Development and Integration of a B2B Pricing Model in a Glass Industry

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Abstract

There's no question that, in the current day and age, pricing is a fundamental aspect of every business. With this in mind, the objective of this thesis, carried out in a business environment in BA Glass, is to develop a pricing automation model that can bring value to the company not only through time-saving in the pricing process, but also through meeting the customer's willingness to pay in each instance.

The methodology behind the present work involved gathering data relative to product attributes and to the market dynamics, finding the best set of variables for the establishment of a distinct product identity. This required the collaborative efforts of many departments in the company. Additionally, these variables were designed to accommodate specific customer preferences and characteristics, such as their own product's selling price, ultimately facilitating the determination of an optimal price and reaching the client's maximum willingness to pay in every case.

The final result is a pricing model that categorizes the products according to their most basic elements and characteristics, providing a base price for each category, and then constructs a price for any given material sold to any given client based on a set of pricing variables.

Resumo

Desenvolvimento e Integração de um Modelo de Preço B2B numa Indústria Vidreira

É inquestionável que, nos dias de hoje, a fixação de preços é um aspecto fundamental de qualquer negócio. Neste sentido, o objectivo desta tese, realizada em contexto empresarial na BA Glass, é desenvolver um modelo de automatização de preços que possa trazer valor para a empresa não só através da poupança de tempo no processo de fixação de preços, mas também através de encontrar a disponibilidade máxima do cliente para pagar em cada momento.

A metodologia do presente trabalho envolveu a recolha de dados relativos aos atributos do produto e à dinâmica do mercado, encontrando o melhor conjunto de variáveis para o estabelecimento de uma identidade de produto distinta. Para tal, foi necessário um esforço colaborativo de vários departamentos da empresa. Além disso, estas variáveis foram concebidas para acomodar preferências e características específicas dos clientes, tais como o preço de venda do seu próprio produto, facilitando, em última análise, a determinação de um preço óptimo e atingindo a disponibilidade máxima do cliente para pagar em todos os casos.

O resultado final é um modelo de preços que categoriza os produtos de acordo com os seus elementos e características mais básicos, fornecendo um preço de base para cada categoria, e que depois constrói um preço para qualquer material vendido a qualquer cliente com base num conjunto de variáveis de preço.

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Last, but certainly not least, to my parents, for their love, support, encouragement, and endless sacrifices. For being an example and shaping the person I am today, I am truly grateful.

To my family and friends

Contents

Acronyms and Symbols

ASP	Average Selling Price
B2B	Business to Business
B2C	Business to Consumer
BA	BA Glass, S.A.
BG	Bulgaria
CE	Central Europe
CRM	Customer Relationship Manager
DE	Germany
ERP	Entreprise Resource Planning
ES	Spain
FR	France
GR	Greece
IB	Iberia
IT	Italy
KPI	Key Performance Indicator
PL	Poland
PT	Portugal
RO	Romania
SEE	South East Europe
URL	Uniform Resource Locator

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Chapter 1

Introduction

The present work, developed within the scope of a Master Thesis in Mechanical Engineering, was conducted in a business environment in BA Glass. The project has the primary goal of optimizing the pricing process, developing and integrating a pricing automation model. BA Glass is a multinational glass packaging manufacturer company.

In this chapter, the project and its objectives will be presented in a more descriptive manner as well as the company in which it was carried out, BA Glass. A description of the project's methodology and structure will also be included.

1.1 BA Glass Presentation

In 1912, Raúl da Silva Barbosa and Domingos de Almeida established BA Glass, SA, previously known as "Barbosa & Almeida, Lda.". In 1930, the company expanded its operations with the establishment of a plant in Campanhã, where semi-automatic technology was used for bottle production. Over the next 39 years, the company experienced continuous advancements in Portugal, introducing automatic feeding systems and molding machines in 1947, and later purchasing an automatic machine in 1965.

Afterwards, in 1969, the operations of the new industrial unit located in Avintes began with two regenerative furnaces allowing for heat recovery, instead of the traditional method that consisted in melting raw materials.

BA Glass underwent a number of changes throughout the years, including it become a publicly traded business in 1987 and engaging in alliances and acquisitions. Building the Villafranca de los Barros factory in Spain, buying CIVE in Marinha Grande in 1993, buying Vilesa in 1999, and adding the SOTANCRO Group in 2008 — which included units in Venda Nova and Xinzo de Limia (the latter is no longer a part of the group) — are notable acquisitions.

By buying the Polish company Warta Glass in 2012, BA Glass marked a crucial turning point in its global development, by expanding beyond the Iberian Peninsula. In 2016, it furthered its expansion by purchasing HNG Global, a German glass packaging producer with headquarters in Gardelegen. The company completed the acquisition cycle in 2017, when it bought the Yioula Group, which had four plants spread across Greece, Bulgaria, and Romania. Since these purchases, BA Glass has increased daily production to almost 20 million units.

The company's headquarters are in Avintes, Portugal, and twelve plants are currently operating in seven different European countries: Gardelegen, Sieraków, Jedlice, Bucharest, Sofia, Plovdiv, Athens, Léon, Avintes, Marinha Grande, Venda Nova, and Villafranca de los Barros.

In Figure 1.1, it is possible to see the location of all of BA's plants.

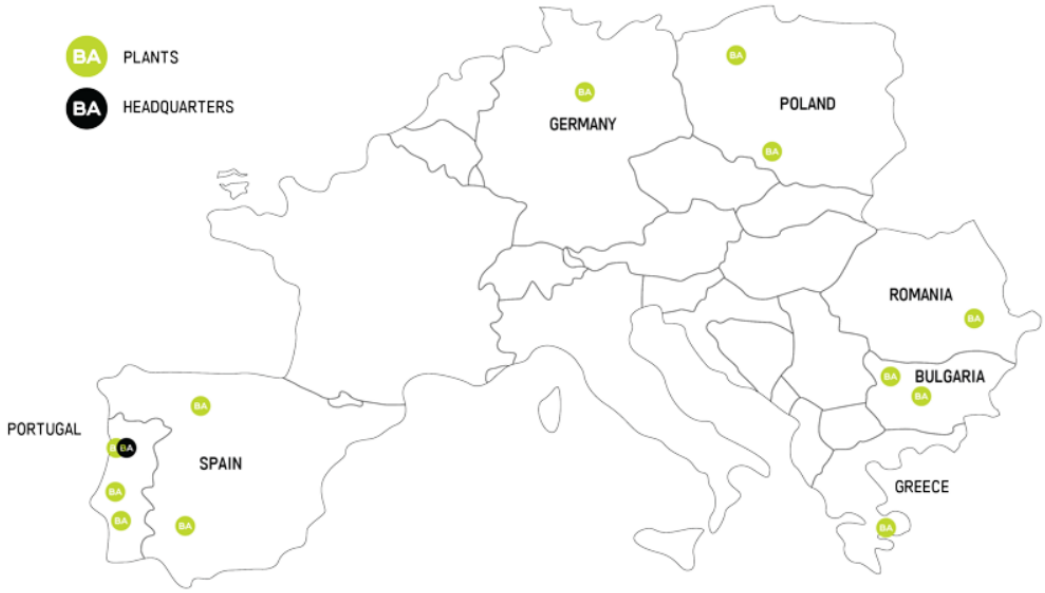


Figure 1.1: Location of BA Glass's plants (Source: BA Glass, 2023).

Currently, BA Glass has almost 4000 employees and supports the principles of humbleness, emotion, ambition, rigour and transparency.

Sales are split up across various product categories: Beer, Food & Oils, Soft Drinks, Wine and Spirits & Porto. Food accounts for 35% of total sales, making it the biggest segment. The business's highest-ever revenue level was over 1 billion euros last year.

Additionally, BA has been dedicated to sustainable expansion throughout the past few years. As a result, the business has achieved World Finance's designation as "The Most Sustainable Company in the Glass Industry" for the past three years. This recognition stems from the company's use of renewable energy, decreased use of gas, water, and CO2 emissions, as well as assistance provided to consumers in minimizing packaging.

1.2 Project Setting and Contextualization

BA Glass is a glass packaging manufacturer. It produces millions of glass jars and bottles each year and has clients all over the world.

BA Glass's Prices & Marketing team gives thousands of prices each year. The team does several analyses to the market, segment and customer, however it takes some time to do it and most of the times it is uncertain if the willingness to pay of the customer/market is being reached. That being said, the goal of the project is to develop a pricing automation tool that can bring value to the company not only through time-saving in the pricing process, but also through meeting the customer's willingness to pay in each instance.

1.3 Project's Goals

As stated in the previous section, the main goal of the project is to develop a pricing automation tool that can bring value to the company not only through time-saving in the pricing process, but also through meeting the customer's willingness to pay in each instance.

As is common in many businesses, most of BA's revenue comes from a relatively small number of large clients. That being said, most of the Prices & Marketing team's time is spent evaluating prices for small costumers that will not have a significant implication on the company's sales numbers. The first of the tool's goals is to be able to give these prices in an automated manner, thus allowing for the team to relocate their time towards more impactful negotiations and other projects.

Moreover, without the model, the prices given originate from analyses to the market, segment and customer, as well as the Sales Manager input, which can sometimes be far from the client's willingness to pay. That's the tool's second goal: by automating the process, more congrous prices will be given, and the customer's true willingness to pay will consistently be reached and the value will be maximized in each negotiation.

1.4 Methodology Followed

The methodology followed throughout the development and writing of this Master thesis has been established based on the thesis structure as well as the Prices & Marketing team's inputs.

The first step was an extensive literary research on subjects relevant to the context of the project - not only pricing strategies and their appliance in various settings, but also important topics that should be considered when developing and integrating the tool, such as pricing variables and applications.

Then, in order to get a comprehensive view of the entire sales ordering process and be able to correctly define the situation prior to the development of the project, meetings with several departments were organized (Prices & Marketing, Planning, Product Implementation, Front Office, Transport and Decoration). The background and knowledge gained from these sessions allowed for a step-by-step construction of the method outlined in the third chapter of the paper. What followed was an in-depth analysis of some KPIs for the current pricing methodology, this was instrumental to understand the main issues with the current method and what would be the best course of action to follow.

After that, the focus shifted towards the development of the model, *per se*. The initial step was to clearly define the goals of the project, and that was accomplished by discussing with the company supervisor and the team what would be the best course of action. It was agreed upon that it would be fundamental to sort the existing products into categories, like depicted in the fourth chapter. That was done in an integrated effort with the Prices & Marketing team as well as the Sales, Product Development, and Product Implementation departments, in order to guarantee the feasibility of the categorization both from a commercial and a technical point-of-view. Subsequently, an extensive examination was undertaken to determine the variables that warrant inclusion in the model. Multiple factors were carefully scrutinized to assess their relevance and significance in the pricing framework. Some of them required a greater effort to implement, like the final product price, so that was the main focal point during this stage of the process. To give a periodic contextualization of the model design and evolution process, fortnightly meetings were conducted.

