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CALCULATION OF CARBON PRINT IN THE WINE INDUSTRY: THE STUDY CASE OF FRANALCO S.A. WINE CELLAR - PRODUCTION OF BOTTLED AND BULK WINE

IZRAČUNAVANJE KARBONSKOG OTISKA U INDUSTRIJI VINA: STUDIJA SLUČAJA NA PIMERU VINSKOG BUNARA FRANALCO S.A. - PROIZVODNJA FLAŠIRANOG VINA I VINA U RINFUZI

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Abstract:
The aim of this research is to calculate the Carbon Print (CP) of the production of bulk and bottled wine of FRANALCO wine cellar. Another objective is to design an innovative tool in the environmental management of the examined company and the companies related to it in the value chain, forward (customers) and backward (suppliers), as well as the rest of the indirectly related service companies (cluster).

Key words:
carbon print (CP), wine industry, corporate social responsibility (CSR).

Apstrakt:
Svrha ovog istraživanja jeste da se izračuna karbonski otisak u proizvodnji rinfuznog i flaširanog vina u vinskom podrumu FRANALCO. Takođe, rad nastoji da kreira inovativna sredstva za kontrolu ambijentalnih uslova u pomenutom preduzeću kao i predeuzećima sa kojima je direktno povezan u lancu vrednosti, klijentima i dobavljačima, kao i ostalim uslužnim preduzećima koji su indirektno uključeni u sam proces.

Ključne reči:
karbonski otisak, industrija vina, korporativna društvena odgovornost.

1. INTRODUCTION

1.1 CLIMATE CHANGE, A CURRENT INCREASING PROBLEM

Atmospheric global warming is one of the major environmental issues on a global scale. Currently, there is strong evidence that the rising of the mean global temperature over the last 150 years is a consequence of the rising atmospheric Greenhouse Gases (GG) concentration.

The Greenhouse effect is a natural process by which the GG in the atmosphere "trap" part of the radiation that reaches the Earth, thus softening thermal daily and nightly oscillations and rising of the average temperature, which creates the environmental conditions for the proper balance in the Earth's ecosystem.

The problem arises when human activities generate a substantial increase of the GG that trap the rising quantities of radiation and produce an increase of the Earth's average temperature that breaks the ecosystem balance.

Many human activities provide GG, and one of the most important is industry. The solution to this problem has two perspectives: responsibility of public policies and responsibility of private ones. As regards public policies, the United Nations deal with the problem through the UNFCCC, United Nations Framework Convention on Climate Change, and/ or the UNESCO, with the Man and the Biosphere Pogramme (MAB)[1]. Countries adhere to these policies and contextualize their particular situations by formulating national public policies with ad-hoc bodies.

1 MAB: Man and Biosphere Program. It has the Biosphere reserves as instruments.

From the private sphere, companies must recognize their impact on the environment, measure its magnitude and choose the cleanest production policies on the basis of impact mitigation and/ or compensation. In other words, they take over their externalities with the environment and avoid the fact that society as a whole pays for them by developing the Corporate Social Responsibility (CSR) policy based on their concrete practice.

The context of the private sector gives rise to the main objectives of this research: to calculate the Carbon Print (CP) of the production of bottled and bulk wine in FRANALCO wine cellar and propose mitigation and /or compensation policies. Bearing this in mind, a calculation tool was designed that can also be applied to other related companies. The paper proposes a model of environmental management of the company under this study and the companies related in the value chain, forward (customers) and backwards (suppliers), as well as the rest of indirectly related service companies (cluster).

1.2. CARBON PRINT

The concern for climate change has encouraged the development of environmental evaluation metrics in different areas. One of the accounting and environmental report tools is the Carbon Print (CP), which refers to the totality of Greenhouse Gases (GG) release by director indirect effect of an individual, organization, event or product. The GG considered are those defined by the United Nations in the Kyoto Protocol: CO2, CH4, N2O, HFC, PFC, SF6 and the total amount is expressed in equivalent mass units of carbon dioxide (tCO2-e).

This tool has become important as an indicator of sustainability during the last years, partly due to the simplicity of its report and the possibility of making comparisons in time and

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among products of the same category. The calculation of the CP constitutes a starting point for the comprehension and analysis of a particular situation which allows the responsible bodies to implement concrete improvement measures such as energetic efficiency, operational efficiency, the use of renewable energies, among others[2]. The generalization is that the reductions of CP imply, in turn, cost reductions and, in many occasions, they outweigh the efforts and investments. To summarise, the CP is a new business variable which enriches the comprehension of the activity and allows improvements in costs and image.

