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Study of sanitation taxes that levies a water pollution in different European Union countries

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1. Introduction

The worry of societies from industrialized countries for the environment is more notable each time. This fact is about this much paradoxical, since the development of these countries' welfare has been one of the main causes of the environmental deterioration of the planet in the last century. However, we can see as something evident each day that the environmental worry exists and, in fact, corrective measures are being implanted for some decades in order to alleviate the damages which have already been caused, and to eliminate, or at least, to reduce significantly the environmental negative effects which are originated by the industrial activities. The environmental problems affect to the ecosystems, but they also have an evident effect on societies' development and this makes an impact on the local and global economy. Therefore, the respect about the environment is one of the greatest pillars for what is denominated "sustainable development", which is a model that people try to make more powerful socially, politically and legislatively. (Bala Gala et al, 2012).

One of the serious environmental problems today, which is being caused by the human activity, is the over-exploitation of natural resources. The excess of consumption, which is being caused by the current society's excessive demand to cover their needs without taking care about what would be convenient, affects mainly to water and energy. The aim of this work is to analyse the possibilities of the tributes' use as instruments for stimulating the consumption and the responsible use of water from the public sector, relying on the use of tools of economic valuation of the natural resources.

1.1. Water and the shortage of resource

Water is an essential element for a lot of activities and it has been become a public and a social benefit whose conservation requires a constant effort. It is patrimony of every living being. It must contribute to the sustainable development of each and every one of the territories and its use is, at the same time, a right and a responsibility.

It is an essential resource for the life and good healthy. Today, one of each three people in the world does not have enough water available to satisfy his daily needs. Worldwide, the problem is getting worse due to the demographic and growth of cities and the increase of water needs in agriculture, industry and households. Several studies express the consequences for the health of the shortage of water, its effect in the daily life and how it can obstruct the international development (OMS, 2013).

The shortage of water affects to a greater or lesser extent to all the continents. Around 1.200 millions of people, nearly one fifth part of the world population, live in areas which are characterized by the physic shortage of water, meanwhile 500 millions bring closer to this situation. Other 1.600 millions face situations of economic shortage of water where the countries lack necessary infrastructure in order to transport the water from rivers to aquifers. The shortage of water is not only a natural phenomenon but also a phenomenon caused by the human being's actions. There is enough drinkable water in the planet in order to supply 6.000 millions of people, but it is distributed in an irregular way, it is wasted, pulled and it is managed in an unsustainable way (ONU, 2013).

1.2. Legislation and current regulation

The shortage and the abusive use of water set out an increasing and serious threat for the sustainable development and the protection of the environment. In the International Conference about Water and Environment (CIAMA) celebrated in Dublin, Ireland, January 1992, the experts, who were met, considered that the situation of hydrological world resources was becoming a critique. The participants in CIAMA made a call in order to give a new perspective to the evaluation, use and the paperwork of sweet-water resources; it is only possible thanks to a political predicament and to a participation which include from the Government's high spheres until the communities more basic.

The economic character of water and the need of what it has to be kept in mind in its management are recognised formally in the Declaration of Dublin. Additionally, recommendations are proposed for the conservation and reuse of water. There is a broad field that you can use to economize a volume of water in the agriculture, in the industry and in the supply for the domestic use.

By its part, European Union makes specific mentions of the need of environmental protection which is oriented to the achievement of the sustainable development in the middle of the eighties. Horizontal directives start to appear with the aim of reducing the emissions to the earth, air and water. In that way, the European Union publishes the Directive of Water Framework in 2000. In the first article, DMA establishes the protection of continental superficial water of transition and coastal and subterranean water as an objective. This involves the prevention of the additional deterioration of water, the protection of the ecosystems, the promotion of the sustainable use of water, the reduction of waste of dangerous substances and the prevention of subterranean water pollution as well as the effects of inundation and drought. In this way, the Directive defines a general strategy for the management of water in Europe with the aim of getting a good state of the communitarian water for the year 2015 (Martín-Ortega, 2008).

For the achievement of its ecological aims, the DMA prescribes the use of principles and economic tools, responding to the need of an integrated regulation of water in order to reach a sustainable management of hydrological resources and to confront the increasing pressure of the good quality demand. Inside the economic aspects of the DMA, the notions of benefit and environmental cost have particular relevance. However, its definition has not been sufficiently clarified yet, neither from an institutional field nor from scientific field, making difficult its correct estimation in that way. Because of this, several means have tried to define the environmental cost in a clear and precise way. As an example of this, the guide of WATESCO where the environmental costs are defined as derivate costs of the damages that the water use imposes over the environment and the ecosystems and its users. Subsequently, the same means defined the environmental costs as the economic value of the environmental damage which is originated by the degradation and the depletion of the resource as a consequence of its use. In both cases, we can understand that the society obtains benefits from the good state of the water and we also understand that the environmental costs are corresponded with the "lost benefits" because of not reaching that state.

On the other hand, the concept of environmental benefit is defined as the value of properties and the services which are provided by the hydrographical demarcation as a consequence of the good ecological state of water. We can deduce that its estimation must base on the estimation of the welfare improvement, since it passes from the current situation of the hydrographical demarcation to a situation of a good ecological state.

1.3. Sanitation fee and pollution

The natural water cycle has a great capacity of purification. However, this facility of the water regeneration and its apparent abundance make it became the usual dumping site where we throw the residues which are produced by our activities. Pesticides, chemical rubbish, heavy metals, radioactive residues, etc., are found, to a greater or lesser amount, when you analyse the water from the most remote places of the world. Water is polluted up to the point that water can be dangerous for human health and detrimental for the life. (Echarri, 2007).

The pollution is defined, from an ecological point of view, as the alteration of the properties of a means due to the incorporation -which is generally produced by the direct or indirect action of the man- of disturbances or materials that introduces modifications of the structure and the function of the affected ecosystems. However, the economic definition of the pollution is understood as negative externality or error in the market or that situation in which the activity of the polluter provokes the loss of the welfare to other agent. The pollution, understood as error in the market, supposes an environmental problem that justifies the public corrector intervention (Róman, 2012). The public intervention in environmental material is realised through the conventional regulations. Mainly, they consist in maxim limits of emission, technological rules about products or consumptions. On the other hand, we can count on taxes or transferable rights of pollution which are known as economic instruments of environmental politics (Gago, 1999).

The article 4 of DMA deals about the environmental objectives of superficial water and the need of applying the measures which reduce the contamination progressively. It also deals about how to reduce or interrupt the spill gradually. For that, the member states have developed environmental fee which tax the water spill. They are known as canons of sanitation and there is a specific design in every country.

The canon of sanitation is a tax which is considered as a specific deposit in the Public or Private Entity of Sanitation in Sewage and which is destined to the finance of management expenses and exploitation of evacuation systems, treatment and water depuration, just like in its case, the construction of itself.

The current structure of the fee is relied on a declaration of polluting spilled load which is presented by the industries, and it allows taking in account the environmental and peculiar situation of each taxpayer in the calculation of the final tax payment as well as the level of water consumption. Therefore, the Tax of Sanitation is potentially an incentive for the industries as for promoting the efficient use of water as much in quantitative as qualitative terms (Gispert, 2000).

One thing which must be mentioned is that the cost of the water, only coming from its consumption, is still counting in a lot of businesses. But, the approved normative, in this case by the European Union, oblige to add the cost of the spill like another additional cost of water. The spills of very polluted water, in particular countries or their regions, can suppose a very high cost for the businesses being more worthwhile investing in recycle process of sewage. The differences between the costs of spill of sewage that countries have to bear will be studied later.