Finally, subsequent measures for forthcoming refinements and the development of new tool capabilities were outlined. While the implementation of the new model remains pending, a range of evaluation criteria and key performance indicators have been put forth to assess the efficacy of the model.

1.5 Thesis Structure

The present document is divided into five chapters. The first chapter of this thesis encompassed an introductory section outlining the firm, a comprehensive presentation of the topic, the key objectives, an explanation of the employed methodology, and the fundamental project structure. The primary intent of this chapter was to provide a substantial and comprehensive introduction that establishes a strong foundation for the ensuing chapters.

The second chapter features a literature review on subjects relevant to the context of the project. Initially, a general description of the market is given, followed by an extensive assessment of different kinds of pricing strategies. The topics of client segmentation and the use of CRM tools in marketing are also addressed.

In the third chapter, the pricing process used in BA Glass prior to the implementation of the tool is introduced. Firstly, a contextualization is done, presenting the participants in the procedure and defining its workflow. Then, a handful of relevant pricing KPIs are analyzed as well as some of the variables considered by the team when performing pricing analysis, such as client segmentation.

Chapter four presents the actual methodology behind the development and integration of the pricing model. In the first place, an exposition of the product categorization process is done. Subsequently, a comprehensive examination of the variables incorporated within the model is conducted. And finally, the integration of the model in the company's applications is discussed.

The document's final chapter features the main conclusions regarding the project, as well as insights about possible future work to be done in the topic of this dissertation.

Chapter 2

Literature Review

To understand the creation and implementation of a pricing model, one first needs to understand the fundamental concepts of markets and pricing. Thus, this chapter's focus is to clarify and explore the most important concepts relevant to the project's development.

Starting from a broader towards a more specific scope, the first topic to be covered is a general description of the market. Then, an analysis will be done of the different strategies a company can follow concerning its pricing strategy. After that, a more detailed look will be given into client segmentation, which can and should influence pricing. Finally, more specific concepts and applications relevant to the industry that reveal fundamental to the integration of the tool will be addressed, such as CRM.

2.1 Market Structure

As a starting point, Business to Consumer (B2C) and Business to Business (B2B) commerce should be defined.

The difference between the two is simple. While a B2C model applies to businesses who market their product or service to the final consumer, a B2B model applies to businesses who market their product or service solely to other business and not to consumers (Kumar and Raheja, 2012).

In the context of this work, the B2B model is going to be analyzed in a more detailed manner, as it is the business model that applies to BA Glass.

The literature is unanimous in recognizing the importance of pricing and its decisions in the success of company operating in a B2B model. Hutt and Speh (2021) stated that pricing is a critical element in the marketing strategy of any company that operates in business-to-business (B2B) markets.

Following this, it is of paramount importance to understand what factors influence said pricing decisions in B2B model.

The first step should be to comprehend the concept of market. A market is a set of buyers and sellers (commonly referred to as agents) who through their interaction, both real and potential, determine the price of a good or a number of goods. As a result, the idea of a market structure is defined as those aspects of a market that have an impact on the actions and outcomes of businesses operating in that market (Indounas, 2019).

Naturally, pricing decisions become a function of this structure – the unique characteristics of a market (e.g. consumers' price elasticity, suppliers' bargaining power, product differentiation, regulation, technology, intensity of competition and market concentration) (Diamantopoulos, 1991).

Furthermore, when considering the level of attainment, in a B2B model, pricing objectives can be divided into those aiming for maximum financial results, such as sales maximization and profit maximization, and those pursuing satisfactory financial outcomes. It is often challenging to operationalize and achieve maximization-related objectives, leading managers to prioritize satisfaction-oriented objectives, such as a specific market share increase within a certain time frame (Indounas, 2019). This will be explored in more detail in the following section.

2.2 Pricing Strategies

As a business, there are several pricing strategies that can be adopted to price products or services. This categorization is subjective and can variate from author to author, but some of the strategies will be presented below.

Research has shown that most pricing methods fall into three main categories: cost-based; competition-based and customer-based (Indounas, 2009). This section will be structured in accordance with these categories.

2.2.1 Cost-based Methods

Cost-based pricing strategies, often relying on full costs, are the most widely used in industrial settings, mostly due to the simplicity of its application (Indounas, 2009; Fabiani et al., 2005). Naturally, the use of cost-based methods does not mean that other types of information are not considered. A model based on cost can also incorporate competitors and customers' inputs (Amaral and Guerreiro, 2019).

The main advantages of these types of methods are related not only to its simplicity, like previously mentioned, but also to being considered fair by both customers and competitors, as well as the price stability that it establishes in an industry (Indounas, 2009). Regarding the strategy's disadvantages, the main one that stands out is its disregard of the market conditions (Zeithaml et al., 2006).

Besides that, some authors consider that cost-based methods reduce flexibility and lead firms to unavoidable assumptions about costs that may be incorrect (Shipley, 1983).

It is relevant, in this subsection, to go over three cost-based methods: cost-plus method; target return pricing and marginal cost pricing.

2.2.1.1 Cost-plus Method

The cost-plus method consists in adding a margin to the average cost of producing a product or performing a service (Indounas, 2009). Empirical research has shown that this strategy is the most widely used cost-based strategy (Shipley and Jobber, 2001). It is implemented mainly by retail corporations such as Auchan and Wal-Mart on most brands retailed through their stores (Sammut-Bonnici and Channon, 2014).

Furthermore, contrary to what happens in competition-based methods of pricing (which will be presented in the following subsection), this strategy is more indicated for large businesses rather than small or medium sized ones. The principal behind this is the distinction between price takers and price makers. Price takers, i.e., corporations that base their prices on other firms' prices, will have less reason to draw on cost information when pricing their products or services, as prices are determined by the market. Large companies can be expected to be major players in markets - price makers - and therefore are the ones that can influence prices charged. In light of this, it is expected they will have greater cause to draw on cost information when pricing goods and services (Hanson, 1992).

2.2.1.2 Target Return Pricing

Target return pricing is a method very similar to the one introduced before. It consists in adding a predetermined target rate of return on capital employed as a safeguard to recuperate the costs of setting up complex infrastructure, instead of a fixed margin (Indounas, 2009).

Basically, this approach is a specification of normal cost pricing, and its formula is based on a standard profit rate that corresponds to a standard capacity utilization rate. Therefore, target-return pricing clearly permits the intersectoral reliance of cost margins among sectors (Kim, 2006).

This method is adopted primarily in industries that require a high capital investment, like automobile manufacturers and telecommunications, electricity, and gas service providers (Sammut-Bonnici and Channon, 2014).

2.2.1.3 Marginal Cost Pricing

Finally, in marginal cost pricing, only variable costs are considered during price calculations, i.e., only the direct costs of a product or service are taken into consideration when setting the price (Indounas, 2009; Tzokas et al., 2000). The companies to whom this method is more adequate are

those whose fixed costs make up a large proportion of their total operating cost (Tzokas et al., 2000).

2.2.2 Competition-based Methods

Pricing methods based on competition are, like the name suggests, those in which pricing decisions are triggered by competitors' prices and actions (Tse, 2001). These are the strategies that best apply to the pricing model being implemented in the present project, therefore they will be explored with more detail.

The main advantages and disadvantages associated with a competition-based approach are similar to the ones of cost-based pricing. Its positive points are related to price stability and data readiness (Hinterhuber, 2008). Concerning the most negative aspects, the strategy's negligence of the customers' inputs and willingness to pay stand out (Hinterhuber, 2008).

The existing types of competition-based methods are straight forward. A firm can price its products or services either above, below, or similarly to the competition (Indounas, 2009).

The factors that can impact the form of competition-based pricing that each company selects are the extent to which their product differs from those of their competitors, the intensity of competition, and the position they hold in the market. More often than not, large corporations will set the pricing standard and the smaller ones will follow (Indounas, 2009).

These kinds of strategies are primarily used, like aforementioned, on small or medium-sized companies competing with big ones but can also apply to products with low differentiation or commodities (Sammut-Bonnici and Channon, 2014).

2.2.3 Customer-based Methods

The last category of pricing methods to be presented are the customer-based methods. These are pricing strategies centered around value, i.e., the focus of a company utilizing them should be how a client values their product or service, rather than the cost of producing or providing said product or service (Hinterhuber, 2008).

Although still playing a relatively minor role in pricing strategies, customer-based strategies are increasingly recognized by authors as the superior, most reliable approach (Hinterhuber, 2008). For example, Monroe (2003) states that: "... the profit potential for having a value-oriented pricing strategy that works is far greater than with any other pricing approach".

Its main advantage is: setting prices as a function of value instead of cost will allow to reach the client's full willingness to pay and thus maximize the income. However, most of the times, the perceived value of the customer is data that can be tough to obtain and interpret, as there is an inherent difficulty in estimating the value associated with a product or service. Besides

that, it could lead to relatively high prices that could endanger the firm's long-term profitability (Hinterhuber, 2008; Zeithaml et al., 2006).

The three most notorious customer-based pricing strategies will now be covered: perceived-value pricing, value pricing and discount pricing.

2.2.3.1 Perceived-value Pricing

Perceived-value pricing method has in its essence the aforementioned foundation of the customer-based pricing strategies - the price is based on the customers' perceptions of value, maximizing the value that the buyer assigns to the product based on its utility (Indounas, 2009). The concept of utility in this context is in direct relation with the theory of expected utility. It claims that price is the value of a service and therefore consumers spend their income so as to maximise the "value" they get from services (Von Neumann and Morgenstern, 2007).

This perception of value is a combination of tangible factors (such as the utility of the product) and intangible factors (such as product quality or brand attributes). This strategy is adopted by businesses where the perceived value of the product or service is much higher than its cost, such as luxury brands (Sammut-Bonnici and Channon, 2014).

Moreover, the concept of perceived value goes beyond a straightforward comparison between quality and price, and it is not solely determined by any single factor. Perceived value can be described as the overall evaluation made by consumers, considering various dimensions of value, including benefits and sacrifices, such as quality and price. This evaluation takes into account the original behavioral intentions and customer satisfaction, ultimately shaping the perception of value (Boksberger and Melsen, 2011).

It is also important to distinguish perceived value from desired value, as existing literature agrees that the customer differentiates between the two concepts (Morar et al., 2013). Flint et al. (1997) state that perceived customer value refers to the evaluation of specific benefits and sacrifices, while desired customer value focuses on the needs and desires of customers, representing a higher level of abstraction. Unlike perceived customer value, desired customer value is not influenced by specific usage experiences and has a more lasting impact.

