ACCOUNTING COSTS WITHOUT A COST ACCOUNTING SYSTEM: THE CASE OF A SMALL ITALIAN WINERY OF EXCELLENCE

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1. Introduction

The relevance of Management Accounting and Control (MAC) practices has been widely acknowledged for a long time but, especially in recent years, a review of the traditional systems has tried to provide adequate and flexible answers to recent environmental changes, such as globalization, enhanced international competition, information technology development and financial crises (Brusa, 2012; Broccardo, 2014). Cost management is one of the main issues in MAC studies (Drury, 2008; Atrill and Mc Laney, 2009). Further, cost measurement and accounting methodologies should be adapted to the specific informative needs of the different sectors (Dearden, 1978; Evans and Bellamy, 1995).

The wine industry plays a meaningful role in the world economy (Rossi, 2013; Lombardi et al., 2015) and Italy is currently the main producer on a global level (ISMEA, 2017), surpassing other European countries, including France and Spain (De Marchi and Grandinetti, 2016), and also outperforming the USA, Australia, Asia and Africa (OIV, 2017).

The need to face growing competition, especially from emerging countries, and the uncertainty of performance, primarily influenced by economic, climatic, and environmental conditions, require wineries to accurately determine and control the costs of their products through accounting information supporting the decision-making processes. Nevertheless, the wine sector is generally not very receptive to managerial innovations (Antonelli and D'Alessio, 2007).

Most Italian wineries are small-sized enterprises, often family-run (ISTAT, 2015, 2017), and may not be able to afford to implement cost accounting and management control systems due to resource constraints.

In this context, this study proposes a detailed model to determine the full cost per unit of output (the bottle of wine), starting from financial accounting information. To this end, we analyse the case of a small-sized, family-run, Italian winery of excellence, devoid of a cost accounting system.

The originality of this work lies in its theoretical and practical contri-

bution. Indeed, within this stream of research, little attention has been devoted to providing an easy way to tackle the accounting and evaluating issues raised by such a product. This would meet the needs of governance and management of wineries (for control and decision-making purposes), as well as of other companies interested in the assessment of wineries' inventories (e.g. for insurance purposes).

The remainder of the paper is structured as follows. Section 2 presents a critical review of national and international references on cost management and accounting in the wine sector, highlighting a gap in the literature available, and introducing the research question. Section 3 explains the method we followed and the case study. Section 4 describes the proposed model to calculate the full cost of wine production and its application, presenting the findings. Section 5 offers conclusions, highlighting strengths and weaknesses of this study as well as its theoretical and practical implications.

2. Literature review

Within the MAC stream of research, studies on cost management in wineries have been mainly carried out in non-traditional wine producer countries, e.g. the USA, and have addressed primarily to professionally-run businesses (Maxwell, 1946; Cribari, 1953; Dal Poggetto, 1985; Smith et al., 1993; Ball et al., 2004, Yeh et al., 2014).

Notwithstanding the importance of the Italian wine industry, a few contributions have recently investigated the cost of the grape (Pomarici et al., 2005; Seccia et al., 2012) and the cost of wine (Ciaponi, 2005; Bagnod et al., 2005; Casini et al., 2012, 2014; Marone et al., 2017) in the Italian literature. Unlike in other countries (i.e. Portugal, Spain, Australia) (see Couto Viana and Lima Rodrigues, 2006), no specific wine accounting standard exists in Italy.

Moreover, most of the research has been performed by agrarian economy scholars and do not tackle this topic from an accounting perspective. Therefore, although management accounting in the wine industry has gained momentum in recent years (Kunc, 2007; Reddaway et al., 2011), there still remains much room for improvement in developing cost accounting methodologies for wineries.

Winery accounting should consider two important elements:

(i) the wine category/quality: accounting for premium wines differs from accounting for low quality level wines (Blake et al., 1998; Couto Viana and Lima Rodrigues, 2006; D'Amato, 2013), in that the former require a longer ageing time and, as explained in further detail below, this raises several accounting issues;
(ii) the size of the company: accounting for large companies differs from accounting for small businesses (Welsh and White, 1981; Perera and Ba-

ker; 2007; Reddaway et al., 2011; Bracci and Maran, 2012), in that the latter generally face resource constraints (i.e. time, money, expertise), and therefore may not be able to afford to implement the accounting and information system needed.

Furthermore, in order to identify the cost elements in the wine business, it is important to analyse the whole production chain, which consists of different stages (Ciaponi, 2005): (i) farming: growing grapes (viticulture); (ii) manufacturing (winemaking), which can be further divided into: production of new wine, wine ageing, bottling and logistics; (iii) marketing/sales. Costs occur during all three phases while revenues are earned only in phase three.

Hence, over the years, the literature has identified several accounting concerns for the wine sector (Dal Poggetto, 1985; Lee and Jacobs, 1993; Blake et al., 1998; Pisoni and White, 2002; Fickle et al., 2005; Couto Viana and Lima Rodrigues, 2006), mainly:

- time-related issues: the higher the quality (thus the ageing time) of the wine, the more demanding the assessment of inventories is;
- valuation-related issues: in the case of companies using home-grown grapes, the viticulture cost must be assessed, whilst if grapes are purchased the costs are easily determined by the price paid;
- cost-related issues: cost allocation for wineries is quite challenging compared to other production since most costs are overhead expenses and the production of wine requires a number of different processing steps.

