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Economic and Financial Performance of the Portuguese Wine Market

A Business Intelligence Approach

Débora Antunes Santos

Dissertation

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NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação
Universidade Nova de Lisboa

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ECONOMIC AND FINANCIAL PERFORMANCE OF THE PORTUGUESE WINE MARKET: BUSINESS INTELLIGENCE APPROACH

by

Débora Antunes Santos

Dissertation presented as a partial requirement for obtaining the Master's degree in Advanced Analytics, with a Specialization in Business Analytics.

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledge the Rules of Conduct and Code of Honor from the NOVA Information Management School.

Débora Antunes Santos

Lisboa, 30/11/2022

DEDICATION

I dedicate this study to my family and friends for their patience and comprehension during this period.

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ABSTRACT

In the past years, the international wine industry has been subject to intensive globalization and international competition as a result of the aggressive entrance of new players (New World Wine) as well as the consolidation of traditional producers' countries (Old World Wine), which brings, simultaneously, challenges and opportunities to the industry. In Portugal, winemaking is one of the most relevant socio-economic activities, which makes it one of the most critical industries in Portugal.

This study aims to develop a prototype business analytics solution that delivers the necessary inputs to evaluate Portuguese winemaking enterprises' financial and economic health. Consequently, three research questions were defined: How can one create segments of Portuguese winemaking companies based on their financial performance? What was the evolution of the main financial indicators and margins within each segment and vineyard region? What has been the impact of COVID-19 on these companies' profitability?

Multiple financial ratios for 148 Portuguese companies were computed based on information from 2016 through 2020. Additionally, data of the entire sector was retrieved from the Bank of Portugal for the same period. This study uses analytical tools and dashboards to analyze the wine sector performance and the firms' performance under each region by comparing their financial results.

This study contributes to the literature by expanding on previous research on specific regions of Portugal. Additionally, this study presents the results employing a business analytics solution, including cluster techniques and AI insights.

It was concluded, through the analysis of the economic-financial performance, that large companies have higher financial performance. Additionally, the sector, in general, suffered a drop in financial results because of the impacts of the COVID-19 pandemic.

KEYWORDS

Business Intelligence; Business Analytics; Economic-Financial Performance Indicators; Cluster Analysis; Dashboards; Wine

Sustainable Development Goals (SGD):

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LIST OF ABBREVIATIONS AND ACRONYMS

AI	Artificial Intelligence
AR	Accounts Receivable
BI	Business Intelligence
CNAE	Classificação Nacional de Atividades Econômicas
COGS	Cost of Goods Sold
DAX	Data Analysis Expressions
DBSCAN	Density-Based Spatial Clustering of Applications with Noise
DW	Data Warehouse
EBIT	Earnings Before Interest and Taxes
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
EBT	Earnings Before Taxes
EDW	Enterprise Data Warehouse
ERP	Enterprise Resource Planning
ETL	Extract, Transform, Load
GAIA	Geospatial Artificial Intelligence for Agriculture
GVA	Gross Value Added
ha	hectares
IBM	International Business Machines Corporation
IVV	Instituto da Vinha e do Vinho, I.P.
IoT	Internet of Things
MHA	Million hectares
OEC	Observatory of Economic Complexity
OIV	International Organisation of Vine and Wine
RFM	Recency, Frequency and Monetary value
ROA	Return on Assets
ROCE	Return on Capital Employed

ROE Return on Equity

USA United States of America

1. INTRODUCTION

The world is undergoing a significant technical and digital transformation, which is causing commercial competition to rise at a breakneck pace. Because of this, businesses need to be able to make quick, educated decisions in order to remain competitive. For that reason, companies must have access to data and the ability to quickly turn it into information to find available optimizations, identify new opportunities, and make accurate business projections to ensure longevity in their industry. In this context, due to their incredibly useful potential in helping businesses improve their decision-making, tracking, benchmarking, and strategic planning processes, Business Intelligence tools have seen their importance and use grow in the past few years, and businesses have invested heavily in such tools, allowing them to have a competitive advantage over its competitors.

1.1. STUDY OBJECTIVES

The main objective of this project is to develop a business intelligence conceptual model to analyze the economic and financial performance of wine companies in Portugal, which will help address the following research and hypothesis questions:

- How can one create segments (clusters) of Portuguese winemaking companies based on their financial performance?
- What was the evolution of the main financial indicators and margins within each segment (cluster) and vineyard region?
- What has been the impact of COVID-19 on these companies' profitability?

In order to achieve the goals presented above and answer the proposed research questions, the following specific objectives were defined:

I. Conceptual Model Creation

- Identify and understand the database that will serve as a source of information for this study.
- Identify the BI components that will compose the model, such as the appropriate dimensions and fact tables that should answer the previously listed research questions.
- Selection of Key Financial Indicators.

II. Proof of Concept

- Development of the data model.
- Development of dashboards to present the results.

III. Discussion and Evaluation of results

1.2 BUSINESS FRAMEWORK

1.2.1. International Wine Industry

In the past years, the international wine industry has been subject to intensive globalization and international competition as a result of the aggressive entrance of new players (New World Wine) as well as the consolidation of traditional producers' countries (Old World Wine), which brings, simultaneously, challenges and opportunities to the industry (Tabau, 2017).

The global vineyard surface area has not changed much since 2016, when it landed at 7.3 MHA of area surface area planted with vines for all purposes. However, the trends on the surface area have been witnessing differentiation among countries. Italy and France, together with China and Iran have been increasing their vineyard surface area, whereas others, such as USA, Turkey, and Moldova, are experiencing the opposite trend, thereby balancing out their effects at the world level. (OIV, 2022).

Even though the surface area planted with vines for all purposes has been relatively stable since 2017, world wine production has fluctuated over the years, reaching a plateau of 284 million hectoliters in 2018, followed by a decline to approximately 250 million hectoliters in 2019. Those fluctuations can be explained by weather conditions and harvest yields (OIV, 2022)

Country/Year (million hl)	2016	2017	2018	2019	2020*	Δ 2020-2019	Δ 2020-2016
Itália	50,9	42,5	54,8	47,5	49,1	3,4%	-3,5%
França	45,4	36,4	49,2	42,2	46,7	10,66%	2,86%
Espanha	39,7	32,5	44,9	33,7	40,7	20,77%	2,52%
Estados Unidos	24,9	24,5	26,1	25,6	22,8	-10,94%	-8,43%
Argentina	9,4	11,8	14,5	13,0	10,8	-16,92%	14,89%
Chile	10,1	9,5	12,9	11,9	10,3	-13,45%	1,98%
Australia	13,1	13,7	12,7	12,0	10,9	-9,17%	-16,79%
África do sul	10,5	10,8	9,5	9,7	10,4	7,22%	-0,95%
China	13,2	11,6	9,3	7,8	6,6	-15,38%	-50,00%
Alemanha	9,0	7,5	10,3	8,2	8,4	2,44%	-6,67%
Portugal	**6,0**	**6,7**	**6,1**	**6,5**	**6,4**	-1,26%	6,81%
Roménia	3,3	4,3	5,1	3,8	3,8	0,00%	15,15%
Brasil	1,3	3,6	3,1	2,2	2,3	4,55%	76,92%
Grécia	2,5	2,6	2,2	2,0	2,3	15,00%	-8,00%
Outros***	29,7	30,0	23,4	21,4	10,7	-50,1%	-64,0%
Total	**269**	**248**	**284**	**248**	**242**	**-2,1%**	**-10,0%**

Figure 1: Wine World Production – Source (IVV, 2022)

To what wine consumption worldwide is concerned, there has been a negative trend initiated in 2018 with the decline in China's consumption and further exacerbated in 2020 by the COVID-19 pandemic, which brought restrictions in the movement of the population and the disruption of the hospitality sector contributing even further for this decline (OIV, 2022).

1.2.2. Wine Industry in Portugal

Historically, winemaking is one of the most relevant socio-economic activities, making it one of Portugal's most important industries. The country's investment in vines has been so pronounced that, despite its small size, Portugal has the world's nineth (9th) biggest vineyard surface area compared to major vine-growing countries (OIV, 2022) and occupied Europe´s fourth (4th) place concerned the most extensive vine area (OIV, 2022) with, approximately, one hundred and ninety-three thousand (193,000) hectares, in terms of delimited regions, in 2019 (IVV, 2022). The evolution of the vine area is shown in Figure 2.

Vineyard Region	2016	%	2017	%	2018	%	2019	%	2020	%	2021	%
Minho	21,020	11%	21,307	11%	21,973	12%	23,999	12%	24,240	13%	24,371	13%
Trás-os Montes	14,381	7%	14,510	8%	13,539	7%	12,252	6%	11,613	6%	10,701	6%
Douro e Porto	42,766	22%	42,023	22%	42,556	22%	43,863	23%	44,162	23%	44,180	23%
Terras de Cister	2,520	1%	2,161	1%	2,184	1%	2,346	1%	2,272	1%	2,215	1%
Beira Atlântico	15,086	8%	15,134	8%	14,630	8%	13,693	7%	13,314	7%	13,259	7%
Terras da Beira	15,687	8%	15,520	8%	15,110	8%	14,328	7%	13,914	7%	13,874	7%
Terras do Dão	14,647	8%	14,837	8%	14,476	8%	13,723	7%	13,321	7%	13,409	7%
Tejo	12,874	7%	12,221	6%	11,944	6%	12,517	6%	12,751	7%	12,847	7%
Lisboa	19,186	10%	18,641	10%	17,989	9%	19,287	10%	19,639	10%	19,869	10%
Península de Setúbal	7,203	4%	7,213	4%	7,265	4%	7,866	4%	7,986	4%	8,027	4%
Alentejo	23,375	12%	23,879	12%	24,544	13%	24,709	13%	25,057	13%	25,461	13%
Algarve	1,722	1%	1,434	1%	1,352	1%	1,404	1%	1,400	1%	1,427	1%
Açores	1,700	1%	1,700	1%	1,708	1%	1,708	1%	1,708	1%	1,708	1%
Madeira	1,052	1%	1,051	1%	1,052	1%	1,047	1%	1,025	1%	681	0%
Total	193,219	100%	191,632	100%	190,322	100%	192,743	100%	192,401	100%	192,029	100%

Figure 2: Evolution of the Vine Total Area - Portugal (ha) – Own creation. Source (IVV, 2022)

The country is currently divided into fourteen main high-quality wine-producing regions, as shown in Figure 3. This division is a consequence of the creation of denominations areas called Geographical Indication (IG) or Origin Denomination (D.O). IG or D.O denominations were created when Portugal joined the European Union (at the time of the European Economic Community (EEC)) to identify wines that, due to their characteristics, are intimately associated with a specific region. The Certifying Entities guarantee not only the geographical area of origin of these wines but also that they are subject to high control at all levels of the winemaking process ranging from soil typology, farming practices, winemaking methods, authorized and recommended varieties, minimum natural alcohol content, among others (IVV, 2022).

Given that wines labeled as IG or D.O go through such a rigorous process, it has been increasingly important for customers to consume wines labeled as such. For that reason, Portugal has witnessed a decrease in the number of wines that are not subject to strict rules of control (see Figure 4) to increase the wines' marketability inside the country and in the international markets (IVV, 2022).

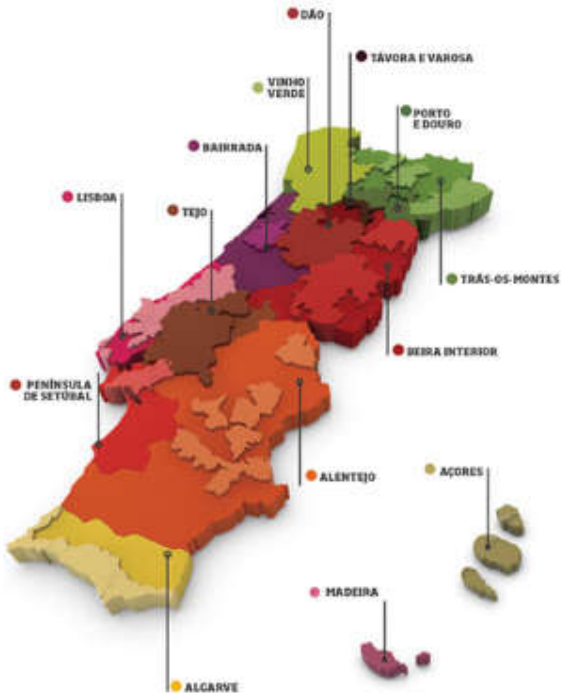


Figure 3: Wine Regions in Portugal - Source (Turiventos, 2015)

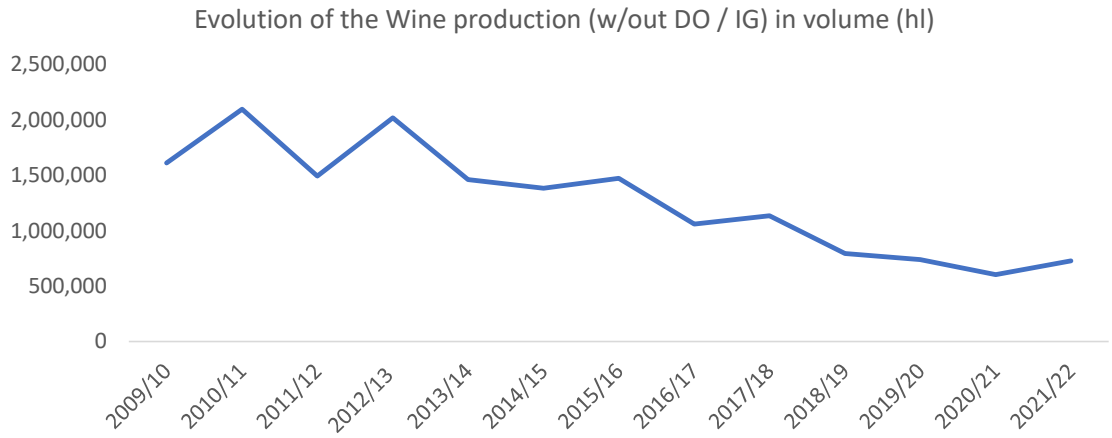


Figure 4: Evolution of the Wine Production (without DO / IG) by Region in volume (hl) – Own creation. Source: IVV data (IVV, 2022).

