public institutions have increased their concern into natural areas and rural employment, by granting subsidies for cork oak reforestation and its correspondence increasing of cork production (Campos 2008a, Campos 2005, European Commission 2005).

Table 1: Worldwide cork oak area and raw cork production by country [Apcor, 2012]

Country	Cork oak area (ha)	Cork oak area (%)	Raw cork extracted yearly (t)	Raw cork extracted yearly (%)
Portugal	715,922	34	100,000	49.6
Spain	574,248	27	61,504	30.5
Morocco	383,120	18	11,686	5.8
Algeria	230,000	11	9,915	4.9
Tunisia	85,771	4	6,962	3.5
France	65,228	3	5,200	2.6
Italy	64,800	3	6,161	3.1
Worldwide	2,119,089	100	201,428	100

As pointed above, the production of cork is the main objective for the cork exploitation, and until the end of the 19th century, the cork industry has been developed in cork-producing countries (Portugal, Spain, France and Italy) and other net importers countries of unmanufactured cork (USA, the United Kingdom, Germany). This, together with a growing market demand, led to growth of international trade in cork products. During the 20th century there was a concentration of production, industry and commerce in the Iberian Peninsula, mainly produced due to the development of synthetic materials, reducing the product diversification that the agglomerated cork offered and the consequent return to stopper industry, with a high dependence on the wine industry. Moreover, others additional reasons were the location in the major wine-growing regions of the world and possessing abundant raw cork and a cheap workforce (OIV 2013, Parejo 2010, Zapata 2009, Parejo 2004, Zapata 2002). This has resulted in a concentration of the global cork business, both in Portugal and Spain, but in an unequal distribution. Portugal has experienced an important evolution, becoming the world's main cork industry power, replaced Spain from the preeminent position it had occupied since 18th century. Meanwhile, Spain has specialized in unmanufactured cork, mostly going to Portugal; but Catalonia, a region in the northwest of Spain, has an important cork-processing industry, that is world leader in champagne stoppers (Rives, 2012a).

Because of this concentration of the cork business, an important forestry and industrial structure has been developed around this raw material. The cork industry structure is composed by a supply chain with different links: forestry, the half-manufactured cork industry and the cork-processing industry. At the primary stage, the forestry implications of cork industry are related to forest management in terms of quantity and quality, as happens in the rest of the wood sector. The uniform supply of raw material flows is essential for sustainable development of the successive links in the supply chain. Some studies have proposed different types of controls to regulate and optimize cork harvest scheduling subject to even flow constraints (Costa, 2010). A better quality of raw cork can provide better selling opportunities and higher prices, and hence increased profitability of farms. This can be also beneficial for sustainable forestry industry development and the rational use of raw material and other forestry potentials: such as those associated with traditional agro-silvopastoral practices and from gathering of a number of non-timber products (e.g. mushrooms, berries, aromatic plants and hunting) (Bojnec 2014, Campos 2008b, Zapata 2002). The half-manufactured industry is located in the proximity of cork oak forest and it is composed by small companies with a low technological development, although

some large manufacturing companies, due to the increase in the cost of the raw material and its very fragmented supply, are beginning to absorb the half-manufactured industry (Zapata, 2002). The cork-processing industry is mainly composed by the manufacturers of wine and champagne stoppers and agglomerated products, eg thermal insulation panels. These industries add economic value to the raw material that process, and according to Bojnec (2014), also generate the development of supply chains with strong linkages for intermediate use, capable of processing the raw cork and half-manufactured cork.

The purpose of the paper is to analyse in an economic approach the global trade of the cork industry in the Iberian Peninsula, mapping the current trade patterns, specifically of the most valuable goods: raw cork from the forest, natural and champagne cork stoppers and agglomerated cork. Through this empirical analysis, a characterization of the cork industry in the Iberian Peninsula has been made, identifying the differences between the sectors analysed.

2. Material and methods

2.1 System definition

The system considered in the study is the cork industry in the Iberian Peninsula, and the time period analysed is one year, 2012. The study is divided in three levels: a global level; as in the Iberian Peninsula; a country level; Portugal and Spain; and a regional level; Catalonia. The Portuguese and Spanish cork sectors are analysed because of their leadership position in the global cork market, as discussed above. The Catalan sector, despite being included in Spanish data, has been selected because of their particular and interesting characteristics with the rest of the Spanish cork industry, where a specific Cluster has been created recently that previously had developed studies related to the environmental balance of its products. Moreover it is a reference region in the field of cork due to the fact that it is where the stopper business began.

2.2 Data

Trade flows data are presented in three levels: Iberian Peninsula, Portugal and Spain; and Catalonia. The products are categorized by the Harmonized Commodity Description and Coding System¹ (or HS), which is responsible for classifying goods. Cork and its manufactures belong to the 45th group, where four subgroups are defined by the six-digit code classification shown in Table 2. Once the pattern of the data is observed, trade-off can be simplified to four groups from the four digits code: 4501, 4502, 4503 and 4504; which are reflected in the study as raw cork, cork half-manufactured, natural cork stopper and agglomerated cork products, respectively. This simplification is applied because within the six-digit subgroup no relevant information is specified.

¹ Tariff nomenclature internationally standardized system of names and numbers for classifying traded products developed by the World Customs Organization (<http://www.wcoomd.org/fi>).

Table 2: HS classification for cork and its manufactures. (UN, 2010)

45 Cork and its manufactures	45 01 Raw cork, raw or simply prepared; waste cork, crushed, granulated or ground cork.	45 01 10 Natural cork, raw or simply prepared.
		45 01 90 Others.
	45 02 Natural cork, debarked or roughly squared, or in rectangular (including square) blocks, plates, sheets or strip (including sharp-edged blanks for corks or stoppers).	
	45 03 Articles of natural cork	45 03 10 Cork stoppers
		45 03 90 Others
	45 04 Agglomerated cork (with or without a binding substance) and articles of agglomerated cork	45 04 10 Blocks, plates, sheets and strip, tiles of any shape, solid cylinders, including disks.
		45 04 90 Others

In order to collect this data, national statistics of imports and exports in mass (Ton) and monetary (\$) flows during 2012 have been obtained. The results for Portugal and Spain have been compiled through the specific research of trade off country by country according to the United Nations Commodity Trade Statistics Database (UN Comtrade, 2013). In the case of Catalonia, this data is collected from the external trade database of Base de Datos de Comercio Exterior (ESTACOM-EUROESTACOM, 2012). The results for Portugal and Spain are contrasted with the data provided by ESTACOM-EUROESTACOM (2012), EUROSTAT (2012), BACI (2010) and APCOR (2012) to make sure that there are no substantial differences. Catalan results are contrasted with the trend of previous years due to an absence of different sources.