The adoption of a cost accounting system would help to tackle these issues by allowing a more accurate cost allocation. However, cost accounting is neither compulsory nor traditionally used in small family-run wineries, this also includes Italian producers (Antonelli and D'Alessio, 2007; Casini et al., 2012). The management accounting system should provide fairly accurate and readily available information for the decision-making process but, at the same time, be sustainable on a cost-benefit basis (Broccardo, 2014).

As a result, despite its relevance, frequently the cost of the product still remains unknown to these businesses. A few attempts have been made to overcome this lack of information. Gonzalez-Gomez and Morini (2006) tried to determine the cost of winemaking through an adapted Activity-Based Costing (ABC) system, but do not consider the viticulture phase, taking the grape cost as an input (calculated using an average market price). Also, Lopez-Valeiras Sampedro and Gonzalez Sanchez (2008) proposed a free online tool to assess the costs absorbed in the cultivation of the vineyard but focused only on the grape-growing activity. Recently, drawing on a previous version of our paper, Marone et al. (2017) developed a software to estimate the total cost of a bottle of wine considering all stages of the production chain. The research applied to different Tuscan wines;

however, how this process is applied, how indirect costs are allocated, and which cost drivers have been selected were not detailed.

In the light of the above, this paper seeks to answer the following research question: if and how is it possible to determine the cost of a bottle of wine in the absence of a cost accounting system?

3. Research methodology and case study description

In order to address our research objective, this paper adopts an interventionist research approach based on a single case study.

Interventionist case studies aim to achieve two goals at the same time, one theoretical (to improve scientific knowledge) and one practical (to solve organisational problems) (Chiucchi, 2013: VIII; Dumay, 2010: 47). In this study, the theoretical goal is to contribute to the winery cost accounting stream of research, by improving the knowledge about cost determination processes in wineries devoid of a cost accounting system; the practical goal, on the other hand, is to support a company in its cost determination process.

Interventionist research has points of strength and weakness. Among strengths we could list (a) the researcher's ability to study a phenomenon closely – informants tend to be open about sharing information with the researcher in this setting, as they expect practical benefits from this approach (Chiucchi, 2013: 61); (b) the topics subject to interventionist research typically have a practical relevance; (c) finally, in this kind of research, recollection problems are not common since the core dynamics under investigation are typically ongoing during the study (Jönsson & Lukka, 2005: 8). The main weaknesses of interventionist research include the risk of the researcher "going native" (i.e. becoming so personally involved in the context analysed as to distort research results), and the related risk of low impartiality in conducting the research process (Jönsson & Lukka, 2005: 8-9).

We decided to apply the case-study methodology as the features of this type of research are well aligned with the analysed phenomenon (Chiucchi, 2013: 9-10; Creswell et al., 2007). Indeed, (a) the use of a case study enabled us to observe directly the wine production process and identify the various phases in which production costs are generated; (b) cost generation and allocation processes were observed in their natural context; (c) a variety of data collection and analysis techniques were applied (i.e. direct observation, participant observation, financial and non-financial document analysis, face-to-face meetings and semi-structured interviews).

As the literature review highlighted, higher wine quality and smaller company size are associated with increased difficulty in determining product cost. Therefore, we chose a case displaying the highest level of com-

plexity: a small, family-run company producing and selling ultra-premium wine from home-grown grapes (namely, a company carrying out all three stages of the wine production chain).

We opted for a single case study as the company analysed (hereinafter "the company") is at the same time a typical and unique case (Yin, 2003: 40-42). It is a typical case in that the problem of determining the cost per unit of output without an analytical accounting system recurs with very similar issues in many wineries. It is a unique case because some of the peculiar activities it performs (e.g. integration of a garden in winemaking and a long ageing period) determine a complex production process (these activities are described further in this section). This means that the proposed model could be easily adapted to other entities with a lower degree of complexity (larger company size, lower wine quality, and/or fewer activities in the production process).

The procedure used for the development of the case study went through the elaboration of a research protocol (Yin, 2003: 67 ss.) whose main aspects concerned: a) the documental sources chosen to gather the information necessary to achieve the research objectives (see point d); b) the choice of personnel with whom to liaise during the project and the means of communication, agreed with the owner; c) protection and dissemination of data and research results; d) a draft framework of the final report for the company.

With regards to data collection, data were either internally produced by the company (7-years of financial accounting statements, information about yearly bottle production, information about all the steps of the production process, information about all costs related to the production process, register of depreciable assets) or obtained through observation (direct observation of the production process, face-to-face meetings and semi-structured interviews with the owner – who provided information on the production process –, his daughter – who provided accounting information – and some employees). Data obtained through observation have always been gathered by the research group as a whole. Each researcher made their own notes, and these were subsequently reorganised by individual researchers to then be compared within the research group and organised in a single report.

Regarding data analysis, the researchers (with the help of the accounting manager) first reclassified costs from the company's accounting system as direct and indirect through the application of cost accountancy criteria. Costs were subsequently reallocated based on specific drivers. Details on the methodology used are included in section 4.

In case studies, generalization is a critical matter. This is often interpreted not in statistical terms, but as "analytical generalization", which could be defined as an «attempt to raise the level of discussion from "raw observations" to the level of "meta-observations", which include some general

elements, true or meaningful in other instances than the studied cases» (Lukka and Kasanen, 1995: 78). The external validation of the selected case study was verified in two ways: a) the cost calculation model was further applied to other wineries (for reasons of conciseness, in this paper there is no specific reference to this later stage of the research); b) triangulating our data sources with external references related to the cost calculation process (specifically, the ABC method). As for the internal validation of the selected case study, we relied on both "data triangulation" (i.e. we compared the cost per unit of output obtained through our model with a rough estimate already elaborated by the company) and "investigator triangulation" (i.e. an ongoing comparison among the members of the research team in both data collection and analysis, to reduce the risk of error and personal bias) (Modell, 2005: 233). As far as the case study description is concerned, the company was founded in the early 1970s in Tuscany. It is a family-owned company, in which the following people work: the founder, some of the members of his family, nine full-time workers and some seasonal workers.