On other hand, the establishment of this canon helps to establish the structure of different prices. The cost of water increases to a greater consumption of water allowing, in that way, that the businesses consider innovating and improving their productive processes. This can be reflected in the water consumption more efficient. These practices are not carried out in countries which are in development ways, since the businesses pay a fixed fee in the most of them without keeping any type of relation with the real quantity that is consumed.

In addition, in order to improve the investment in the recycle processes and treatment of sewage is indispensable lightening the financial load of capital costs, developing mechanisms of Price collections of the water service and sanitation which reduce the financial risk and also the risk Premium over the loan. What are very important are the will and the capacity of the banking sector in order to support the investments in ecological systems of production in the private sector and in order to invest directly in necessary infrastructures like water-treatment plants.

All of this is because of the world commercial sector demands, each time with more force that businesses achieve, with environmental standards of the products, the productive processes and its right certification. The market will be only accessible for the ecological businesses which know how to produce more quantity with fewer resources besides preserving and treating resources which are already polluted.

On other hand, the governments can play a proactive role when they are going to invest in hydraulic infrastructures that have a relatively high cost of initial investment. Its role is important because the benefits and the incomes by these investments are obtained in a long period of time and in a great measure, like positive externalities, and by the commercial risk which is associated to the new technologies.

In short, increasing the number of people with access to sanitation services and drinkable water bring great benefits for the development of countries, since it improves their health results and the economy. Moreover, the investments in sanitation and drinkable water bring very high and equivalent economic efficiencies -according to estimations of the World Bank by the average term- to approximately 2% of the gross domestic product (PBI), even it can reach the 7% in some countries with particular contexts (GLAAS, 2010).

1.4. Water and feeding

One of the great challenges humanity is facing is the research of equilibrium between the economic development and the protection of human health and environment. The European food and agriculture industry is conscious about the environmental implications associated to the production and consumption of its products throughout its life cycle. It is part of an essential and strategic sector, since its products are mainly products of first need consumption. In addition, it has an important role in the economic national activity due to the volume of the investments realised in the sector and the kick-start in the creation and proliferation of other no-agricultural industries that are related, in some way, to them (Seoánez, 2003).

On other hand, the food sector gives advantage to the development and growth of businesses. Its concentration comes motivated by the necessity of investing in investigation and development. The change in the alimentary habits make costumers to demand, more each day, healthier and more natural products which provide a physical welfare and health, through practices that provoke a smallest or lacking aggression to the environment.

All these actions, in one way or another, contribute to the development of green economy concept. In a green economy, we put a special emphasis in taking advantage of the opportunities of investment in those sectors that are supported or served of natural resources and of the services of ecosystems. Investing in green sectors -like the water sector can be-entails the creation of more jobs and a greater prosperity. Investing in the provision of these services on time constitutes a prerequisite for the progress. Having done these investments, the progress will be faster and sustainable, making possible the transition to a green economy. Water in the green economy concentrates on the socioeconomic opportunities, provided by an appropriate management, to the social and economical development at the same time that the ecosystem of fresh water is protected. In a green economy is recognised, valued and paid for the role that water plays in the maintenance of biodiversity, in the services of ecosystems and in the water supply (Pnuma, 2011).

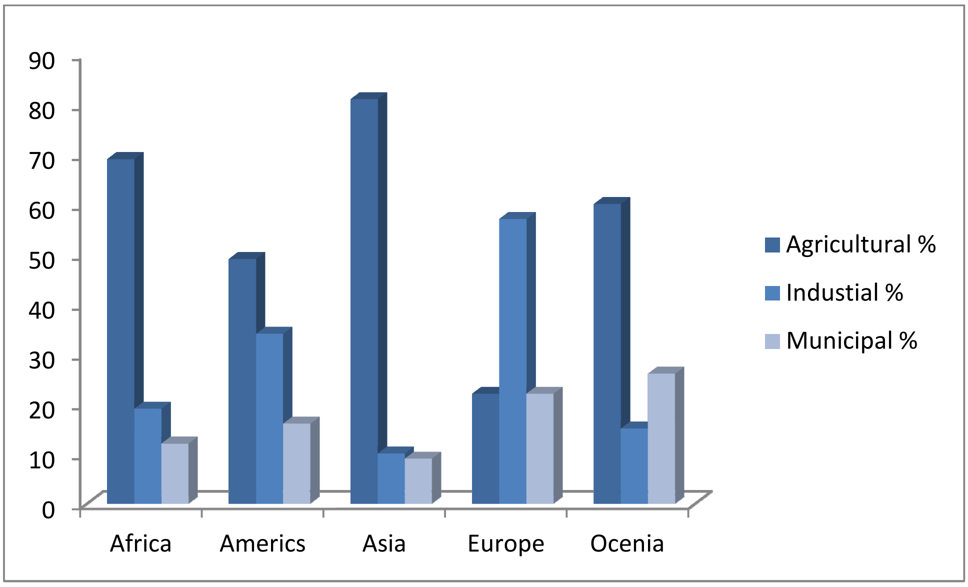
2. Agricultural industry in Europe

The industrial sector is an important indication of the development level of a country. The developed countries concentrate their main economic activity on the industries, contributing in that way, with a very high percentage, to GDP. An important input of raw materials, energy and natural resources -which are necessary for the correct processing of products- are necessary for the development of the industrial activity.

The supply is intrinsically linked to the human welfare. The agricultural production carries out a crucial function for the sustenance of particular people and for the economy in general.

The agriculture is the main supply source of the food industry and, at the same time, it is which imposes a heavy and growth load over the European hydrological resources and threatens with provoke shortage of water and damages in the ecosystem. It uses the greatest quantities of water, reaching even 65-70% of all the water consumed in the country. This phenomenon is more marked in countries which are in development, since their activity is based mainly on agriculture.

Figure 1



Source: FAO

** Includes use of desalinated water, the use of treated municipal wastewater and the direct use of agricultural drainage water.

As we can see in the figure 1, the water extraction for agricultural aims is very high in Asian continent, where the main productive activity is developed in primary sector, followed by Africa and Oceania. All of this linked to poor infrastructures of water distribution in no-urban areas, to the inefficiency of irrigation and water waste make these countries to consume much water than is actually needed. On the other hand, the fewer consumption of water for agricultural aims is represented by European continent where the water extracted for agriculture supposes a 22% average of the total water. However, we have to stand out the important consumption of water in Mediterranean Europe which supposes even 52% of the total water extracted for irrigation facing a 5% in Occidental Europe. All of this is due to the different climatic conditions between the north and south of European continent.

The importance of a good development of agriculture sectors and industry is vital because we hope the world population reach the 8.300 millions of people in 2030. The food production will have to double in the next 40 years in order to feed this growth number of people. As we have said before, the agriculture and the food production depend on natural resources, like water, greatly. If changes are not introduced in the alimentary habits or in the food chain and the productivity of the ground and water is not improved, the world consumption of water in the agriculture will increase drastically. Probably, water will be one of the factors that will make conditional on the food production in the future (ONU, 2011).

The food and agriculture industries, as a part of industrial gears of productive sector, cannot remain unaware of its role in the sustainable development of the European regions and every part of the world. For that reason, they must watch over instituting or adopting conduct ways which allow covering the expectations of every costumer -the administrators stand out among them- with their legal requisites. Moreover, the consumers are tougher each time with aspects which are linked to environmental and social respect.