It should be noted that flows of cork products which are included in other finished products, is not consider in the study. As is the case in the wine sector regarding the cork stoppers that are part of bottles of wine, champagne and cava.

3. Results

The results obtained from the trade study are detailed below. It has been calculated in physical mass and in monetary quantities for each area: Iberian Peninsula, Portugal, Spain and Catalonia in order to obtain a general view of the differences within the market and values of the cork as a commercial product in the Iberian Peninsula.

3.1 Global level: Iberian Peninsula

The cork exploitation in the Iberian Peninsula is 1,290,248 ha that produces 161,504 tonnes of cork, which means an average of 120 Kg/ha/year. This rate can be higher or lower depending on different factors such as climate conditions, age of the trees, density of the exploitation, and other (Pereira and Tomé, 2004). At the present time, Portugal extracts the 49.6% of the cork world production while in Spain this percentage is the 30.5%. It means that the 80% of the worldwide cork extracted comes from the Iberian Peninsula (Table 1). The cork industry is a significant part of the Portuguese and Spanish economy, which represents 1.5% and 1.2% of their industrial production respectively (Autoridade da Concorrência, 2012; INE, 2012). Moreover, Portugal and Spain are world leaders in the cork sector, concentrating most of the cork trade flows with the rest of the world (Parejo 2009, Zapata 2009, Parejo 2004, Zapata 2002).

Table 3 comprises data collected from different sources and shows a broad picture of cork industry from Iberian Peninsula and its different cork-regions both in Portugal and Spain. The cork industry in Iberian Peninsula is composed by over 792 companies that employ approximately 11,793 workers directly.

Table 3: Economic indicators of the cork sector in Iberian Peninsula

	Iberian Peninsula	Portugal	Norte	Centro	LVT	Alentejo	Algarve	Ref.	Spain	Extremadura	Andalusia	Catalonia	Castilla La Mancha	Comunidad Valenciana	Ref.
Area of cork oak forests (ha)	1,290,248	716,000	11,935,00	45,221.00	23,610,00	601,906,00	33,250,00	(1)	574,248	252,600	168,300	63,000	13,432	4,828	(1,6)
Production (t)	161,504	100,000	18,978	NA	NA	NA	NA	(1,4)	61,504	19,032	37,882	7,600	1,539	70.2	(6)
Cork stoppers produced (millions of stoppers)	17,600	14,600	10,950	NA	NA	NA	NA	(1)	3,000	NA	NA	3,000	NA	NA	(7)
Manufactured cork products (t)	476,587	374,919	NA	NA	NA	NA	NA	(2)	101,668	NA	NA	NA	NA	NA	(2)
Companies (n)	792	592	477	4	48	41	17	(3)	200	70	50	80	NA	NA	(5,7)
Workers (n)	11,793	8,593	7,005	10	421	1,015	142	(3)	3,200	1,000	1,000	1,200	NA	NA	(5,7)

Source:

- (1) APCOR, 2012
- (2) EUROSTAT, 2012
- (3) GEE/MEE 2011
- (4) UNAC 2012
- (5) INE, 2011
- (6) MAGRAMA, 2010
- (7) Gencat, 2012

It can be observed in Figure 2 that the mass quantity of imports in the Iberian Peninsula is 23,553.16 tonnes and \$49 Million, while exports amount to 174,050 tonnes and \$1,147.5 Million; showing the high capacity of the cork sector to export. Exports are 6 times higher than the imports, in mass quantity, and in monetary terms exports are 23 times higher than imports. In physical mass, the most imported product is raw material that represents over 16,857 tonnes, but in monetary terms natural cork stoppers are the most imported product, \$16 Million. In the case of exports, agglomerated cork accounted for the majority of the exports both in mass and value; while natural cork stoppers, despite representing a low mass quantity, 18,215 tonnes, they play an important role in the value of exports, \$508 Million.

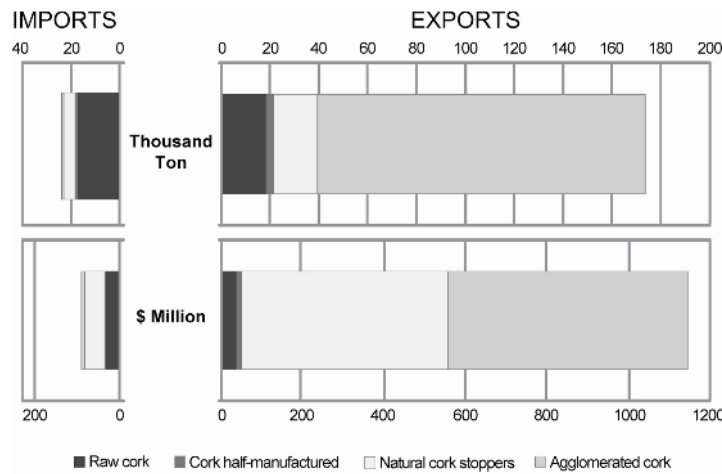


Figure 2. Trade balance of cork in the Iberian Peninsula by product (2012)

Source: UNComtrade, 2013

Figure 3 shows, graphically, the distribution of import and export flows of the global trade of cork, here it can be seen that Iberian Peninsula is the epicenter of this, indicating the importance of the Iberian Peninsula as an exporter to other continents.