2. METHODOLOGY

Accounting and report methodology: The estimation of the Carbon Print is based on the methodology of "Green House Gas Protocol" (GHG Protocol). The GHG Protocol is the result of an initiative driven by NGOs, governments, the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Such initiative was launched in 1998 with the aim of developing internationally accepted standards of Greenhouse Gases accountability and report for institutions and promotion of its worldwide adoption.

The first edition of the GHG Protocol is a corporate standard of accounting and report published in September 2001, which was widely accepted around the world by companies, NGOs and governments. The revised edition, which is used in this work, is the result of a two- year dialogue among the participants of the initiative aimed at building on the experience gained from the use of its first edition.

In 2006, International Organization for Standardization (ISO) adopted the GHG Protocol as a basis of its certification *ISO 14064-1, Specifications and guidelines at organizational level for the quantification and presentation of gases emission and absorption reports.*This event positioned the GHG Protocol as the international standard for the corporate accounting of GG. The methodology provides a step-by-step guidance for any organization to quantify and report its GG emissions. The results of the CP are reported as CO2-e (CO2 equivalent) using the indexes of global warming potential for different GG (Appendix1).

Three scopes: The GHG Protocol divides the emissions into three origins: the first scope (scope 1) measures the emissions that the company produces for its productive process and they are called "direct". The second scope (or scope 2) measures the indirect emissions coming from the consumption of electric energy acquired from third parties. The third scope (or scope 3) are also indirect emissions, but referred to the materials required in the process.

Five principles: The GHG Protocol proposes 5 principles to govern the quantification: Relevance, Integrity, Consistence, Transparency and Precision. These principles try to strengthen all the aspects of the accounting and report of GG. Their application guarantees that the GG inventory provides an impartial and reliable representation of the company's emissions.

Period of report: The Carbon Print is an estimation of the GG emissions during a calendar year of an organization. For the purpose of this work, the year 2013. was established as the basis for calculation.

Operational and organizational limits:There are two different approaches aimed at establishing the limits of the inventory and consolidating the GG emissions: that of shareholding and the control approaches (financial and/ or operational control). The companies account and report GG consolidated data, either as a shareholding participation or through the control exercised over particular operations. For the present study, the CP of Franalco wine cellars will be calculated for their activity at farms and the production of shuttle and bottled wine based on the criterion of control over the operations.

Exclusions: The present calculation of the Carbon Print excludes the emissions generated by the champaign production, which is another production of the company.

Primary data collection: Open interviews to the manager of the company were carried out, which provided the information required for the calculation of the CP of the electric consumption, established in scope 2, volumes of grape and wine production, harvesting and hauling, *etc.*

Assumptions: Some data were taken from similar research works, such as the bottles CP: four different values were identified from three studies of the calculation of the carbon footprint in wine. Different calculations were carried out since the values differ among themselves.

3. DESCRIPTION OF FRANALCO S.A. WINE CELLAR

3.1 THE COMPANY

FRANALCO S.A. has been devoted to the production of wine in San Juan province since 1973. It is a family company with its administration and a wine cellar/ premises located in RN N° 40, N° 4000. It has the capacity to produce 5 million liters. The grapes are provided by their own vineyards. It has

150 hectares of vineyards distributed in two farms in Sarmiento and Angaco departments, respectively. The grapes varieties produced by their vineyards are Syrah, Cabernet Sauvignon, Malbec and Bonarda. With reference to white grapes, it is fair to say that Chardonnay and Torrontésare are the most distinguished types.

FRANALCO S.A. has been the first wine cellar in San Juan and one of the first in Argentina to obtain the International Standardization Organization (I.S.O.), the ISO certificate with respect to "Elaboration, Sale and customer service of fine wine." The certification process started in April 2000, achieving the certification in May, 2001, and ISO 9001 Version 2000 in 2004.

The company also boasts 48 permanent employees and, during the harvest and elaboration periods, the figure rises to 30 more for two months (approximately 1200 wages). Currently, the company is venturing the production of champaign, and, for this purpose, it has expanded the plant to install the new equipment and machinery.

4. IDENTIFICATION AND CALCULATION OF GG EMISSIONS

4.1 SELECTION OF RELEVANT FACTOR EMISSION AND TOOLS FOR CALCULATION

Below are presented the sources of emission. They are divided into stages: farm, wine-making and storage, fractioning, loading and transfer[3]and retail distribution.