The systems of industrial production will have to become more sustainable in order to cover the present and future generations. A lot of businesses consume more raw material and energy that their production processes really need. That is due to the use of out-of-style and ineffective technologies and to the failure at the time of adopting systems of appropriate management. One of the mainly challenge for the industry is to address, in an effective way, the exploitation and unsustainable pollution of the fresh water resources in the world. In comparison with other sectors, the industry uses relatively a little proportion of water in a global scale. Even so, the quantity of water which is used annually by the industry is increasing, just like the pollution level of industrial water which is also higher than the other which is from the urbanisations. This implicates the deterioration of the resource in a global level, since in a lot of cases, the water continues without treatment or it is only treated in an insufficient way and it is spilt to the sea or other hydrological sources, so it lets the natural ecosystems, to a greater or lesser efficacy and risk, degrade the waste in a natural way. In developed countries, a proportion of spill, which is greater each time, is treated before arriving to rivers or seas in WWTP. The aim of these treatments is, in general, reducing the polluting load of the spill and turning it on innocuous for the environment. There are some types of treatment in order to achieve these aims. These different types of treatment depend on pollutants that drag the water and other factors which are more general like the localization of the water-treatment plant, climate, affected ecosystems, etc. (Echarri, 2007).

The industry can play a role of leadership at the time of imposing more sustainable practices in water material, addressing the topic of overexploitation and improving the hydraulic infrastructures and the hydrological resources management. In order to get these aims, the industry must “make more with less”, moving forward to the objective of zero spill applying, for example, a production system of continuous cycle. The industries must work in order to turn their sewages sources into useful actives for other processes, industries or industrial groups (ONU, 2011).

On the one hand, the food and agriculture industries develop an important economic social role due to their repercussion in the creation of employment, fundamentally, as to agricultural sector: reducing the unemployment, increasing its incomes, strengthening its industrialization, even offering permanent jobs in that industry with good possibilities of specialization and promotion. On the other hand, it strengthens the development of other industrial or business activities like transports, packaging, quality management, equipment, etc.

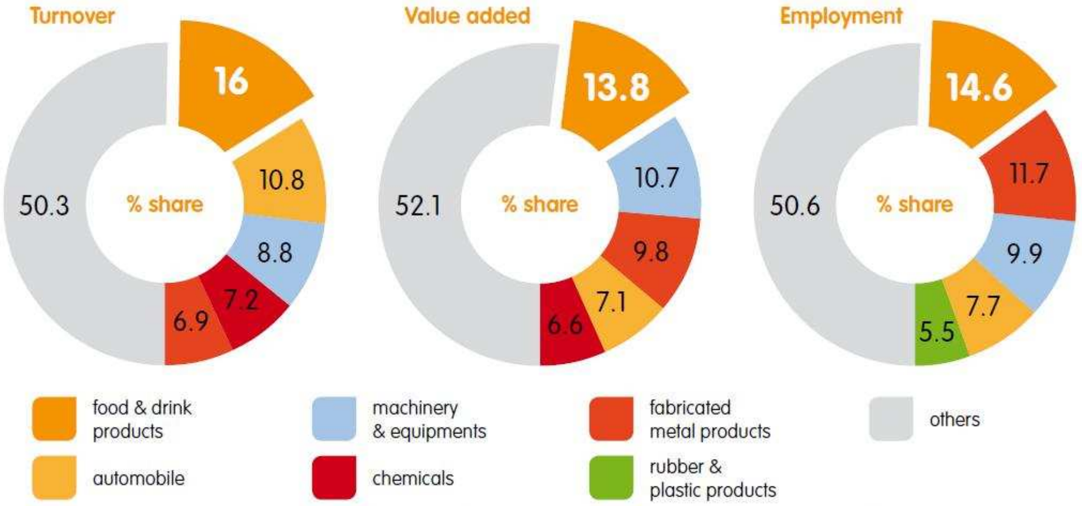
2.1. Food and Agriculture industry: General Observation

The agricultural industries encompass a set of different activities whose heterogeneity is mainly due to the variety of industrial processes which are used to final products obtained and to the raw materials which are used. The concept of agro-industry has been developed due to the application of this definition to the food and agriculture sector. This concept of Agro-industry is understood as that system of production, transformation and distribution of food products and it is in order to satisfy the nutrition needs of a society that is inserted within a growth process of industrialization and capitalist urbanization (Seoánez, 2003).

The food and agriculture industry have a strong dependency of agricultural sector, since agriculture is the only source of raw materials supply. This subordination to the agricultural production implicates an aspect of temporary nature which is subject to the rhythms of natural seasons, and therefore a series of biological and climatic factors such as an availability of natural resources.

As we can say before, the food and agriculture system contains a complex network which includes from the agricultural sector, supplier industries to agricultural sectors, industries of distribution, or industries of transformation, to reaching to retailers and finally to the consumers. The importance of agricultural sector lies basically in its socioeconomic implications. The European food and agriculture system has a market with more than 500 millions of consumers that usually spend ¼ of what they take in food. In addition, the food and agriculture industry is the main activity of the European manufacturing industry, representing the 16% of its total invoicing with a value which is higher to 956.000 millions of Euros. It counts on about 274.000 businesses in UE-27, where the most of them are SME with less than 250 workers (a 99.1% of the total), that give direct work to 4.1 millions of people and it represents the 48.7% of the total production in the food and agriculture industry in UE (Ministry of Agriculture, Feeding and Environment, 2011). In short, the food sector is the number one in terms which are represented in the figure number 2.

Figure 2



Source: Data&Trends of the European Food and Drink Industry 2011- http://www.fooddrinkeurope.eu/publication/data-trends-of-the-european-food-and-drink-industry-2011/

2.2. Food and Agriculture industry: Water consumption

The use of water in the food businesses is essential for the development of the productive activity. The total consumption in the European food industry can vary between the 8% and 15% of the total consumption of the industry, so it supposes from 1% to 1.8% of the total water which is consumed in Europe. The businesses of the food and agriculture sector use water as an agent of cooling in many production processes. On the other hand, the clean water is essential for the food security, since it is used in order to clean and disinfect the floors, processing equipments, containers and ingredients, and it can represent even the 70% of the use of water in the business (FoodDrinkEurope, 2012). In this way, for example, the tinned vegetable food industry consumes on average between 10-35m^3 of water per each tonne of raw material; the dairy industries consume between 1-2m^3 of water per each m^3 of milk; and the sugar industries consume on average of 0,30m^3 of water per each tonne of sugar canes (Seoánez, 2003).

The water constitutes a key resource but it is limited for the development of activity of food industry. The consumption and availability of this resource after its use set out a series of technological, social, economical and environmental questions that affect in a significant way to the long term sustainability. The improvement in the water management and sewage in the industry have an effect on the rationalization of the associated costs (energy, canon, consumption fee, treatment of sewage and water of process, etc.) reaching significant economic savings. The management of water in the business constitutes an element of first magnitude cost in a lot of food and agriculture subsectors with an intensive use of resource and, therefore it is decisive in efficiency and productivity terms. The availability of the resource, the increase of the cost and other effects related to the shortage of water are factors that we have to take in account. Therefore, the saving of water and its reuse are actions to develop in order to increase the competitiveness of the industry.

2.3. Food and Agriculture industry: The problem of wastewater

The pollution of hydrological resources has always existed, since it is linked to living beings and their development. However, the pollution, as a problem, has totally gone unnoticed for a long time. This happens because of the pollution do not exceed the capacity of auto depuration. In the last years, this threshold has been totally surpassed due to the continuous and indiscriminate contribution of polluted water whose origin is urban and industrial.

The environmental normative, which is tougher each time, has contributed in general industries and in particular food and agriculture industry, to adopt politics of reduction in the consumption of water, as much to own productive process as to cleaning tasks. At the same time, the normative must foment the minimization of the polluting load in the spill of sewage that the food and agriculture industry and others carry out. The final objective is clear: getting a sustainable system that is, achieving that the level of economic, social and environmental resources does not reduce over time, neither quality nor quantity and, in addition, it has to be distributed in a equitable way among the population (Román, 2013).

