Foundations for a framework for measuring SCM practices performance in the wine industry

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Abstract
In order for wineries to excel in a highly competitive industry it is necessary to identify and implement the best practices and strategies available. Therefore it is necessary to have a framework for proper benchmarking the performance of different practices and strategies. In this paper we present a framework for logistics benchmarking for the wine industry based on the previous work of García et al. (2012). As part of the benchmark framework analysis we will include control variables to isolate the effects of different variables such as the size of the firm, products portfolio, country's legislation system, among others. These control variables help to understand the effect of practices and strategies themselves. Further research will also include a comparative case study between Chilean wineries and the Argentinian wineries presented by García et al. (2012), validating the presented framework.

Keywords: Wine, Supply, Chain, Benchmarking, Framework, Performance.

1. Introduction
In a highly competitive industry, such as the wine industry, outperforming other companies is a complex task. Supply Chain Management (SCM) is a key factor to excel above other companies to achieve a world-class organizational effectiveness (Waters, 2010). The inefficiency of logistics has been identified as a major constraint to productivity and competitiveness for different countries and companies (Yildiz, 2014). Therefore the importance of adopting the best practices available in the industry. Different have been proposed since the late seventies (Estampe et al., 2013), but none has been proved to actually predict which are the best practices for every industry. Furthermore, different models will work better on different industries, but what has proven to be the best of the best predictor available are benchmarking frameworks (Estampe et al., 2013).

Given the importance of the wine industry, which can be measured by its size and its projected growth, it is crucial understand the effect of SCM in this industry. According to the IWSR (International Wine & Spirit Research, 2013) in 2011 the world consumption reached 24.11 billion litres of wine and, by 2016 this figure will reach 25.86 billion litres. Out of the somewhat more than 32 billion bottles consumed in 2011 around a quarter was imported (27%). Therefore, SCM takes an important role in the whole business. The imported wine sector continues to grow fast, at a rate of 7.82% compared to the 2.82% growth of the whole market in the period 2007-2011. Thus SCM's importance is expected to keep rising.

There is an increasing importance of the Southeast Asian market for the wine industry. In 2011 China surpassed US as the third largest red wine-consuming country, consuming a 61.5% of the world's spirits, growing in 74.31% within the 2007-2011 period (International Wine & Spirit Research, 2013).

According to most of the research in the wine SCM area, only around 37% of the companies have adopted a sustainable view on SCM due to competitive advantages. Most companies adopt this due to legal demands and/or legal regulation (51.8%, considering an overlap between the incentives) (Seuring, 2008). One cause for this non adoption could be in spite of it's well know relevance there is no consensus on how to measure and evaluate it, and therefore the management picks performance indicator in their convenience (Dos Santos, 2013).

On top of the difficulties explained before, different segments of the wine industry, ranging from table to super-premium, need special different logistics activities. Which is why it is important to segment the analysis. Dollet (2010)
studied the premium and super-premium segments proposing a multi-level supply chain (SC) network to reach the market meeting its customization needs. Cheap table wines SCM focuses mainly on transport cost reduction, competing as a commodity. Some research has been done in this area (Roy, 2010; Wen, 2010).

Over the past few years there has been an increase of coordination within a certain SC, and the wine industry has not been an exception (Ngai, 2011). Therefore coordination has gained importance to achieve competitiveness. Still, there are not enough mathematical tools to really measure who is doing it right, there is just the sense that this is happening (Wong & Wong, 2008). Some models for SC practices and policies for the wine industry have been proposed over the last couple of decades (Souza, 2002; Hansen, 2004; De Rossi, 2009; García et al., 2012; Kumar et al. 2013), but all of them fail to predict what is the actual outcome of implementing different practices and strategies. The main gap is that there are not many models that can allow to segregate the effect of the SCM versus the competitive and comparative advantages, and disadvantages (Estampe et al., 2012). The need to separate the effect of best practices and result by using the advantages a certain firm has can be illustrated by the fact that some of the “old world” companies that do not enjoy the perfect conditions (ie Germany) but do enjoy a competitive position (Hussain et al., 2008).

The rest of this article is organized as follows, first a brief description of the wine supply chain, then the benchmarking framework presented by García et al. (2012) is explained, after which improvements are proposed and finally some concluding remarks from this work.