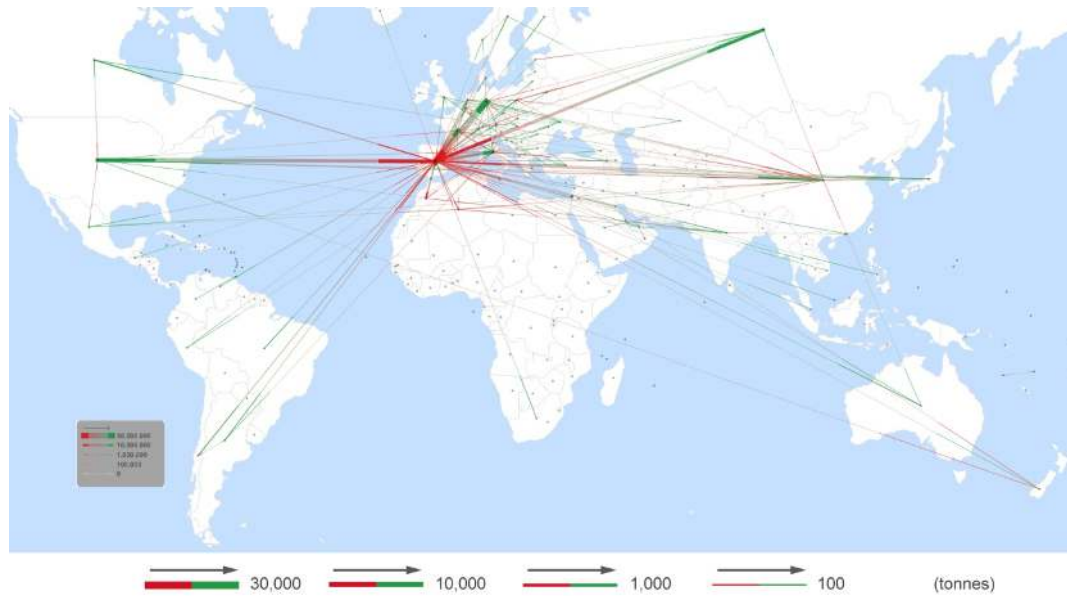


Figure 3. The global distribution of trade flows of cork products (UN Comtrade 2013, Boyandin et al. 2010).

In order to make the visualization easier, in Figure 4 exports and imports of the Iberian Peninsula are expressed in percentages for each individual continent by product type, referring to the totals amounts from that specific region. The most imported product, raw material, represents over 70% of total tonnes imported, but in monetary terms is 25%. Also natural cork stoppers is nearly 20% of total imports in physical mass but in monetary quantity represents more than 50 of imports. It can be observed that over 60% of the volume of imports comes from North Africa, mainly raw material, while the remaining imports are especially from European countries. In the case of exports, the main importers of cork products from the Iberian Peninsula are European countries, accounting for 50% of total exports; mainly Germany, France, Italy and the Russian Federation, as can be seen in Figure 5. The rest is subjected to American flows, in which USA imports 12% of the total exports. This graph also shows that nearly 80% of the exported products are in the form of agglomerated products with a value of 51%, while 11% is exported as natural cork stoppers with a value of 44%.

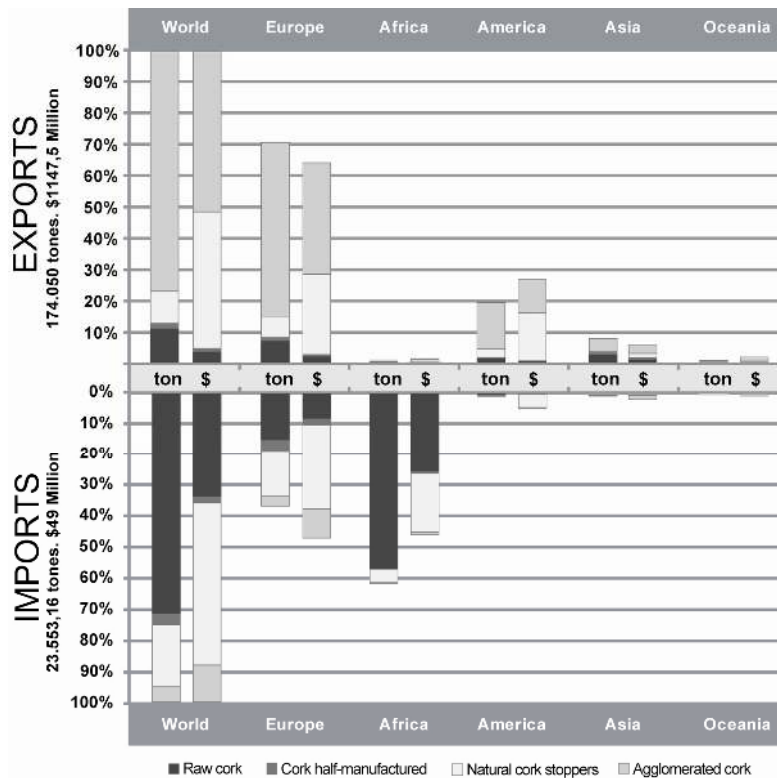


Figure 4. Percentage distribution of the trade in the Iberian Peninsula by continent and by product (2012)

Source: UNComtrade, 2013

Figure 5 shows the main countries importing cork products from the Iberian Peninsula. The largest importer is Germany, who mainly imports agglomerated cork as building material. The high import data in mass and monetary quantities, for France, USA, and Italy; are associated with its world leader position in production and bottling wine and, as in the case of Chile and Argentina, this is relative to their growth rates (OIV, 2013). This is why important flows of natural cork stoppers take place in these cases.

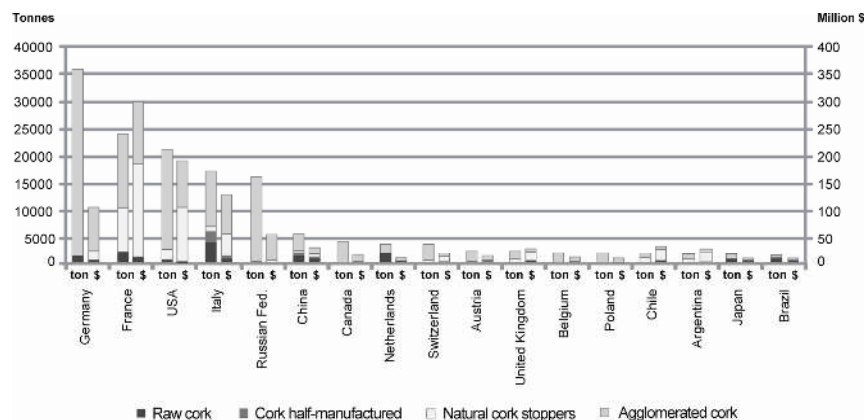


Figure 5. Main raw cork and cork products exports of Iberian Peninsula by country (2012)
 Source: UNComtrade, 2013

The Iberian Peninsula hosts important sectors of producers and bottlers of wine and sparkling wine (champagne and cava); that export million of bottles around the world, containing natural cork stoppers or agglomerated cork stoppers. Spain is the third producer and the second exporter of wine; meanwhile Catalonia is the second producer and the first exporter of sparkling wine (OIV, 2013). These sectors distribute millions of bottles around the world, so actual flows of processed products from cork should be higher than those included in this study.