2 The extension of the CP calculation beyond the boundaries of the organization opens a valuable space to work with customers and suppliers, which allow a better understanding of the risks and opportunities of the business in light of climate change; it opens new spaces for improvement and allows the re-enforcement of relations among these important actors. The reductions of the CP are often shared with suppliers and/ or customers achieving a better integration among the participants of the product cycle.

3 Transfer (Trasladista): it is the name given to wine cellars that make wine or must and do not have a brand and do not bottle, they sell in bulk to other, generally bigger, wine cellars which have distribution channels, brand, bottling, *etc.*

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FARM: For the typical agricultural activities in the company farms, tractors are used and, as there is no exact record of the hours assigned per hectare, the INTA guide for wine grapes cultivation has been used. An average of 41 hours per hectare a year with 4 liters of gas oil per hour of work is estimated. In total, , a consumption of 24.600 liters of gas oil is estimated for 150 hectares of farm.

$$Qof\ KgCO2 = 2.77\frac{kgCO2}{lts}.6150\ h.4\frac{lts}{h}$$

$$Qof\ kgCO2 = 68.142\ kgCO2$$

As regards irrigation, farms have irrigation rights and they do not need electrical wells for water extraction. They do not generate CO2 for this activity. The grape production activity generates a seizure of 0.3 kg of CO2 per kg produced. The total seizure of CO2 is 900 mil kg for the three million kg grapes produced in the farms.

HARVESTING AND HAULING: Another activity carried out at the farm is harvesting and hauling, which consumes 4.900 lts of gas oil including the transfer of the grapes from the farm to the wine cellar.

a. Distance: Transport from each farm to the wine cellar. The distance from the farm to the wine cellar is 50 km.
b. Volume per truck: the average transported per truck is 12 thousand kg.
c. Oil consumption: 4 km per liter. Another proposed value is: 0,235 kgCO_2 x tn x km for loaded trucks.
d. Number of travels: The company transfers 2.250.000 kg which imply 180 travels with an average of 12 thousand kg per travel.
e. Total km travelled: 150 travels x 50 km/travel x 2 (return) = 15.000 km
f. The total oil consumed in transportation is:

$$Q\,KgCO2 = 0.235kgCO2.Tn.Km + 2.77\frac{kgCO2}{lts}.\frac{x\,km}{\frac{4km}{lts}}$$

$$QkgCO2 = 0{,}235kgCO2 * 2250tn * 50km + \left(\frac{50km}{4km/l}\right) * 190\,travels * 2{,}77kgCO2/lts$$

WINE MAKING AND STORAGE: this is the stage of wine production and physical and chemical processes. Engines are used to set the wineries to work, the milling machinery and the pressing equipment use electricity acquired from the local distribution company. Fermentation takes place in the wine cellars and uses electricity to keep the temperature, clarification and percolation is also carried out with electrical equipment. This stage ends with the first storage, which is necessary for wine production

FRACTIONING: In this stage, the machinery works with electricity acquired from the local distribution company. This activity is the one that needs the highest number of inputs produced by other companies: glass containers, cork, labels, caps, back label, cartons, cardboard partitions, pallets and electricity. The amount of wine that is bottled is 800.000 lts. This volume is bottled in 1.000.000 bottles of 750 ml. The 50 thousand- liter waste is lost in the bottling process.

LOAD AND RETAIL DISTRIBUTION: The volume of wine that is sold in bulk is 1.000.000 lts and has different destinations: 65% of this amount is transported to Mendoza, which implies 22 travels to this city, and this wine is all red wine.Such wine is sold to wine cellars that pack the wine in bottles or tetrabrik, identify them with a brand and distribute and commercialize them. The distance of each travel is 360 km. The remaining 35% is all white wine which is sold to a company that uses it to incorporate it to other beverages.The destination of this production is Buenos Aires City (Ciudad Autónoma de Buenos Aires) which implies 12 travels with one- way distances of 1110 km (we consider the return travel of 2220 km). The consumption calculation formula is:

to Buenos Aires:

$$QofKgCO2 = 0.235kgCO2 * 0.35 * 1\ m\ de\ lt * 0.794\frac{kg}{lt} * 1110Km$$

to Mendoza:

$$QofKgCO2 = 0.235kgCO2 * 0.65 * 1\ m\ de\ lt * 0.794\frac{kg}{lt} * 360\ Km$$

5. RESULTS OF THE CALCULATION OF THE CARBON PRINT

The wine cellar produces 1,8 million liters and generates 2.090 tn of CO2 in total. On average, it generates 1.16 kg CO2 per liter, but this average hides a great variability between bottled and bulk wine, which is described in Tables 2 and 3.