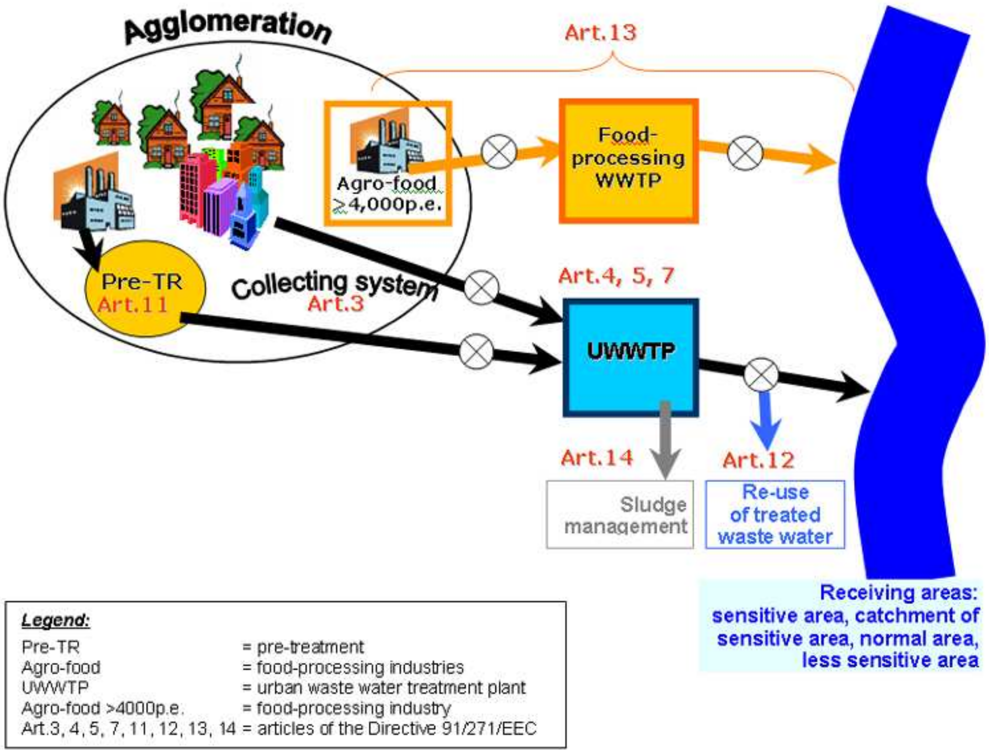
Moreover, the spills of agricultural industries are much specialised water which cannot be always mixed with urban sewage, since it needs a different treatment method. Another point which has to be taken in account is the costs of treatments, since agricultural industries often lack sufficient profitability to install treatment plants in situ because its economic performance is not very high. In this point, research on one hand and Estate aids on the other may influence and improve noticeably the quality of stills. Therefore, the use of depuration technologies which are low cost and the state support are essentials (Seoánez, 2003).

Most of the residual spills can be treated so that the recipient channels do not reach almost any substances which are able to produce pollution. Our society is more conscious each time about the new environmental culture which collects a greater level of sensitivity and worry in all sectors, governments, political party, companies and industries, Nature protectors, citizens, etc. All of this linked to a real serious situation in some aspects, with great environmental problems of international repercussion, is carrying governments and National and International Organizations to a progressive increase of the environmental legislation.

The main problem in the food and agriculture industry is the liquid spills. Practically, every sector in this type of industry is affected, to a greater or lesser degree, by the respective legislation. At European level, the spills of food and agriculture industries are affected by the Directive 91/271/CEE. This Directive regulates the collection, treatment and spilt of urban sewage and the treatment and spilt of sewage from particular industrial sectors, including the food and agriculture sector.

As we can see in the image, the effluents from urbanizations and particular industries, like the food and agriculture industry, are treated in the same treatment plant, according to the article 13 of the European Directive, although they could be spilt to hydrological sources.   We have to emphasise that the spilt of sewage of food industries, in order to be treated in the same treatment plant than water of urban consumption, has to be analysed previously in order to check that it does not contain inorganic pollutants which need more complex and intensive treatment systems.

Image 1



Source: Urban Waste Water Directive http://www.europa.eu/environment/water-urbanwaste/

The waste of the food and agricultural industry contains, generally, organic pollutants whose composition is as varied as the made products, therefore, this is difficult to characterise, as much in quantity as quality. However, we can stand out the following sectors as the most polluting inside this type of industry.

- Extraction of seed oils.
- Extraction of olive oils.
- Diary industries.
- Meat industry.
- Fabrication of wine alcohol.

Practically, for every agricultural industry there are treatment methods of their spills, but sometimes the cost of any of these procedures makes them unviable. In this way, the technology has methodologies of treatment which are viable technically. Its cost makes its application difficult with certain frequency.

According to the information which is treated, we are going to concentrate our objective of this work on the consumption and pollution of water in the food and agriculture industry. Within that, we will analyse the sector of wine production. We have based our choice on the economic importance of this product generally for Europe and particularly for Spain, since we consider that it is one of the industries that spill water with more pollutants.

3. Winemaking sector: World market situation

Spain is one of the great world producers of wine: first in the ranking of planted surface, second as a world exporter in volume terms and third by production and this last one is expressed in value terms. This sector is extraordinarily important in Spain due to its importance in economic, social and environmental terms as well as the importance of the wine as the image of the country abroad.

Globally, according to information of International Organization of the Vineyard and the Wine, in 2011 the world vine-producing surface decrease in 94.000 hectare with respect to 2010, estimated the total global in 7.495.000 hectare. The total community vineyard (UE-27) is reducing progressively its planted surface, decreasing in a 6.9% in the period of time 2008-2011. This process is a consequence of the combination of factors like the vineyard restructuration and the impact of vine-producing crisis that has been felt in a different way in areas and types of wine. On the other hand, the wine production in 2011 can be situated in 265.8 millions of hectolitres, 700.000 more than the previous year. The first wine-producer country is France, with a global 18.7%, followed by Italy with a global 15.6%, and Spain, with a global 12.9%.

By time of wine, France is in the first position as wine-producer with the Designation of Origin Wines with 23.3 millions of hectolitres, facing the 13.8 of Italy and the 13.7 of Spain.

The global exchanges in the wine sector have more importance each time because from a total of 72.2 millions of hectolitre on average in the period 2001-2005, has gone to 103.5 millions of hectolitres in 2011, according to the estimations of OVI. In 2011, the global exportations of wine represented, approximately, 42.8% of the consumption which is 8.2 percentage points greater than in the year 2006. If we start from the premise that information gives us, we can deduce that the viticulture market presents a stable tendency over the last years.

3.1. Winemaking sector: Economic importance in Europe

At European level, the sector of wine elaboration is dominated basically by 5 countries: France, Italy, Spain and less Portugal and Germany. As we can see in the table 1, 81.2% of the wine production is shared out between the three countries adding the countries of the rest of Europe. The wine industry represents an important role for each country, as much production, exportation and importation terms as noted quality.

Table 1

European production of wine and grape-juice (Campaign 2011/2012)		
Country (datum in thousands of hl)	**2011/2012**	**% s/total**
France	50.244	30,5%
Germany	9.395	5,7%
Italy	43.459	26,3%
Portugal	5.925	3,6%
Spain	40.324	24,4%
Rest of UE	15.653	9,5%
TOTAL of UE	**165.000**	**100,0%**

Source: Wine in numbers www.winefromspain.com/icex/cda/controller/

We are going to concentrate this work on the analysis of the main viticulture industries of these five countries. For that, we have chosen the wine productions with Origin Designation. On the other hand, all of them keep a narrow relation in terms of international competence and exportation/importation between them. Therefore, we are going to take in account in this study the following Origin Designations.