Portugal occupies the eleventh (11th) place as the biggest wine producer (OIV, 2022). The level of wine production has mostly stayed the same in the last decade, with an average of 6,2 millions hectoliters (IVV, 2022). However, according to the forecasting data of IVV (IVV, 2022), Portugal will achieve 7,4 million hectoliters in 2021, the highest wine production volume since 2006. Figure 5 illustrates the annual wine production of the fourteen (14) vineyard regions during the last decade.

According to data from the same source (IVV, 2022), in 2019, the top three country's regions with the highest volumes of wine produced, which accounted for more than half of the country's wine production in terms of volume produced (in hl), were Douro (20%), Lisboa (20%), and Alentejo (18%), as shown in Figure 5.

Vineyard Region	2021/22	2020/21	2019/20	2018/19	2017/18	2016/17	2015/16
Minho	893,694	848,311	816,396	759,757	967,067	736,430	874,491
T. Montes	106,029	94,425	118,014	50,670	85,430	76,549	112,407
Douro	1,614,569	1,264,349	1,692,188	1,259,683	1,448,874	1,337,201	1,612,670
Beira Atlântico	180,630	174,391	159,063	177,782	260,668	195,534	272,680
Terras do Dão	286,821	189,197	257,481	178,409	312,462	237,186	342,316
Terras da Beira	261,418	219,298	255,658	162,032	190,394	255,818	226,203
Terras de Cister	65,378	37,744	59,417	37,307	54,052	69,560	67,052
Tejo	713,233	644,153	615,736	635,514	648,441	551,300	611,183
Lisboa	1,339,162	1,253,303	987,009	1,170,068	1,225,840	998,804	1,202,711
P. Setúbal	548,124	475,135	503,579	472,197	525,049	463,035	504,129
Alentejo	1,289,473	1,159,067	996,290	1,092,617	954,910	1,050,439	1,152,184
Algarve	15,939	13,043	13,926	17,042	15,777	10,419	13,630
Sub-total continent	**7,314,469**	**6,372,416**	**6,474,757**	**6,013,078**	**6,661,245**	**5,982,274**	**6,991,655**
Madeira	37,612	37,264	38,559	34,880	42,773	33,849	45,747
Açores	6,458	8,350	13,246	13,285	5,034	5,845	10,404
Sub-total islands	**44,070**	**45,614**	**51,805**	**48,165**	**42,908**	**39,694**	**56,150**
Total	**7,358,539**	**6,418,030**	**6,526,562**	**6,061,243**	**6,736,772**	**6,021,968**	**7,047,805**

Figure 5: Evolution of the Total Production by Vineyard Region in Volume (hl) - Source (IVV, 2022)

Portugal is currently known as one of the best wine producers worldwide, which granted the country nineth (9th) place in export values in 2019 (OEC, 2022).

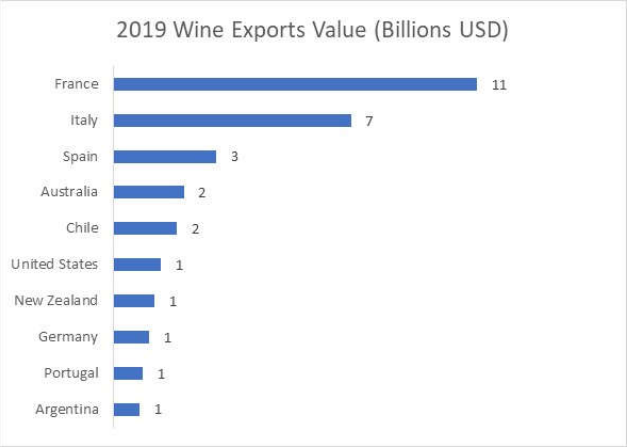


Figure 6: Wine Exports Values, 2019 - Source: (OEC, 2022).

1.2.3. Justification

Due to the wine industry's importance to the Portuguese economy, this study attempts to evaluate winemaking enterprises' financial and economic health. With the growing competition in the wine sector due to globalization, it is increasingly important to perform a financial analysis versus several competitors in order to understand the economic situation of the company and the sector in which it operates.

There is a gap in the literature where there are almost no studies financially comparing the companies in different wine regions of Portugal. It was also noticed that an analysis grouping companies by profitability makes more sense for the economic-financial analysis of companies in the sector.

Therefore, the report built with seven dashboards will allow to perform a detailed comparison of the companies' financial results under each vineyard region. Furthermore, the companies within the sample were aggregated into three different clusters according to their profitability using a feature available on Microsoft Power BI[1] contributing to a better understanding of how companies in different wine regions of Portugal perform financially and who their peers actually are based on economic-financial clustering.

[1] BI tool developed by Microsoft https://powerbi.microsoft.com

2. LITERATURE REVIEW

2.1. ECONOMICAL AND FINANCIAL ANALYSIS

The basic financial statements are raw financial results and are of limited value. Nonetheless, there are several ways this information can be used to analyze companies' economic and financial performance, while measuring and evaluating business performance.

One of the most common is to compute financial ratios, which is an outcome of two or more selected numerical values taken from company's financial statements, allowing one to gather a great deal of insight into a company's performance by synthesizing a vast amount of data and information. This complements the process of simply analysis the financial statements in absolute values (Fernandes, Peguinho, Vieira , & Neiva, 2016). In addition, financial ratios monitor key trends over time, eliminate the effect of size, inflation, and other metrics that affect annual comparability, and allow for comparing the company's performance against its peers.

Even though financial ratios analysis usually leads to similar conclusions about the economic performance and financial position of the company than the analysis of the financial statements, financial ratios are a powerful tool obtained by analyzing different aspects of the balance sheet and financial reports of companies, particularly when combined with an understanding of the company and the industry in which it operates in (Farinha J. B., 1994). If the companies differ significantly in size or report the financial data in different currencies, it is not useful, for example, to compare the reported net income. Thus, financial ratio analysis removes size as a factor and eliminates the requirement of translating the reported currencies into a common currency, given that the focus is on ratios.

Yet, ratios also have some limitations, such as i) giving a firm the ability to compare only quantitative aspects, ii) need to be analyzed over time and against peers to have value, and iii) they cannot be analyzed without contextualization, because the same ratio can have a different meaning on different situations (Fernandes, Peguinho, Vieira , & Neiva, 2016). Furthermore, it is difficult to define the best indicators/ratios once there is no standardization of ideal ratios. That is not different in the winemaking sector. Therefore, different authors have presented different perspectives on measuring a wine-producing firm's economic and financial performance.

Profitability is commonly used to measure economic performance. Within this category, Return on Assets (ROA), Return on Equity (ROE), and Return on Investment (ROI) were used by Sellers-Rubio (2010) to analyze the performance of Spanish wine companies. Other authors also included Return on Sales (ROS) ((Carreira, Monica, & Heliodoro, 2012); (Migliaccio & Tucci, 2019)) and Gross Added Value (GAV) (Arimany-Serrat & Farreras-Noguer, 2020) as profitability measures.

Productivity is also commonly used to measure wine companies' performance through GAV per employee ((Seller & Alampi-Sottini, 2016); (Rochi & Stefani, 2001), (Rebelo, Faria, Lourenço-Gomes, & Gouveia, 2020)) and Sales per employee ((Sellers-Rubio, 2010); (Seller & Alampi-Sottini, 2016); (Rochi & Stefani, 2001)).

Operational and financial indicators also are used as a proxy to measure companies' performance. Rocchi & Stefanie (2001) analyzed structural and financial ratios (i.e., total assets turnover, stocks

turnover, current ratio, debt over assets, revenue, and production costs trend) to understand the performance of Italian wine industries. Leverage (Migliaccio & Tucci, 2019), solvency (Arimany-Serrat & Farreras-Noguer, 2020), liquidity, and financial autonomy ratio ((Rebelo, Faria, Lourenço-Gomes, & Gouveia, 2020); (Geraldes, 2021); (Carreira, Monica, & Heliodoro, 2012)) are other ratios used to measure performance of Portuguese wine companies .

Furthermore, some authors defend that other factors explain the disparities between the performance of some companies in the same industry. Geraldes (2021) analyzed the industries of the Douro Region in Portugal. The study compared family-owned businesses with not family-owned ones and concluded that family-owned companies in this region presented better results than those that were not family-owned.

Age is also a factor used to explain disparities between companies. Rossi et al. (2015) analyzed the impact of age on the Italian wine industry and concluded that old firms outperform younger firms in terms of revenue growth, profitability, and financial strength. The authors added that it could also be related to the fact that Italian old wine firms are small and lead by families, which facilitates sustainability over time due to the speed of the decisions, the resilience in the processes, and the ability to adapt to changes. On the other hand, Rebelo et al. (2020) did not find a linear relationship between age and firm performance when analyzing the Portuguese wine industry. Yet, they concluded that firm size, labor productivity, financial autonomy, and short-term debt ratio are positively related to economic performance. The impact of firm size on the performance of companies operating in the Douro region has also been analyzed by Cerveira et al. (2018). The results showed that large farms (an area greater than 20 ha) in Douro Superior and Cima Corgo reveal higher productivity, unlike Baixo Corgo, where the results suggest that medium-sized farms (with an area between one and eight ha) may provide higher productivity. Farms with small areas displayed weaker productivity.

Still in the research on the economic performance of the Portuguese wineries, Carreira, Diz & Heliodoro (2012) characterized the Portuguese wine industry by comparing companies of different regions of the country using liquidity, profitability, operational and leverage ratios between 2006 and 2008. The results show that the North Region is the most profitable one. Alentejo is a region in constant growth, and Lisbon and Tejo are economically stagnant regions. Vieira & Fragoso (2022) also compared Portuguese regions, but their research analyzed accounting and operational variables that affect wine industry efficiency. The results indicate that 36% of the firms are efficient. Setúbal, Alentejo, and Algarve regions are noteworthy since these obtained the highest percentage of efficient companies. The findings suggest that wine companies should focus primarily on reducing inventory and fixed assets and increasing sales revenue to increase efficiency. Authors suggest wine firms can achieve it by raising customers' perception of quality, monitoring the inventory, adopting operation strategies that reduce inventory levels, or outsourcing several services to move assets off the balance sheet. Farinha (2021) also compared Portuguese wine industries, but in her research, the focus was on comparing the performance of industries located in the Setubal region with the Portuguese market from 2015 to 2019. The author also separated the companies by size (Micro, small, medium, and large). The conclusion was that the larger companies presented better profitability and are financially healthier compared to companies in other regions in Portugal and, specifically, in companies within Setúbal Region.

Nonetheless, for this study, the ratios were chosen based on the studies previously carried out in this field and, furthermore, limited to the ones which were possible to calculate according to the data available. For this study, profitability, liquidity, financial leverage, and operational and efficiency are the four categories in which those indicators have been aggregated. A synopsis of each is given in Table 1**Error! Reference source not found.**, followed by the formula and application of each one of them.

Table 1: Financial Indicators

Measure	Computed as…	Application
Return on Assets (ROA)	After-tax operating income / Total assets at the start of the year	Measures after-tax operating income as a fraction of the firm's total assets
Return on Equity (ROE)	Net income / Equity	Measures the income to shareholders per dollar that they have invested
Return on Capital Employed (ROCE)	EBIT / (Total Assets - Current Liabilities)	
Current Ratio	Current assets / Current liabilities	Understand how well a company is generating profits from its capital
Liquidity Ratio	(Current Assets - Stock) / Current Liabilities	Assesses if a company has enough cash to pay its immediate liabilities
Solvency	Total Equity / Total Assets	Measures the amount of equity the business has when compared to the total assets owned
Financial Leverage	Total Liabilities / Total Equity	It can assess the extent of a firm's reliance on debt.
Debt-to-Assets Ratio	(Short-term Debt + Long-term Debt) / Total Assets	A measure of the company's assets that are financed by debt rather than equity
Short-Term Debt Ratio	Short-term Debt / (Short-term Debt + Long-term Debt)	Indicates the likelihood that a company will be able to deliver payments on its outstanding short-term liabilities
Asset Turnover	Sales / Total Assets	Asset requirements and effectiveness
Stock Turnover	Sales / Stocks	Shows how many times a company turned over its inventory in a given period
Credit Period	Average Account Receivables / Net Credit Sales / Days	Measures the number of days that a customer is allowed to wait before paying an invoice
Collection Period	365 Days * (Average Accounts Receivables / Net Credit Sales)	Measures the amount of time it takes for a business to receive payments owed by its clients in terms of accounts receivable (AR)

2.1.1. Profitability

The primary objective of any executive team is to generate profit for the firms' owners/shareholders. In other words, a company's goal is to ensure its sales turnover is bigger than the amount of expenses in a certain period. To assess the team's capability of achieving profits, profitability ratios are frequently used. Profitability ratios are the group of indicators, expressed in percentage, in which

the absolute profitability is divided by some proportionate financial statement batch. There are several profitability ratios. However, for this study, the ones used are Return on Assets (ROA), Return on Equity (ROE) and Return on Capital Employed (ROCE).