2.2.3.2 Value Pricing

Value pricing is a much simpler concept, very commonly utilized. It revolves around offering a product or service at the lowest possible price. A company that follows this method must be well organized in order to keep its operating costs at a minimum level, so it is mainly adopted by big retailers (mostly discounters) with a good structure (Indounas, 2009).

An interesting point can be raised about this strategy - Hamilton and Chernev (2013) studied how "... a retailer can establish a low price image despite having relatively high prices or, conversely, can have high price image despite its relatively low overall price level".

Hamilton and Chernev (2013) concluded that contrary to the misconception that price image solely depends on a store's average price level, it can be argued that it is influenced by multiple factors. Lowering prices without addressing other price-related and nonprice drivers may not significantly affect a retailer's price image, as consumers rely on various cues beyond actual prices. Consumers' reliance on nonprice factors contributes to the discrepancy between price levels and perceived price image.

2.2.3.3 Discount Pricing

Discount pricing strategy involves temporarily setting prices below the market price or even lower than cost price. The idea is to attract new customers quickly and consequently gain market share, so this method is used primarily by growing companies trying to build a strong customer base (Sammut-Bonnici and Channon, 2014).

Armstrong and Chen (2020) recently concluded that there are two main reasons why this strategy could make a rational consumer more willing to buy. The first reason is the fact that the product being originally sold at a steep price suggests that it possesses a high level of quality. Secondly, a reduced price can signify that the product is an exceptional deal, making it unnecessary to search for cheaper alternatives.

It is also worth noting that this is a common but rather controversial approach, as many scholars believe that a poorly executed discount pricing strategy could have very punishing results. Dolgui and Proth (2010), for example, state that the discount's price reduction "... should generate enough supplementary sales to compensate the reduction in income. However, this is rarely the case. Few companies realize the true discount cost. When a product discount is offered for a given period, it applies to all sales, which often leads to disastrous consequences".

2.3 Client Segmentation

Client segmentation is a marketing strategy adopted widely by businesses across all industries. The rationale behind this segmentation and the benefits it offers are well established in the marketing literature.

Cuadros and Domínguez (2014) noted that "from the modern management perspective, maximizing customer value is the key to surviving fierce competition in the business world" thus, differentiating between more and less profitable clients and focusing on long-term customer connections rather than short-term customer relationships seems like a critical step for survival in today's competitive industry. That is the principal behind the segmentation strategy.

Segmentation theory suggests that customers with similar needs and behaviors are likely to respond similarly to marketing efforts. The market segmentation process involves segmenting customers based on common variables and designing marketing programs or business strategies tailored to the targeted segments (Dibb and Simkin, 2001).

Moreover, focusing on the actual value of customers can help organizations develop competitive advantages by better allocating resources. For example, understanding the real value of customer segments enables the redistribution of marketing budgets accordingly. Marketing objectives can vary, from improving relationships with certain segments to reducing focus on others. Criteria such as customer lifetime value, current value, and loyalty are more informative for decision-making than just revenue or client volume. Accurate measurement of these factors leads to accurate results (Cuadros and Domínguez, 2014).

Furthermore, following a client segmentation method can also influence a company's pricing approach and allow for new possible strategies. For instance, segmented or group pricing, which consists in dividing the market into different categories based on consumer attributes and adapting the price offers based on the varying acceptability and willingness to pay of each section (Iyer et al., 2002).

From a more practical perspective, Cortez et al. (2021) propose a 5-stage method on how businesses can adopt and incorporate a market segmentation strategy:

1) **Conceptualization**

The authors argue that to begin with, companies must undertake the process of conceptualizing market segmentation. This entails two essential considerations: determining the perspective of the market, whether it is perceived as static or subject to constant change, and understanding the dynamics of segmenting the market, whether it involves discrete or continuous categorization.

2) **Pre-Segmentation**

Once companies have gained a comprehensive understanding of these factors, they can progress to the pre-segmentation stage, where they ascertain the definition of a market and the purpose behind segmentation.

3) **Segmentation**

Subsequently, companies can move forward to the segmentation stage itself. At this juncture, they need to identify the variables to be used for segmentation, select a suitable segmentation approach or model, and choose the target markets to focus on.

4) **Implementation**

   In the fourth stage, companies can implement their segmentation strategy by exhibiting leadership and allocating resources, making adjustments to the marketing mix, and considering organizational restructuring if relevant.

5) **Evaluation**

   Finally, companies evaluate the outcome of their segmentation efforts by analyzing changes in customer satisfaction, sales force performance, and the financial performance of the company.

Moreover, it is asserted that the entire market segmentation system is influenced by factors such as the extent of segmentation, whether it is focused on local or international markets, the coverage of the market, whether it is horizontal or vertical, the nature of the offering, which could be goods, services, or solutions, and the status of the offering, whether it is new or existing (Cortez et al., 2021).

2.4 Customer Relationship Management

Xu et al. (2002) define a Customer Relationship Management tool (or CRM) as "... an information industry term for methodologies, software, and usually internet capabilities that help an enterprise manage customer relationships in an organized way". Nowadays, however, a CRM is more than that. A CRM system allows businesses to manage customer and prospect relationships with data. You can store, track, and analyze customer and prospect information in one central location, including contact and account information, sales opportunities, service cases, and marketing campaigns. With data in one central location, organizations have a complete picture of customers and prospects that can be shared and analyzed by teams across the company in real time.

Moreover, the use of these types of applications is fundamental to the implementation of customized or automatic pricing tools. Shang et al. (2008) concluded that CRM applications in the pricing process can help evaluate customers' individual demand curves using information from CRM touchpoints like call centers, emails, and retail stores. Besides that, intelligent agents in CRM systems estimate buyer preferences by combining touchpoint data with data mining models. This allows businesses to charge customers the highest price they are willing to pay and provide tailored products, services, and prices based on individual preferences, maximizing profit.

Furthermore, when taking into consideration market segmentation and group pricing (presented in the previous section), CRM tools play an important role in helping the company bettering its segment identification. Like aforementioned, customers are divided into various groups based on specific facts about them. These tools allow the businesses to set different prices for various target groups based on the worth of the consumer. Assessing group elasticity and calculating the value of

externality are made easier with the use of CRM data and analysis. These applications also reduce switch costs and foster client happiness and loyalty through individualized attention. The use of Customer Relationship Management tools in managing the lock-in effect and externality boosts pricing flexibility and effectiveness for producers, resulting in larger total benefit than traditional economic techniques (Shang et al., 2008).

Chapter 3

AS-IS Situation

This chapter introduces the pricing process used in BA Glass prior to the implementation of the new model. Firstly, a contextualization is done, presenting the participants in the procedure and defining its workflow. After that, a few pricing KPIs are analyzed. Finally, it is also relevant to take a closer look to some of the variables considered by the pricing team, like client segmentation.

3.1 Pricing Procedure

As it was previously stated when introducing the project's context and goals, in BA Glass the prices given to each customer in each deal are not fixed. Every case is analyzed individually, taking into consideration the customer, the segment and the market as well as many other situation specific details. Naturally, different customers and different segments mean different ideas of value, and as a result, different prices.

In this section, the pricing process used in the company will be presented.

3.1.1 Process Intervenients

As a first step in the presentation of the pricing procedure, the partakers are listed and briefly described.

- **Sales Managers**

  Sales Managers' main responsibility is to handle the customer relationship. They handle tasks such as determining monthly forecast and managing new businesses and new productions. Usually, Sales Managers attend only to larger clients who have significant impact in the company's sales.

- **Front Office Assistants**

  Front Office department is responsible for following up daily activities of sales orders with customer. It must create the link between the customers and other departments from BA Glass. Needs to ensure orders fulfillment and provide the unblocking of sales orders when needed.

- **Prices & Marketing Team**

  The duty of the Prices & Marketing Team is, simply put, to propose a price for each request. To accomplish that, quantitative and qualitative methods are used to analyze the request, assess market share and margins, and track customer engagement in order to reach maximum value possible. This is done by accessing data from a variety of sources and using it to derive insights into pricing strategies and market trends.

- **Decision Makers**

  In BA Glass, the sales teams are organized by geography: Iberia, Central Europe and Southeast Europe. The Decision Makers are the heads of each of those teams. They are responsible for overseeing the work of the Sales Managers in their respective division, as well as handling the most sensitive deals and situations. Decision Makers are also the ones who have the final say in all prices given by the company.

3.1.2 Applications and Software Used

In order to fully understand the workflow of the pricing procedure, it is mandatory to not be oblivious to the tools that are used by the company to facilitate it. In BA Glass, the four intervenients previously described use two applications in the various stages of the process in issue: Salesforce and SAP.

In the literature review (Section 2.4), some research was done on Customer Relationship Management tools and their importance relative to implementing more complex pricing strategies. Salesforce is the CRM software used in BA Glass.

At its core, Salesforce offers an integrated platform that enables businesses to manage customer data, track sales leads, keep an eye on marketing initiatives, and promote teamwork and communication. The platform provides a variety of customized features and modules, such as contact management, opportunity tracking, lead creation, analytics, and automation, allowing companies to streamline their processes and increase overall effectiveness. In BA, it is in this platform that the price requests are managed.

SAP, on the other hand, specializes in providing enterprise resource planning (ERP) software solutions to businesses across various industries. This software is an extensive collection of integrated applications that helps businesses automate and simplify their essential operations in areas like

finance, human resources, supply chain management, sales, and manufacturing. A consolidated database offered by the ERP system enables real-time data exchange and departmental cooperation, increasing productivity and facilitating informed decision-making. In the company, SAP is used to manage almost all the data, from productions and stocks to sales information and invoices. It is also in this platform that the Prices & Marketing team reviews and suggests prices.

3.1.3 Process Workflow

It is also relevant to understand the workflow of the pricing procedure.

The initiative to initiate the communication between BA and the customer can originate from either side. The company can get in touch with the client if they are a key client or if doing business with the client fits in the corporation's action plan, like an expansion, for example. In this case, the Sales Managers are usually the ones responsible for the communication. On the other hand, the customer can also get in touch in the company, via phone or email - thus reaching the Front Office Sales Assistants.

Following this first interaction, the process commences. A price request is submitted through Salesforce by either the Sales Managers or the Front Office Sales Assistants. The request then appears in SAP, as both tools are connected in this regard. It is via SAP that the Prices & Marketing team then responds, by conducting both quantitative and qualitative assessments to support their suggested price. This involves performing cost studies and evaluating market pricing, as well as examining the client's price history, to try and find the most adequate price for the deal. It is also worth noting that the cost evaluations encompass various factors, including fixed and variable costs, expenses associated with raw materials like molds and other materials, as well as transportation and packaging costs.

After that, the pricing will undergo evaluation by the Decision Maker responsible for a particular division, such as Iberia, Central Europe, or Southeast Europe. It is the Decision Maker's role to either approve or decline the proposed price. The duration of this process can vary depending on the specific circumstances.