Wine of Riesling, region of Rhine, Germany;

Rioja Wine, region of Rioja, Spain;

Bordeaux Wine, region of Aquitaine, France;

Wine of Tuscany, region de Florence, Italy;

Wine of Douro, region of Oporto, Portugal;

Next, we are going to do a brief analysis of each one of the markets of these wines.

3.1.1. Market of the French wine

France is the first wine-producer in the world, the first consumer nowadays and also one of the first main exporters. For the campaign 2010, the French wine production was established in 45,7 millions of hectolitres, so it supposes a fall of 2% in relation to the amount in 2009. In general terms, the consumption in France faces to a crisis situation with an inexorable fall from the sixties to nowadays, whose number of individual consumption is in 43 litres per person, per year in 2010, facing to 100 litres in 1960.

The French importations of wine in 2010 increased to 5,9 millions of hectolitres. So, Spain was situated as first supplier of France in wine in bulk, followed by Italy and Portugal. However, in terms of value, Spain is in the second position followed by Italy. Portugal, on its behalf, is the first supplier of France in value, although it is also important to stand out that around 80% of the value of the exportations corresponds to wine of aperitif of Oporto, the region which is considered in this study. In short, Spain, Italy and Portugal represent in volume the 87% of the importations which are realised by France. In this part, it is seen the narrow relation that exists between these countries in terms of the wine industry.

3.1.2. Market of the Germanys wine

Germany is in the first place in the raking of global importing countries in volume with a fee of 16,4%, before United Kingdom with 14,43% or US with 10,74%. Germany is the fourth greater global market in wine consumption and the first in sparkling wines. In terms of per capita wine consumption is 24,4 litres where 20,5 litres corresponds to still wine and the rest, 3,9 litres, to sparkling wine.

The wine consumed in Germany is greatly from other countries. Germany imports 15,2 millions of hectolitre in front of 6,9 millions of hectolitres produced in its own territory. In the ranking of supplier countries, the three main countries take 75% of the total of importations.

Italy is in the first position as much in volume as value. In the second position, as for volume, is France with a fee of 16,47%. The Spanish importations support themselves in similar terms to the French ones as for volume. However, the information puts Spain very far from French values, where France has a fee of 29,16% of the total of importations, while Spain has only 13,75%.

3.1.3. Market of the Italian wine

The Italian viticulture industry is one of the greatest important in the world: it is the second country that produces more wine (42,2 millions of hectolitres), the first exporter (4,4 billions of Euros) and the third consumer of wine (23 millions of hectolitres).

The tendency to the generalized fall in relation to the wine production globally during 2012 has also affected to Italian sector. In 2011, it suffered a fall of 12,8% in the production in relation to 2010 due to unfavourable climatic conditions, to the diversification in the grape-employment, to the politics of extraction of vineyard in the European Union and to the "green wine harvest" technique.

However, the exportations and importations have increased in a noted way: 12,4% and 14,9% in value, respectively. The main addressees of Italian exportations are Germany, United States and United Kingdom. As for their suppliers, the first in value is France, followed by Spain and United States. Spain is the main supplier of Italy in terms of volume and the second in value.

The demand of wine in Italy presents a tendency to the fall since the year 2000. Several investigations speak about consumption per capita of 39 litres in 2011 and of 35 litres in 2012. However, Italy continues being the second consumer in the world. The changes in the wine consumption by Italians are seen in the typology of wine, in the quality, in the place and mode of consumption. The 98,8% of wine consumed in Italy is from Italian brand.

3.1.4. Market of the Portuguese wine

The market of Portuguese wine presents an important growth in the last years. In 2010, it recorded an increase of 16% in value and 19% in volume, with a total of 2,56 millions of hectolitres which were exported by a value of 649,10 millions of Euros. On its behalf, the strong wines with Protected Designation of Origin, like Oporto and Madeira, represent the half of value of what is exported by all producers of the country.

Within main destinations of Portuguese wine stand out Angola with a 27% in volume and with a 17% in value of the total exportations. The second greatest buyer of Portuguese wine is United Kingdom which represents the 12% of the total exportations in terms of value. On its behalf, France is the third main market in value and the second in volume for Portuguese viticulture products, with an increase of 49,7% in value and 14% in volume.

3.1.5. Market of Spanish wine

The Spanish viticulture sector has great importance, as much in the economic value that it produces as the population who occupies, and the role which is played in the environmental conservation. Spain, with 1,032 millions of hectares, continues being the country with more extension of vineyard in the European Union and in the world.

The wine production in Spain has seven continuous campaigns of a great stability around 40 millions of hectolitres. Moreover, the global exchanges in the sector gain more importance every day. In terms of value, the global amount of wine and grape-juice exportations has reached, in 2011, the number of 23.264 millions of Euros, representing a growth of 7,9% in relation to the previous year. In terms of volume, En terms de volume, almost two thirds of Spanish production go to the countries of the European Union. France, Germany, Italy, United Kingdom and Portugal are the five main destinations of Spanish exportations.

3.2. Introduction and application of the water footprint concept

Achieving a more efficient and sustainable management requires knowing how the existing resources of a region are being used, just like social, economic and environmental benefits which are produced by these uses. In this sense, the water footprint concept represents a very useful indicator in order to estimate the real consumption of water which is spent in the production of properties or associated to the different sectors of the economic activity in a territory (Willaarts, 2012).

This paper studies the viticulture sector in Europe and its main representatives: France, Italy, Spain, and in a lesser degree, Portugal and Germany. The main raw material of this industry is different types of grapes which are cultivated in specific conditions, since we are concentrated on wines with Designation of Origin in each one of the regions. We will do a use of the water footprint concept, which is introduced the first time by Hoekstra in 2000, in order to understand better the impact of water in the previous stage to wine production, that is, the cultivation.

The water footprint is an indicator of freshwater use that looks not only at direct water use of a consumer or producer, but also at the indirect water use. The water footprint can be regarded as a comprehensive indicator of fresh water resources appropriation. It is multidimensional indicator, showing water consumption volumes by source and polluted volumes by type of pollution; all components of a total water footprint are specified geographically and temporally. The blue water footprint refers to consumption of blue water resources along the supply chain of a product. The green water footprint refers to consumption of green water resources. The grey water footprint refers to pollution and is defined as the volume of fresh water that is required to assimilate the load of pollutants given natural background concentrations and existing ambient water quality standards (Hoekstra, 2011).

In application of this concept, the global average water footprint of grapes is 610 liters/kg. One kilogram of grapes gives 0.7 liters of wine, so that the water footprint of the wine is 870 liters of water per liter of wine. This means that one glass of wine (125 ml) costs 110 liters: 70% of green water, 16% of blue water and 14% of grey water. In France, Italy and Spain, the largest wine producing countries in the world, the average water footprint of wine is 90, 90 and 195 liters per glass of wine, respectively (Water footprint network, 2013). According to previous studies, the largest water consumption and greatest impacts occur during grape cultivation, and we found large variation between the regions. These variations are mostly induced by the heterogeneous nature of soils across the landscape, plus the differences in local climate which is dominated by rainfall (Herath, 2012).

Image 2

Source: personal compilation based on Water Footprint Network www.waterfootprint.org

4. Consumption and pollution of water in wine industry

The viticulture companies, the same as all the food and agriculture industries, have a strong dependency of water. It is an industrial sector that transforms products from the primary sector, so it has to carry out strict hygienic-sanitary requirements. That explains why intensive processes of cleaning with a high consumption of water are carried out in wineries.