3.2. Country level: Portugal and Spain

Portugal produces a very high part of the peninsular cork with a productivity of 140 Kg/ha/year (APCOR, 2012). Besides cork extraction, Portugal accounts for, with its important industry and businesses related to cork and its processes, 70% of world production. It's estimated that the cork arriving to the production process is distributed in 40% to manufacture stoppers, 30% to thin cork bark and 25% to by-products (APCOR, 2012). Table 3 shows the collected data for Portugal by region, and presents the current socio-economic situation in the cork sector of Portugal. There are 592 companies operating in the cork sector, producing 40 million cork stoppers a day, and employing about 8,593 workers. Cork products are obtained from both small and large companies and can engage in the production of one product or can diversify their production. The 85% of the companies have less than 250 people, but nevertheless it is a very dynamic industry, based on the transforming activity (GPP, 2006).

In the international trade of Portugal (Figure 6), the mass quantity of exports, 189,568 tones, doubles the imports, 71,545 tones, (2.6 times). The monetary quantity of exports is 7 times the imports, \$1,087 Million compared to \$153 Million. In monetary terms, the most imported product is raw cork, and the finished-cork products are the most exported products.

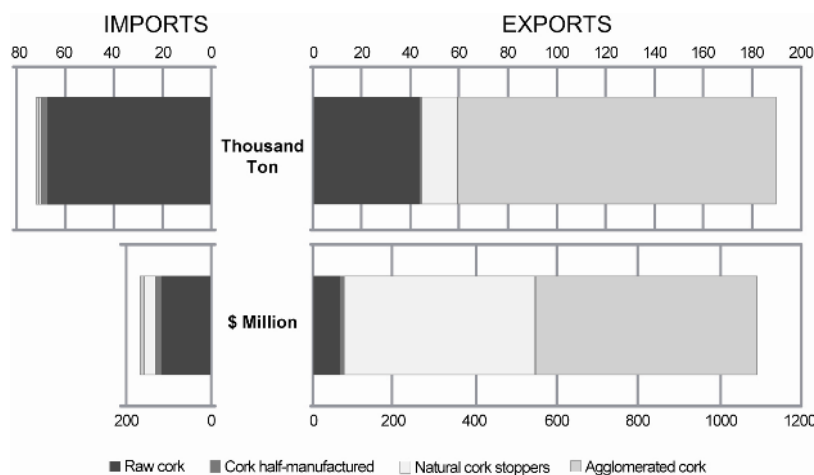


Figure 6. Trade balance of cork in Portugal by product (2012)

Source: UNComtrade, 2013

Figure 7 illustrates the percentage distribution of exports and imports by product and continent. Within imports, raw cork represents 93% of the total tonnes imported, of which 79% comes from Spain and the rest mainly from North African countries. The imports of natural cork stoppers represent 16% in monetary terms of total imports in spite of representing merely 2% of physical mass. In the case of the Portuguese exports are characterized by the high percentage of agglomerated products in both mass terms and monetary terms (69% and 50%), where are mainly included the champagne stoppers and building material. Raw cork has a significant relevance (23%) and natural cork stoppers only represent 8% of net weight, but in monetary terms cork stoppers have a 43% of total exports value. When analysing the data by continent, cork products are mostly exported to Europe except in the case of the USA, which is the third importer, specially agglomerated cork. If the exports are compared with the national production (100,000 tonnes), the extraction of Portuguese raw cork only represents 53% of the national production needs, this explain the importance of the import of raw material, according to Zapata (2002). The final balance between its sales and is own cork production is an increase of 25% of raw cork to process into other cork products with higher value. Portugal produces over 165,000 tonnes of finished products that represent around \$1,300 Million (EUROSTAT, 2012), of which exports \$566 Million of agglomerated cork (champagne stoppers and building material) and \$490 Million of natural cork stoppers, resulting in an economic value 9 times higher than initial raw cork. These data give an idea of the characteristics of the sector, the importance of the foreign trade and the processing-cork industry. In summary, it can be considered that Portugal is mainly importing of raw cork, processing it in industry and selling abroad as final products, that is between 80 and 90% of total production (Autoridade da Concorrência 2012, EUROSTAT 2012).

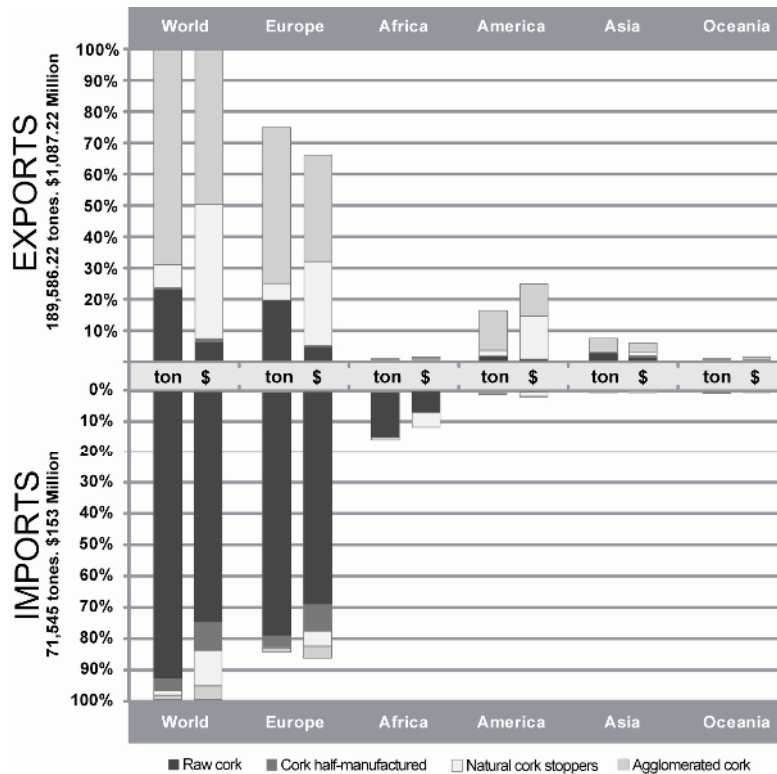


Figure 7. Percentage distribution of the trade in Portugal by continent and by product (2012)