Once the pricing has been authorized and entered into the system, it becomes the responsibility of the Sales Manager or the Front Office Sales Assistants to convey it to the client. At this point, the client has the choice to accept or reject the offer. If the client accepts the price, the negotiation concludes and so does the pricing stage of the sales ordering process.

In Figure 3.1, it is possible to consult a graphical representation of the workflow described in this subsection.

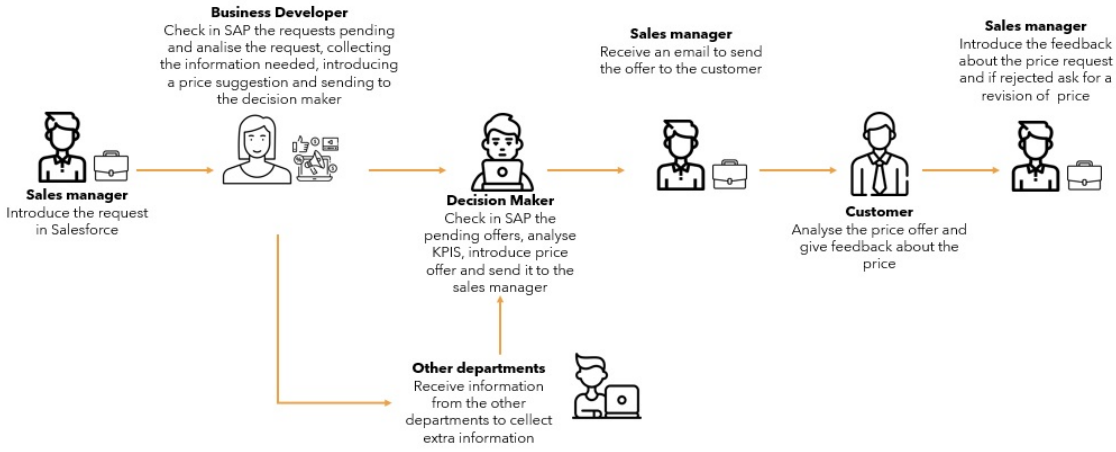


Figure 3.1: Pricing Workflow (Source: BA Glass, 2023).

3.2 Price Request Analysis

Following the presentation of the pricing methodology, it becomes clear that individual customers are assigned distinct prices for specific materials, which vary among customers. Thus, it is now appropriate to direct attention towards the price requests.

A comprehensive analysis is conducted to examine the quantity of price requests received during the preceding three-year period. The purpose is to figure out what percentage of these price requests translates to accepted price requests and their weight on the company's sales. Moreover, it is intended to attain an understanding of the segments generating the highest number of price requests and discern the most competitive market. This data compilation holds significance as it lays the groundwork for an initial approach towards formulating a solution for the project.

Table 3.1 compiles the number of price requests, as well as the percentage of accepted requests and their translation to BA's sales, per year, from 2020 to 2022.

Table 3.1: Number of requests, % of accepted requests and their translation to sales.

	2020	**2021**	**2022**
# Requests	3,893	4,059	2,430
% Accepted	46%	46%	48%
% Sales	11%	16%	11%

Concerning the number of price requests observed over the past three years, an examination reveals that the figures for 2020 and 2021 remain nearly identical, whereas in 2022, a decline is evident. This disparity can be attributed to the exceptional circumstances surrounding the market in the previous year, characterized by an insufficiency in supply capacity relative to the prevailing demand. The percentage of orders accepted by the client, on the other hand, remains relatively stable over the years.

The price requests that have been submitted and approved by the team in the last year account for a mere 11% of the overall sales of the company. However, this figure does not provide substantial insight due to the fact that a significant portion of sales are pre-negotiated with clients, and these price requests represent mainly new quotations for other types of materials that clients do not normally buy, or for completely new material projects. Nonetheless, it is imperative to enhance this percentage, thereby facilitating a substantial increase in business volume for the company.

Next, on Table 3.2, it is possible to observe the distribution of price requests per product segment, in 2022.

Table 3.2: Distribution of price requests per product segment, in 2022.

Segment	Requests	% Requests	% Accepted
BEER	170	7%	52%
FOOD & OILS	716	29%	47%
OTHERS	179	7%	12%
SOFTDRINKS	125	5%	51%
SPARKLING WINES	87	4%	49%
SPIRITS & PORTO	214	9%	57%
WINE	939	39%	52%
Total	**2430**	**100%**	**48%**

It is clear from the interpretation of the previous table that Wine (39%) and Food & Oils (29%) were the segments with most price requests in 2022. Together, they amount to 68% of all price requests submitted.

Lastly, on Table 3.3, there is data regarding the distribution of price requests per market, again referring to the previous year.

Table 3.3: Distribution of price requests per market, in 2022.

Market [a]	Requests	% Requests	% Accepted
PT	439	18%	50%
ES	582	24%	49%
PL	179	7%	50%
DE	87	4%	48%
GR	133	5%	56%
BG	89	4%	60%
RO	91	4%	43%
FR	213	9%	51%
IT	227	9%	35%
EXPORT	390	16%	45%
Total	**2430**	**100%**	**48%**

[a] The abbreviations can be consulted in the Acronyms and Symbols section.

It can be noted that Spain (24%) is the most expressive market in terms of price requests submitted, closely followed by Portugal (18%) and the export markets (17%). It is relevant to point out at this stage that although France and Italy are not native countries for BA, they are not considered exports markets due to the large volume of business conducted by the company in such countries.

3.3 ASP Analysis

Examining the average selling price, or ASP, of each material is a fundamental step for the Prices & Marketing team when analyzing a price, as it gives a clear notion of previous prices given for the same material.

In this section, a study of the deviation of new price requests, from 2022, from the ASP is performed. This analysis, in accordance with what was done in the previous section, is carried out by segment (Table 3.4) and by market (Table 3.5).

Table 3.4: New price requests' deviation from the ASP, per product segment.

Segment	Deviation from ASP
BEER	17%
FOOD & OILS	8%
OTHERS	12%
SOFTDRINKS	3%
SPARKLING WINES	5%
SPIRITS & PORTO	-3%
WINE	-2%

Looking at the deviation of new price requests from the ASP per product segment, in Table 3.4, it is noticeable that Beer (17%) and Others (12%) are the segments with more deviation from the average selling price - positive deviation in both cases. Also worth mentioning that the Spirits & Porto and Wine segments are the only two segments with negative deviations from the ASP, respectively -3% and -2%, in price requests from 2022.

Table 3.5: New price requests' deviation from the ASP, per market.

Market	Deviation from ASP
PT	-4%
ES	6%
PL	14%
DE	5%
GR	1%
BG	-6%
RO	2%
FR	4%
IT	15%
EXPORT	17%

Moreover, upon reviewing the data resulting from a comparable analysis, albeit categorized by market segmentation, it becomes apparent that the Polish, Italian, and export markets have the most significant deviations from the ASP, with 14%, 15% and 17% respectively. These numbers can be better understood with a contextualization. BA Glass is a company that traditionally operates by expanding and exploring new markets. And, when performing this study, the new price requests are being compared to the ones from the most recent previous years. As such, these years have, in some markets - like the Italian and the export markets - the ASP influenced by a strategy of undercutting and selling at a lower price in order to penetrate the market. So the high positive deviation that is observable could result not necessarily from new price requests with a high price, but from historic values of low prices during a phase of entering a new market.

Regarding negative deviations, it is noteworthy that such occurrences are exclusively observed within the Portuguese (-4%) and Bulgarian (-6%) markets.

As a final note regarding the ASP analysis, it is important to note that 2022 was a year full of uncertainties and with price increases across all industries. That naturally impacts this analysis, resulting in large positive variations from the ASP that probably would not verify under more regular conditions.

These conclusions are of paramount importance in comprehending the segments and markets where the current pricing methodology exhibits is more flawed, thereby providing valuable insights for the development of the new tool.

3.4 Time-to-Price Analysis

As stated in the project's contextualization, one of the most concerning issues with the state of the current pricing method is the amount of time the Prices & Marketing team spends analyzing prices. As such, and because reducing this time is one of the project's main goals, the time-to-price is a fundamental KPI to analyze in order to understand which segments or markets could be posing a bigger problem regarding time consumption.

To perform this investigation, all price requests submitted in 2022 were analyzed regarding the amount of days between the submission of price and it being decided and communicated to the client.

In Table 3.6, the time-to-price, in days, per product segment is presented.

Table 3.6: Time-to-Price, in days, per segment.

Segment	Time-to-Price
BEER	4.20
FOOD & OILS	10.03
SOFTDRINKS	1.13
SPARKLING WINES	3.56
SPIRITS & PORTO	4.45
WINE	8.25
Average	**7.52**

Analyzing the data from the previous table, it is possible to observe that the Food & Oils (10.03 days) and Wine (8.25 days) segments have much larger time-to-price than the remainder. The Soft Drinks segment (1.13 days), on the other hand, has a much lower time-to-price than the others, being more than 6 days below the average time-to-price for 2022.

Analogously, in Table 3.7, the time-to-price, in days, per market can be consulted. This is once again referring to the price requests submitted in 2022.

Table 3.7: Time-to-Price, in days, per market.

Market	Time-to-Price
PT	5.58
ES	5.10
PL	1.44
DE	11.25
GR	7.36
BG	2.43
RO	8.35
FR	1.56
IT	19.32
Export	9.41
Average	**7.52**

Furthermore, upon scrutinizing the results of the analysis performed in Table 3.7, Germany (11.25 days) and Italy (19.32 days) stand out as the markets with the largest time-to-price. It is imperative to address the noteworthy time-to-price duration of approximately 20 days within the Italian market. Not only does this figure surpass the average duration by nearly threefold, but it also raises concerns regarding its acceptability and adverse impact on business operations. The notion of clients waiting for a duration as long as 20 days to receive a price offer appears to be both unacceptable and detrimental to overall business performance.

On the opposite side of the spectrum, the Polish, Bulgarian, and French markets have times-to-prices substantially lower than the average, respectively 1.44 days, 2.43 days, and 1.56 days.

Finally, a comment should be made about the overall average time-to-price for the last year - 7.52 days. Although this value does not strike as particularly small or large, it sets a clear goal for

the implementation of the tool, as reducing it is one of the project's main objectives. Addressing the challenges faced in the product segments and markets exhibiting significantly higher time-to-price presents a viable opportunity to achieve a reduction of over 50% in the average value, as, notably, only a few segments and markets with substantial time-to-price duration exert a significant influence on the overall average. This would be a very valuable and important improvement.

3.5 Client Segmentation

Client segmentation plays a critical role in the pricing analysis. This categorization of clients is determined by their Margin, Price per Ton, Growth Potential, and Workload. This process consists of two sections: the first part assigns clients to sales revenue groups (A, B, C, or D), and the second part identifies the specific cluster for each customer, labeled as "1" or "2".