Water is used in a greater number of processes in wineries. Most of water which is consumed is destined to washing and cleaning of equipments and systems. A study of the Ministry of Environment of Junta de Andalucía indicates that 90% of water consumption of wineries is destined to cleaning operations. Moreover, the use of water as a coolant in the fermentation with a controlled temperature, after the wine harvest, supposes a consumption which is greater each time because all the important systems have a refrigeration tower.

The water consumption in wineries varies between 1 and 6 liters of water per liter of elaborated wine, depending on a lot of factors, such as type and quality of systems, material and cleaning habits, supply costs and water purification. In that way, Prodanov and Cobo (2004) indicate that the production of one liter of wine in Spain produces approximately one liter of spilt water (Esandi and Abad, 1997); for Portugal, it varies around 1,5 liters (Caetano and Di Berardino, 1998); and for France, from 0,13 to 0,50 liters (Galy and Menier, 1998). While Pizarro and Soca (2003), calculate the water consumption per liter of wine produced in 2-5 liters for the wineries of Rioja and 1 liter for the French ones.

In general terms, the consumption depends on the stage, so during the fermentation is required over 1-3 liters of water per kilogram of grape; during the aging is required over 1-2,5 liters of water per liter of wine; and in the storage and bottling is required between 0,5-1,5 liters.

Moreover, we can estimate that from the annual consumption of water in a winery, between 40-50 % of the total is used during the wine harvest and decanting, between 25-35% is for treatments and aging, and from 15 to 25% is used in stabilization and bottling.

If we base on previous investigations and we take in account that each winery follows a model of consumption of water per each liter of wine produced, in addition to have in mind the characteristics of different countries which are considered for this study, we will use a ratio of 1,5 liters of water which is consumed for each liter of wine. This ratio is perfectly viable, being until now the economic and legal aspects, before than demands, what oblige to consume less water.

There is a direct relation between the water consumption throughout the process and the quantity of effluent. In the next graph, it is seen how the quantity of sewage varies throughout the year, reaching its highest values in the months of February and March coinciding in that way with the period of wine harvest and decanting. It is also seen how the consumption and rejection of water is decreasing in the rest of the year, when the winery realizes tasks of treatments, aging, stabilization and bottling.

Figure 3

Source: Winery Wastewater Management & Recycling, Operational Guidelines, Australian Government

In the process of elaboration, aging, bottling and aging of grape-juice is produced an important quantity of substance of waste, such as lees, marc and sediments of wine are susceptible to be used later and have a great economic value in market niche as sub products. The greatest part of waste, for example what are produced in the laboratory, sewage, cardboard, crystals, etc., are not. These spills must be treated conveniently according to the legislation. (LIFE SYNERGY, 2012).

Due to the strong irregularity of wine waste as much in time and composition as in volume, is complicated to establish an average value in the parameter of pollution. However, it can determine that the following parameters have a decisive effect in the search of common characteristics:

- Size and capacity of wineries. Tamaño y capacidad de las bodegas.
- Practical operations. Elaboration, aging, storage, bottling.
- Type of the wine which is elaborated. Red wine, White wine, cava, etc., and its way of elaboration.
- Realised practices.
- Location.
- Antiquity of wineries.
- Recipient means of waste.

Table 2

Characteristics	Description
Seasonal nature	The main source of pollution coincides with the wine harvest and the following months, the pressing and defanged are specially polluter.
Discontinuity throughout the working day	Most of the effluents processes in wineries have discontinuous character.
Variability according to the winery	The characteristics and volume of spills depend on the type of fermentation, the material of store, the equipment used and the greater or lesser use of sub products.
Strong content in organic material	These spills present a high content of organic material, with a concentration of DQO which goes from 10.000 to 35.000 mg/l in the wine harvest period. The advantage that it presents is that the effluents have a good biodegradation.
Importance of the material in suspension	Water presents a high volume of solids in suspension (grains, peels, soil, yeast, products of cellulosic nature, etc.).
Acid Character	The wine spills have a pH moderately acid, except the spills from cleaning operations that in the moment are mixed with alkaline water, its pH increases.

Presence of polyphenol	The presence of these compounds which are a bit degradable is common in this type of spills; the red wine presents a superior load to white wine.
Deficit of nutrients	Nitrogen and phosphorus

Source: personal compilation based on LIFE SINERGIA project.

4.1. Treatment of wastewater

There are three main ideas of action in the industrial management:

a) Saving of water expense.

b) Purification-treatment of effluents.

c) Recycling of water used in the process.

The first step in the management of water must be to minimize to the limit the effluents which are produced in the winery, since lower volume of waste, lower cost of treatment, so we will need a deep study of the productive process of the business with the aim of having an exhaustive knowledge about the points of water which is produced. It is essential to know what characteristics this waste has and where the greater volume of sewage is produced in order to impose mechanisms and good practices of operation which are destined to reduce its volume.

Since no domestic sewage which is spilt by wineries from cleaning operations, refrigeration and accidental spillage produced in the numerous transfers that are realized, the characteristics of waste in wineries vary thoroughly based on the season and the operation which produces the waste, generally related to a particular localization inside the installation. The composition of sewage has its origin in the own components of the grape, grape-juice or wine: peel, scrape, soil, sugars, acid, alcohol, polyphenols, etc., the products that are added and the waste that is produced in each process.

In some installations, there are own wells as source of alternative supply and/or complementary municipal network, so if it is linked to the existence of several points of connection to the network of sewage system, make difficult the determination of pollutant loads of this waste.

Generally, the characteristics are related to a series of weekly, monthly operations, which are realized, making difficult the characterization of sewage and obliging to use automatic equipments of sample gathering in order to obtain representative samples, realizing its programming on the base of previous knowledge of the operations which are realized in the winery and in the timetable of waste.

The pollution of the viniculture companies is measured through the parameters that the table 3 shows to us. In this table, we can see the comparison of waste in a winery with the urban water.

Table 3

Parameter of pollution	**Description**	**Water interval of a winery**	**Urban water interval**
DBO_5	The biochemical demand of oxygen represents the quantity of organic material that we have in water; it is the quantity of water which is necessary for stabilizing biologically the organic material contained in a simple of water incubated for 5 days to 20ºC.	3.000-15.000 mg/l	< 350 mg/l
DQO	Measure that represents the organic material in the sewage; it estimates the necessary oxygen for oxidizing chemically the organic material in water.	5.000-25.000 mg/l	500-700 mg/l
Solids in suspension		1.000-6.000 mg/l	150-300 mg/l
Conductivity	Notes the amount of salts dissolved in the sample.	1.000-2.000 S/cm	> 2.000 S/cm
pH		4-5	

Source: personal compilation based on LIFE SINERGIA project.

The great difference between domestic waste and sewage which is produced in wineries demonstrates the need of using own purification systems in companies, since the urban water-treatment plants are not prepared to assume waste with values which are so strong. The urban water-treatment may become useless when it receives wine waste, stopping to clean up the sewage which is received by the population and it is because they are not conveniently adapted.

The wastewater of wineries will be submitted firstly to a primary treatment and subsequently to a secondary treatment in order to be cleaned up.

The aim of the primary treatments is to prepare sewage for the subsequent organic or secondary treatment; it eliminates certain pollutants and reduces the variation of volume and concentration of water which goes to purification plant; it is based on the use of physical or physical-chemical treatments. The secondary treatments are more usual because they offer better results in wine waste, since the bacteria and other microorganisms destroy and metabolize the organic, soluble and colloidal material.

While the physical-chemical treatments have a cost of high reagent, the organic aero bios systems are great consumers of energy which is needed in the process of addition of main reagent (oxygen) that organisms need in order to digest the material.