The company produces Brunello di Montalcino, a red wine entirely made from Sangiovese Grosso grapes. In 1980 this wine obtained the Controlled and Guaranteed Designation of Origin seal (DOCG). It is a wine that requires a long ageing period. The company produces two types of the same wine: (i) the "Brunello di Montalcino", which needs to age for at least five years before being marketed; (ii) the "Reserve", which needs to age for at least six years before being marketed; so it can be considered as a mono-product company. The manufacturing process of the company is based on a business philosophy aimed at creating a high-quality product. The vineyard is part of a complex ecosystem designed to create optimal conditions for the ripening of the grapes. Close to the agricultural land there are a forest, a stream, a pond, an orchard and a garden. The latter includes extremely rare plant species that make it a true natural heritage. This environment is home to many species of animals and creates ideal conditions for the production of an ultra-premium wine, without the use of chemicals and other harmful substances. The entire production, from the vineyard to the bottle, takes place according to strict rules aimed at obtaining the best possible quality of wine. The staff employed in the company is carefully trained and ready to intervene at any time, both in the vineyard and in the cellar. The production activity requires continuous material intervention on the vines, in order to improve the product's quality. This company's philosophy leads to the production of a quantity of wine by far lower than what is potentially attainable, but of premium quality. On average the company produces 15,000 bottles of wine yearly. Due to the strict rules of the production process and the necessary upkeep of the land, carried out with little use of machines, the company supports unusually high production costs compared to other wineries (e.g. costs for management and maintenance of the forest, the gar-

den and the orchard; costs for the many manual tasks carried out in the vineyard and in the cellar with low use of mechanization).

4. The model to calculate the full cost of a bottle of wine

The proposed model adopts a full cost approach and determines the production cost of a bottle of wine (the "cost object") by applying an adapted ABC method to the whole standard production process of a winery. First of all, the full cost configuration is here intended as the sum of all costs – direct and indirect – of manufacturing and selling a unit of the product. For the purpose of assigning expenses to cost objects, costs are classified as either direct or indirect, depending on whether or not they can be easily and conveniently traced to a specified cost object (Garrison et al., 2010; Cinquini, 2017). Generally speaking, in a mono-product company, determining the full cost per unit of output could seem to be simple. For example, one could roughly divide the average total cost of the production period (e.g. seven years for the Brunello di Montalcino wine) by the average number of the bottles produced per year. This calculation, however, would be distorted due to the discrepancy between the production period and the accounting records, and due to the production process itself. The bottles produced during a specific year usually include production factors over a significantly longer period; this is particularly true for premium wines.

In the company, the production process of the product is as shown in Tab. 1.

Tab. 1 – Production process of a bottle of wine

	COSTS				COSTS/REVENUES
	Viticulture	Winemaking	Ageing	Bottling and logistics	Marketing/Sale
Brunello	Year 1	Year 1 (late)	Years 2-6	Year 6	Year 7
Riserva	Year 1	Year 1 (late)	Years 2-6	Year 7	Year 8
Semi-finished product	Grapes	Bulk wine	Aged wine	Bottled wine	Sold wine

Source: our elaboration

The Year 1 vintage is ready for being marketed by the end of Year 6 (at the end of Year 7 for the "Reserve" type). Therefore, the first revenues related to the Year 1 vintage will be recorded in Year 7 (in Year 8 for "Reserve" quality). Thus, in order to know the cost of production of the Year 1 vintage, one cannot consider only the costs dating back to that specific year. It is also necessary to look at the costs of the related ageing period (Years 2-6).

During any period of reference, the production costs of different vintages overlap. In other words, the costs recorded in the Years 1-6 period cannot be allocated exclusively to a single vintage. In summary, there are two main problems: (i) calculating the expenses recorded during the production process; (ii) finding a way to assign them to a single vintage.

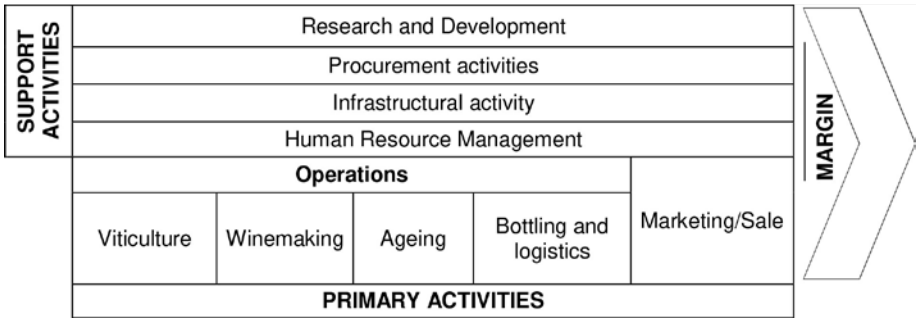
Since the cost of the products sold in the last year is the sum of the costs of the individual activities carried out in a number of different years, and the cost of each activity may be related to a specific semi-finished product (i.e. grapes, bulk wine, aged wine, bottled wine), we propose to apply an adapted ABC method to the whole production process (Cooper and Kaplan, 1988, 1991, 1992, 1998; Staubus, 1971 ,1990; Brusa, 1995; Bubbio, 2002; Gonzalez-Gomez and Morini, 2006). In this way, the activity is the event that causes the consumption of overhead resources. Hereby, the costing process is divided into several stages:

1. selection of the main activities involved in the production process;
2. cost allocation to the relevant activities: (i) attribution of direct costs; (ii) assignment of indirect costs using appropriate allocation criteria (namely, cost drivers);
3. transfer of costs allocated to activities for semi-finished products, estimating an activity cost per unit;
4. calculation of the full cost of the product.