Regarding the sales revenue group letter, its characterization is pretty straight forward. Clients are grouped with respect to their sales revenue percentile within the company. As for the calculation of the sales revenue, it can be illustrated by Equation 3.1.

$$SR_k = \sum_{i=1}^{N} (Price\ per\ Ton_{k,i} * Tons\ Sold_{k,i}) \tag{3.1}$$

where:

SR_k is the sales revenue of client k;

$Price\ per\ Ton_{k,i}$ is the price per ton of material i, bought by customer k;

$Tons\ Sold_{k,i}$ are the tons of material i sold to client k.

As for the clusters, customers in cluster 1 have higher profit margins and similar pricing per ton, but their potential for expansion is limited. These clients contribute to BA's profitability by generating higher associated profits. More often than not, negotiations with clients within this cluster have resulted in improved terms, allowing them to purchase tons at rates higher than the BA average. However, they have experienced a decline in sales over the past four years.

On the other hand, cluster 2 consists of customers with lower profitability and below-average prices. Clients in this group have, however, shown a positive growth trend by purchasing increasing amounts of tons. It is important to note that while there are differences in growth potential between the clusters, these variances are not as significant as the disparities in margins and prices per ton.

It is also worth mentioning that this model differentiates between dealers and other clients - dealers are represented by the E letter. Additionally, there is a segment F that is not separated into clusters and represents clients with extremely low sales revenue.

In Figure 3.2, it is possible to see a graphical representation of the aforementioned segmentation model.

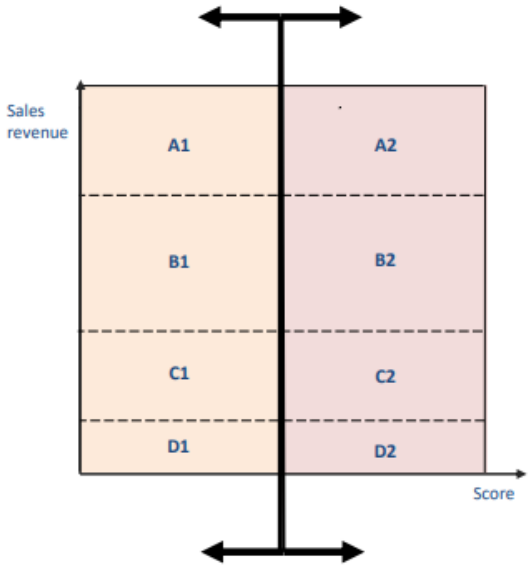


Figure 3.2: Client Segmentation model (Source: BA Glass, 2023).

Looking at the distribution of sales (in tons) per client segment, in Figure 3.3, it is possible to conclude that clients in segments A and B have the most expressive number of sales - together they amount to about 72% of the tons sold. Besides that, it is of interest how the A1 and A2 clients have such a high disparity in number of tons sold, with benefit to the latter. This can be rationalized by the fact that cluster 2 comprises customers with lower profitability and below-average pricing. Thus, this cluster primarily consists of the company's larger clients, who naturally account for a substantial portion of the overall sales volume. Finally, it is relevant to point out that segments D1, D2, and E2 demonstrate the lowest volume of tons sold among all client segments.

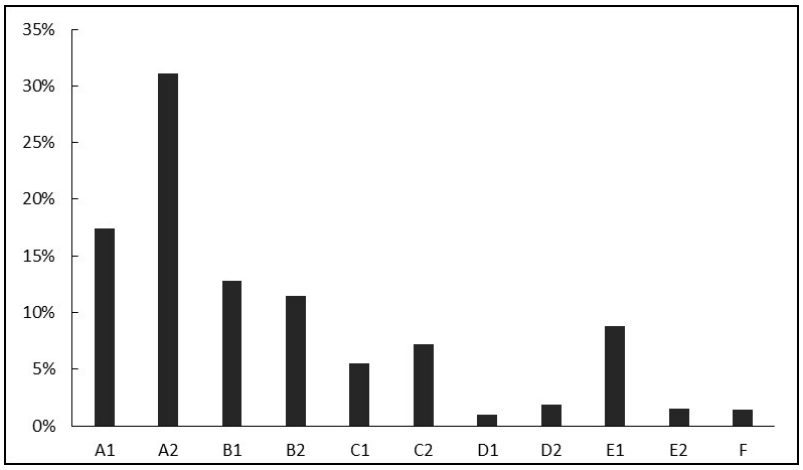


Figure 3.3: Distribution of sales (in tons) per client segment, in 2022.

Furthermore, Table 3.8, compares the number of price requests per client segment to their representation on BA's sales (in tons), in 2022.

Table 3.8: Number of requests and their representation on sales, per client segment, in 2022.

Segmentation	Requests	% Requests	% Sales
A1	94	4%	**17.4%**
A2	258	11%	**31.1%**
B1	185	8%	**12.8%**
B2	110	5%	**11.5%**
C1	194	8%	**5.5%**
C2	266	11%	**7.2%**
D1	85	3%	**1.0%**
D2	152	6%	**1.9%**
E1	322	13%	**8.8%**
E2	174	7%	**1.5%**
F	459	19%	**1.4%**
Prospects	131	5%	**0.0%**

From this perspective, it can be noticed that customers in segment F make the most pricing requests. This is because they are smaller clients that do not generally fit into the company's sales plan. One of the most serious issues with the existing methodology is that it takes a long time to examine each order. Thus, it is of concern that F segmentation clients account for 19% of price requests (by number of orders) but only 1.4% of overall sales (in tons).

3.6 Current Situation Summary

This section serves the purpose of summarizing all that was described from Section 3.2 through Section 3.5, providing a brief description of the main issues identified with the current pricing model.

The analysis on the price requests' acceptance rate and their translation to sales volume concluded that, in 2022, only 48% of the price requests submitted were accepted and they only accounted for a mere 11% of the overall sales of the company. These are naturally figures to improve, specially in the Others segment and in the Romanian and Italian markets, that have the lowest acceptance rate of price requests.

Concerning the investigation on the new price requests' deviation from the ASP, it was possible to attribute the cause of some of the results to the out-of-the-ordinary characteristics of the previous year in the industry. Nonetheless, the Beer and the Others segments, as well as the Polish, Italian and export markets showed very high deviation values. This allowed to conclude not only that 2022's price request data for these segments and markets was less reliable to examine when developing the model, but also that these should be the primary focuses when the model is implemented.

As for the time-to-price analysis, it once again made possible for inferences to be drawn regarding the segments and markets with the worst performances in this KPI that, consequently, were in need of more attention upon the implementation of the model. They were the Food & Oils segment and the German and Italian markets. Additionally, it was noted that the average BA's time-to-price in 2022 was 7.52 days, which allows to set the bar for the model's evaluation in the future, as the goal is to significantly reduce this number.

Finally, regarding the study on the distribution of sales per client segment, it confirmed that customers in segment F make the most pricing requests - accounting for 19% of price requests (by number of orders) but only 1.4% of overall sales (in tons). This was one of the premises of the project as the implementation of the new model will allow to automate the prices given to these clients, thus allowing the Prices & Marketing team to focus on client's that have a larger representation on the company's sales volume.

Chapter 4

TO-BE Situation

In this chapter, the methodology behind the development and integration of the new pricing model is covered. It begins with an exposition of the product categorization process, highlighting the creation of distinct product "families" and the metrics utilized to assign each product to its corresponding "family". Subsequently, a comprehensive examination of the variables incorporated within the model is conducted, with particular emphasis placed on the final product price variable. This variable assumes a central role within the model, as it holds utmost significance in discerning the customer's true willingness to pay. Lastly, the integration of the model in the company's applications is discussed.

4.1 Product Categorization

Categorizing products into groups of similar models is deemed as essential in order to have a foundation for the model. These categories should serve as base-price points when formulating a new price, i.e., similar models should always have a similar base price. Only then, should mark-up or mark-down variables be taken into consideration.

The initial intention entailed the creation of product families that possessed a similarity in terms of visual appearance. However, a more discerning approach proved to be necessary, leading to the segregation of these product families based on other fundamental characteristics, selected by identifying the most pertinent variables.

As such, four variables were taken into consideration when categorizing the models: sub-segment, size, category and shape. Each of these variables is described in the following four subsections.

4.1.1 Product Sub-segment

As previously mentioned, in BA products are divided into 5 segments: Beer, Food & Oils, Soft Drinks, Wine and Spirits & Porto. However, in each of these segments, there are various other

sub-segments to help better differentiate the products. This could be better understood with the example of the Food & Oils segment - naturally, a glass container for a small jam is much different from a glass container for caviar, not only in terms of design and production but also from a consumer standpoint. However, since both of theses products are (correctly) placed in the Food & Oils segment, the existence of these sub-segments is fundamental.

Following this, it is only natural for these sub-segments to be implemented in this product categorization, as they are essential to categorize each product and will evidently have an impact on its selling price.

The codification for this variable is a two letter code identifying the sub-segment. For example, in the Spirits & Porto segment, a Port Wine bottle will have "PW" in its codification, while a vodka bottle will have "VK".

4.1.2 Product Size

Product size is a variable that could be very easily overlooked when categorizing a product. Nevertheless, it is a very important variable because a material with a higher capacity will have, in general, a larger size and therefore a larger quantity of glass by weight, which should naturally imply a higher price.

To each product will be attributed one of five possible size ranges, as it is irrelevant to analyze small variations in capacity. To choose the range of capacities, a market analysis was made with the most common capacities. Also noteworthy that these levels are different for each product subsegment, because, as might be expected, a large glass container for a yogurt has a much smaller capacity than a large glass container for a wine, for example.

Regarding the codification, the product size variable is also defined by a two letter code. This codification follows the international standard for sizes - the codes are XS, SS, MM, LL, and XL.

As an example for greater clarity, a 20cl beer bottle is categorized in this matter as XS, while a 75cl wine bottle is assigned to the LL size range.

4.1.3 Product Family

The product family variable is the most complex of the 4 variables considered in the product categorization. Its goal is to group materials that are similar in appearance, with respect to their shape, height, and basic geometry, thus allowing for similar materials to have similar prices.

In a more initial stage of the project, the idea was to do this grouping by segment and have different families for each group. In such manner, each segment would have its own product families, based on their model's visual appearance and the market's perception of it. For instance, in the Wine segment there would be, among others, the Bordeaux and the Burgundy product families,

while in the Beer segment there would be the Long Neck and the Belgian families. This way, as the market's valuation of an article is the most important factor in a pricing model, dividing the products by categorized "market standardized" shapes seemed like the best option.