From the total wine produced, 1 million liters are sold in bulk, which generates 361 tn of CO2 and corresponds to 17.2 % of the total emissions and 55 % of the total wine. They generate 0.36 kg of CO2 of GG per liter.

The remaining 0,8 million liters is fractioned in glass bottles (in the process 50 thousand liters are lost and 1 million bottles of0.75 cc are finally bottled). This activity generates 1729 tn of CO2 and corresponds to 82% of the total emissions. They generate 2,16 kg of CO2 per liter and 1,73 kg of CO2 per bottle of 0,75 cc.

By analyzing the results obtained from the division as a productive process, it is observed that the grape production in the farm only generates 4% of the GG, wine- making and storage 17%, fractioning 48% and distribution the remaining 31%.

6. CONCLUSIONS

The scope with the greatest CP impact is Scope 3 both for the total produced with 78.9% of the emissions and for the packing disaggregation with 89% of the emissions. When the bulk wine production is analyzed, Scope 2 has the greatest impact with 56% of the emissions.

For the bottled wine production, Scope 3 has the greatest impact and, within this, the component with the greatest impact is transport, both retail and glass bottles transport.

When analyzed per liter of wine, a value of 1.16 kg of CO2 per liter is obtained and when disaggregated per bottle of wine 1.73 kg of CO2 is obtained. These values are similar to those obtained in other CP calculations for the wine industry: for instance, the total emissions generated in Chile by a bottle of wine of 750cc in the wine cellar is 1,67 Kilos of CO2. In Spain, the wine QubélRevelación 2009 (D.O. Vinos de Madrid) generates 1.6 kg of CO2 per bottle. New Zealand differs with a CP calculation of 0,840 kg of CO2 for a bottle of the wine Mobious Marlborough, which was the first one to declare its CP on the label in the national market.

Finally the company currently counts with an impact measurement of their activity on global warming. This knowledge allows the company to:

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SCOPES	TOTAL CP generation/CO2 emission	% of Participation of the emission source in the total emission	kg CO2 per liter
SCOPE 1	78.530	3,76	0,04
SCOPE 2	362.395	17,34	0,20
SCOPE 3	1.649.600	78,91	0,92
SCOPES 1 + 2	440.925	21,09	0,24
SCOPES 1 + 2 + 3	2.090.525	100,00	1,16

Table 1. Total CO2 disaggregated by the scope of the sources of emission of the total production.

SCOPES	TOTAL CP generation/CO2 emission	% of Participation of the emission source in the total emission	kg CO2 per liter
SCOPE 1	43.628	12%	0,04
SCOPE 2	201.331	56%	0,20
SCOPE 3	116.152	32%	0,12
SCOPES 1 + 2	244.958	68%	0,24
SCOPES 1 + 2 + 3	361.110	100%	0,36

Table 2. CO2 disaggregated by the scope of the sources of emission of the bulk production.

SCOPES	**TOTAL CP generation/ CO2 emission**	**% of Participation of the emission source in the total emission**	**kg CO2 per liter**	**kg CO2 per bottle**
SCOPE 1	34.902	2%	0,04	0,03
SCOPE 2	161.064	9%	0,20	0,16
SCOPE 3	1.533.448	89%	1,92	1,53
SCOPES 1 + 2	195.966	11%	0,24	0,20
SCOPES 1 + 2 + 3	1.729.415	100%	2,16	1,73

Table 3. CO2 disaggregated by the scope of the sources of emission of the bottled liter of wine and the bottle of 0.75 cc.

	sub totals of kgCO2	% subtotals wine cellar
I. FARM	78.530	4%
II. WINE CELLAR, WINE- MAKING AND STORAGE	362.320	17%
III. WINE CELLAR FRACTIONING	1.002.922	48%
IV. LOAD AND TRANSFER AND RETAIL DISTRIBUTION	646.753	31%

Table 4. GG generation according to the productive process

- Design different reduction and/or compensation of emissions policies;
- Identify the activities with the greatest CP impact and analyze their reduction possibilities;
- Use the CP as an indicator of efficiency by comparing the values obtained with other calculations from other wine cellars;
- Get ahead to future regulations that are currently being implemented in European countries, imposing this criterion for the commercialization of products;
- Use the CP as a product differentiator that empowers the brand image, adds value to the product and offers competitive advantages to reach new markets.