4.1 Selection of the main activities involved in the production process and cost drivers

Drawing from Porter's value chain model (1985), and based on the literature about winery production process (Ciaponi, 2005), five primary activities (i.e. viticulture, winemaking, ageing, bottling and logistics, marketing and sales) and four support activities have been identified (see Tab. 2).

Tab. 2 – Value Chain of the company



Source: our elaboration

4.1.1 Description of the primary activities of the company

a) Viticulture

In the viticulture macro-activity, there are two main phases: (i) installation and development of the vineyard; (ii) vineyard management.

The vineyard productivity (yield of grape per hectare) is linked to the life cycle of the plant. On average, the maturity phase, characterised by constant productivity, spans from 6 to 30 years from the installation of the vines, and then productivity starts decreasing (Spano, 2010). However, life cycles and related productivity are specific to each vineyard, and quality is in an inverse relationship with productivity, as evidenced by the experience of the company. Hence, the best wine is produced by the oldest vines.

Management activities aimed at grape production are different in terms of quality and accuracy depending on the vineyard. Because of these activities, the company is an excellence on the international scene. Preventive operations, soil management and analysis are carried out with extreme accuracy. For example, thinning operations are carefully carried out to reduce the quantity of grape produced by vines in order to improve the quality of the remaining grapes. All operations are carried out manually.

The pruning is likewise delicate and precise: specific rules must be observed in order to obtain an ultra-premium wine. This operation begins in February when the plant is dormant and it is done in order to prepare the plant as well as possible (assuming oncoming adverse weather). All this is possible if the vine is preset to extremely low yields (even down to only one bud per plant).

The arrangement of trellis structures for the vineyard is carried out immediately after the pruning in order not to disturb the gems that will be blooming during the spring. The maintenance of trellis structures and especially the tying of trunks is made so that the cords are not too tight and the sap is allowed to flow without impediments). Suckering operations are equally difficult, because they may affect the gems.

In case of adverse weather, further operations take place: drastically reducing the bunches, keeping only the best in terms of both health and maturation level; removing leaves and buds that block light and heat for the few remaining clusters; eliminating any bunch which is dry or affected by mould or has incurred other incidents; waiting for the optimal time of grape maturation for the harvest; making a further manual selection of the clusters in the winery before vinification.

For the company, the management of the garden bordering with the vineyards must be added to the described activities, since it aims to create an ideal ecosystem for the vineyard.

b) Winemaking

In this study, "winemaking" refers specifically to the first transformation of grapes into wine (production of new wine), namely must production and vinification, excluding ageing. Indeed, given the importance of the ageing operations, both in economic and quality terms, this activity is considered separately. Winemaking starts with the reception and selection of the grapes and their chemical and organoleptic analysis. The fruit is carefully selected and, within an hour, destemmed in the cellar and placed in vats, where fermentation will take place thanks to indigenous yeasts, without temperature checks and with the manual pumping of the must to the surface. All these operations are carried out trying to minimize human interventions. The must will remain there for over thirty days. After these operations, there is the stripping, i.e. the removal of stems from the grapes. The company purchased a cutting-edge machine to do this in order to minimize the impact of mechanization on grape quality.

These stages are usually followed by crushing and maceration, during which procedures juice and skins remain in contact at a certain temperature, and applied pressure allows the substances contained in the skins to leach into the must. In the company, however, in order to avoid ruining the grapes' quality, they are not crushed. During the same evening that the vats are filled, the owner proceeds personally to pump the must to the surface outdoors, and, at a later stage, this operation is done three times a day for each vat. Every morning, samples of must are taken for analysis from each vat and, late in the evening, the results of the analysis are checked. Another important consideration is the age of the vines from which the grapes come. The vinification shows different trends between the vineyards of 35/36 years and the vineyards planted in the end of 2000. In the first case, the duration of the vinification is usually shorter (20/22 days), in the latter it is longer (28 days). For the purposes of this study, the vinification ends the winemaking activity.

c) Ageing

It is a peculiar activity linked to quality standards that allow the wine to acquire specific organoleptic characteristics. The minimum period is determined by the production regulations. In the company, in order to produce an ultra-premium wine, maturation times are greatly dilated and the wine is constantly monitored and analyzed with the support of a university. Wine maturation takes place in specially designed cellars with the right temperature, humidity, air circulation, light, noise and odour, in large wooden barrels that do not transfer flavours and aromas to the wine. In this way, the wine naturally acquires its taste and smell from the grapes, which

would otherwise be destroyed and replaced by flavours and aromas of the oaks. The owner has designed and built a detailed studied wine cellar, focused on ageing activity in order to enable the maturation in the best possible circumstances.

d) Bottling and logistics

Although part of the ageing takes place in the bottles and the bottling process precedes bottle ageing (which is part of the ageing activity), in order to identify cost units, bottling, packaging and commission management are considered separately. In this way, this phase is monitored independently from the purely operational phases of winemaking and it is considered as a management activity, not as a productive one.