However, an obstacle came up when trying to combine the families created for each segment and set the criteria to place any model designed post-fact in one of the families. The issue can be better explained with an example. Specifically, within the Food & Oils segment, Figure 4.1 depicts two distinct types of olive oil "market standardized" bottles, namely "Terra Neck" and "Bordeaux" - represented by two BA models. As it is easy to perceive, although these products are distinct in visual inspection, it is very difficult to find measurements that would allow the tool to differentiate between the models, without the need for human visual inspection.

Figure 4.1: Side to side comparison between a "Terra Neck" and a "Bordeaux" olive oil bottle.

Taking this into consideration, a modification to the original plan was deemed necessary. It was determined that the optimal approach would involve categorizing the three primary components of a product, namely the neck, shoulder, and body. By doing so, it is possible to get a three letter code - one letter for each element - that fully identifies the product family.

First, it is important to clearly define each one of these elements. The neck is the portion of the glass container that is above the shoulder and below the finish, it is where the cross-section of the bottle grows smaller to join the finish. The shoulder is the part of the bottle that joins the narrower neck to the wide main body. The body is the remainder, the main section of the bottle. Figure 4.2 depicts a drawing of a glass container, accompanied by captions identifying each respective element.

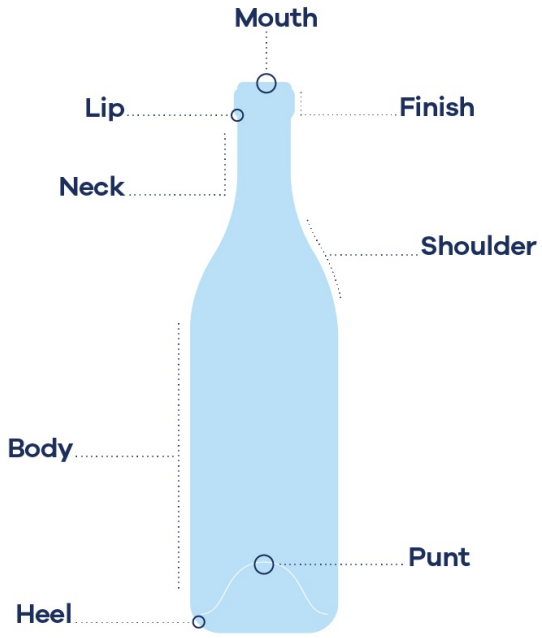


Figure 4.2: Elements of a glass container (Source: The Cary Company, 2023).

Before dwelling into the specifics of each one of the three analyzed elements, it is mandatory to introduce two measures that were developed to facilitate the categorization of these elements. They are: Neck Ratio and Shoulder Ratio. These measures are very simple and easy to understand. They are used to find the proportion of neck or shoulder in a bottle, since, as can be easily understandable, the height of the neck only has meaning if compared to the full height of the product. This way, Equation 4.1 and Equation 4.2 feature the formula of both these criteria.

$$Neck\ Ratio = Neck\ Height / Total\ Height \tag{4.1}$$

$$Shoulder\ Ratio = Shoulder\ Height / Total\ Height \tag{4.2}$$

Beginning with the neck element, the categorization encompassed the definition of four distinct neck types:

- No Neck: when the Neck Ratio is inferior to 0.1;
- Straight: when the top neck measure is equal to the bottom neck measure;
- Round: when the top neck measure is inferior to the middle neck measure, that in turn is superior to the bottom neck measure;
- Conical: when the top neck measure is inferior to the bottom neck measure.

In Figure 4.3, an example for each of the four types of neck can be visualized (in the order of their introduction, from left to right).

Figure 4.3: Examples of each neck type. From left to right: No Neck, Straight, Round, Conical.

Moving forward to the shoulder element, once again four different shoulder types were identified:

- No Shoulder: when there's no shoulder measure on the drawing;
- Sharp: when the Shoulder Ratio is inferior to 0.1;
- Round: when the Shoulder Ratio is superior to 0.1 and inferior to 0.25;
- Long: when the Shoulder Ratio is superior to 0.25.

Figure 4.4 features a visual representation of each of the four types of shoulder (in the order of their introduction, from left to right).

Figure 4.4: Examples of each shoulder type. From left to right: No Shoulder, Sharp, Round, Long.

Finally, regarding the body element, the categorization process revealed, also, the identification of four distinct body types:

- Straight: when the top body measure is equal to the bottom body measure;
- Round: when the top body measure is inferior to the middle body measure, that in turn is superior to the bottom body measure;
- Conical: when the top body measure is inferior to the bottom body measure;
- Tronco-conical: when the top body measure is superior to the bottom body measure.

Figure 4.5 presents a graphical illustration showcasing each of the four body types (in the order of their introduction, from left to right).

Figure 4.5: Examples of each body type. From left to right: Straight, Round, Conical, Tronco-conical.

Combining the aforementioned 4 types of neck, shoulder and body, would result in 64 possible product families. Naturally, that number is both high and unpractical. Therefore, only families with more than 10 models were considered and the remaining ones grouped together in an "Others" family. This reduced the number of families from 64 to 20.

To conclude the analysis of the product family variable, a study was conducted on how these different types of elements affected the ASP of the product. Instinctively, if the deviation from the overall ASP was insignificant in all or most cases, this categorization would not be useful or well designed. The objective behind this analysis is to find out which types of each element are more valued by the customer and therefore have a more positive deviation from the overall ASP, in order to include this data in the model.

Table 4.1, Table 4.2, and Table 4.3 depict the deviation from the ASP of products by each type of neck, shoulder, and body, respectively.

Table 4.1: Deviation from the ASP, per type of neck.

Type of Neck	Deviation from ASP
No Neck	15%
Straight	-3%
Round	5%
Conical	0%

Table 4.2: Deviation from the ASP, per type of shoulder.

Type of Shoulder	Deviation from ASP
No Shoulder	-3%
Sharp	1%
Round	-1%
Long	4%

Table 4.3: Deviation from the ASP, per type of body.

Type of Body	Deviation from ASP
Straight	0%
Round	-19%
Conical	13%
Troncoconical	-1%

The results presented allow for important conclusions to be drawn regarding the product families. First of all, analyzing the deviation from the ASP per type of neck, it is noticeable how products in the No Neck category have a considerably above average ASP. These conclusions are aligned with the anticipated expectations as these type of glass containers are usually associated with more premium products, who have more heavy and elaborated bottles. An also expected result is the Straight neck products having a negative deviation from the ASP, as it is the most standard type of neck.

When looking at the deviation from the ASP per type of shoulder, the results are not so clear. None of the shoulder types displays a significant deviation from the overall ASP, except for the Long shoulder containers with a deviation of 4 positive percentage points. A possible explanation for this would be that the shoulder element has reduced impact on the market valuation of a product, and therefore, on the product's price.

Lastly, upon reviewing the data resulting from the deviation from the ASP per type of body, it becomes apparent that the Conical body bottles have a very significant positive deviation from the average selling price. Similarly to the situation of the No Neck type of neck, in this case, bottles with a conical body are also usually associated with more premium products, so these results are logically consistent as well. As for the Round body type products, who have a very below average

ASP (-19% deviation), the results could be consequence of it being a very specific type of body, that is sold to few clients in large quantities, thus lowering its average selling price.

4.1.4 Product Shape

The final variable to be considered in the product categorization process is the product shape. Internally, when a product is conceived, it always has one of some possible geometries - from round to squared, oval or one of a few more complex and less common ones. Thus, this variable is very relevant in some segments, specifically in Food & Oils, where there are many different geometries.

From this categorization standpoint, it might not make sense to differentiate all these shapes. For example, the differences between a squared container and a rectangular one have reduced to no impact on either the client's valuation of a product or the technical specifications of producing it. However, it is very pertinent to discern a round bottle from the remainder, as a round bottle is not only much more common and standardized but also much easier to produce.

That being said, once again a two letter code is used to identify the product shape. In this case, only two possible codifications exist: RO for a round shaped container, and SH (Shaped) for any other type of shape.

4.1.5 Categorization Summary

This subsection serves the propose of summarizing what was described in Subsections 4.1.1 to 4.1.4. and provide a better understanding of the final codification and the impact of the categorization on the pricing model.

Within this section, a comprehensive presentation was made regarding the four product variables that contribute to the formation of the product categories. By combining these variables, a distinct nine-letter code is derived, which subsequently becomes associated with one of the product categories. For example, a product with a category code BESSCRSRO, would be a beer bottle, with a capacity ranging from 21cl to 30cl, a conical neck, round shoulder, straight body and round shape. All glass containers that fit into this description should have the same base price.

The method used to determine the base price for each category was a rather simple one. From all the products already featured in the company's portfolio, the average selling price for every existing category was determined and used as the base price for it.

4.2 Pricing Variables

After having grouped the products into categories of similar models with uniform base prices, it is now fundamental to consider all factors that impact a product's price, contributing either to increase or decrease it.

Along this section, these factors will be introduced and listed. They can be either physical characteristics of the product, such as engravings, which are considered mark-ups or mark-downs, or factors related to the client to whom the product is sold to, such as the market region or the final product price.

4.2.1 Mark-up & Mark-down Variables

Mark-ups are qualities and characteristics customers value and for which they are historically prepared to spend more money. Mark-downs are the exact opposite. The goal is to understand and list them, ultimately prioritizing them based on their perceived value.

Moreover, while some elements are purely cosmetic and have minimal bearing on the container's production costs, other traits that the customer assigns value to also influence its production cost, as will be detailed below.

4.2.1.1 Mark-ups

After discussing within the team which qualities could be considered mark-up variables, a study was conducted in order to understand which of those variables had significant impact on the customers valuation of a product. Those were the variables considered as mark-ups. After reviewing the prices of all products sold in 2022 with and without these distinguishing characteristics, it was possible to determine that the price variation hovered around 5% for each markup taken into account.

The following enumeration entails the mark-up variables taken into account within the model:

- **Color:** the color of the glass depends on the meticulous management of impurities that contribute to off-coloring, as well as the attainment of the desired hue throughout the glass-manufacturing process. To accomplish this, specific types and quantities of chemicals are introduced into the glass batch. Consequently, the production costs for certain glass colors exceed those of others. This required the implementation of mark-ups for selected colors in order to establish price differentiation. Additionally, these mark-ups can be attributed to the historical perception among clients that certain colors are inherently more premium in nature.

- **Finish:** certain customers have preferences for particular bottle finishes, which are directly associated with the type of cap they intend to utilize, such as crown, cork, or screwcap. However, the specific requirements for bottle finishing extend beyond cap selection and are heavily reliant on the customers' own filling machines and processes. Typically, clients' manufacturing facilities are configured to accommodate a specific type of finishing in terms of diameter, resulting in relative uniformity across different materials for the same client. It is worth noting that the bottle's finishing is a characteristic that influences the production cost, as certain types of finishing necessitate a more meticulous production process.