2.1.1.1. Return on Assets (ROA)

Return on Assets refers to a financial ratio that indicates how profitable a company is in relation to its total assets. It allows to assess how efficiently a company uses its assets to generate earnings and profit, regardless of its origins. The higher this ratio is, the more efficient and productive at managing its balance sheet to generate profits a firm is, whereas a lower ROA indicates there is room for improvement (Fernandes, Peguinho, Vieira , & Neiva, 2016).

2.1.1.2. Return on Equity (ROE)

Return on equity (ROE) is the most used ratio by the financial analysts. It's a measure of financial performance expressed as a percentage and calculated by dividing net income by shareholders' equity. For a lot of companies, ROE configures one of the main goals of the management. The higher the ROE, the more efficient a company's management is at generating income and growth from its equity financing (Farinha J. B., 1994). Nonetheless, whether an ROE is deemed good or bad will depend on what is usual among a stock's peers. A good rule of thumb is to target a ROE equal to or just above the average for the company's sector—those in the same business.

2.1.1.3. Return on Capital Employed (ROCE)

Return on capital employed (ROCE) is a financial ratio that can assess a company's profitability and capital efficiency. In other words, this ratio can help to understand how well a company is generating profits from its capital as it is put to use (Whiting, 1986). Ultimately, the calculation of ROCE tells you the amount of profit a company generates per one monetary unit of capital employed. The more profit per monetary unit a company can generate, the better. Thus, a higher ROCE indicates more robust profitability across company comparisons. Consequently, investors tend to favor companies with stable and rising ROCE levels over companies where ROCE is volatile or trending lower.

2.1.2. Liquidity

Liquidity assesses the company's capacity to reimburse its debt in the short term. In other words, it answers the question: "Will the company be able to repay its loans within the next year?". When banks grant short-term loans, they worry more about the firm's ability to pay back than the overall asset structure. Therefore, a company must have enough cash, cash equivalents, or assets with high liquidity all the time that can be utilized in case of surprising and unpredictable obligations in order to get through payment obligations.

There is, however, a minor limitation in the calculation of these types of ratios. Since short-term assets and short-term liabilities can easily change, liquidity measures can rapidly become obsolete.

In this study, the liquidity metrics presented in the following sections were considered.

2.1.2.1. Current Ratio

The current ratio measures a company's ability to pay short-term obligations or those due within one year. It tells investors and other stakeholders how a company can maximize the current assets on its balance sheet to satisfy its current debt and other payables. It is calculated by dividing the firm's current assets (i.e., assets that are expected to be liquidated or turned into cash in less than one year, such as cash, accounts receivable, inventory, and other current assets) by current liabilities, which include accounts payable, wages, taxes payable, short-term debts, and the current portion of long-term debt.

In theory, the higher the current ratio, the more capable a company is of paying its obligations because it has a larger proportion of short-term asset value relative to its short-term liabilities. Tend to be acceptable values for current ratio between 1.3 and 1.5. However, any current ratio should be put into perspective against what has been historically normal for the company and its peer group. (Fernandes, Peguinho, Vieira , & Neiva, 2016)

2.1.2.2. Liquidity Ratio

The liquidity ratio, also known as the quick ratio or the acid-test ratio, compares a company's short-term assets, except inventory, to its short-term liabilities to assess its ability to pay its immediate liabilities, such as short-term debt, using cash (Farinha J. B., 1994). In contrast with the Current Ratio, previously discussed, the liquidity ratio disregards current assets that are difficult to liquidate quickly, such as inventory. It is thus a more conservative metric.

2.1.3. Financial Leverage

When a firm borrows money, it promises to make a series of interest payments and repay the amount it borrowed. Leverage ratios measure how much financial leverage the firm has taken on. Financial leverage is usually measured by the ratio of long-term debt to total long-term capital. Nonetheless, leverage may also be measured by the short-term debt ratio, the solvency ratio, or the debt-to-assets ratio.

2.1.3.1. Solvency

Solvency is determined by dividing a firm's total equity by its total assets, and it is expressed as a percentage. Solvency refers to a business's ability to pay all its debt if it were to have to sell its operation immediately. In other words, how much assets are being by shareholders' capital (Farinha J. B., 1994).

2.1.3.2. Financial Leverage

Financial Leverage, also known as the debt-to-equity (D/E) ratio, illustrates the proportion of equity and debt that a company uses to finance its assets (Farinha J. B., 1994). It is calculated by dividing a company's total liabilities by its total amount of shareholders' equity. It signals the extent to which shareholders' equity can fulfill obligations to creditors in the event of a business decline. Low financial leverage indicates a lower amount of financing by debt via lenders, versus funding through equity via shareholders, whereas a higher ratio indicates that the company is getting more of its financing by borrowing money, which subjects the company to potential risk if debt levels are too high.

2.1.3.3. Debt-to-Assets Ratio

Debt servicing payments must be made under all circumstances. Otherwise, a firm runs the risk of being forced into bankruptcy by creditors. Therefore, a company with a high degree of leverage may thus find it more challenging to stay afloat during a recession than one with low leverage.

Debt-to-assets is a ratio used to measure a firm's degree of leverage that defines the total amount of debt relative to assets owned by a company. As its name implies, it is calculated by dividing a company's total debt by its total assets (Ross, Westerfield, Jaffe, & Jordan, 2019).

Investors use the ratio to evaluate whether the company has enough funds to meet its current debt obligations and to assess whether the company can pay a return on its investment. On the other hand, creditors use the ratio to see how much debt the company already has and whether the company can repay its existing debt. A ratio greater than 1 shows that a considerable portion of the assets is funded by debt. A high ratio also indicates that a company may be putting itself at risk of defaulting on its loans if interest rates suddenly rise. Even though a company's debt-to-assets ratio is specific to that company's size, industry, sector, and capitalization strategy, a ratio around 0.3 to 0.6 is generally where many investors will feel comfortable.

2.1.3.4. Short-Term Debt Ratio

The Short-Term Debt Ratio allows one to assess how much of a firm’s debt is short-term compared to its total debt being calculated by dividing the short-term debt by total debt (Fernandes, Peguinho, Vieira , & Neiva, 2016). . Consequently, companies reliant on short-term funding are more vulnerable to liquidity shocks than those with longer-term debt finance. That being said, companies with lower short-term debt ratio are generally perceived as more stable and less risky by investors and creditors compared to firms that highly depend on short-term debt to finance operations.

2.1.4. Operational and efficiency indicators

Operational and efficiency indicators try to understand what factors contribute to this firm’s overall profitability. In order to do that, we can use several financial ratios such as the asset turnover ratio, or sales-to-assets ratio, which shows how much sales are generated by each dollar of total assets, the inventory turnover, which shows how efficient firms are in turning over their inventory, the Credit Period Ratio, number of days that a customer is allowed to wait before paying an invoice and the Collection Period, which indicates the average number of days clients take to pay their bills.

2.1.4.1. Assets’ Turnover

The asset turnover ratio is a metric that compares revenues to assets by measuring the value of a company's sales or revenues relative to the value of its assets (Farinha J. B., 1994). It is calculated by dividing the firm’s total sales by total assets and dividing that number by two. It is used as an indicator of efficiency, which helps investors understand how effectively companies are using their assets to generate sales (Fernandes, Peguinho, Vieira , & Neiva, 2016). The higher the asset turnover ratio, the more efficiently a company generates sales or revenues from its assets base. Conversely, a company with a low asset turnover ratio indicates it is not efficiently using its assets to generate sales.

2.1.4.2. Stock Turnover

Stock turnover, also known as inventory turnover, is a financial ratio showing how many times a company turned over its inventory in a given period (Fernandes, Peguinho, Vieira , & Neiva, 2016). Therefore, it is calculated by dividing sales by inventory in that period. Through this calculation, an enterprise is able to answer the question: "on average, how many days does it take me to sell my inventory?".
Even though a high stock turnover ratio can result from insufficient inventory, it typically suggests strong sales, whereas a low stock turnover ratio might be a sign of weak sales or excessive inventory due to factors such as inadequate marketing, for instance (Ross, Westerfield, Jaffe, & Jordan, 2019).

2.1.4.3. Credit Period

The credit period is the number of days a customer is allowed to wait before paying an invoice – not the amount of time the customer takes to pay an invoice (Ross, Westerfield, Jaffe, & Jordan, 2019). It indicates the amount of working capital that a business is willing to invest in its accounts receivable to generate sales.

2.1.4.4. Collection Period

The average collection period ratio measures the average number of days clients take to pay their bills. It provides insightful information about the firm's effectiveness in collecting money regarding goods/services already provided (Bragg, The Essential Controller: An Introduction to What Every Financial Manager Must Know, 2012).

It is calculated by dividing receivables by total sales and multiplying the product by 365 (days in the period).
For a firm to be able to determine if its average collection period results are good, it must compare its average against the credit terms it offers to its customers (Bragg, Business Ratios and Formulas - A Comprehensive Guide, 2006). For example, if a firm allows its clients to pay it back in 30 days, but the average collection period is 45 days, that indicates a problem in the collection processes. On the other hand, however, if its average collection period is less than 30 days, that is favorable.

2.2. BUSINESS INTELLIGENCE

The amount of data accessible inside and outside of businesses is growing, which increases the need for systems and procedures to turn that data into information that can be utilized in decision-making.

According to Turban et al. (2010), creating systems that enable the formulation of analysis to the decision-making process is increasingly crucial to enhancing the quality and quantity of the information. Business Intelligence (BI) surges in this context. BI's primary goal is to help business users make better decisions, allowing them access to information in the right way, at the right time.

BI was first cited by Hans Peter Luhn (1958), an IBM researcher. He stated that the main goal of a business intelligence system is to support business users by gathering, storing, loading, and distributing information to the users speedily and efficiently.

However, according to Negash & Gray (2008), the term business intelligence was first used in 1989 by Howard Dressner, at the time, a fellow researcher at Gartner Group.

The same authors stated that BI seeks to improve the timeliness and the quality of the data in the decision-making process by combining data gathering, data storage, and knowledge management with analysis to evaluate corporate and competitive information (Negash & Gray, 2008).

More recently, in 2016, Trieu highlighted the fact that the term BI does not have a single and specific definition, but the author defines that commonly BI is used as a general word used to describe ideas and techniques for leveraging fact-based assistance in corporate decision-making (Trieu, 2016).

Figure 7 shows the core elements of a BI platform.

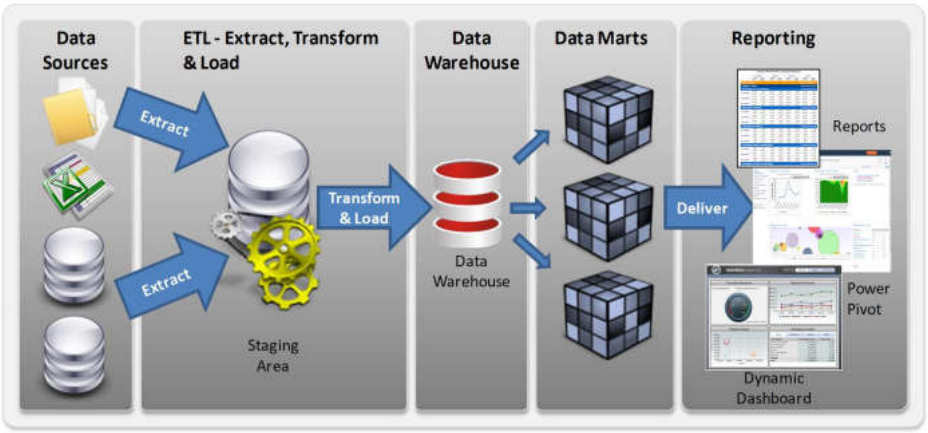


Figure 7: Core Elements of BI platform (Neto, 2021)

The structure of a BI environment has four main elements:

1. Data Sources: The BI application consolidates data from different sources with different formats (e.g., csv, xls, txt, legacy systems, ERP).
2. ETL: ETL means to extract, transform, and load. According to March & Hevner (2005), these processes are responsible for data gathering from different internal systems (i.e., legacy systems and enterprise systems) and external sources, transformation, and pre-processing of data to produce useful integrated data and finally, loading the data into the data warehouse (DW) structure. According to Kimball & Ross (2013), the ETL system consumes a disproportionate share of the time and effort required to build a DW/BI environment.
3. Data warehouse/Data Marts: After the data pre-processing and transformation, data is loaded into the warehouse, where historical information is stored, organized, and structured to facilitate analysis and decision-making. Inmon (2002) defines a data warehouse as “a subject-oriented, integrated, nonvolatile, and time-variant collection of data in support of management’s decisions”. In the next section, more details about techniques for building a good data warehouse will be presented.
4. Reporting: According to Gartner (2022), this element has been gaining emphasis in the past years. Reports and dashboards aim to present information in a way that is easy to

visualize, understand and analyze quickly and, consequently, facilitate decision-making. The reports can go from something as simple as a table to more complex structures, such as indicators, metrics, graphs, and maps. Recently, BI tools also have predictive analysis and automated insights using artificial intelligence.