This solution is inconsistent in terms of sequentiality of the process, but it preserves the advantage of separately considering tasks belonging to different activities, whose costs are allocated separately. In the company, bottling is done without any fining, filtration, polishing, additives, preservatives, colours, flavours and/or fragrances. In addition, there is a studied selection of bottles, caps and packages for the best preservation of wine.

e) Marketing/Sales

This category includes management activities of national commercial agents, foreign importers, sale targets, contractual terms and conditions of any financial incentives linked to the sale budget and all the activities related to promotion in a broad sense (organizing events, trips abroad, participation in fairs, etc.). With reference to the advertising strategy, the company, in line with the niche occupied by its wine, promotes the brand with targeted interventions: it avoids the most common media channels and integrates the promotion with a continuous activity of hospitality/reception to raise awareness regarding the quality of the product purchased for those who have specific interests in it.

4.1.2 Description of the support activities of the company

a) Research and Development (R&D)

It includes all the activities carried out by the owner in constant collaboration with the university, through specific agreements aimed at continuously improving the quality of the product. Consistent with the corporate production philosophy and intrinsic exclusivity of the product, research on the consumers' taste and demands on the produced wine have not been undertaken.

b) Procurement activities

They include some of the activities supporting production. In this model, for the purposes of assigning costs, the cost of each purchased input is allocated to the activities which consume that productive factor (e.g., the cost of the stemmer machine is allocated to the vinification activity and not to the procurements); consequently, only the inputs used in purchasing activities (human resources, infrastructures, tools used to perform activities) should be linked to procurement activities and not the objects of purchasing activities (machines, services, fertilizers, bottles, corks, etc.). The purchased productive factors are distinguished between factors used in the operating cycle of the vineyard/wine cellar (e.g. fertilizers, fungicides, bottles, corks, labels, capsules, packaging) and structural factors (e.g. barrels, vats, buildings).

c) Infrastructural activities

They include those operations that fulfil the accounting, legal and tax functions.

d) Human Resource (HR) Management

It includes all the activities related to research, selection, training and management of the personnel in a broad sense (i.e. full-time workers, freelance workers employed cyclically, national commercial agents and importers), and the incentive system related to sale activities.

Although from the value chain point of view it is correct to keep support activities separated, for the purposes of simplification and due to the lack of more detailed information, the procurement, infrastructural and human resources management activities are all grouped into a single category called "administrative activities".

As a consequence, a total amount of 7 activities will be used to calculate the cost per bottle.

4.2 Costs allocation to main activities

The next phase of the costing process consists in the allocation of direct costs to the activities. This allocation has been made considering the nature of the cost (e.g. the cost of fertilizers is clearly a direct cost of vinification).

Then, indirect costs should be assigned. They are: a) wages; (b) amortization; (c) maintenance and consumptions.

a) Wages

For personnel costs, the cost driver is "days dedicated to each activity". The costs are calculated separately for each full-time employee and team of autonomous workers.

b) Amortisation

Information given in the register of depreciable assets was used to understand the link between asset and activity (assets directly and indirectly attributable to specific activities). Most part of the amortisation is represented by the wine cellar (approx. 71%), this cost was allocated between winemaking, ageing and bottling/logistic on the basis of the square meters for any activity (respectively 10%, 70% and 20%). Other indirect costs (equipment, vehicles, etc.) have a lower incidence (1-2%), except for the building that hosts the main office (the owner's house), which is around 4.5% of the total depreciation. In view of the relative weight, it has been decided to allocate these costs in equal parts to the seven activities (1/7).

c) Maintenance and consumptions

Maintenance has an extremely small effect on the total business costs. It is related principally to the operative and logistic activities (in particular the wear and tear of the bottling machine), but defining a parameter for cost allocation is a difficult goal. Consumptions could theoretically be related to all the activities and not just to operative and logistic ones. In view of the insignificance of the amounts, it has been decided to select a linear distribution criterion with respect to the various activities.

4.3 From activities to semi-finished products

Having quantified the costs (direct and indirect) of any activity, it is possible to transfer them into their related semi-finished products (grapes, bulk wine, aged wine, bottled wine). Dividing the activity cost by the units of product (within the same time horizon) it is possible to determine the cost of performing that activity per single unit of product. For simplicity's sake, following tabs show detailed costs only for some of the analysed activity. Vineyard hectares and quintal of harvested grapes are extracted from the ARTEA (Tuscan Regional Agency for Supplies in Agriculture) database, converting the units respectively in hectares (ha) and quintals (ql). In absence of official data for the Years 1 and 2, the average for the 3-7 period has been used (see Tab. 3). The harvest has been considered as producing only "Brunello" type, even if a portion of the total belongs to the "Red" type. In any case, considering the products separately would not change the logic used. In this case, it would be sufficient to spread the total costs of the two pro-

ducts under examination using the respective volumes as a cost driver. The vineyard productivity provides strategic data for the analysis of the production cost. Indeed, the average cost per harvested quintal is strongly influenced by the acres of terrain and the quantity of harvested grapes: by changing the input values, the average harvest cost is significantly modified.