- **Push-up:** a push-up in a glass container is the dome in the bottom of the bottle that faces inwards. Besides adding to container's stability, this presence of the push-up and, more specifically, how accentuated it is, is normally associated with a more premium product.

- **Exclusivity:** the exclusivity of a material refers to its exclusivity in terms of sale, wherein BA commits to producing materials that can only be sold to a single customer. Consequently, these materials are considered exclusive and, as a result, command a higher price.

- **Engravings:** an engraving is the incision of a design onto the bottle. Thus, the presence of engravings in a product is directly related to its exclusivity, as, in the large majority of the time, clients want to engrave the brand's name or logo in the container, so naturally, a material cannot have an engraving if it is not exclusive.

- **Returnability:** glass containers are well-suited for both single-use and repeated utilization, with returnable glass bottles capable of being employed more than 40 times. The growing concern surrounding the environmental impact of packaging has resulted in an increased demand for this particular type of glass container. However, returnable glass containers undergo significant strain as they are repeatedly refilled and washed. Therefore, it becomes imperative to adhere to specific production specifications to ensure the bottle remains undamaged throughout its entire utilization cycle, which results in a higher production cost.

- **Stock:** a product is said to be "Out of Stock" when there are more orders in the sales forecast than the production forecast can keep up with. It seems mandatory to include the variable as a mark-up factor, since, naturally, materials with limited or no stock availability will experience price inflation.

4.2.1.2 Mark-downs

Regarding the mark-down variables, the approach employed was analogous to the one described previously for the mark-ups. A comparable study was conducted, once again resulting in the establishment of a 5% price variation for each mark-down, in this case, a negative variation, as expected.

The mark-down variables considered in the model are listed in the following itemization:

- **Color:** as exposed in the previous subsection, the production costs for certain glass colors exceed those of others. Consequently, akin to the rationale behind implementing mark-ups for selected colors, it is imperative to incorporate mark-downs for colors that entail lower production costs. An illustrative example is the color change batches, which serve as a transitional stage between the production of two colors and thus represent products featuring a unique, not completely defined transition color, that naturally falls short of the established requirements.

- **Quality:** a company can evaluate, uphold, and improve product quality by implementing quality control measures. This ensures, among other things, that products exhibit a high level of uniformity and minimizes errors and inconsistencies. Within the context of quality control at BA, the same principle holds true, encompassing not only adherence to quality standards but also meeting specific client requirements. As a result, even when all security guarantees are in place, there are some batches of products that do not adhere exactly to the company's standards and are typically sold to specific customers for a lower price. Consequently, the development of a variable that negatively impacts the price was deemed necessary to account for these unique cases that are sold as special operations.

- **Stock:** similar to what happens with the color characteristic, stock can serve as either a mark-up or a mark-down. Just like materials with limited or no stock availability experience price inflation, products that have stock available for a large period - more than six months - without a sales plan, need to have a lower price.

4.2.2 Client Segmentation

As concluded in the Literature Review, client segmentation is a strategy that is fundamental to any pricing model in a modern industry context. Furthermore, as disclaimed in Section 3.5, it is also a strategy that is already in use in BA Glass.

Before dwelling into how the client segmentation is implemented in the new pricing model, a quick rehash of the client segmentation model in use at BA Glass will be given.

Client categorization is based on Margin, Price per Ton, Growth Potential, and Workload. It involves two sections: assigning clients to sales revenue groups (A, B, C, or D) and identifying specific clusters (labeled as "1" or "2") for each customer. Sales revenue groups are determined by the percentile of a client's sales revenue within the company. Clusters differentiate clients based on profit margins and pricing per ton. Cluster 1 comprises clients with higher margins but limited expansion potential, while Cluster 2 consists of clients with lower profitability but positive growth trends. The model also distinguishes dealers (E) from other clients and includes a segment (F) for clients with extremely low sales revenue.

In order to incorporate this variable into the new pricing model, an analysis of the company's sales over the preceding three-year period was conducted. This assessment focused on the segmentation of clients and examined the price deviations for each client segment.

In Table 4.4, it is possible to consult the results of this analysis. For each client segment, the fluctuation of the price relative to the company's average is shown.

Table 4.4: Price fluctuation per client segment, considering the last 3 years.

Client Segment	Price Fluctuation
A1	-6.0%
A2	-5.0%
B1	-4.0%
B2	-3.0%
C1	0.0%
C2	1.0%
D1	2.0%
D2	3.0%
E1	6.0%
E2	8.0%
F	8.0%

The results of this examination reflect the Prices & Marketing team's, as well as the Sales team's, effort to take into consideration the client segmentation when evaluating a price. Additionally, it is a natural consequence of the criteria used for the segmentation. In general, if a client buys a larger volume of a product, the price will be lower, so it is expected that the clients in the highest segmentation tiers will have negative price deviations while the clients in the lowest tiers will have positive price deviations.

Taking this into consideration, the values in Table 4.4 - price fluctuation per client segment, considering the sales in last 3 years - will be used in the model to implement the client segmentation variable.

4.2.3 Market Region

As previously mentioned, BA Glass operates on a global scale, catering to clients worldwide. Consequently, it becomes imperative to also differentiate these clients based on their specific material requirements and the unique characteristics of each market.

In light of this, once again a comprehensive analysis of the company's sales over the past three years was conducted to gain insights into major market trends and identify potential deviations from expected patterns. The distinct variations among markets are evident, necessitating appropriate adjustments to ensure that customers are offered a value proposition that maximizes sales and preserves competitive advantage.

Table 4.5 depicts the results from the aforementioned analysis, presenting, for each market, the fluctuation of the price relative to the company's average.

Table 4.5: Price fluctuation per market, considering the last 3 years.

Market	Price Fluctuation
PT	1.0%
ES	-2.0%
PL	-5.0%
DE	6.5%
GR	4.0%
BG	0.0%
RO	3.0%
FR	3.0%
IT	4.0%
EXPORT	10.0%

The conclusions that this analysis provides are somewhat not new. Some price fluctuations are already common practice for certain markets such as, for instance, France and Italy, that have a more significant price inflation than one might anticipate because BA Glass has no factories in these countries. This is obviously also true for the export markets.

Nevertheless, these numbers provide a better understanding of the exact price fluctuation being put to practice in recent years. As such, just like it was done regarding the Client Segment variable, after discussing with the Prices & Marketing team, as well as the Sales team, it was decided to implement these values in the model in order to differentiate the price based on the different market regions.

4.2.4 Final Product Price

As mentioned in previous section, one of the project's main goals is to meet the customer's true willingness to pay. As such, it is fundamental to account for the final product's price in the to-be implemented pricing model.

An example will be given to better illustrate this necessity, considering a standard 75 cl "Bordeaux" wine bottle sold to dozens of different customers. This same bottle can be bought by two distinct clients, one of which uses it to bottle a value wine that will be sold for 5€, while the other uses it in a premium wine subsequently sold by 50€. As it is comprehensible, both of these clients' willingness to pay will be different, as the former has a very low margin that will not allow him to buy this same bottle at an increased price, while the latter has a significantly higher margin since the difference in cost of producing the premium wine does not directly translate to the difference in price, and thus could be buying the same bottle at a higher price.

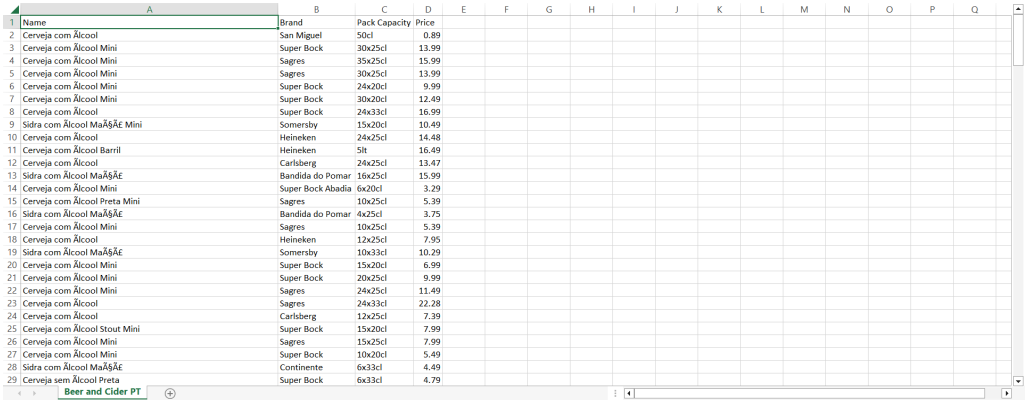
However, there is a distinct problem directly associated with the implementation of this variable in the pricing model - the lack of information about the final product's price. BA Glass has many clients all over the globe, who sell their products under many different brands in many different

countries, so naturally this type of information is not something that is either available or easy to attain. Thus, a way to get this information in an easy and timely manner had to be devised.

With this in mind, a price scrapping tool was developed in Python to extract products and prices information from supermarkets' and retailers' websites. The tool's final result is an executable file where the user inputs the website's URL and a name for the file to be created, and the application outputs an Excel file with the name, brand, pack, and price of all products listed on the website.

In Figure 4.6, it is possible to observe the tool's interface for the user's inputs, while Figure 4.7 features an example of the output file created in Excel (in this particular case for the Portuguese supermarket *Continente*).

Figure 4.6: Price scrapping tool's interface.



	Name	Brand	Pack Capacity	Price
2	Cerveja com Ãlcool	San Miguel	50cl	0.89
3	Cerveja com Ãlcool Mini	Super Bock	30x25cl	13.99
4	Cerveja com Ãlcool Mini	Sagres	35x25cl	15.99
5	Cerveja com Ãlcool Mini	Sagres	30x25cl	13.99
6	Cerveja com Ãlcool Mini	Super Bock	24x20cl	9.99
7	Cerveja com Ãlcool Mini	Super Bock	30x20cl	12.49
8	Cerveja com Ãlcool	Super Bock	24x33cl	16.99
9	Sidra com Ãlcool MaÃ§Ã£ Mini	Somersby	15x20cl	10.49
10	Cerveja com Ãlcool	Heineken	24x25cl	14.48
11	Cerveja com Ãlcool Barril	Heineken	5lt	16.49
12	Cerveja com Ãlcool	Carlsberg	24x25cl	13.47
13	Sidra com Ãlcool MaÃ§Ã£	Bandida do Pomar	16x25cl	15.99
14	Cerveja com Ãlcool Mini	Super Bock Abadia	6x20cl	3.29
15	Cerveja com Ãlcool Preta Mini	Sagres	10x25cl	5.39
16	Sidra com Ãlcool MaÃ§Ã£	Bandida do Pomar	4x25cl	3.75
17	Cerveja com Ãlcool Mini	Sagres	10x25cl	5.39
18	Cerveja com Ãlcool	Heineken	12x25cl	7.95
19	Sidra com Ãlcool MaÃ§Ã£	Somersby	10x33cl	10.29
20	Cerveja com Ãlcool Mini	Super Bock	15x20cl	6.99
21	Cerveja com Ãlcool Mini	Super Bock	20x25cl	9.99
22	Cerveja com Ãlcool Mini	Sagres	24x25cl	11.49
23	Cerveja com Ãlcool	Sagres	24x33cl	22.28
24	Cerveja com Ãlcool	Carlsberg	12x25cl	7.39
25	Cerveja com Ãlcool Stout Mini	Super Bock	15x20cl	7.99
26	Cerveja com Ãlcool Mini	Sagres	15x25cl	7.99
27	Cerveja com Ãlcool Mini	Super Bock	10x20cl	5.49
28	Sidra com Ãlcool MaÃ§Ã£	Continente	6x33cl	4.49
29	Cerveja sem Ãlcool Preta	Super Bock	6x33cl	4.79

Figure 4.7: Price scrapping tool's output file example.