Significant information to know is the cost of the treatment system of purification. After the waste has been purified until getting the limits which are allowed by the legislation, it is possible to play with a degree of water sanitation which can be greater or lesser. We have to take in account that to more purification, the cost of the treatment will be greater, but as an advantage, the sanitation canon, which is fertilized, will be inferior. In as much clean the water is, lesser the cost of the canon, which is to fertilize, will be. Therefore, we must find the ideal point of purification in order that global costs (cost of treatment plus waste canon) are as low as possible.

In France, we can estimate, in general terms, that each litre of wine produces a pollutant load between 8 and 12 g of DBO_5 and the national level of wine effluents are equal to 10 millions of population. In addition, they indicate that the organic load of the waste is fundamentally composed of ethylic alcohol (ethyl alcohol), getting to exceed a 80% of the total of soluble DQO. For example, The Water Police Station of the Hydrographical Federation of the Guadalquivir estimates that the specific pollutant loads which are produced by these wineries are over 2,5 kg of DBO_5 per m^3 of wine during the wine process and other 1,8 kg in the aging and bottling.   These ratios in relation to solids in suspension suppose 0,75 and 1,6 kg per m^3

of wine in every one of the stages. Moreover, the sewage of red wines elaboration have the disadvantage of presenting a content in polyphenol until five times greater than the content of white wines, what make difficult its treatment by organic via.

As we have said previously, there is a great variety of available systems in order to purify this sewage which goes from a minimum pre-treatment to a complete treatment including its reuse of the same industry or irrigation of vineyard. The adoption of a particular method or the combination of several methods, in order to get the efficiency which is wanted, will depend on the particular conditions of each winery, among them we can name its size, availability of territory, localization, possibility of spill to sewage system, demands of spill, water cost, canon of spill, etc.

The alternative of reuse the spill as water of irrigation in the own vineyard after its treatment, is applied in those areas which are allowed. The disadvantage of this practice is the big necessary areas, the possible generation of bad smells and the irrigations of pollution of subterranean water. On the contrary, it has as advantages that the nutrients cycle is not closed, the spill is not produced and it is a weak method of purification.

5. Sanitation fees analysis

The growth environmental raising-awareness of society since in the middle of twenty century and the existence of international agreements binding on material of pollution have determined the apparition of environmental public politics, which have been modified throughout the years in order to improve its effectiveness, efficiency and viability. The named environmental, ecologic or green imposition has played a growth role within environmental corrector politics in the developed world. It is fundamentally because in relation to other alternatives of environmental politics, it allows to introduce a cost for the pollution as a mechanism to guarantee flexibility and efficiency in the achievement of environmental objectives. The environmental taxes emulate, in this way, the performance of market, but precisely in order to correct its mistakes when it makes all the different agents (producers and consumers) to consider the environmental resources as lacking and with economic value (Labandeira, 2010).

The environmental normative has contributed in the last years to the industry in general, and the food and agriculture industry in particular, to adopt politics of reduction in the consumption of water, as much in the own productive process as cleaning tasks. At the same time, it pretends to foment the minimization of the polluting load in the spills of sewage that the food and agriculture industry and others carry out. The last aim is clear: achieving that the level of economic, social and environmental resources does not decrease throughout the time, neither in quality nor quantity, and in addition, be distributed in an equitable way among the population.

The environmental imposition is defined within environmental corrector politics, that is, those which hope to tackle the problem of environmental externality from the public intervention. So, the price for contaminating, that is implemented in the environmental tax, achieves that all the polluting agents equalize its marginal cost of reduction among them, since it is preferred to decontaminate instead of paying the tax, on condition that the costs associated to the necessary innovation for decontaminating, reusing or recycling are under the total cost that is established by the fee. In this way, by means of the increase of tax efficacy, will be achieved the reduction of the cost of the environmental politics, at the same time that it promotes the technologic development with the aim of reducing the pollution; it is known as dynamic efficiency (Labandeira, 2010).

The aim of this paper is to show the need to optimize and harmonize the regulation tax levied on water pollution, in order to encourage the proper management of water and reducing the negative externalities associated to discharge. It involves studying the effect this environmental tax legislation has on water pollution, that is, if incentives to polluters to reduce pollution discharges and debug before leaving the plant, or on the contrary are merely tax collection . To assess the economic impact of environmental taxes, specifically sanitation canons, we have focused on agribusiness industry and within the winemaking industry. Analyze specific cases of production of wines with Designation of Origin in Spain, France, Italy, Portugal and Germany by applying the sanitation tax calculation to winery effluents.

Sanitation fee is the tax of local or regional competence, although in some cases, it is controlled by the government and it is the same for all the regions (case of Germany). But we will see that in most of cases this tax is of regional competence and it differ in an important way from a region to another, such as the cases of Spain, Italy, Portugal and France.

Generally, the structure of the tariff of the canon has two terms. The first term is its fixed cost, independently of the spill volume, and the second is a variable term which depends on the sewage volume that is spilt and on its level of pollution, that is, the polluting load.

Therefore, in the practice, the calculation of the fee to pay will be the result of multiplying the polluting load of the spill, which is expressed in units of pollution, times the value that is ascribed to the unit. In this way, the taxable base is expressed in units of pollution and tax type in Euros by unit of pollution.

$$I = V \cdot PUCV$$

Being:

I = Amount of canon of spills control.

V = Spill volume.

P_{UCV} = Unit price of spill control.

Table 4

Region/Country	Tax base of sanitation fee	Observations
Aquitania France	$ST_{Aquitania}$(€/year) = [(BOD·0,149) + (COD·0,074) + (SS·0,119)+ (P·0,4)]·Q_w	
Rhin Germany	ST_{Rhin} (€/year) = [SE_{COD} + SE_N + SE_P]·35,79 $SE_{COD} = \frac{COD \cdot Qw}{50}$ $SE_N = \frac{N \cdot Qw}{25}$ $SE_P = \frac{P \cdot Qw}{3}$	SE: pollutant units CC: price per pollutant unit - 35,79€
Florencia Italy	$ST_{Florencia}$ (€/year) = FC + (FT + DT)·Q_w + I_{COD} + I_{SS} + I_N + I_P FC (€/year) = 15000 FT (€/m^3) = 0.18; DT (€/m^3) = 0.33 I_{SS} =0.35·(SS-0.2)·Q_w I_N =2.5·(N-0.03)·Q_w I_P =3.5·(P-0.01)·Q_w I_{COD} = 0.35·C_{COD}·(COD-0.5)·Q_w	FT: sewer tariff DT: depuration tariff I_{COD}, I_{SS}, I_N, I_P are pollution coefficients applied if: S>0.20 (kg/m^3) N>0.03 (kg/m^3) P>0.01 (kg/m^3) COD>0.5 (kg/m^3) C_{COD}: COD coefficient function of COD and BOD
Oporto Portugal	ST_{Oporto} (€/year) = [a_i + (b_i·SS) + (c_i·MO) + (d_i·SIT)]·Q_w MO (kg/m^3) = [(2·BOD) + COD]/3 SIT (kg/m^3) = [(MP·5) + (As·1000) + (CN·50) + (FEN·1,25) + (HC·1)]	a_i: constant relative to flow, €/m^3 b_i: constant relative to total suspended solids, €/kg c_i: constant relative total oxidize materials, €/kg d_i: constant relative to inhibitory substance, €/kg
La Rioja Spain	ST_{Rioja} (€/year) = 0,35·CC·Q_w CC = 0,276·SS/0,22 + 0,458·COD/0,5 + 0,266·C/0,0024	CC_{min} = 0,35

Source: personal compilation based on the Legislation of each region/country.

In order to characterize the pollution of spill water, we use different parameters, such as the chemical demand of oxygen (DQO), the presence of solids in suspension (SS), the conductivity (C), the biological demand of oxygen (DBO), the concentration of nutrients, mainly nitrogen (N) and phosphor (P), heavy metals (MP), inhibitory substances (IS) and the difference of temperature(ΔT).