Tab. 3 - Viticulture activity cost per ql and kg (in €)

Harvest Year	*Average*	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7
Vineyard (ha)	6,6	6,6	6,6	4,9	6,0	7,3	7,3	7,4
Quantity of grapes (ql)	263,5	263,5	263,5	330,0	347,0	313,0	190,5	137,0
Productivity (ql/ha)	42	40	40	68	57	43	26	19
Viticultural Activity (€)	**178.839**	**133.720**	**160.643**	**236.856**	**194.435**	**163.972**	**161.737**	**200.509**
Wages (€)	103.148	84.648	104.237	128.270	87.217	92.867	98.866	125.929
Depreciation Charge (€)	2.441	3.874	3.827	2.045	2.128	2.026	1.570	1.617
Maintenance (€)	5.657	2.465	4.124	6.422	5.946	5.139	5.272	10.229
Consumptions (€)	4.001	2.815	3.108	3.995	4.718	3.864	4.940	4.564
Direct depreciation (€)	18.934	8.047	8.047	20.984	24.856	24.400	23.308	22.894
Fertilizer and fungicide (€)	9.155	3.199	6.678	27.792	10.193	10.963	519	4.743
Fuels (€)	7.501	7.947	4.868	6.286	8.415	6.544	8.089	10.358
Viti-vinicultural Services (€)	27.864	20.100	25.430	41.037	50.962	18.169	19.174	20.175
Equipment (€)	139	625	325	25	-	-	-	-
Viticultural Activity Cost per ql (€/ql)	747	507	610	718	560	524	849	1.464
Viticultural Activity Cost per kg (€/kg)	7,5	5,1	6,1	7,2	5,6	5,2	8,5	14,6

Source: our elaboration

Focusing on data from Year 7, it is evident that the cost of grapes almost doubles with respect to the previous year, due to a drastic reduction in the productivity of vines. Given the inverse relationship between productivity and wine quality (as stated before, low productivity is usually connected with premium wines), it is clear how the company, managing the vineyards in low productivity, supports considerably higher unit costs. The average cost per quintal of harvested grapes is € 750 (€ 7.5 per kg). ARTEA source data have been used also in this case. With approximately 190 hectolitres produced in total (29 hectolitres per hectare), the average cost is around of € 1,000 per hl of wine (€ 10 per litre). Once again, it is evident that the value is strongly influenced by the yield per hectare (see Tab. 4).

Tab. 4 - Viticulture activity cost per hl and l (in €)

Harvest Year	*Average*	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7
Total Crop Yield (hl)	191	191	191	241	261	232	130	93
Crop yield per hectare (hl/ha)	30	29	29	49	43	32	18	13
Viticultural Activity Cost per hl (€/hl)	1.054	699	840	984	746	708	1.241	2.158
Viticultural Activity Cost per l (€/l)	10,5	7,0	8,4	9,8	7,5	7,1	12,4	21,6

Source: our elaboration

The same logic has been used for winemaking (see Tab. 5). The total cost has been divided by the amount of obtained product. The cost of winema-

king for Year 1 is then determined according to the following calculation: €46,156 / 191.2 hl = €241.4 per hl (€2.4 per litre). The sum of the cost of the viticultural and winemaking activities amounts to approximately €14 per litre.

Tab. 5 - Winemaking activity cost per hl and l (in €)

	Average	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7
Winemaking (€)	**55.859**	**46.156**	**55.675**	**62.809**	**57.105**	**50.137**	**54.641**	**64.489**
Wages (€)	5.157	4.232	5.212	6.414	4.361	4.643	4.943	6.296
Depreciation Charge (€)	26.148	27.198	27.150	25.493	26.048	25.947	25.491	25.708
Maintenance (€)	5.657	2.465	4.124	6.422	5.946	5.139	5.272	10.229
Consumptions (€)	4.001	2.815	3.108	3.995	4.718	3.864	4.940	4.564
Direct depreciation (€)	8.439	6.971	6.971	7.265	9.959	8.816	7.416	11.674
Wine cellar management (€)	6.457	2.475	9.110	13.220	6.072	1.728	6.580	6.017
Cost of viticultural and w inemaking activity (€)	234.698	179.876	216.319	299.665	251.540	214.110	216.378	264.998
Total crop yield (hl)	191,2	191,2	191,2	240,6	260,6	231,6	130,3	92,9
Winemaking Activity Cost per hl (€/hl)	334,7	241,4	291,2	261,1	219,1	216,5	419,2	694,2
Viticultural and Winemaking Activity Cost per hl (€/hl)	1.388,5	940,7	1.131,3	1.245,5	965,2	924,4	1.660,1	2.852,5
Viticultural and Winemaking Activity Cost per l (€/l)	13,9	9,4	11,3	12,5	9,7	9,2	16,6	28,5

Source: our elaboration

For ageing activities (see Tab. 6), the basic problem lies in linking the costs coming from the financial accounting system to the product. The sum of the annual ageing costs (indirect and direct) must then be linked to the object of the activity, namely the wine maturation in the cellar in the surveyed year, to obtain the cost per hectolitre of wine maturation. The amount of wine (in hectolitres) subjected to maturation has been determined analysing stock cards.