2. Wine supply chain

According to Gigler et al. (2002) every SC can be divided into nodes or “actors” to model it as a network. The wine supply chain (WSC) is not an exception, and therefore can be modelled as an interacting network (figure 1). WSC can be divided into 11 actors (García et al. 2012).

1. Grape Owner
2. Raw Materials Supplier
3. Wine Producer
4. Filler/Packer
5. Freight Forwarder
6. Freight Operator
7. Importer
8. Finished Goods Distributor
9. Wholesaler
10. Retailer
11. Final Consumer

These actors play all the roles there can be in wine’s life cycle, it could include a waste disposal party after the final consumer, but this can also be included within this actor. It is believed that in years to come this will be an important actor within the SC (Srivastava, 2007).

![Figure 1: Wine supply chain, taken from García et al. (2012)](image-url)
3. Base Model

Several frameworks have been proposed to analyse the SC performance (Bigliardi & Bottani, 2014) and focusing on different areas, (ie sustainability (Seuring, 2008)). One of the most common is the SCOR model, but as many others it lacks the capability to directly contrast different organizations (Lepori, 2012). As stated before benchmarking frameworks have proved to be the best of the best tools to predict performance. For this framework we use García et al.'s (2012) as a base model.

The framework is based on Frazelle's (Frazelle, 2002) definition on two classification dimensions, performance attributes and logistics processes. The latter is subdivided into four categories, financial performance, productivity performance, quality performance, and cycle time performance. These were afterwards modified by Garcia et al. (2009) in a previous work for WSC, these are Quality, Timeliness, Logistics Cost, and Productivity and Capacity.

1. Quality: It measures both the process and product quality. A proxy for this can be customer’s satisfaction.
2. Timeliness: It measures the time of response of the SC to answer customer’s demands.
3. Logistics cost: Is basically the SC performance from a financial point of view.
4. Productivity and Capacity: It measures the resources usage efficiency.

![Figure 2: Logistic cycle](image)

These measurements are taken along all the logistics processes defined by (Frazelle, 2002), shown on figure 2. The metrics selected by the authors are:

1. Quality
   - Supplier performance index
   - Right quality grapes percentage
   - Production performance index
   - Inventory performance index
   - Warehousing performance index
   - Customer satisfaction index
   - Perfect order percentage
2. Timeliness
   - New demand response time
   - Total production cycle time
   - Delivery cycle time
   - Total logistics cycle time
3. Logistics costs
   - Total logistics cost
   - Total logistics cost contribution
4. Productivity and capacity
   - Resources utilization percentage

These are quantitatively measured according to the formulas on Appendix A.

4. Proposed improvements

The model falls short when trying to predict performance and compare companies with structural differences like the size, objective market, or local legislation. The variables selected to control the performance will be size, because bigger companies can take advantages of scale economies, having little to do with its politics on SCM (Pearcy & Giunipero, 2008). Another thing that does have some correlation with SCM, but it has no causality, is local legislation regarding R & D (Dutz et al., 2014). Therefore it has to be controlled. And finally the product portfolio, since there are big differences between wine markets (Dollet, 2010) they can be treated as different groups for the benchmarking analysis.

Another improvement is that since many frameworks fail to clearly present their results (Dos Santos, 2013), we propose to present the analysis results with a graphic technique based on a Cost Scatter Diagram (Pascual et al. 2009). The x axis of the diagram is the weighted average of the dimensions of García et al.'s framework (2012). The y axis
will be the average of the control variables size and local legislation, the other control variable (objective market) will be the dot's colour segregating the companies into categories depending on their products portfolio. And finally the companies’ performance will be sought using financial performance metrics (Frazelle, 2002). We hope to find a correlation to explain the performance regarding SCM, we will test both equations 1 and 2.

\[
\text{Performance} = \text{Control Variables} + \text{SCM}_{\text{Average}} \\
\ln(\text{Performance}) = \ln(\text{Control Variables}) + \ln(\text{SCM}_{\text{Average}})
\]

This graphic analysis will allow to easily compare companies’ policies and establish the sought best practices in the industry. The expected graph will like figure 3, it was generated with pseudo random data, considering positive correlations between variables. Each dot represents a different company, the size is its performance and the colour represents its objective market. The real data will be gathered by going through companies records and through a survey that will be sent to the companies, getting the data required to get the values for the equations on appendix A. The dot size represents the company’s performance, as stated before. Its value is the EBIT of the company, it does not include interest or taxes because they depend on the country the company is in and the capital structure the company has.