In the following table, we can see what parameters are considered on the calculation of the tax in each one of the selected regions for the study. In this way, for example, the chemical demand of oxygen is considered in all regions, while the conductivity only appears in the calculation of the Spanish tax. The second parameter more considered is the solids in suspension that is calculated in all cases except in the case of Germany. We have to mention the case of France, since in the calculation of the tax to pay can consider any parameter because they multiply the unit cost expressed in kilos times the annual total cost. Therefore, the taxi s very flexible and can be adapted to all types of industries in the Aquitaine region, France.

In short, the consideration or no-consideration of any parameter in the calculation of the tax to pay will be determined by the concentration and characteristics of the industries located in the area. In this way, a region which is a bit industrialised or whose industry is a bit polluting, will be included in its calculation only the parameters more representative. On the contrary, in more industrialised areas, the parameters will be more considered and more specific in order to carry out the principle of “who contaminates, pay”.

Table 5

Country, region	**Pollution parameters**					
	COD	**N**	**P**	**C**	**BOD**	**SS**
France, Aquitania	x	x	x		x	x
Germany, Rhin	x	x	x			
Italy, Florencia	x	x	x		x	x
Portugal, Oporto	x				x	x
Spain, Rioja	x			x		x

Source: personal compilation based on the Legislation of each region/country.

Establishing the spilt type of a winery is difficult because each wine region try to quantify theirs. Although, at the time to analyze the spills, we find pollution rang which are very broad, being in general spills with a high organic load but not too much toxic.

In order to realise a comparison between the sanitation canons of the different regions, we have taken average values of the pollution parameter of sewage which are produced in wineries.

Next, in the table 6, we can see the values of sewage parameter of wineries and the highest parameters which are allowed in the spill to cannel according to the Regulation of Hydraulic Public Territory. These last parameters are taken as a reference for the calculation of the fee to pay, since all wineries, independently of its localization and water pollution, will have to adjust the quality of water which is spill to the legal specifications. In order to analyse them, they will have to submit their spills to a pre-treatment.

Table 6

Parameter	**Physicochemical parameters of wastewater from a winery (average values)**	**Discharge to channel (RDPH)**
Suspended solids (mg/l)	1.800	80
BOD_5 (mg/l)	4.500	40
COD (mg/l)	7.000	160
Nitrogen (mg/l)	80	10
Phosphate (mg/l)	35	10

Source: Public Water Regulation, article 849/1986 and datum from LIFE SINERGIA project.

The objective of any treatment is to eliminate the polluting, irritating or with negative effects compounds for the environment. Each winery, knowing the pollutants of spills and the total volume of water, will determinate the quantity of pollution which is produced by the winery with which it can design or impose a purification system according to its needs. It is not enough to start from the consumption of water; it is essential doing an exhaustive study of spills. The previous levelling down of industrial sewage is, in general, inevitable in order to achieve a stable process and ideal measuring of units.

The sewage of wineries, in order to be cleaned up, will be submitted firstly to a primary treatment and secondly to a secondary treatment. The aim of primary treatments is to prepare sewage for the next treatment; it eliminates certain pollutants and reduces the variations of cannel and concentration of water which goes to purification plant. They are based on the use of physical or physic-chemical treatments. The secondary treatment more usual, because of the fact that they are which offer the best results in the wine-spills, are the organic systems in which bacteria and other microorganisms destroy and metabolize the organic, soluble and colloidal material (LIFE SYNERGY, 2012).

While the physic-chemical treatment has a high cost, the biologic aerobes are big consumers of energy, which is necessary in the adding process of the principal reagent (oxygen) which is need by organisms in order to digest the material. According to the studies realised by I. Román and J.Sánchez, the average cost of depuration of spill water is 0,36€/ m^3. Therefore, all the wineries will have to assume this average cost per each m^3 of polluted water in order to spill it in a public channel.

The production of a winery varies drastically from an area to other one. The factors like climate, localization, water supply, type of cultivation, quality of the product and its demand can determinate the volume of the production. Taking in account all these factors, we have taken an average production of 130.000.000 litres of wine each season. This, taking in account the ratio 1-1,5 that we have defined in the previous part, produces an average effluent of 195.000.000 litres of water. Therefore, independently of the location of the winery, the wine industry will support an average cost of 70.200€, treating it's wastewaters with biological treatment. To this, the cost to pay by the corresponding sanitation tax will have to be added. The addition of these amounts will be the cost which a winery, located in the regions considered in this study with a similar production to the production chosen as a reference, will have to pay by average term.

As we can see in the table 7, the cost to support for each winery varies a lot among regions. The greatest amount is paid by wineries located in the region of Florence, Italy, followed by the winery of Portugal in the region of Oporto. The lesser amount is paid in Aquitaine, France. As we have commented before, this can be due to the flexibility of the French fee which have price per kilogram for each pollutant. In that case, they do not contain very toxic pollutants, so the price is very low and it can be adapted to any type of industry.

Table 7

Country, region	Average cost of pre-treatment, €	Amount payable for sanitation fees	Total discharge cost
France, Aquitania	70.200	6.107,40	76.307,40
Germany, Rhin	70.200	48.388,08	118.588,08
Italy, Florencia	70.200	114.450,00	184.650,00
Portugal, Oporto	70.200	110.763,90	180.963,90
Spain, Rioja	70.200	16.852,54	87.052,54

Source: personal compilation

The average value of the fee to pay by the sanitation canon is 59.312,38€. Three regions are under the average value and two of them exceed it. The regions of Spain, France and Germany pay under the average because they spill the sewage to a public channel. The region of Rhine in Germany is what more approximate is to average value to pay. The regions that are studied as the case of Italy and Portugal support a fee of sanitation which is over the average, it is practically the double.

Therefore, according to the information obtained in this study, a winery will have to realise an exhaustive study of its spills, since it supposes a high cost throughout the economic activity. In the case of Portuguese and Italian wineries, they will have to manage their effluents in an efficient way in order to not affect this cost on their final product and to be competitive in the international markets.

6. Conclusion

The water is the essential compound in the wine production in anywhere of the world. Its importance, high cost and the growth demand of respectful products with the environment oblige to entrepreneurs to take important decisions which affect the productive process. A winery can save water and costs associated to the same through:

- Reduction of water consumption. This action can be difficult to realise in some regions, since as we have seen previously, according to previous studies, some wineries consume even 2,5 litres of water in order to produce a litre of wine.
- Efficient management of water. Treatment, recycling, and its subsequent use in the winery save costs, avoid pollution and minimize the quantity of waste.

The efficiency in the management has environmental and economic benefit. In order to increase the benefit, a company -in our case, wineries- has the option of increasing or reducing the costs. The water cost is a cost which we have to take in account, since with the change of normative of spills, the total amount to pay will be the addition of costs of water consumed and spilt water. As we could prove in this study that the pre-treatment and spill to the public channel suppose a high cost in some regions.

Therefore, it is very important that a company knows the cost of the purification system in order to play with a greater or lesser sanitation of water after reaching the limits which are allowed by the legislation. We must look for an ideal point in order that the costs are the lowest as it is possible, in order to be competitive in the international market.

7. Nomenclature

ΔT	temperature difference (°C)
BOD	biological oxygen demand (kg/m3)
C	conductivity (µS/cm)
COD	chemical oxygen demand (kg/m3)
CC	consumption cost (€/m3)
FC	fixed cost (€/year)
N	total nitrogen (kg/m3)
P	total phosphorus (kg/m3)
Qw	wastewater volume per year (m3/year)
SS	suspended solids (kg/m3)
ST	sanitary tax (€/year)
WWTP	wastewater treatment plant

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