Source: UNComtrade, 2013

From an economic point of view, Portugal generates an increase of the monetary value of the natural resource that it hosts in its forests and it buys from other countries at a low price. As mentioned above, the Portuguese cork industry has developed significantly in the past century, in sales, number of workers, etc; becoming a country that exports mainly manufactured products instead of raw cork as occurred in the first half of the 20th century (Zapata 2002). Portugal currently leads the world in Research and Development in the sphere of cork, through various experiments, innovation and research projects conducted since the early 1970s. These projects were focused on identifying the opportunities of cork such as the environmental and eco-efficiency aspects of cork and the great potential of cork materials and technologies for new applications that diversify the current market (Mestre and Vogtlander 2013. Mestre and Gil 2011, Mestre 2008).

In the case of Spain, in Table 1 it can be observed that from the 574,248 ha, 61,504 tones of cork are extracted; this represents a productivity of 107 kg/ha/year (MAGRAMA, 2010). The cork extraction is mainly concentrated in two southern areas, Andalusia and Extremadura while in the North (Catalonia) there is also an area where cork is extracted and also an important industry cluster is located. An important part of the cork extracted in Extremadura and Andalusia is transformed into products in the North and also in Portugal. Table 3 contains the data collected from reference sources, and it can be seen that Extremadura and Andalusia produced 19,032 and 37,882 tonnes annually respectively. Also, small quantities of raw cork are extracted in other regions of Spain such as Castilla La Mancha and Comunidad Valenciana, but percentages are lower. In Spain, the cork sector is composed of 200 companies and 3,200 workers. In southern Spain, cork sector consists of 120 companies mainly based on the first stages of the value chain like the cork preparation, and employ 2,000 workers. The cork sector of Catalonia will be discussed later.

It can be observed (Figure 8) that the differences between exports and imports in mass volume are much lower than Portugal. Spain exports 64,232 tones while it imports 46,526 tonnes, the exports being 1.4 times higher. In monetary quantity, Spanish exports doubles its imports, \$268.3 Million compared to \$116.8 Million. In value, Spain imports and exports mainly natural cork stoppers but exports also agglomerated cork, mainly processed in Catalonia. The final balance between the own raw cork production and the raw material to process is 10% less, and consequently a lower final quantity of processed products. Spain produces some 20 tonnes of finished products, \$253 Million (EUROSTAT, 2012), and half of them are exported as agglomerated cork and \$96 Million as natural cork stoppers. It can be observed that nearly 25% of its production is domestic demand, mainly by the wine sector.

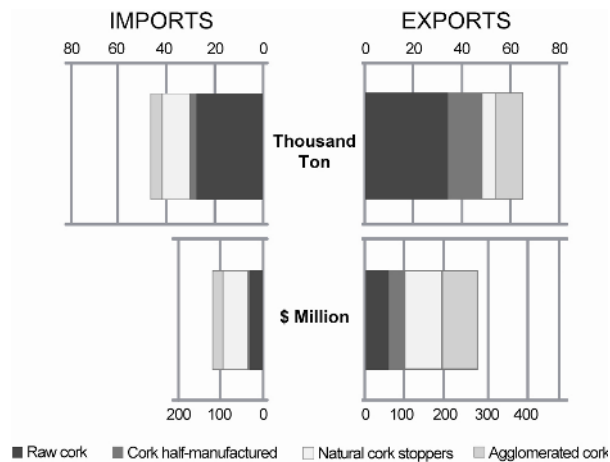


Figure 8. Trade balance of cork in Spain by product (2012)

Source: UNComtrade, 2013

In the international trade of Spain (Figure 9), imports have some similarities with the Portuguese model such as the imports from countries with cork oak forests but there are also many countries from which products already manufactured are imported. The most imported product in physical mass is raw cork too, but the percentage of products already manufactured is higher, with over 25% of natural cork stoppers and 10% of agglomerated cork. In all categories Portugal is the major supplier, providing to Spain with over 70% of the natural cork stoppers and 90% of the agglomerated cork that imports. This may indicate less ability to process of the cork industry, with over 40% of imports being products already manufactured which represent a 75% in monetary terms of total imports. If exports are analysed regarding Spanish production (61,504 tones), it is noticed that raw cork exported represents 55% of the Spanish cork production. Cork half-manufactured is the second largest export in physical mass, 21%, and mainly comes from the southern regions of Spain. This type of product has little value, representing only 13% of total exports. In terms of countries, Spain exports mainly to Portugal, France and Italy, who import about 90% of total Spanish exports. Still, Asian and American markets import more than 4%. If the typology of material is observed, over 50% is raw cork while 18% is agglomerated products.

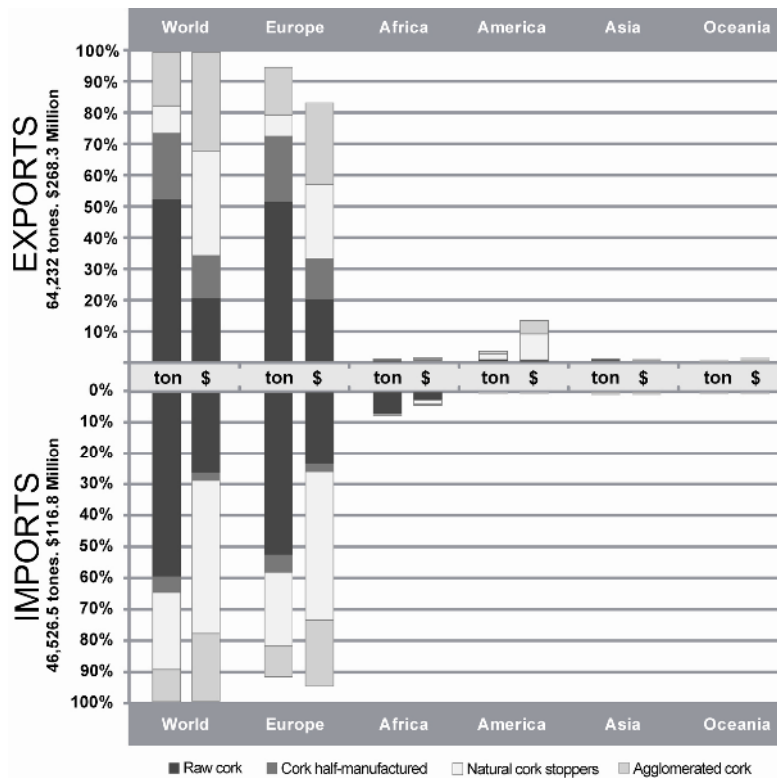


Figure 9. Percentage distribution of the trade in Spain by continent and by product (2012)