Throughout the years, BI has undergone several changes and adaptations along with the development of the internet, increasing data generation, and technology evolution in general. A recent report by Gartner (2022) shows that nowadays, Analytics and Business intelligence platforms emphasize visual self-service for end-users and deliver automated insights using artificial intelligence (AI).

According to Turban et al. (2010), by 2005, BI systems started to include AI and robust analytical capabilities. Figure 8 shows various techniques and tools that may be included in a BI system.

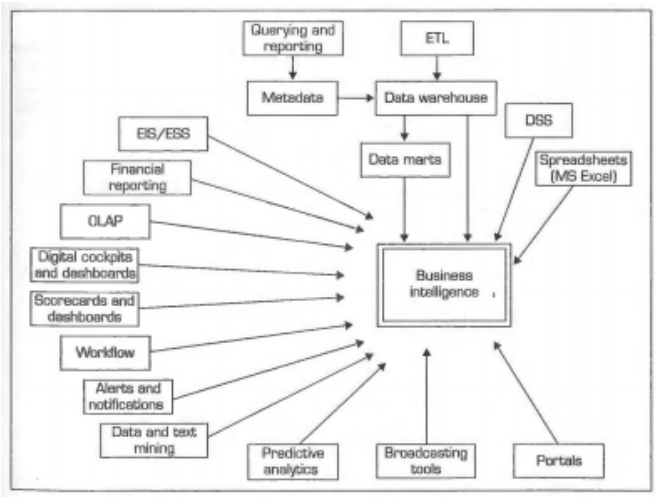


Figure 8: Evolution of BI – Turban et al. (2010)

2.2.1. Data warehouse

The most common type of Data warehouse is called Enterprise Data Warehouse (EDW).

There are two most used approaches to building a data warehouse. The first one was defined by Inmon (2002), and Kimball (2013) defined the second one. According to Howson (2014), both methodologies are very similar in many aspects and the main difference relates to how data is stored. While Inmon (2002) defends normalizing data only once, storing data in a granular way, and later having relevant data marts modeled out of the model, Kimball (2013) advocates building star schemas that can be connected to the data already stored in the model or directly from the source systems.

In other words, according to Inmon's perspective, it is better to build a big warehouse initially and later build data marts using subsets of the data from the warehouse. This architecture is often called hub-and-spoke Corporate Information Factory (CIF). Figure 9 shows a simplified version of CIF.

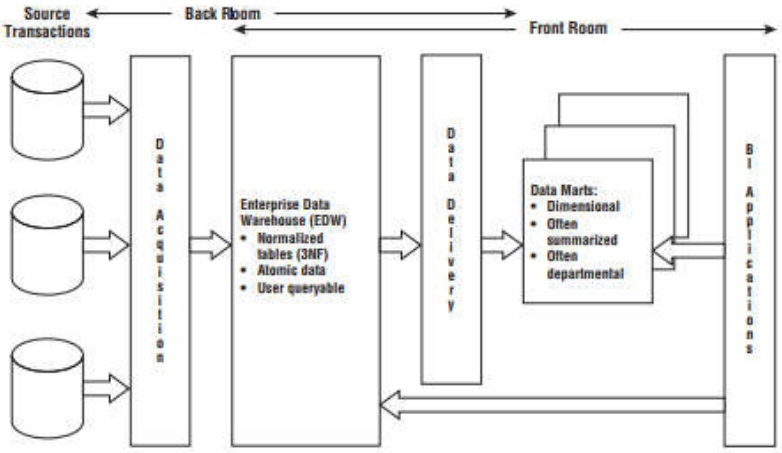


Figure 9: Simplified illustration of the hub-and-spoke Corporate Information Factory (Kimball & Ross, 2013)

On the other hand, Kimball suggests initially building data marts with departmental subsets of the data and integrating them later in a data warehouse. This architecture is often called Data warehouse bus architecture. Figure 10 illustrates a simplified version of Kimball's architecture.

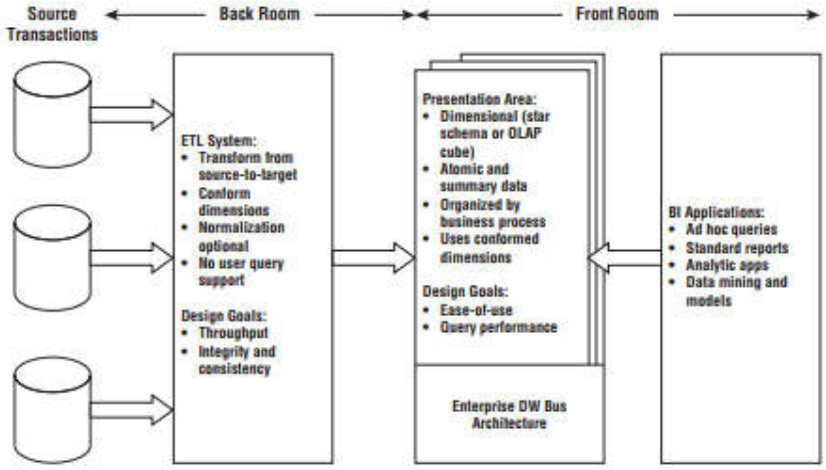


Figure 10: Core elements of the Kimball DW/BI architecture (Kimball & Ross, 2013).

In addition to these two architectures, there are many variations of data warehouse architectures. Figure 11 shows some alternatives architectures that are in between or beyond the traditional architectural structures.

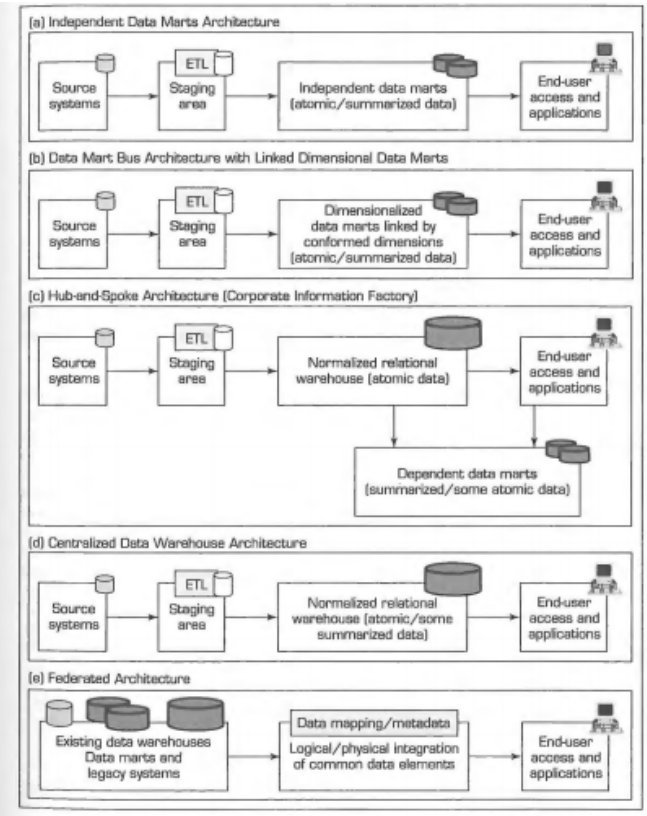


Figure 11: Alternative Data Warehouse Architectures (Turban, Ramesh, Dursun, & King, 2010)

According to Turban et al. (2010), even with the existence of different architectures, the design of data representation has always been based on the concept of dimensional modeling.

Dimensional modeling organizes huge data sets in ways that are meaningful to decision-makers. Those models are relatively easy to query and analyze (Arnott & Pervan, 2005).

Kimball & Ross (2013) state that dimensional modeling is widely accepted as the preferred technique because it delivers data understandable to business users and fast query performance.

There are two typical schemas to develop the dimensional model: star schema and snowflake schema. Both schemas are a logical arrangement of tables by building relationships between them. Typically, these schemas have centralized fact tables connected with dimension tables. Beyond the format, the main difference between both schemas is that, in the snowflake schema, the dimension tables can be represented by multiple related tables because the data is normalized, while in the star schema, each dimension is represented by one single table with denormalized data (Turban, Ramesh, Dursun, & King, 2010).

2.2.2. Big data and Information Systems in Wine Sector

Big data is transforming the agriculture industry and in the recent years the transformation is became increasingly visible. The three factors most affected by the opportunities presented by Big Data are improve the efficiency and reduce costs of operating machines, improve productivity and

efficiency of crops and mitigation of the effects of weather conditions and optimize pricing. (Rijmenam, 2014)

When one examines the investment in big data, the relevance of the wine industry is not ignored. The wine sector is one of the agricultural industries that have been received a lot of investments in terms of big data technology, from data collection to development of algorithms to improve the several stages of the wine making process. The data generates by the sector has grown and nowadays, the data can come from field-embedded sensors, (i.e., water stress sensors), air sensors (i.e., drones and satellite images), field machines (i.e., tractors). Also, Artificial Intelligence and Machine learning has been used in every stage of the winemaking process - from monitoring vineyards to increasing production efficiency to predicting the quality of wines (Tivon, 2018).

In California, in the United States of America, with the use of satellite pictures, the Internet of Things (IoT), physical analytics, and cognitive computing technologies, IBM and the E.J Gallo Winery developed an irrigation system based on data analysis. With the help of that technology, both the efficiency on water usage for irrigation and the vineyard outputs were increased (Fortune, 2016).

In Australia, Wine Australia, Digital Globe, and Consilium Technology worked together to develop a Geospatial Artificial Intelligence for Agricultures (GAIA). The software provides valuable insights about vineyards across the country. Deep learning neural network allows GAIA to improve the classification of vineyards and crop conditions, monitor plant health, assess soil moisture, and even determine fruit quality (Tivon, 2018).

"Horizon 2020" was an EU's financing program for research and innovation from 2014 to 2020 that was underway throughout Europe with, an approximately, €80 billion budget.

In Portugal, Horizon 2020 partially funded the development of a system called WINEGRID. The system was developed in an established partnership between Sogrape Vinhos S.A., a global family-owned wine company, with a strong international presence in more than 120 markets, and Watgrid S.A., a Portuguese company focused on the development of innovative technological solutions for process digitalization in liquid related industries (Sogrape, 2022). It combines the use of sensors with artificial intelligence and real-time dashboards. The sensors, when placed inside a vat of fermenting wine, measure and continuously send essential data to evaluate the quality of the process and the final wine. Afterwards, a dashboard consolidates all the sensors' data and transforms it into useful information for the users. In addition, the platform uses artificial intelligence to provide insights to the users and can be accessed remotely, allowing the decision-makers to access it anytime and anywhere (Winegrid, 2022).

The winemaking industry did not go unnoticed by the recommendation systems. There are several available systems, such as Preferabli and Hello Vino. Both use artificial intelligence to understand consumer preferences and make suggestions of wines. Another app, Vivino, also uses label recognition technology but does not provide recommendations. Instead, it offers instant access to wine reviews and prices. The company Wine Searcher uses AI to classify wines and link users to half a million products at over 80,000 retailers, a task that otherwise would be incredibly difficult and time-consuming (Tivon, 2018).

Those are some examples where the AI and big data applications were applied in the winemaking process. When it comes to BI, in particular, a system called Wine Pulse[2] was developed to analyze wineries' performance. It updates the winery DTC performance daily and compares it with its peers based on location and size. The platform also provides RFM analysis, a data mining technique to analyze customer purchase habits.

[2] https://www.winepulse.com/

3. METHODOLOGY

3.1. DATA SOURCES

The solution implemented is characterized by two different analyses related to the wine market in Portugal:

i) Analysis of a consolidated view of companies that shared their financial and statistical information with Bank of Portugal according with the Portuguese law (Decreto-Lei nº 8/2007) and for the purpose of this study, it will be referred as entire wine sector.
ii) Analysis of the sample of this study: the sample creation will be explained in the following paragraphs.

Thus, for this study, companies in the Portuguese wine sector were grouped, through the Classification of Economic Activities, revision 3 (CAE-Rev.3) – CAE 11021, entitled "Produção de vinhos comuns e licorosos" (INE, 2007).

The sector data of wine in Portugal was retrieved from a dashboard called "Quadro do Setor" publicly shared by the Bank of Portugal[3]. The dashboard has data of all Portuguese sectors. For the purposed of this study was filtered only the data related with Economic Activity 11021 as cited previously. The report presents the consolidated view of the entire Portuguese wine sector from 2016 to 2020.

Regarding the sample of this study, it was taken from Orbis database (which provides accounting information of private companies). The data was retrieved for the years 2016 to 2020. It was proceeded two steps to build the final sample. The first step was filter Portuguese companies with Economic Activity 11021 as cited previously, resulting in an initial sample of 316 firms. The second step was in the instances for which this database does not report information on any relevant variable, the company was removed from this study. 148 wineries comprise the final sample.

Those 148 wineries were grouped according to their vineyard region. Some regions are presented together due to a low number of companies under them. Figure 12 shows the distribution of the sample by each vineyard region:

Vineyard Region	Number of Companies
Alentejo	23
Bairrada	9
Dão	7
Douro/Porto & Trás-os-Montes	34
Lisboa	13
Portugal Ilhas	7
Setubal & Tejo	16
Vinhos Verdes	39
Total	**148**

Figure 12: Number of Companies by Vineyard Regions

3.2. SOFTWARE

The software used to develop the business intelligence model was Microsoft Power BI.