Tab. 6 - Ageing activity cost per hl and l (in €)

	Average	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7
Ageing (€)	**128.978**	**119.165**	**126.947**	**135.997**	**126.723**	**125.893**	**127.740**	**140.381**
Wages (€)	30.944	25.394	31.271	38.481	26.165	27.860	29.660	37.779
Depreciation Charge (€)	85.416	85.507	85.460	84.115	85.850	85.748	85.292	85.937
Maintenance (€)	5.657	2.465	4.124	6.422	5.946	5.139	5.272	10.229
Consumptions (€)	4.001	2.815	3.108	3.995	4.718	3.864	4.940	4.564
Direct depreciation (€)	2.961	2.984	2.984	2.984	4.044	3.282	2.576	1.872
Wine subjected to maturation (hl)	933	796	871	874	898	1.149	984	960
Ageing Cost Activity per hl (€/hl)	140	150	146	156	141	110	130	146
5 years Ageing Cost Activity per hl (€/hl) (average)	698	698	698	698	698	698	698	698
Viticultural, Winemaking and Ageing Activity Cost per hl (€/hl)	2.087	1.639	1.830	1.944	1.664	1.623	2.358	3.551
Viticultural, Winemaking and Ageing Activity Cost per l (€/l)	20,9	16,4	18,3	19,4	16,6	16,2	23,6	35,5

Source: our elaboration

It is reasonable to assume that the product is all the wine in stock, excluding the bottles ready for sale. In other words, it is necessary to find a criterion to distinguish the semi-finished products from bottles sold, as they ended their production process. Since the bottles are ready for sale at the end of a 5-year period after the harvest, it can be assumed that it is necessary to determine the total inventory of the saleable wine in order to identify the wine undergoing maturation (also in the bottle).

For example, for the Year-1 the warehouse would consist of a total stock of 876 hl, divided as follows:

- marketable wine (produced from five years and over) (80 hl);
- wine under maturation (876-80 = 796 hl).

At this point, the period costs can be allocated to the semi-finished product to get the annual unit cost of maturation. This approach determines on average a cost of around €700 per hl for the past five years (140 €*5 years), equal to about €7 per litre (on average €1.4 per year). An alternative solution for the allocation of these costs can be suggested, as most of the costs are related to assets used for maturation (tanks, casks). The result, in this case, is given by the annual cost of each asset divided by its capacity in hectolitres and again divided by 365 days (unit cost per time unit). Thanks to this algorithm, the maturation cost for a hectolitre per day is determined with reference to a particular asset. As a result, the maturation cost of a certain amount of hectolitres for a specified period shall be given by the unit cost per time unit x (Hl) x (time). This solution is definitely more accurate because it does not allocate the costs of underutilization to the ageing wine if the aged hectolitres are less than the barrel capacity. In addition, this method has the advantage of considering not only the volumes of the product but the time as well.

On the other hand, the first method has the advantage of allocating to the product all the costs related to the maturation: not only barrels but also personnel, maintenance, bills, i.e. all the productive factors consumed in order to get the wine to the market. It also considers the bottles in stock that absorb part of the costs of ageing in the cost allocation process. Time is also considered as a factor: annual costs of ageing for each of the five years are allocated to the wine. Following the former method, the cost linked to 5-years ageing is around € 7 (140*5=€698; € 6,9 per l., for simplicity the average annual cost has been considered).

All the costs related to bottles washing and sterilization, the transfer of bulk wine in bottles, capsule and label application, bottles packaging, general packaging, order management costs and logistics are attributed to this activity (see Tab. 7).

The sum of the unit costs of the activities represents the full production cost. On average, over the period considered, this cost amounts to €2.839 per hl, corresponding to € 28.4 per litre.

Tab. 7 - Bottling and logistic cost per hl and l (in €)

	Average	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7
Bottling and logistic (€)	**84.207**	**75.634**	**76.359**	**80.424**	**95.850**	**68.798**	**70.469**	**121.917**
Wages (€)	5.157	4.232	5.212	6.414	4.361	4.643	4.943	6.296
Depreciation Charge (€)	14.294	15.536	15.488	13.769	14.088	13.987	13.530	13.663
Maintenance (€)	5.657	2.465	4.124	6.422	5.946	5.139	5.272	10.229
Consumptions (€)	4.001	2.815	3.108	3.995	4.718	3.864	4.940	4.564
Direct depreciation (€)	-	-	-	-	-	-	-	-
Packaging (€)	37.069	25.781	30.650	29.975	47.831	25.001	26.636	73.608
Consumable materials (€)	18.029	24.805	17.777	19.849	18.906	16.164	15.148	13.557
Bottled wine (hl)	112	112	112	112	112	112	112	112
Bottling and logistic Activity Cost per hl (€/hl)	752	675	682	718	856	614	629	1.089
Vit, Win, Ag, Bottling and logistic Activity Cost per hl (€/hl)	2.839	2.314	2.511	2.662	2.519	2.237	2.988	4.639
Vit, Win, Ag, Bottling and logistic Activity Cost per l (€/l)	28,4	23	25	27	25	22	30	46

Source: our elaboration

All the costs generated by the sales force, events organization, trade fairs, travel and the overall hospitality activities are allocated to the "marketing/sales" activity. The cost driver is represented by the bottles sold. In order to work on the same unit of measure as for other costs (Hl), 0.75-litre bottles have been considered in terms of hectolitres of sold wine. In the interest of simplicity, average data have been used (112 hectolitres).

This cost should be added to the amount of lost revenues, i.e. the costs related to the commercial brokerage, which are paid through a discount on the purchasing price instead of through a commission on the final sale price. In this instance, however, it has been decided not to consider this aspect. The cost per litre of commercial activities is, thus, on average, approximately €15.

The support activities consist of the R&D and administrative activities, which are overhead costs. The total wine lying in stock has been selected as the basis of cost allocation excluding the sold wine. Also for what concerns support activities, some cost items should be accounted for in more detail. In any case, the calculation logic would not be affected. The cost per litre of these activities is about €4.

4.4 Full cost calculation

By adding the cost of the individual activities, the full cost can be obtained (See Tab. 8).