Source: UNComtrade, 2013

These data reinforce the idea that currently the Spanish cork industry is based on the raw material and cork half-manufactured as already indicated by Parejo and Zapata (Parejo 2010, Zapata 2009). As opposed to Portugal, Spain has become a country that divides its exports between unmanufactured cork and manufactured cork products, instead of exporting only manufactured cork as occurred in the first half of the 20th century. Moreover, the Spanish imports have grown from negligible to account for nearly half of exports, and mainly from Portugal, which represents a serious deterioration of foreign trade of Spanish cork industry (Zapata 2009, 2002). According to this, the economic potential of the cork oak forests, as natural resource, is not fully used. Extensive resources have been invested in forestry labors and in the cork extraction, but all of the raw material extracted not passes across the cork industry chain, and the possible added value is not maximized. Except in the Catalonia case, it will be explained below; in Spain, R&D policies have not been promoted in the cork industry, neither from public or private sector. Despite being a country with high level of innovation in other productive sectors and, more specifically, of ecoinnovation (EIO, 2013).

3.3. Regional level: Catalonia

At regional level, in the case of Catalonia, due to the different productive and industrial models unlike the rest of Spain, may show significant differences in the data. In reference to Table 1, Catalonia produces 7,600 tonnes per year, and its cork sector is based on 80 companies that have all the activities of the value chain, although it concentrates on the manufacture of cork stoppers, both wine and champagne stoppers.

In the international trade of Catalonia (Figure 10), the mass quantity of exports, 11,648 tones, is higher than imports, 7,490 tones, (1.5 times). But in monetary quantity, exports are 3 times the imports, \$121.3 Million compared to \$40.5 Million. In mass quantity, the most imported product is raw cork, while in monetary terms natural cork stoppers are the most imported product.

Agglomerated cork is the most exported product both in mass and monetary terms. This fits precisely with Rives et al. (2012a) indicated by saying that Catalonia is the largest producer of agglomerated corks and especially of champagne and sparkling wines with 60% of the worldwide production. In the case of Catalonia, as well as Portugal, the balance of cork to process increases by 28% the initial raw cork, due to the fact that Catalonia imports more raw cork than exports. The Catalan cork sector has a turnover of \$1,160 Million² (INE, 2012), of which 20% is abroad, \$50 Million of natural cork stoppers and about \$100 Million of agglomerated cork. In foreign trade, the exports of natural cork stoppers and champagne stoppers provide 4 times more income than import of raw cork expenses.

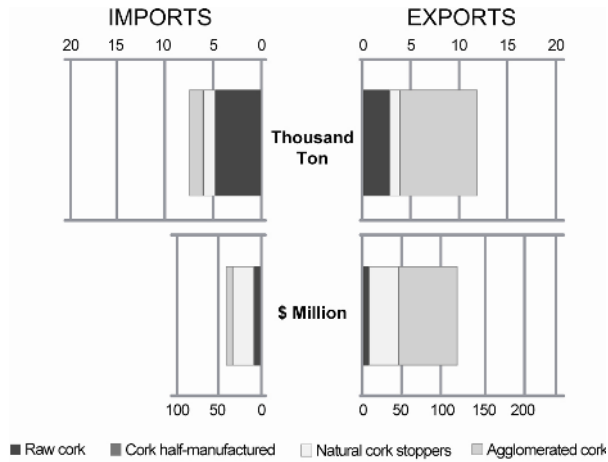


Figure 10. Trade balance of cork in Catalonia by product (2012)
Source: UNComtrade, 2013

Catalonia imports especially raw cork, almost 64% of total imports, mainly from European countries, Portugal, Italy and France. Also natural cork stoppers are very representative in imports, because while representing over 16% of total mass imports, it reaches 61% in monetary terms (Figure 11). These natural cork stoppers are imported from European countries, mainly Portugal and France. In the case of exports, it can be seen in Figure 11 that the most exported product are products of agglomerated cork (68%) and also, in a percentage significantly lower, raw cork (22%). This data may reflect a better industrial capacity of the cork industry than Spain, with a broader-based material processing. In the case of comparing the export of raw material, with Catalan production (7,600 t), significant differences are observed with respect to the Spanish results. For example, 72% of the Catalan cork production is exported to Italy, Portugal and France as agglomerated products but this percentage in the Spanish case is about 10%. On the other hand, Catalonia needs to import raw cork, because its raw cork production only represents 65% of its production, and transforms it and exports it as products, mainly as agglomerated cork. It should be noted that the influence of the champagne or cava market in the cork sector, due to both, own use within the region as well as exporting, requiring a huge quantity of agglomerated cork stoppers.

² It is considerate the entire 162 sector of Spanish Classification of Economic Activities: Wood and Cork (excluding furniture).