![Graph](image)

Figure 3: Reference graphic results using pseudo random data

## 5. Concluding remarks

In spite of being commonly acknowledged as an important topic by managers around the world SCM still has not been able to be measured properly. This has been tried by different models (SCOR, Balance Score Card and benchmarking analysis) without much luck. This has led to a number of performance indicators being invented, and the problem with this is that managers nowadays choose at their convenience how they are measured. Most of the models lack at making different companies’ positions comparable, which is why we propose to include control variables to deal with this situation. The result of this research is to propose a user friendly, easy to use, benchmarking tool that can be used by decision makers. Further research includes gathering data to prove the proposed correlations and adjusting properly the parameters, because the variables selected might not be the most suitable variables. Therefore we would need to look for more proxies to measure the proposed attributes.

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## 6. References


Appendix A

The performance indicators introduced on section 3 are calculated the same way proposed by García et al. (2012). And they are:

1. Quality
   - Supplier performance index
     \[ \sum \text{Number of perfect purchase orders/number of placed purchase orders} \] (3)
   - Right quality grapes percentage
     \[ \sum \text{Quantity of grapes of right quality obtained/total quantity of grapes obtained} \] (4)
   - Production performance index
     \[ \sum \text{Orders produced as planned without failures and rejections/total orders from customer} \] (5)
   - Inventory performance index
     \[ \sum \text{Lower level indicators performance/total number of lower level indicators} \] (6)
   - Warehousing performance index
     \[ \sum \text{Numbers of items received or put away or picked or shipped correctly and without damages/number of items manipulated} \] (7)
   - Customer satisfaction index
     \[ \sum [\sum \text{Quantity of perfect customer order}/\text{total orders entered for customer}] / \text{number of customers} \] (8)
   - Perfect order percentage
     \[ \sum \text{Quantity order without any problems/total orders} \] (9)

2. Timeliness
   - New demand response time
     \[ \sum [\text{Reception date-new demand confirmation date}]/\text{total number of new demands} \] (10)
   - Total production cycle time
     \[ \sum \text{Quality tasting cycle time + elaboration cycle time + aging cycle time + bottling cycle time/total number of order produced} \] (11)
   - Delivery cycle time
     \[ \sum [\text{Reception date by customer - order ready date in the Warehouse}]/\text{total number of delivered orders} \] (12)
   - Total logistics cycle time
     \[ \sum [\text{Reception date - transaction confirmation date}]/\text{total number of orders} \] (13)

3. Logistics costs
   - Total logistics cost
     \[ \text{Supply log. cost + production log. cost + inventory log. cost + warehouse log. cost + transportation log. cost + log. cost of returns from customers + customer response logistics cost} \] (14)
   - Total logistics cost contribution
     \[ \text{Total logistics cost/total operational cost} \] (15)

4. Productivity and capacity
   - Resources utilization percentage
     \[ \sum \text{Utilization % of resource i/number of resources} \] (16)

Finally, the SCM_Average, required as input on equations 1 and 2 equation 17 has to be used:

\[ \sum [\sum \text{Indicator performance}/N]/N \] (17)

Where the indicator performance value is the one calculated with equations 3 through 16, \(N_i\) stands for the number of indicators per attribute, and \(N\) is the number of attributes, which is four.

On the other hand to calculate the value of the control variables the attributes considered are taken from Dutz et al. (2014):

- Area Planted
  \[ \text{AP}=\text{Area planted (acres)}/\text{Max}\{\text{Area planted, (acres)}\} \] (18)
- GDP per capita
  \[ \text{GDPPC}\!=\text{Country’s GDP per capita in US$} \] (19)
- Physical capital investment
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PCI = Physical assets value / Max{ Physical assets value, }

- R&D efforts
  \[ RD_1 = \text{Company’s R&D investment/Budget} \] (21)
  \[ RD_2 = \text{Country’s R&D Investment/GDP} \] (22)

Finally the Control Variables (CV) value used as input for equations 1 and 2 is obtained by using equation 23.

\[ CV = (1 + AP) \times (1 + RD_1 + RD_2) \times (GDPPC + PCI) \] (23)