[3] https://www.bportugal.pt/node/574500?mlid=1339

The platform allows users to combine multiple data sources and perform data cleaning and transformation. Furthermore, it enables users to build the dimensional model and create reports and dashboards. In the past years, the platform has also developed some Artificial Intelligence techniques to deliver automated insights to users.

According to the Magic Quadrant of Gartner (2022), in January of 2022, Microsoft Power BI was the market leader in Analytics and Business Intelligence platforms, as seen in Figure 13. According to that same report, the platform's main advantages are the integration with other Microsoft tools, such as Office 365, Microsoft Teams, and Azure Synapse, and its cost-benefit.

Figure 13: Magic Quadrant (Gartner, 2022)

3.3. DATA DIMENSIONAL MODEL

A Dimensional Model is designed to read, integrate, summarize, and analyze numeric information in a data warehouse, such as values, balances, counts, and weights.

This project follows the dimensional data modeling guidelines proposed by Kimball and Ross (2013). The concept stated by Kimball's methodology is that the dimensional model comprises dimension tables and fact table.

The fact table represents the facts/events, and it has the events' performance measures. The dimension tables describe and categorize the facts.

Additionally, the model follows a star-schema structure with one-to-many relationships between each dimension table and the fact table. The three-dimension tables are connected directly to the fact table. This style of dimension model allows for performance increase and easy deriving of insights.

Figure 14 shows the dimensional model. In this context, the *Dim Location* answers "where" questions. The dimension table *Dim_Fiscal_Year* provides information about when the fact happened. The third dimension table, *Dim Identification*, answers the question "who," and, together, the three tables give context to the measures in the fact table that consists of financial and economic data and metrics. In order to create the relationship between dimension tables and fact table, surrogate keys were created during the ETL process. Each surrogate key is a numerical key used to improve the performance of the relationship between the tables.

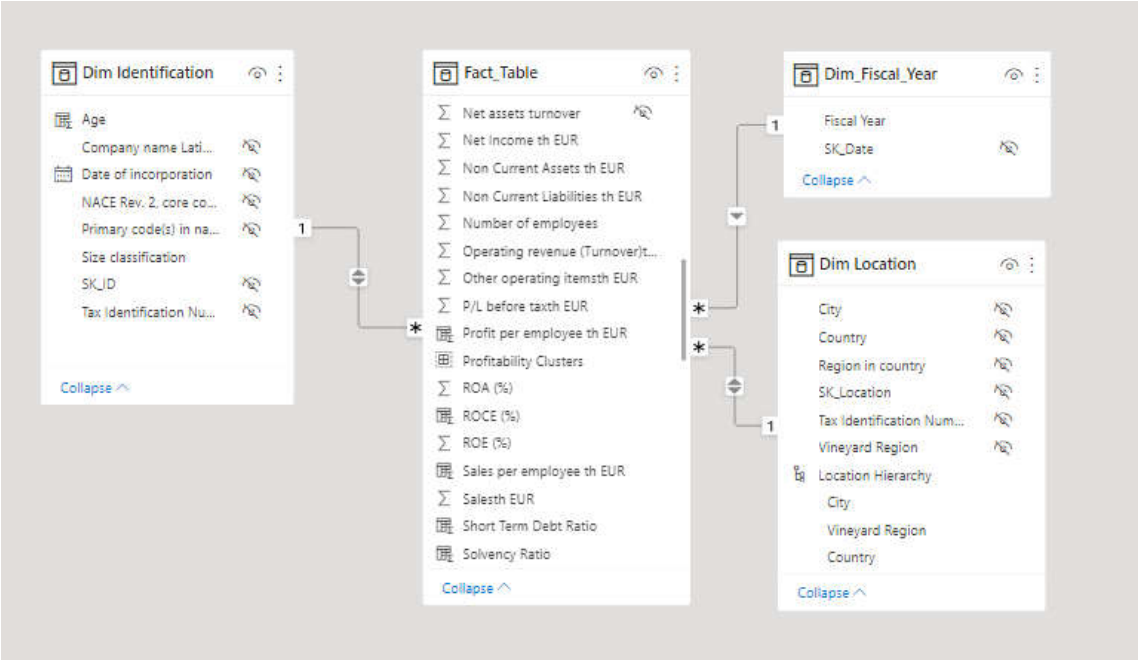


Figure 14: Dimensional Model

The model is divided in the following way:

1) Dimension Data: *Dim_Fiscal_Year*. When performing a financial analysis of companies, it is crucial to analyze the evolution of the ratios over time. This dimension is the one that ensures the evolutionary analysis of the companies in this study.
2) Dimension Location: *Dim Location*. As stated before, this study aims to analyze the wine market in Portugal by comparing the companies of each vineyard region. This dimension will be responsible for providing the location of the companies.
3) Dimension Company: *Dim Identification*. This dimension provides more details about the companies' characteristics, such as date of incorporation and size classification. This table also contains the Code of Industry classification, the NIF (i.e., the Portuguese vat number), and the name of each company, but those columns were hidden from the

model, since the objective of this study is the analysis by vineyard region, not by company.

4) Fact_Table: All the ratios cited in ***Section 2.1*** that will be used to perform the financial and economic analysis, as well as some financial metrics necessary to this study, are in this table.

3.3.1. ETL

The ETL process was done using first Microsoft Excel to make some treatments and transformations, and later the data was loaded into Power BI.

All data preparation inside Power BI was carried out using Query Editor.

The first main preparation in Query Editor was a concatenation of 6 tables to create the *Fact table*. This table results from the concatenation of five tables from Orbis (one for each year) and one containing the data extracted from the Bank of Portugal. Thus, the resulting table contains all the financial data of the companies and the entire sector in Portugal.

After that, some small transformations were done, such as replacing null values and removing columns.

The *Dim Location* and *Dim Identification* came from the data retrieved from Orbis. But for each table, only the columns related to that dimension were kept, removing the other columns.

Additionally, a manual table was created to include a location for the data related to the Portugal Sector. A vineyard region called Portugal was inserted to distinguish the sector data from the companies' data, and this manual table was concatenated into *Dim Location*.

Finally, a manual table was created to be the *Dim_Fiscal_Year*. This table contains two columns: The Fiscal Year and SK_Fiscal_Year.

The last transformation on the Query Editor was the creation of the relation between the dimension tables and the *Fact_table* by creating the Foreign Keys.

In the Report View, some transformations were done but more related to the creation of the dashboards.

The first one, in the table *Dim Location* was created a location hierarchy containing three attributes: City, Vineyard region, and country, with the city being the lowest level and the country the highest level.

A calculated column called Age was created in the table *Dim Identification*, which was calculated as the difference between the year of this study and the company's year of incorporation. It will help the analysis of any relationship that can be found between the age of companies and companies' performance.

Finally, some calculated columns and measures were created in the *Fact Table*. Not all ratios needed to perform the financial analysis were available in the data sources, so it was necessary to create some calculated columns to have them available to perform the analysis. Additionally, during the

development of the dashboards, some measures were. Measures and calculated columns are calculations built in the tables, using DAX, to analyze the information. DAX is an expression language used in Power BI, and it is very similar to the formulas used in Microsoft Excel.

DAX helps create new information from data already in the model, such as the measures and calculated columns. The main difference between calculated columns and measures is that in calculated columns, the calculations are performed at the row level, while measures are more related to the aggregation of numeric columns that already exist in the model. **Error! Reference source not found.** shows the entire content of the fact table.

Table 2: Fields of the Fact Table

Original fields	Fields created to build the relationship between the tables	Calculated collumns created using DAX	Measures created using DAX	Collumns Created using AI insights
Tax Identification Number (TIN)	FK_Location	EBITDA th EUR	%EBIT Margin	Profitability Clusters
Salesth EUR	FK_ID	Profit Per Employee th EUR	%EBITDA Margin	
EBIT th EUR	FK_Fiscal_Year	Liquidity Ratio	%EBITDA Sample of Sector	
Financial P/Lth EUR		Sales per employee th EUR	%FTE Sample of Sector	
P/L before taxth EUR		Employment Cost per employee	%Net Income Margin	
Taxationth EUR		Gross Added Value th EUR	%Sales Sample of Sector	
Net Income th EUR		ROCE%	EBIT 2016	
Material coststh EUR		Assets Turnover	EBIT for Sample th EUR	
Employment Costs th EUR		Solvency Ratio	EBIT for Sector th EUR	
Depreciation & Amortizationth EUR		Financial Leverage Ratio	EBITDA 2016	
Other operating itemsth EUR		Debt to Assets	EBITDA for Total Sample th EUR	
ROE (%)		Short Term Debt Ratio	EBITDA for Total Sector th EUR	
ROA (%)		Gross Added Value per employee th EUR	Financial Leverage Ration Total Sample	
Stock turnover %			Financial Leverage Ration Total Sector	
Collection period (days)			Liquidity Ratio Total Sample	
Credit period (days)			Liquidity Ratio Total Sector	
Current ratio			Net Income 2016	
Number of employees			ROE (%) Total Sample	
Total Assets th EUR			ROE (%) Total Sector	
Equity th EUR			Stock Turnover (%) Total Sample	
Non Current Liabilities th EUR			Stock Turnover (%) Total Sector	
Current Liabilities th EUR			Total EBIT	
Liabilities th EUR			Total EBITDA	
Current Assets th EUR			Total FTEs Sample	
Non Current Assets th EUR			Total FTEs Sector	
Stocks th EUR			Total Net Income	
			Total Sales	
			Total Sample Sales th EUR	
			Total Sector Sales th EUR	

3.4. CLUSTER ANALYSIS

While comparing the financial results of the vineyard regions, it has been witnessed that, even inside each region, there were significant asymmetries between companies, even inside each region. Therefore, it was necessary to aggregate the companies in clusters based on their profitability. That way, this study could analyze the financial indicators of the several companies included within the sample in a fairer and more substantiated way, instead of comparing them solely based on the region they belong to.

As stated in Section 2.2, BI tools are increasing their capabilities regarding AI insights and predictive analysis. The clustering functionality available in Power BI was used to group the companies according to their profitability.

Cluster analysis is a machine learning algorithm that is used to group entities.

The major of machine learning algorithms fall under a category called supervised learning. Those algorithms learn to link data with a target, based on a previously known sample. Once the algorithm is trained, it can be used to create predictions on new data. However, there is another type of

algorithm called unsupervised learning. Those algorithms are used when there is no target, and the algorithm tries to group the data into clusters. From a data collection about a group of entities, the algorithm seeks to organize them in homogeneous groups, assessing a frame of similarities/differences between units.

There are three main stages for clustering:

I. Define the variables to be used: The objective of this study was to group the companies according to their profitability. So, the profitability ratios were chosen to perform the cluster: ROE, ROCE, and ROA.
II. Define the clustering algorithm: there are several algorithms, such as hierarchical clusters, K-means, Density-Based Clustering (DBSCAN), Mean-shift algorithm, Fuzzy clustering, and Self Organizing Maps. In Power BI, the clustering function uses the K-means algorithm to create the clusters.
III. Profiling the clusters: Assess, analyze, and validate the results of the solution. In this case, a scatter plot was used to see the cluster distribution (Figure 19: Dashboard 5 – Portuguese Wine Market: Cluster Analysis). Also, some further analysis is presented in Section 4.

3.5. REPORTS/ DASHBOARDS

The last stage of developing a BI model is the creation of dashboards to present the results. The **Wine Report** has seven pages.

The first page has a general view of the wine sector. This page presents some measures about the sector, such as EBITDA, EBIT, and Net income, as well as the percentage of these indicators against total sales. Additionally, this page has multiple KPIs, which showing the variances of the three (3) metrics mentioned before throughout the analysis period (Year against 2016).

Moreover, another analytics functionality of Power BI was implemented. This page has a forecasting of 5 years for the sales amount. The forecast was calculated using a confidential interval of seventy-five percent (75%), and it is presented in a line chart showing the upper and higher bounds.

Finally, the page shows the number of employees employed by the sector and their costs by fiscal year.

The second page is also related to sector data. However, on this page, the focus is on the financial ratios. Profitability, liquidity, leverage, and efficiency and operational ratios are shown by fiscal year. Furthermore, productivity ratios such as sales amount per employee, gross added value per employee, and employment cost per employee are presented.

Both pages are based on the data of the Bank of Portugal, and they will allow the economic and financial analysis of the sector.

The third page has a general view of the sample. This page presents the same visualizations shown on page one, but the data is related to the 148 companies chosen for this study.

The next page is a comparison between the entire sector and the sample. This page allows the analysis of the sample's representativeness compared with the entire sector and the financial performance of the companies in the sample compared with the entire sector.

The fifth page is a more detailed view of the sample, providing more details about each vineyard region. On this page, it is possible to understand the sample's distribution by vineyard region regarding the number of companies and EBIT amount. Additionally, this page shows the average number of employees per company of each region as well the average ages of them. Finally, some financial measures are shown: Average Sales Amount, Average Gross Added Value and Average Net Income by region, Average EBT per employee by region, and Average Employment Cost per employee by region.

On the sixth page, a cluster analysis was performed. This page is important for understanding the characteristics of each cluster. A scatter plot is shown to demonstrate the distribution of each cluster. The number of companies by region and by cluster is also presented. Moreover, the profitability, liquidity, and leverage ratios are shown for each cluster. Finally, the total sales amount by cluster by year is presented. The creation of these clusters will facilitate the economic and financial analysis of each vineyard region on the next page.

Similar to the second one, financial ratios are presented on the last page. However, this page focuses on the analysis by vineyard region and cluster, which can be chosen by applying some filters.