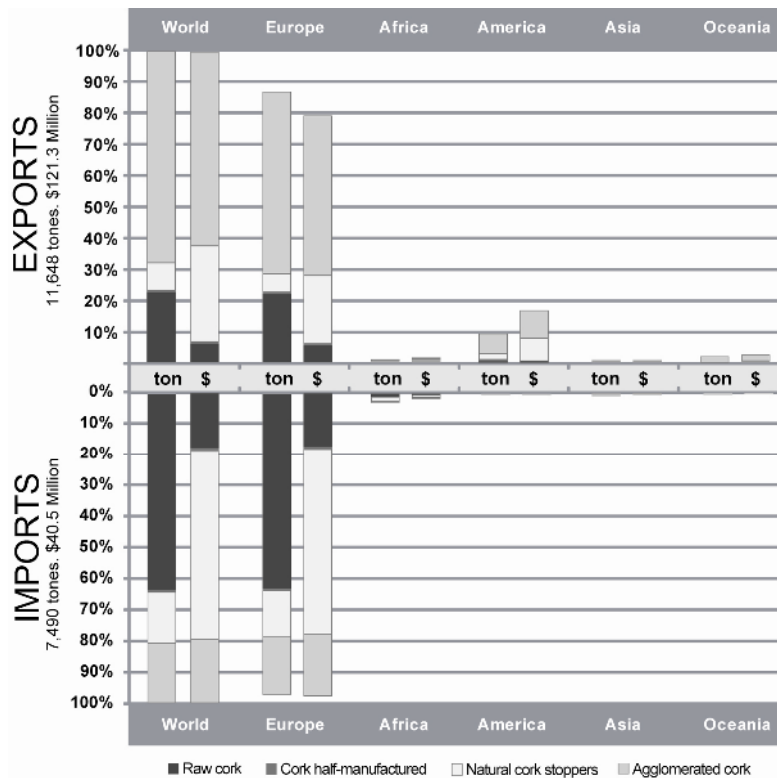


Figure 11. Percentage distribution of the trade in Catalonia by continent and by product (2012)

Source: UNComtrade, 2013

From an economic point of view, Catalonia focuses its cork industry in manufactured products; and as well as Portugal, generates an increase of the added value of the initial raw cork. The most of the raw cork is imported, due to the fact of its low cork production, and this dependence limits the development of its industry. Nowadays, Catalan cork oak forests are not fully used, it is estimated that 50% of them are not managed in any way (Tusell and Garcia, 2008) and, if exploitation of these forests begins, the cork extraction in Catalonia could be doubled and this dependence would decrease. According to Zapata (2002), in the early 20th century, Catalan sector presented the largest concentration of cork manufacturing industry worldwide; but in the first half of 20th century, setting the Spanish trend, there was a dramatic decline in the cork industry. Currently, the scenario is more optimistic; the government agencies have identified the cork industry as a strategic sector, and the Catalan Cork Institute has established to promote cork products or boost R&D activity. Moreover, due to the geographical concentration of agents involved in the cork market, both industry and forestry, a cluster was created; and one of the strategies that the cluster wants to strengthen is sustainability.

4. Discussion

The collection of data is difficult in order to get good quality statistical data on production and external trade of cork products, and therefore different sources were consulted in the data collection: UN Comtrade (UN, 2013), ESTACOM-EUROESTACOM (2012), EUROSTAT (2012) and BACI (2010). Usually it has been observed that data have similar trends, although there are some fluctuations in one of the database presented. In Figure 12 the data of exports and imports of Portugal and Spain collected in each database are shown as an example.

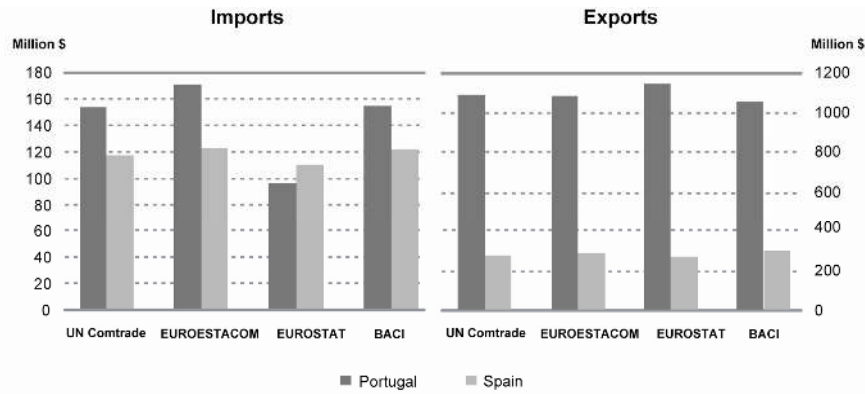


Figure 12. Comparison of different sources of information to trade data from Spain and Portugal (2012)

UN Comtrade is a database generated from various sources, including EUROSTAT (Statistical Office of the European Communities), and IMF (International Financial Statistics); and also private sources. It starts with an estimate which is adjusted in the following two years analysed through actual data provided by the national offices (in Spain ESTACOM-EUROESTACOM). On the other hand, BACI is a database that processes data from UN Comtrade in order to reconcile the information asymmetries that exist between countries, but the reconciliation of exporter and importer reporting in BACI provides a significant improvement, but it does not provide an assessment of the reliability of entire database or of individual data points. Finally UN Comtrade database was used, due to the fact that it represents more closely the reality, and also UN Comtrade is specialized in the commodities market while the rest of database are specialized in external trade of a country. Due to the concentration of cork production and processing in two developed countries, excessive dependence on data sources can be avoided and the consequences of its possible asymmetric information. The various databases searched allow mainly, the observation of the general export trend in order to know the behaviour of different sectors.

Focusing on the empirical results of the cork industry trade, there are clear differences between the sectors within the Iberian Peninsula, following the trend that Parejo (2009) reported. On the one hand, Portugal and Catalonia are mainly processors of raw cork into finished cork products; and on the other hand, the southern regions of Spain are eminently producers of raw cork. From an economic view, the industries focused in manufactured products are more capable of generate wealth, due to the fact of increasing greatly the value of the initial raw material. The southern regions of Spain are not capable to use fully the potential that cork, as a natural resource, provides. However, this potential is transferred to Portugal and Catalonia at a low price, which increase the initial value in 9 and 4 times, respectively. In Table 4 the ratio of the value (\$) per mass unit (Kg), for each flow and by product type, can be compared. It can be identified more specifically the significant differences between the three sectors analysed. Catalonia has the largest ratio of total exports and imports, and its cork sector would have the greatest capacity to generate wealth. But due to the fact that both the trade of Catalonia is still lower than Portugal and Spain and its market is eminently focused on cork stoppers for champagne, its cork industry has not yet reached the degree of competitiveness desired. In the case of Portugal, it can be observed that its capacity to generate wealth is high, due to its exports are focused on the finished products with high added value, especially in relation to natural cork stoppers. Although agglomerated corks accounts for the majority of physical exports, but still represents a low added value, with a great potential for innovation in new products with high added value. Thus, it can be developed by its productive structure due to the large number of enterprises and the huge number of workers that it is comprised. For its part, Spanish data, including Catalan data, has the lowest rate for total exports. If Catalan data are not taken into account, the ratio for Spanish exports for natural cork stoppers and agglomerated

cork is reduced by one-third, indicating the least capacity of the rest of Spain to generate wealth.