Tab. 8 - Full cost of the company's wine (in €)

	AVERAGE (€)	%
Viticulture per l (€/l)	10,5	22%
Winemaking per l (€/l)	3,3	7%
5 years Ageing (€/l)	7,0	15%
Bottling and Logistic per l (€/l)	7,5	16%
Marketing/Sale per l (€/l)	14,8	31%
R&D,administrative activities per l (€/l)	4,0	9%
FULL COST per litre (€/l)	**47,2**	
FULL COST per bottle (€/bottle)	**35,4**	
FULL COST per hl (€/hl)	**4.715,8**	

Source: our elaboration

The average full cost for 5-years aged wine is approximately €35. The scheme shows some variability over the years, due to the different vineyard productivity during the period under investigation. This estimate, however, represents only an initial assessment requiring further refinements. Accounting for the cost of brokerage would require using specific data rather than average data and the hypothesis of wasted production has not been considered in this study. The average cost per hectolitre, about €4.700, is consistent with the evaluation of inventories included in the balance sheet. However, the cost as defined in this study can still be considered partial. There is, in fact, a further cost configuration called "technical and economic cost". To quantify the technical-economic cost, which goes beyond the objectives of this study, at least the remuneration of the owner and his wife and the opportunity cost of the cultivated land should be added to the full cost.

5. Conclusions

Consistent with an interventionist research approach, this paper has both theoretical and practical implications. From the theoretical point of view, it joins the debate on cost accounting by offering a contribution to evaluate the cost per unit of output for the wine industry, proposing a model to determine the full cost of wine which (i) takes into consideration size of the business, quality of the wine and stages of the wine production process, (ii) tackles the wine accounting issues raised by the literature, and (iii) combines multiple existing methodologies (i.e. full-costing and ABC) and adapts them the to the wine production chain.

From the empirical point of view, this approach is an easy way to determine the cost of a bottle of wine even without a cost accounting system (as in small-sized businesses) by providing information which supports the management/governance decision-making processes in assessing inventories, monitoring expenses and efficiency (for each activity and/or semi-finished product), and setting the price. Moreover, considering sabotage in some wineries (e.g. Soldera Case Basse farm in Montalcino, in 2012; Cantina Abraxas in Pantelleria in 2012; Cantina Conte Vistarino in Oltrepo Pavese in 2016), where thousands of litres of wine were destroyed by criminals who opened casks of ageing wine, the proposed model could also be a tool for insurance companies to estimate the cost of damage. The strength of this study is that, if the model has been successfully applied to the case of a small-sized, family-run winery, which carries out all the stages of the wine production chain and had no cost accounting system, this means that the proposed solution could be easily adapted to other entities which have a lower degree of complexity (larger in size, lower quality level of wine, and/or fewer phases of the production process) and do not have, or do not want to implement, a cost accounting system. However, there are some limitations. Firstly, as usually happens in cost allocation, although cost drivers assist with assignment of expenses which may result in a more accurate calculation of the proper cost of a product, the cost allocations are chosen at management's discretion. In fact, there is no standards or regulations that guides cost driver selection. Even before, another element of subjectivity lies in the choice of the activities to which expenses are allocated. These decisions, if not carefully made, may affect the reliability of the final result. Moreover, in the case of joint production of different wine types, further considerations must be applied. For example, it may be necessary to focus on production batches and also check the availability of data already classified by a product, in order to minimize the use of cost drivers. Nevertheless, although perfectible by further research, this contribution represents a step forward in MAC studies in the wine sector.

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Abstract

The need to face growing competition, especially from emerging countries, and the uncertainty of performance, influenced by economic, climatic and environmental conditions, require wineries to accurately determine and control the costs of their products.

However, many of them are small-sized, often family-run businesses (such as in Italy), and may not be able to afford to implement cost accounting systems.

In this context, this study proposes a model to determine the full cost of a bottle of wine, starting from financial accounting information. To this end, the case of a small-sized, family-run, Italian winery of excellence is analysed.

The originality of this paper lies in its theoretical and practical implications. Within this stream of research, it provides a contribution to tackle the accounting and evaluating issues raised by such a product. Moreover, it can be used by wineries and insurance companies to improve their knowledge on the wine production cost.

Riassunto

Le mutate condizioni competitive ed ambientali degli ultimi anni hanno fatto avvertire con sempre maggior forza l'esigenza, da parte delle aziende vitivinicole, di conoscere e controllare il costo dei loro prodotti.

Tuttavia, molte di esse sono realtà di piccole dimensioni, a carattere familiare (come quelle tipiche del tessuto produttivo italiano), per le quali l'introduzione di sistemi di contabilità analitica può risultare non sostenibile sul piano costi-benefici.

In questo contesto, il presente lavoro intende proporre un modello di determinazione del costo del prodotto (la bottiglia di vino), partendo dai dati di contabilità generale. A tal fine, prende in esame una piccola azienda vitivinicola Italiana di eccellenza.

L'originalità del presente studio risiede nelle sue implicazioni sia teoriche, in quanto fornisce un contributo nell'ambito del filone di ricerca della contabilità dei costi nel settore del vino, sia pratico, offrendo uno strumento informativo di supporto tanto alla governance ed al management di tali aziende quanto ad altre realtà potenzialmente interessate alla determinazione del costo di prodotto in questo settore.

Jel classification: M41, L66, D24

Keywords (Parole chiave:): wine sector, cost accounting, management control (aziende viti-vinicole, contabilità dei costi, controllo di gestione)

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