4. RESULTS AND DISCUSSION

In this section, the dashboards created are presented, followed by the economic and financial analysis arising from the data presented in each.

4.1. DASHBOARD 1 – PORTUGUESE WINE MARKET: SECTOR ANALYSIS

The first dashboard, titled *Portuguese Wine Market: Sector Analysis*, presents a consolidated view of the performance of the wine sector in Portugal throughout the years.

On the left side of the dashboard, some sector metrics are presented in a multi-row card. At the top, a few KPIs are presented, comparing some financial indicators from the selected year against 2016. These KPIs will clarify if the performance is better or worse when compared to the first year of the data and conclude if there is an evolution. A line chart is presented with the sales amount evolution over the years. Furthermore, on that same chart, a forecast of 5 years was calculated using the Power BI functionality. Finally, on the bottom right side, the employment cost of the sector throughout the years is presented together with the task forces employed by the sector.

Looking at this dashboard, it is possible to conclude that, apart from the year 2020, the sector presented a better EBITDA, EBIT, and Net Income when compared to 2016. In 2020, those indicators were worse than in 2016, which the effects of the COVID-19 pandemic can justify. The impact of the pandemic is also noticeable in the evolution of sales. The CAGR had an increase of 2,4% in the sales amount between 2016 and 2019. However, it declined to 0,75% when the period analyzed was 2016 to 2020. According to the sales forecast base scenario, the sector only will achieve 2019's sales in 2023.

The financial indicators show that the wine industry has a high profitability compared with the other sectors in Portugal. One can conclude that because the sector had a Net Income Margin of 6,20% for the period from 2016 to 2020, whereas all the activities of Portugal, in the same period, had a Net Income Margin of 3,66%, according to the Bank of Portugal (2022).

Even with the decline in sales in 2020, the number of people employed by the sector increased from 8.436 in 2016 to 9.599 in 2020. Nonetheless, the labor cost per employee remained almost constant during this period.

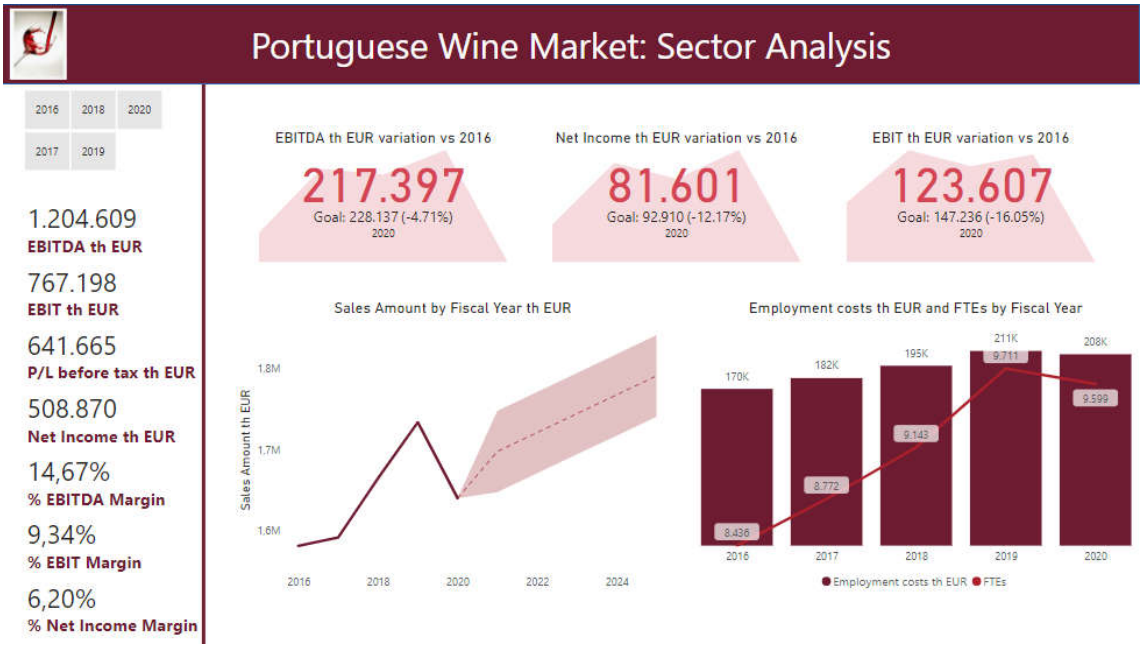


Figure 15: Dashboard 1 - Portuguese Wine Market: Sector Analysis

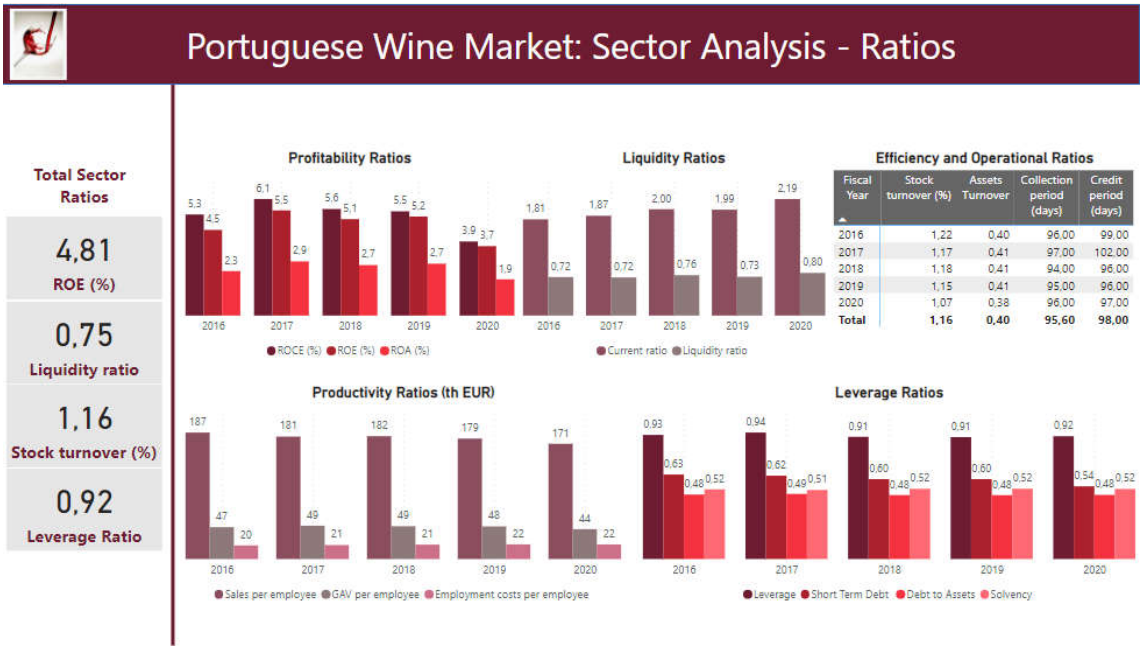
4.2. Dashboard 2 – Portuguese Wine Market: Sector Analysis - Ratios

Similarly, to the first dashboard, the second dashboard, *Portuguese Wine Market: Sector Analysis - Ratios*, also presents a view of the performance of the wine sector in Portugal over the years. However, it is more focused on financial ratios. Each category of ratios is presented in a bar chart, except for the operational and efficiency ratios, which are shown in a table.

Analyzing the profitability and productivity ratios, one can conclude that there has been a reduction in these indicators in the year 2020, most likely due to the restriction imposed by the COVID-19 pandemic. The sector has shown a return of 5€ for each additional euro invested by the shareholders on average in the last few years, apart from 2020, in which this return was only 3.70€. To what productivity is concerned, one can identify that the sales by employee have decreased. However, that decrease is not witnessed in the GVA per employee except in 2020, the year in which that indicator witnessed a drop of almost 10%.

Analyzing the liquidity ratios, one is able to infer that the inventories represent a high percentage of the current assets. The current ratio shows a high capacity to pay its short-term obligations. Nonetheless, the liquidity ratio, which is nothing more than the inventory subtracted from the current assets divided by the current liabilities, shows a drop of more than 50%. In other words, the companies operating within this sector could not to pay back their short-term liabilities without selling out their inventory. Furthermore, in 2020, even though both the current and the liquidity ratios have gone up, the increase is higher in the current ratio, which suggests an increase in inventory levels due to the drop in sales as a consequence of COVID. That can also be confirmed by analyzing the operational and efficiency indicators, with the reduction of the stock turnover ratio in 2020.

The leverage ratios were stable throughout the period, indicating that the companies operating in the winemaking industry did not face many changes in their capital structure. Nevertheless, in 2020, the sector witnessed a drop in its short-term debt ratio, which might indicate that its liabilities have been restructured from short-term debt to long-term debt.



Fiscal Year	Stock turnover (%)	Assets Turnover	Collection period (days)	Credit period (days)
2016	1,22	0,40	96,00	99,00
2017	1,17	0,41	97,00	102,00
2018	1,18	0,41	94,00	96,00
2019	1,15	0,41	95,00	96,00
2020	1,07	0,38	96,00	97,00
Total	**1,16**	**0,40**	**95,60**	**98,00**

Figure 16: Dashboard 2 – Portuguese Wine Market: Sector Analysis - Ratios

4.3. DASHBOARD 3 – PORTUGUESE WINE MARKET: SAMPLE ANALYSIS

The third dashboard, titled *Portuguese Wine Market: Sample Analysis*, has a general view of the sample chosen for this study, which contains 148 companies. This page looks very similar to the first dashboard. Yet, on this view, the user can filter the data per vineyard region. Thus, it is possible to analyze the total sample or by each region by looking at the same indicators, according to the user's preference.

It is possible to conclude that the companies in the sample were less impacted by the COVID-19 pandemic than the overall sector. When one compares the financial results of these companies in 2020 against 2016, the results are better, which is not valid for the sector as a whole. Nonetheless, these companies presented a worse outcome when compared with 2019. The CAGR had an increase of 4,72% in the sales amount between 2019 and 2016, but it declined to 3,17% when considered in 2020, reinforcing the impact of COVID-19, but on a lower level compared with the entire sector. In the case of the companies in the sample, according to the base scenario of the forecast, the sales amount predicted for 2021 will get to the 2019 levels.

In general, the dashboard demonstrates an expansionist policy of the companies included in the sample, showing constant growth in financial metrics such as EBITDA, EBIT, and Net Income. Moreover, it also shows growth in the number of people hired by these companies.

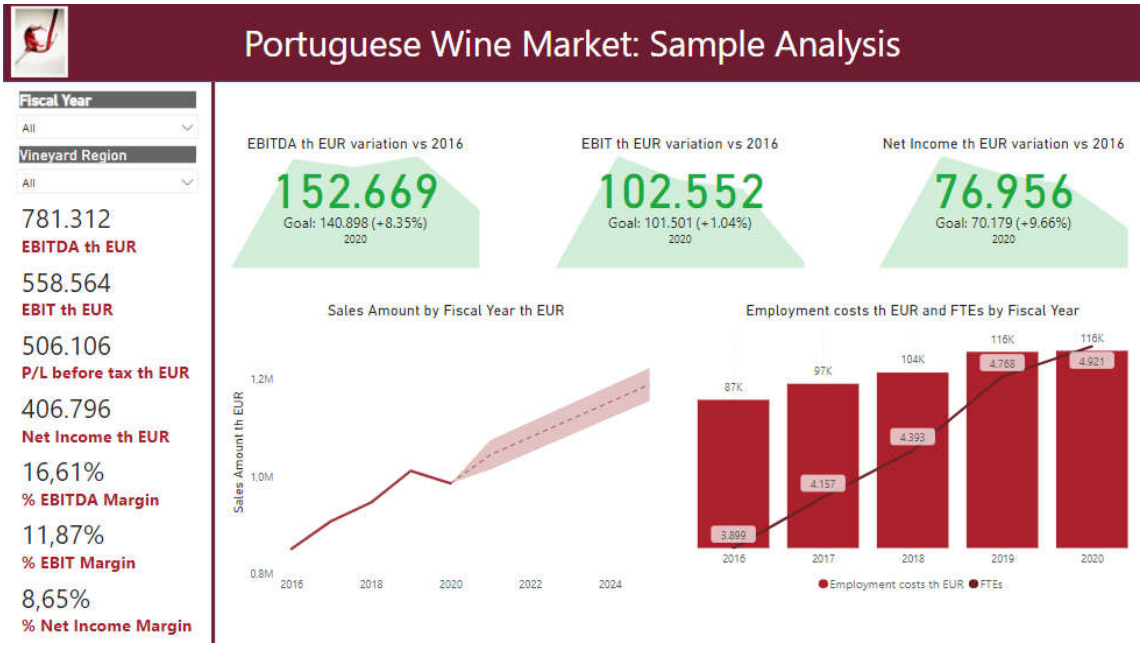


Figure 17: Dashboard 3 - Portuguese Wine Market: Sample Analysis

4.4. Dashboard 4 – Portuguese Wine Market: Sector vs Sample

The fourth dashboard created for this study, *Portuguese Wine Market: Sector vs Sample*, presents to the user a financial comparison between the entire wine sector and the sample.

According to the Bank of Portugal, the wine sector was represented by 970 companies in 2020, while the sample of this study has 148 companies. Although the number of companies is small, they represent 64% of the total EBITDA of the sector from 2016 to 2020. Additionally, each year, these companies have increased their representativeness, being 61% of the total EBITDA of the sector in 2016 to more than 70% of the total EBITDA of the sector in 2020. This information is presented by using a multi-row card. One can analyze the evolution throughout the years using the filter at the top left side of the dashboard. To show the proportion of EBIT of the sample when compared with the sector, a funnel chart is used.