Table 4: Ratio of the value (\$) per unit volume (Kg) for trade flows (2012), (UN Comtrade, 2013).

	Country level				Regional level			
	Portugal		Spain		Catalonia		Rest of Spain	
	Import (\$/Kg)	Export (\$/Kg)	Import (\$/Kg)	Export (\$/Kg)	Import (\$/Kg)	Export (\$/Kg)	Import (\$/Kg)	Export (\$/Kg)
TOTAL	2.3	5.7	2.5	4.2	5.4	10.4	1,9	2.8
Raw cork	1.7	1.4	1.1	1.6	1.4	2.6	1	1.5
Cork half-manufactured	4.9	7.0	1.2	2.6	11.4	18.5	1	2.6
Natural cork stoppers	19.3	32.5	5.0	15.5	20.1	35.3	3.2	11.1
Agglomerated cork	6.4	4.1	5.2	7.7	5.7	9.6	5	3.1

It is confirmed the crucial role in the cork industry in the Iberian Peninsula that is played by the finished cork products, due to their capacity to generate wealth. This wealth not only is generated by the economic value added to the raw material in the manufacturing process; but also generates the development of supply chains, stimulating the installation of companies that process the raw material that, currently in Spain, is exported. This could involve the development of rural areas where cork is the main economic activity, and it would mean the employment generation.

Moreover, the cork-manufacturing industry can play a decisive role in the promotion of raw cork as a renewable source of a finished cork product with high added value, as well as the use of cork finished products as a by-product of some other kind of product. These new products could expand the cork market to other sectors, because of currently is too focused to wine market, and depends strongly on its trends and its market is concentrated in countries that produce, bottle and consume wine, which are mostly European, as well as USA, Argentina and Australia. Some potential applications are building material, transport, furniture, lighting or design; and as appointed above, there is a great potential for innovation in new products made of agglomerated cork, and taking advantage of other byproducts and waste of cork to by transforming into products with high added value. This diversification of the market would increase the competitiveness of the sector and it may cause an increased in demand of higher finished products and a leading to a greater economic wealth. In this way, e.g. Spain can decrease its exports of raw material and increases exports of cork transformed products, resulting in an increase of value of exports. Also this contributes to a greater internal trade and a half-manufactured cork and raw cork import, in order to meet demand within the internal market. In view of the above, it can be concluded that wealth is not only obtained with large areas of cork oak from which to extract the raw material, but also through a production structure that is able to take advantage of its own natural resources and not move its exploitation to other sectors in other countries, in order to produce manufactured products with high value enhancing its competitiveness. From an environmental view, this integration between forestry and the cork-processing industry, reducing the distances to transport reproduction cork and consuming local raw material, and thereby reduce the environmental impact related.

In addition to the diversification of the cork market, other R&D and innovation long-term strategies for this sector have to be established; taking into account the characteristics of renewable and non-infinite resources and its slow growth. On the one hand, these strategies should be focused in ensuring the cork quality and the required quantity for being capable of responding to market demands. This can be achieved through appropriate forestry activities,

both publics and privates, which ensure a good natural regeneration on the cork oak forests. On the other hand, these R&D should strengthen the sustainability and the eco-efficiency in every link of the cork chain industry, not only as an inherent attribute from cork material. The environmental aspects should be integrated into the cork extraction, the manufacturing process, transport and distribution, use or disposal; it should be become part of the cork sector DNA. In previous studies, the importance of transport on the environmental balance has already been indicated, especially in raw material trade (Rives, 2011). The global trade of cork industry has a high concentration of flows in the Iberian Peninsula and, consequently those exported products that require higher energetic needs to reach their destinations. These energetic needs have a significance increase in environmental impact, which would alter the balance of CO₂ emissions calculated in previous studies by means of LCA methodology (González-García, 2013; Rives, 2013a, 2012a, 2012b, 2012c, 2011). In future studies the previous environmental evaluations will be updated and assessed in order to quantify how the global market affects the overall impact of the product.

5. Conclusions

This paper has analysed the international trade of the cork sector in the Iberian Peninsula, who hosts the most of the worldwide cork oak forests and the processing industries of cork. Its performance has followed the same trend which was indicated in previous studies, consolidating its hegemony despite of the economic crisis that Iberian countries have suffered. Portugal is producer and processor of raw cork, having a leader position into the global market and with a very powerful industry. The Spanish cork industry is based on the raw material and cork half-manufactured; except for Catalonia, who is mainly processor of raw cork into finished cork products, and its industry is the world leader in champagne stoppers market.

Some weaknesses have been identified for each sector analysed; in general, all those sectors are too focused in wine market, and they have to expand their markets for diversifying their opportunities. In the cases of Spain and Catalonia, the forest management must be improved, due to the fact of the lack of forest management in Spain. That is, in the case of Catalonia 50% of Catalan cork oak forests are not managed in any way. Improving the forest management would increase the quantity and the quality of the extracted cork. The increase of the cork quality will improve the performance of the cork-manufacturing products, and the availability of more quantity of raw material will ensure the supplying to the cork-manufacturing industry.

The cork-manufacturing industry can play a crucial role in the cork industry in the Iberian Peninsula. This industry can generate the development of supply chains, stimulating the intermediate links of it, increasing the capacity of cork industry to generate wealth. This wealth not only is generated by the economic value added to the raw material in the manufacturing process; but also involves the development of rural areas where cork is the main economic activity: stimulating the installation of companies that process the raw and providing employment opportunities.

The cork sector in the Iberian Peninsula has to establish its own development strategies for the future. It has to increase the investment in R&D and innovation long-term strategies, taking into account the characteristics of renewable and non-infinite resources and its slow growth. These strategies should focus on developing new products with higher added value, but also on strengthening the sustainability and the eco-efficiency in every link of the cork chain industry, not only as an inherent attribute from cork material. The environmental aspects should be integrated into the cork extraction, the manufacturing process, transport and distribution, use or disposal; it should be become part of the cork sector DNA.

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