Furthermore, the Python script used in the development of the tool can be consulted in its entirety in Appendix A.

Nevertheless, while this tool represents a major breakthrough regarding the obtainment of the final product's price information, it was still necessary to understand how this data can be implemented in the model.

The selected method for this integration is the calculation of a Glass Weight in the Final Product's Price variable. This variable represents the price at which the client buys a container from BA as a percentage of the price at which they sell their product. Equation 4.3 depicts the formula used for the variable calculation.

$$\textit{Glass Weight in the Final Product's Price} = \textit{BA Price}/\textit{Product's Price in Supermarket} \quad (4.3)$$

The variable was calculated for every material and the average value determined for each client. From this point onward, various tiers of Glass Weight in the Final Product's Price were created, and different price variations assigned to each one of those tiers, ranging from -10% to +10%. Thus, if a client has a low value of Glass Weight in the Final Product's Price, the subsequent prices given to him will be higher.

4.3 Model Integration & Results

This chapter's final section addresses the model's integration in the company's applications as well as expectations and metrics to evaluate its results in the future.

Regarding the model's implementation, the conceptualization of the integration process is already well defined. The model will be integrated into Salesforce, allowing for the user - either the Prices & Marketing analyst or the Sales Manager - to get the tool's output when submitting or analysing the price request. The variables are already introduced into the application, but as this is a complex integration, the process is still ongoing both from the company's side and with the Salesforce provider.

It is also important to note that during the initial testing phases, it will be necessary for the Prices & Marketing team to continue setting prices using the existing method, while using the model solely for result verification purposes. This phase will prove highly advantageous as it will facilitate ongoing tool development, including any required adjustments, and enable the team to familiarize themselves with the entire process.

Upon confirmation of the tool's effectiveness, it will transition into autonomous operation, initially catering only to clients within the lowest segmentation tiers. This approach aims to alleviate the team's workload, as these clients typically consume a significant amount of time and yield lower profit margins for the company.

As for the results evaluation, and considering that the new model has not yet been put into practice, it is not possible to currently measure its results. It is possible, however, to establish metrics upon which the model can be evaluated.

Thus, it was determined that the model should be evaluated through three distinct perspectives, namely: the reduction in time required for each request, the higher rate of acceptance, and the increase in the value of new price requests compared to the average selling price. These were regarded as the most relevant KPIs to analyze when taking into consideration the project's main goals stated in the document's introductory chapter.

Chapter 5

Conclusions

The Prices & Marketing team at BA Glass is responsible for evaluating a substantial number of price requests annually. The team conducts various market, segment, and customer analyses, and these processes often consume significant time and there is uncertainty regarding whether the customer's or market's willingness to pay is effectively being reached. Therefore, this project's objective was to develop a pricing automation model that can deliver value to the company by streamlining the pricing process while simultaneously ensuring alignment with the customer's willingness to pay in each scenario.

After mapping the existing pricing process and analyzing the relevant KPIs, it was possible to reach two main takeaways. The first one is the confirmation of one of the premises of the present work - most of the Prices & Marketing team's time is spent evaluating prices for small costumers that won't have a significant implication on the company's sales numbers. Analyzing the distribution of sales per client segment, confirmed that customers in segment F make the most pricing requests - accounting for 19% of price requests (by number of orders) but only 1.4% of overall sales (in tons). The second one is the understanding of which markets' and segments' data can most reliably be examined when studying the variables for the model, and which markets' and segments' have poor performances on the analyzed KPIs and, as such, have less dependable data and should be the primary focuses when the model is implemented.

Regarding the developed model, the categorization of products played a pivotal role in grouping materials into distinct categories, thereby establishing a base price for each category. Also fundamental was the setting of specific criteria for each product element identified - in the definition of the product family variable - as during the process of categorizing the products, it became clear that future models needed to be placed in a category automatically, without any human input. This approach enabled the identification of product categories that should share identical entry-level prices.

Subsequently, in the process of collecting pricing variables, a deliberate selection was made to determine the general characteristics of the materials that customers value, which in turn could result in higher prices. These characteristics inherently introduce variations in the internal cost structure of the materials, necessitating their inclusion in the analysis. Then, the identified variations already in practice in the company were also applied to each market and customer segmentation.

Completing the comprehensive assessment of the pricing variables to be implemented in the model, it was mandatory to integrate the final product's price as it is an instrumental variable to assess the customer's true willingness to pay. The case study of a standard 75 cl 'Bordeaux' wine bottle illustrated the significant differences in customer willingness to pay based on the final product's price. However, incorporating this variable into the pricing model posed challenges due to the lack of information about the final product's price across BA Glass's global clientele. To address this, a price scraping tool was developed in Python to extract products and prices information from supermarkets' and retailers' websites, which proved to be a major breakthrough in obtaining the necessary data. Additionally, the integration of this data into the model was achieved through the calculation of a Glass Weight in the Final Product's Price variable. This variable represents the percentage at which the client buys a container from BA Glass compared to the price at which they sell their product. Various tiers of Glass Weight in the Final Product's Price were created, and different price variations were assigned to each tier.

Lastly, regarding the model's integration and evaluation, although the implementation process is a complex one and is still ongoing both from the company's side and with the Salesforce provider, a clear plan for it was defined. During initial testing, the existing pricing method will be used alongside the tool for verification. This allows for ongoing tool development and team familiarization. Once confirmed effective, the tool will operate autonomously, initially serving lower-segment clients to reduce workload and enhance efficiency. As for its evaluation, it was determined that the model should be evaluated through three distinct perspectives, namely: the reduction in time required for each request, the higher rate of acceptance, and the increase in the value of new price requests compared to the average selling price; as these were regarded as most relevant KPIs to analyze when taking into consideration the project's main goals.

From the standpoint of future work to be done on the subject of the project and, more specifically, in the company internally on the developed model, there are a few topics worth mentioning. First of all, the incorporation or exclusion of new variables within the framework of the mark-ups and mark-downs can offer significant advantages. It is crucial to recognize that what might currently warrant an increased charge from customers may no longer hold true in the future. Thus, the emergence of new metrics or customer-valued characteristics may necessitate thorough analysis and consideration in order to adapt to evolving market dynamics.

Moreover, it is imperative to establish a systematic process for regularly updating market and customer segmentation variations, taking into account both external market conditions and internal corporate perspectives, ensuring that the segmentation approach remains aligned with the dynamic nature of the market and effectively responds to changing business requirements.

Finally, it is very important to understand how to efficiently transition to a system where the model can evaluate and provide more than 80% of the prices in the company. To this end, it would be necessary to closely monitor the tool within the initial stages of its employment, and, after being certain of its effectiveness, study what changes to the pricing workflow would be needed in order for the Prices & Marketing team to have a residual participation in it.

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Appendix A

Python Script Used in the Development of the Price Scrapping Tool

```
import time
import csv
import easygui
from selenium import webdriver
from selenium.webdriver.chrome.options import Options
from selenium.webdriver.chrome.service import Service as ChromeService
from selenium.webdriver.common.by import By
from selenium.webdriver.support.ui import WebDriverWait
from selenium.webdriver.support import expected_conditions as EC
from subprocess import CREATE_NO_WINDOW
import pandas as pd
from bs4 import BeautifulSoup
def remove_euro(s):
    return float(s.replace(' ','').replace(',','.'))
def remove_pack(s):
    return (s.replace('emb.','').replace(' ','').replace('garrafa','').replace(
        'barril','').replace('lata','').split('',1)[0])


# configure the webdriver to use a headless Chrome browser
chrome_service = ChromeService('chromedriver')
chrome_service.creation_flags = CREATE_NO_WINDOW
chrome_options = Options()
chrome_options.add_argument('--headless')
driver = webdriver.Chrome(options=chrome_options,service=chrome_service)

# user_input
url_input = easygui.enterbox("URL:")
file_name=easygui.enterbox("File Name:")+'.csv'

# navigate to the page
url = url_input+'&sz=5000'
driver.get(url)

# wait for the page to load completely
wait = WebDriverWait(driver, 30)
wait.until(EC.visibility_of_element_located((By.CSS_SELECTOR, 'div.product')))

# scroll down to the bottom of the page to load all the products
```

```
39 last_height = driver.execute_script('return document.body.scrollHeight')
40 while True:
41     driver.execute_script('window.scrollTo(0, document.body.scrollHeight);')
42     time.sleep(10)
43     new_height = driver.execute_script('return document.body.scrollHeight')
44     if new_height == last_height:
45         break
46     last_height = new_height
47
48 # get the page source and create a BeautifulSoup object
49 page_source = driver.page_source
50
51 # create a BeautifulSoup object and find all the product cards
52 soup = BeautifulSoup(page_source, 'html.parser')
53 product_cards = soup.find_all('div', {'class': 'product'})
54
55 # extract the name and price for each product
56 product_data = []
57 for product_card in product_cards:
58     name_elem = product_card.find('a', {'class': 'pwc-tile--description'})
59     if name_elem:
60         name = name_elem.text.strip()
61         brand = product_card.find('p', {'class': 'pwc-tile--brand'}).text.strip
              ()
62         quantity = product_card.find('p', {'class': 'pwc-tile--quantity'}).text
              .strip()
63         price = product_card.find('span', {'class': 'ct-price-formatted'}).text
              .strip()
64         product_data.append({'Name': name,'Brand': brand,'Pack Capacity':
              remove_pack(quantity), 'Price': remove_euro(price)})
65
66 # close the browser
67 driver.quit()
68
69 # create a dataframe with the product data
70 df = pd.DataFrame(product_data)
71
72 # save the dataframe to a CSV file
73 save_path='C:/Users/dsantos/Desktop/'
74 df.to_csv(save_path+file_name, index=False)
75 easygui.msgbox(msg = f'Successfully wrote {len(df)} products to {file_name}',
      ok_button = 'OK')
```