The sales evolution over the years is presented on the bottom right side. In addition, four financial ratios are presented using bar charts. It is possible to see that the ROE of the sample is similar to the ROE of the sector. However, the companies included in the sample are much more leveraged, which suggests more third-party capital than equity in the capital structure. Additionally, they present a turnover of stocks three times higher than the sector, in general. Finally, regarding liquidity ratios, the samples' companies have a higher capacity to pay their short-term obligations when compared to the entire sector.

Although the ROE is similar, the profitability of the companies included in the sample is higher than the sector. The EBIT percentage of the margin of the companies within the sample is 11.87%, whereas the sector in its totality presents a 9.34% for the same ratio.

Finally, the numbers related to the workforce are presented on a bar chart at the bottom right side of the page. Looking at it, it is possible to conclude that the companies of the sample are responsible for, approximately, 50% of the workforce hired by the wine sector.

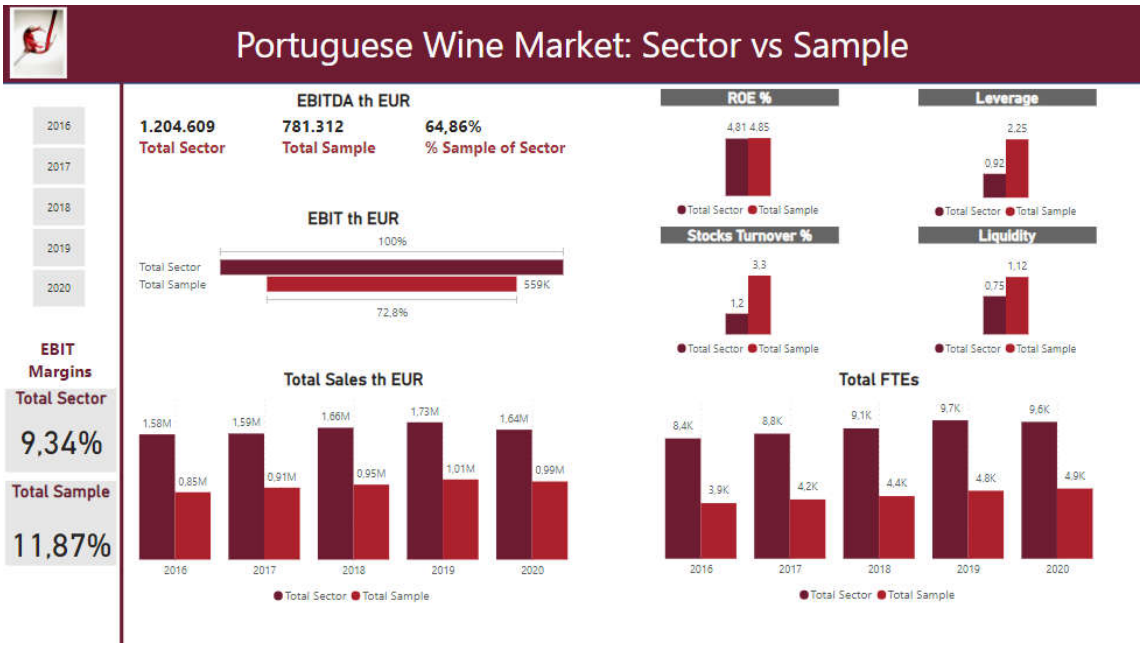


Figure 18: Dashboard 4 – Portuguese Wine Market: Sector vs Sample

4.5. Dashboard 5 – Portuguese wine market: Cluster Analysis

As stated in ***Section 3.4,*** when performing the financial analysis, there was the need to group the companies in terms of profitability. The fifth dashboard, titled *Portuguese Wine Market: Cluster Analysis*, presents the clusters created, their characteristics, and their financial indicators.

The companies were separated into three clusters:

a. **Low Profit:** The companies of this cluster present low profitability.
b. **Intermediate Profit**: These companies present good profitability, with metrics of profitability higher than Low-Profit companies, however not so high returns as the High-Profit companies.
c. **High Profit:** This cluster is composed of companies with the highest profit in the three groups.

The number of companies by cluster is presented in a donut chart. The Low-Profit Cluster has twenty-five (25) companies, Intermediate Profit has the majority with ninety-two (92) companies, and the High Profit has thirty-one (31) companies.

The average number of employees of the companies of each cluster and their average age are presented in bar charts. The bar charts show that Low-Profit companies have, on average, nineteen (19) employees and, on average, forty-three (43) years. On the other hand, Intermediate Profit has thirty-one (31) employees and forty-four (44) years, on average. Lastly, High Profit has thirty-two (32) employees and thirty-three (33) years, on average.

On the right side of the dashboard, a scatter plot is presented to show the sample distribution between the three (3) clusters. Also, there is a line chart showing each cluster's total sales amount over the years.

Finally, some financial metrics are presented in card format on the left side of the page, and the financial ratios are shown in a table at the bottom. Leveraging on that, one can explain the difference between the cluster in performance terms.

The low profitability of the Low-Profit cluster can be explained through several factors:

- The companies present a lower capability to pay their short-term liabilities when one disregards the inventory of its liquidity analysis. On the other hand, when the inventory is considered, that cluster becomes the one with the highest liquidity, which enables one to conclude that the inventory represents a high percentage of the firms' current assets.
- The companies show a low stock turnover. In other words, they cannot convert their stock into revenue. The same happens to its asset turnover, which is the lowest among the three clusters.
- To what productivity is concerned, the companies within this cluster have employment costs per employee very similar to the companies witch belong to the other clusters. However, the GVA is half when compared to the companies categorized in the Intermediate cluster and one-third when compared to the ones in the High-Profit cluster.
- Regarding the capital structure, the firms which belong to the Low-Profit cluster have high leverage, using more external capital than shareholders' capital, which means higher interest expenses.

It is interesting to observe that the net sales amount of the companies within this group has not been impacted much in 2020, which suggests that these firms were only slightly affected or not affected by Covid.

The Intermediate Profit cluster shows very similar ratios to the ones observed in the total sample, showing good profitability, liquidity, leverage, and operational and efficiency ratios. On the other hand, this group witnessed a decline of 8% in its net sales amount in 2020 when compared to the previous year, which suggests that they have been highly affected by Covid.

The High-Profit cluster has an EBIT over Sales, in percentage, higher than 16%, whereas the total sample presents a result of 12% for the same ratio.

The following factors can explain the high profitability:

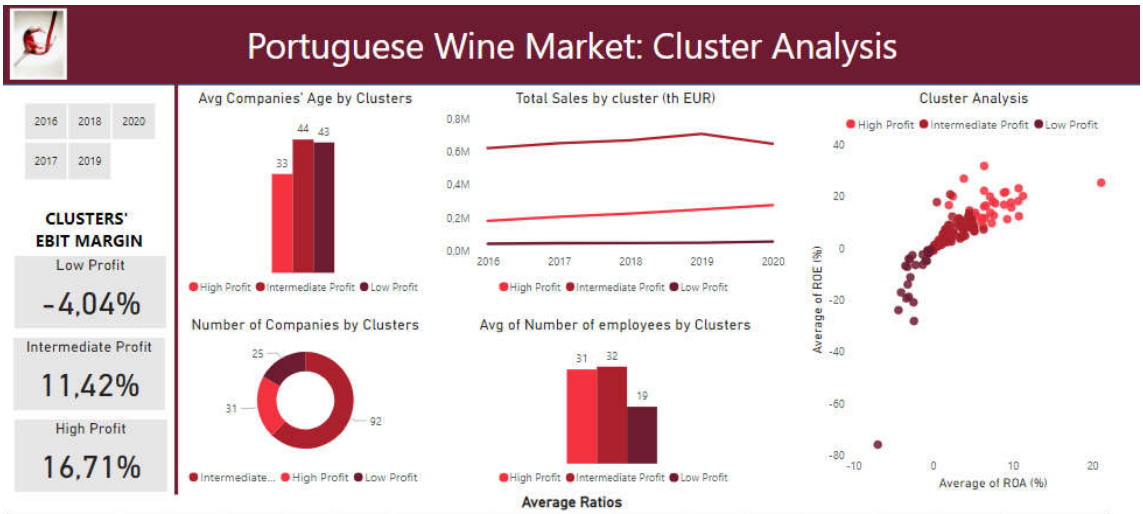
- Efficiency-wise, these are the companies that present the high stock and assets' turnover.
- The companies within this cluster are the most flexible regarding liquidating their short-term obligation using their current assets, even if the inventory is disregarded. Moreover, they show low levels of inventory in proportion to their current assets.

- To what the capital structure is concerned, half of the capital of these companies comes from external sources, whereas the other half comes from internal sources. If one compares these to the firms included in the previously outlined clusters, the High-Profit cluster is the one that has the lowest levels of external source capital in proportion to its internal sources within its balance sheet. Furthermore, 75% of external capital is focused on short-term commitments, whereas this ratio is 50% for the Low-Profit cluster. Considering that the external capital cost in the long-term is higher than on the short-term, the interest expenses these companies will be subject to, will probably be lower compared to the Low Profit and Intermediate clusters.

This group has been witnessing an increasing trend in its sales, and even in 2020, it increased its sales by 10% compared to 2019, suggesting that they have not been affected by Covid.

When other factors are considered, the companies within the Low-Profit cluster have the lowest number of employees. Considering the number of employees as a proxy for the size of the firm, the analysis suggests that the size of the firm might be related to its profitability, similar what has been concluded by Rebelo et al. (2020) and Farinha (2021). Smaller companies have a hard time increasing their volumes and diluting their fixed costs, resulting in low profitability.

Regarding age, the average number of years in which the companies within the Low Profit and Intermediate clusters have been operating is almost the same, 43 and 44, respectively. On the other hand, companies in the High-Profit cluster have existed for an average of 33 years. Consequently, it is not possible to identify a direct relationship between a firm's age and profitability. Nonetheless, one can wonder if younger firms have a high propensity to be more innovative and, therefore, present constant growth and have been less impacted by COVID-19.



Profitability Clusters	ROE (%)	ROA (%)	ROCE (%)	Liquidity ratio	Current ratio	Debt to Assets	Leverage Ratio	Short Term Debt Ratio	Solvency Ratio	Stock turnover (%)	Assets Turnover	Collection period (days)	Credit period (days)	Sales per employee th EUR	GVA per employee th EUR	Employment costs per employee th EUR
High Profit	16,97	7,72	17,26	1,28	2,64	0,51	1,84	0,75	0,49	4,11	0,71	111,46	84,59	417	78	22
Intermediate Profit	5,20	2,19	5,35	1,09	2,65	0,55	2,16	0,60	0,45	3,41	0,53	108,53	91,82	256	54	20
Low Profit	-11,48	-2,31	-3,26	1,04	2,95	0,59	3,09	0,52	0,41	1,74	0,34	111,86	137,42	121	27	21
Total	**4,85**	**2,59**	**6,39**	**1,12**	**2,70**	**0,55**	**2,25**	**0,61**	**0,45**	**3,27**	**0,54**	**109,71**	**98,00**	**267**	**55**	**20**

Figure 19: Dashboard 5 – Portuguese Wine Market: Cluster Analysis

4.6. DASHBOARD 6 – PORTUGUESE WINE MARKET: SAMPLE ANALYSIS BY REGION

The sixth dashboard, *Portuguese Wine Sector: Sample Analysis by Region,* shows a more detailed version per vineyard region.

The same logic of the preview dashboard is used. The dashboard presents the characteristics of the company of each region by showing the average number of employees of the companies per region, their average age, and finally, the companies' distribution by region and cluster.

The regions Vinhos Verdes (Minho) and Douro/Porto & Trás-os-Montes are the ones which are composed by the highest number of firms within the same, thirty-nine (39) and thirty-four (34), respectively. Moreover, those regions have nine (9) and ten (10) companies, respectively, included in the High-Profit cluster and three (3) and six (6) companies, respectively, in the Low Profit. The regions Dão and Portugal Ilhas have the lowest number of companies, with seven (7) firms each. Even with a low number of companies within the region, Portugal Ilhas has two (2) companies in the High-Profit cluster and the remaining in the Intermediate cluster, with not even a single company in the Low-Profit cluster. The Dão region, on the other hand, does not have a single company in the High-Profit cluster and has only one in the Low-Profit cluster.

Taking the number of employees as a proxy for the size of the company, the Vinhos Verdes region is the one which has the biggest companies with, on average, forty-six (46) employees, followed by Lisboa, which has, on average, thirty-four (34). The companies in Dão are the smallest, with, on average, nineteen employees (19).

Age-wise, companies are, on average, forty-one (41) years old. The Portugal Ilhas, Bairrada, and Vinhos Verdes regions are the only ones in which the average age of the companies is above the sample average. The Alentejo region is the one that has the companies with the lowest average age, twenty-one (21).

Additionally, metrics of profitability are presented. A treemap shows the distribution of EBIT by region on the right side of the page. Also, some financial ratios are presented in a table.

By analyzing these visualizations, it is possible to see that Vinhos Verdes is the region that averages the highest sales by year, GAV, and net income. However, to what productivity is concerned, the region with the best EBT per employee is the Portugal Ilhas, even considering that it has the sample's higher employment cost per employee.