APPENDIX 1

HGs occur naturally in the Earth's atmosphere, but human activities, such as the burning of fossil fuels, are increasing the levels of GHGs in the atmosphere, causing global warming and climate change. The Kyoto Protocol is an international treaty for controlling the release of GHGs from human activities, and the GHGs controlled under the treaty are shown in Table 1 below. Often these GHGs are referred to as the "Kyoto gases".

Carbon dioxide (CO2)= 1	*1 kg de CO2 = 1 kg de CO2*
Methane (CH4) = 25	*1kg de CH4= 25 kg de CO2*
Nitrous oxide(N2O)= 298	*1kg de N2O= 298 kg de CO2*
Hydrofluorocarbons (HFCs)= 124 – 14.800	*1kg de HFCs= 14800 kg de CO2*
Perfluorocarbons (PFCs)= 7.390 – 12.200	*1kg de PFCs= 12200 kg de CO2*
Sulfur hexafluoride (SF6)= 22.800	*1kg de SF6= 22.800 kg de CO2*
Nitrogen trifluoride (NF3)= 17.200	*1kg de NF3= 17200 kg de CO2*

Table 5. Kyoto Gases (IPCC 20071). Greenhouse Gas Global Warming Potential

Source: http://ecometrica.com/white-papers/greenhouse-gases-co2-co2e-and-carbon-what-do-all-these-terms-mean

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BIBLIOGRAPHY

Abraham, L., & Alturria, L. (2013). Propuesta para el cálculo de huella de carbono en el cultivo de vid en Mendoza. Retrieved March 10, 2015, from http://www.observatoriova.com/2014/02/propuesta-para-el-calculo-de-huella-de-carbono-en-el-cultivo-de-vid-en-la-provincia-de-mendoza-argentina-2013/

Cerda, A.A., García, L.Y., Ilufi, N.A., & Opazo, V.A. (2010). Huella de Carbono en la Industria Vitivinícola Chilena, CarbonFootPrint in theChileanWineIndustry. *Revista Interamericana de ambiente y turismo*, 6(1), 9-27.

Civit, B. Arena, P., Curadelli, S., & Piastrellini, R. (2012). Huella de carbono y huella hídrica de un viñedo considerando distintos sistemas de riego en Mendoza, Argentina. Retrieved March 10, 2015, from http://www.observatoriova.com/wp-content/uploads/2013/10/CIVIT-ev14huel-1.pdf

Comisión Económica Para América Latina y el Caribe – CEPAL. (2009). Economía del cambio climático en Chile: Síntesis. Colección. Retrieved March 10, 2015, from http://www.eclac.cl/publicaciones/xml/8/37858/W288.pdf

Comisión Económica Para América Latina y el Caribe – CEPAL. (2010). Plan Estratégico Alimentario y Agroindustrial 2016-2020. Retrieved March 10, 2015, from http://www.cepal.org/ddpe/noticias/noticias/4/45184/3_daniel_papotto.pdf

Cuadrat, S. (2011). *Huella de carbono en la industria vitivinícola*. Retrieved March 10, 2015, from http://api.eoi.es/api_v1_dev.php/fedora/asset/eoi:67287/componente67285.pdf

Ecometrica. (2012). Greenhouse Gases, CO2, CO2e, and Carbon: What Do All These Terms Mean?

Retrieved March 10, 2015, from http://ecometrica.com/white-papers/greenhouse-gases-co2-co2e-and-carbon-what-do-all-these-terms-mean

Greenhouse Gas Protocol. (2015). *About the GHG Protocol* . Retrieved March 10, 2015, from http://www.ghgprotocol.org/about-ghgp

IPCC. (2006). *Guidelines for National Greenhouse Gas Inventories*. Retrieved March 10, 2015, from http://www.ipcc-nggip.iges.or.jp/public/2006gl/

Pepall, L., Richards, D. J., & Norman, G. (2008). *Industrial organization: Contemporary theory and empirical applications*. Malden, MA: Blackwell Pub.

Schneider, H., & Samaniego, J. (2009). *La huella del carbono en la producción, distribución y consumo de bienes y servicios*. Santiago de Chile: Comisión Económica Para América Latina y el Caribe, CEPAL.

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