The region with the lowest profitability and productivity is Dão, which presents an average GAV of six hundred eighty-seven thousand euros (687,000 EUR), an average Net income of sixty-six thousand euros (66,000 EUR), and an EBT per employee close to zero (0).

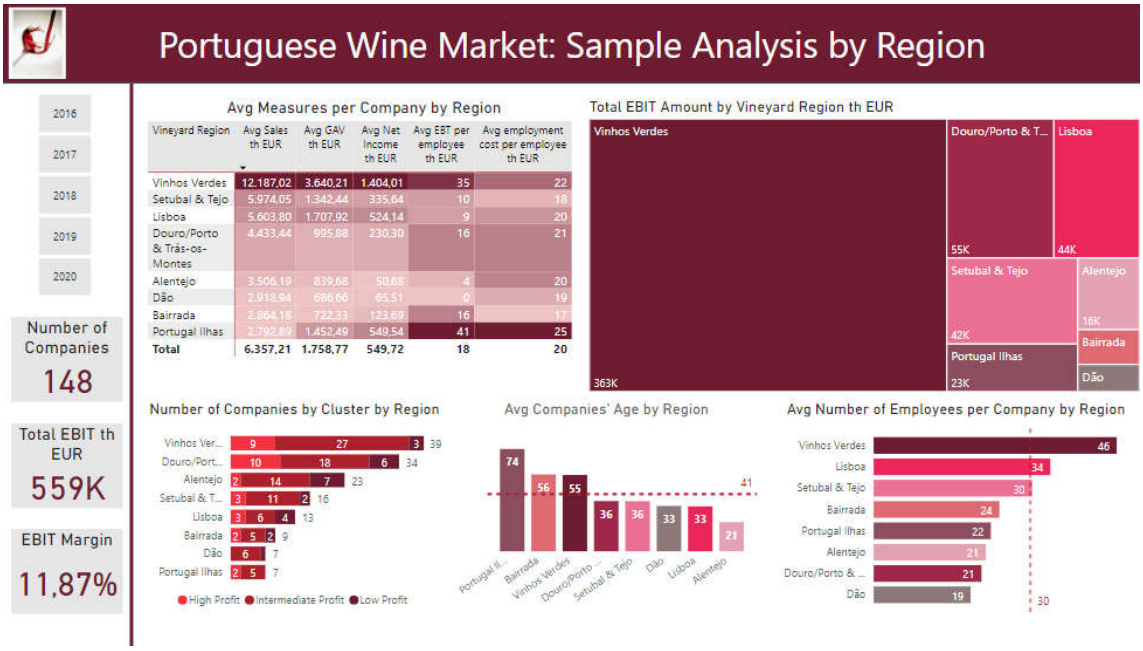


Figure 20: Dashboard 6 – Portuguese Wine Market: Sample Analysis by Region

4.7. Dashboard 7 – Portuguese Wine Market: Sample Analysis – Ratios

In the seventh – and last dashboard – it is possible to dig deeper into the details of the sample as a whole by analyzing the ratios' evolution from 2016 to 2020. Additionally, it is possible to deepen into the ratios' evolution by region as well by clusters. That is possible thanks to the filters at the left side of the dashboard allowing the user to filter by cluster and region.

The dashboard presents all the financial ratios' categories using bar charts except the operational and efficiency indicators, which are presented in a table format. On the left side, the main financial ratios are presented, and they don't change when the user filter the region or cluster. The idea is the user compare each region or cluster against the sample when it's made a filter.

Through a general analysis of the sample, one can conclude that since 2017 the companies within the sample have witnessed a decline in profitability illustrated by a reduction of the ROE, ROA, and ROCE.

Disregarding 2020, which has been an atypical year, all the efficiency, liquidity, and productivity ratios had been stable throughout the period, except for the stock turnover, which also decreased.

To what leveraging is concerned, the companies included in the sample show a decrease in external capital in their capital structure, which resulted in a reduction of interest expenses paid within that period.

Going further into details, the financial analysis per region is shown below.

Alentejo is a region with an overall low profitability which has been decreasing throughout the years, accompanied by the fall of the profitability ratios. Surprisingly, the region has witnessed a recovery in 2020, against what would be expected due to COVID.

Bairrada is the region that presents the best ROE of the sample as a whole. To what efficiency is concerned, the region has a stock turnover considerably lower than the sample. It has a lower leverage than the sample. However, it also shows a lower capacity to liquidate its short-term liabilities. The recovery of the profitability ratios that the region witnessed in 2020 was also a surprise, particularly after the worsening results in 2019.

Dão is the least lucrative region of the eight (8) included in this study. Analyzing its profitability financial indicators in the period of the analysis, it is possible to conclude that only 2016 showed positive profitability given that the situation got worst so much that the companies within this region had all their financial indicators negative in 2020, particularly ROE which was -27,8% on that year. It is possible that this situation drove companies operating in this region to look for external capital in order to be able to comply with their short-term obligations. The operational and efficiency ratios reinforce the deterioration of the situation illustrated through the increase in the credit and collection periods.

The Douro/Porto & Trás-os-Montes region is one of the most profitable regions. That quote is backed up by the profitability ratios, which are accompanied by an improvement in the leverage and liquidity ratios throughout the period in analysis. Productivity and efficiency ratios show a decrease in 2020, most likely due to the adverse effects of COVID.

Lisbon is a region that did not witness significant changes to what the capital structure of the firms operating in this region is concerned throughout the analysis period. Furthermore, the productivity ratios have been stable for the past few years. However, the regions' productivity ratios had been on an upward trend until 2018, but after that, the situation changed entirely and drastically, going from a ROE of 6,9 in 2018 to 2,7 in 2019 and, finally, to 0,3 in 2020.

Portugal Ilhas is the only region where the capital structure comprises more than 50% equity, reaching 75%. Similarly to what happened in Lisboa, this region also witnessed a twist in its profitability ratios from 2019 onwards and was impacted by a considerable drop. However, unlike Lisboa, the Portugal Ilhas' ROE in 2019 and 2020 was higher than the sample's average. The operational and efficiency ratios were also affected. The stock turnover halved, and the assets' turnover dropped from 0,32 in 2016 to 0,2 in 2020.

Analyzing the data of the companies within the Setúbal & Tejo region, it is possible to verify that this region has become stable throughout the period of the analysis, given that all its profitability ratios were constant over time. Similarly, the stock and assets' turnover ratios were very close to the levels witnessed at the beginning of the period. It is important to highlight that the data suggest that the companies were able to improve their efficiency by reducing the credit and collection periods. Moreover, it is a remarkable decrease in the dependency on external sources of capital by the companies operating within this region with a reduction in leverage from 2,73 in 2016 to 1,44 in 2020.

To what the Vinhos Verde region is concerned, it is possible to witness a relatively stable capital structure throughout the analysis period. Even though the leverage ratios have been kept stable from 2016 to 2020, the dashboard allows concluding a very healthy level of the ability to pay back its short-term liabilities is concerned. Additionally, it is important to mention that the region is the only which shows better results on its financial indicators than the sample's average. Even though there

has been a deterioration of the results in 2020 to what profitability is concerned, there was an improvement in the management of its accounts receivables. Furthermore, the productivity ratio with more relevance, Sales per employee, shows an increasing trend significantly robust throughout the whole period, except in 2020.

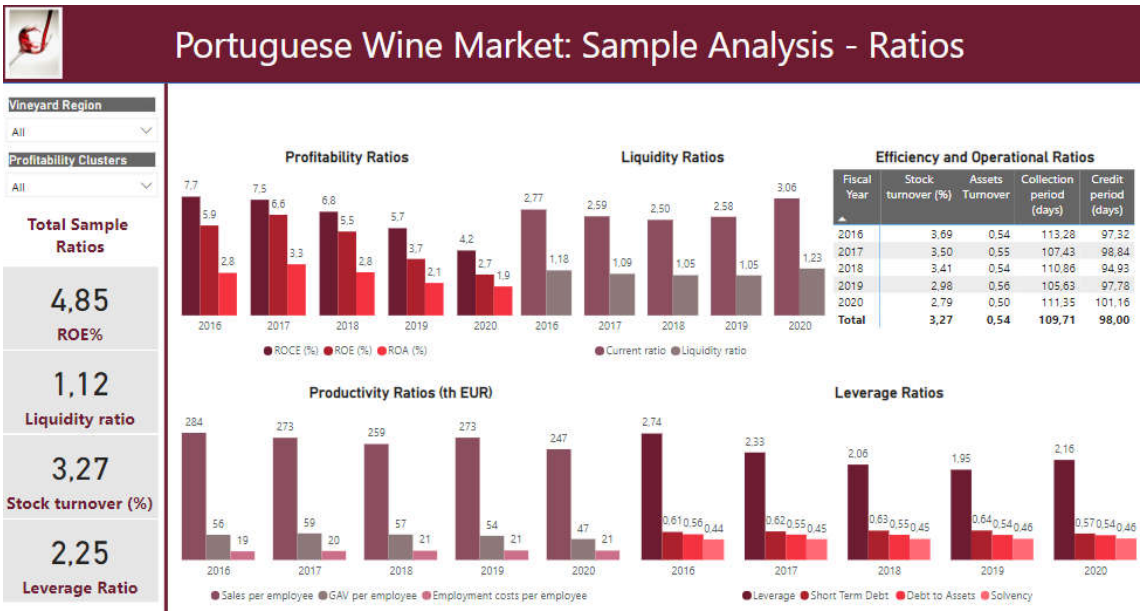


Figure 21: Dashboard 7 – Portuguese Wine Markets: Sample Analysis: Ratios

5. CONCLUSION

This study has as its main goal the development of a business intelligence conceptual model of a BI system to analyze the economic and financial performance of wine market in Portugal. This subject was chosen due to the wine market be one of the most relevant socio-economic activities globally, making it one of Portugal's most important industries. The literature review demonstrated how important the wine market is globally. Furthermore, it also showed how relevant the economic and financial analysis is to assess the performance of any given company and/or an entire sector of a country.

The BI solution developed allows the user to perform the financial analysis by using data visualization. In addition, the cluster functionality of Power BI helped to answer the first question of this research:

- How can one create segments of Portuguese winemaking companies based on their financial performance?

This study presented a final clustering solution of the sample's companies based on their profitability, by using K-means algorithm. It was possible to create three clusters: one with companies of low profit, a second one with companies that presented an intermediate profit and a third, and last cluster, with companies that have the higher profits of the sample. Additionally, the profile of the clusters was presented in details in the fifth dashboard and also it is possible to get more insights in the seventh dashboard, where it's possible to filter by cluster and region.

The seven dashboards presented in Section 4 – Results and Discussions answer the second question of this study:

- What was the evolution of the main financial indicators and margins within each segment and vineyard region?

In the first and second dashboards, it is possible to see the evolution of the main financial indicators and margins over the years for the entire sector. In the third dashboard, the main financial indicators and margins over the years of the sample are presented. Additionally, the fifth, sixth and seventh dashboards allow to go deeper to see the evolution of those indicators by segment and vineyard region. Several measures were created to analyze the data in the different segments and regions and some intuitive filters were created to allow filtering the data in a way that suits best the analysis. The visuals selected to build the dashboards were chosen to provide an accessible way to see and understand the data and the evolution of the financial ratios.

The last question of this study is also answered by analyzing the financial indicators presented in the dashboards:

- What has been the impact of COVID-19 on these companies' profitability?

Looking at the first dashboard and the third dashboard, it is possible to conclude that the sector was more affected by COVID-19 than the companies included in the sample. In the fifth dashboard, it is possible to conclude that companies within High-Profit cluster were not affected by the COVID-19 as the companies in this segment show a growth in their sales in 2020.

It is also possible to say that companies with higher size were less affected by COVID-19 than the ones with low size.

However, these conclusions are supported only by the results of 2020, and it would be better to expand the analysis to include more years to better understand the impacts of the pandemic.

An important contribution of this study to the literature is the financial analysis by vineyard region. The sixth and seventh dashboards allow the comparison between regions, as well as the comparison of each region with the entire wine sector in Portugal or only between the companies included in the sample. Another important contribution is the creation of three segments that allows the analysis by profitability and facilitates the explanation of some factors related with that.

The results found in this study show that companies with high size have higher profitability and better financial ratios. There is no evidence of an existing relationship between companies' age and profitability. The dashboards allow one to understand the distribution of the wine market in Portugal, where the companies are located, and which region has better or worse profitability. Moreover, through the analysis of the companies' financial results, this study demonstrated that segregating them by region it's not the best way, as there are some disparities inside the same region. Instead, a better way to do that is to segment the companies by cluster according to their profitability.

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6. LIMITATIONS AND RECOMMENDATIONS FOR FUTURE WORKS

One of the limitations of this study is the data availability. The Orbis database does not have the data of all companies operating in Portugal. In addition, there are some quality issues on the data made available by the companies. The missing data is a limitation for this study. However, the final data allowed the comparison of the companies in Portuguese Wine Market, and it was possible to provide an understanding of the financial situation of the sector.

The second limitation of this study is related with the distribution of companies per vineyard region. The companies were segregated by vineyard region according to their headquarters location instead according to the wine origin. The vineyard region is determined by Wine Institute of Portugal according with the wine origin. But, the financial results of the companies are presented according to their headquarters location, creating this limitation.

Future research in this field would benefit from considering longer time periods and considering analyze companies of other countries or compare the entire wine sector of Portugal with other countries.

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