



# Lighting the World: the Internationalization of MD Group

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## Abstract

**Title:** Lighting the World: the Internationalization of MD Group

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**Keywords:** Injection moulding; internationalization; entry modes; internationalization strategies; resources and capabilities; business relationships

This dissertation aims to explore the internationalization of MD Group, a one-stop-shop Portuguese supplier of injection moulding solutions, which exports around 95% of its production. The company's business is designing, engineering and manufacturing injection moulds and injection plastics parts.

The study focuses on MD's approach to global competitive factors, market trends, entry modes, international strategies and future opportunities, and how the company competes globally in light of all of these observations. This study is merely pedagogic and has the goal to exhibit the internationalization challenges and opportunities for MD Group and the injection moulding industry.

Throughout the case, it is possible to identify MD's resources and capabilities, network of business relationships and ability to identify new markets as crucial aspects of the company's competitive advantage and at the core of its international strategy. Furthermore, MD's internationalization strategy reflects a balance between high-quality standards in terms of production and customer relationship, and adapting to distinct market demands.

Lastly, in the future the forecasted saturation of traditional automotive markets like Europe and North America are a challenge to take into consideration. Therefore, successful new ventures into significant markets such as India, China and eventually South Asia (i.e. Indonesia and Vietnam) will be crucial for MD's international journey, as there are many psychic distances, competitive barriers and the possible need of product adaptation.

## Resumo

**Título:** A Iluminar o Mundo: a Internacionalização do Grupo MD

**Autor:** Daniel Leal Ramos

**Palavras-chave:** Moldes de injeção; internacionalização; modos de entrada; estratégias de internacionalização; recursos e capacidades; relações empresariais

Esta dissertação tem como objetivo explorar a internacionalização do grupo MD, um fornecedor português de soluções para moldes de injeção de plástico que exporta cerca de 95% da sua produção. O negócio da empresa enquadra-se no desenho, engenharia e fabrico de moldes de injeção e peças de injeção de plástico.

O estudo foca-se na abordagem da MD a fatores competitivos globais, tendências de mercado, modos de entrada, estratégias internacionais e oportunidades futuras, e como a empresa compete globalmente à luz destas condições. Este estudo é meramente pedagógico e pretende demonstrar os desafios e oportunidades da internacionalização do grupo MD e da indústria de moldes de injeção.

Durante o caso é possível identificar os recursos e capacidades, a rede de contactos empresariais e a capacidade de identificar novos mercados da MD como aspetos cruciais da vantagem competitiva da empresa e como o núcleo da sua estratégia internacional. Adicionalmente, a estratégia de internacionalização da MD reflete um balanço entre padrões de alta qualidade em termos de produção e relação com o cliente, e a adaptação a mercados distintos.

Por último, no futuro a saturação projetada de mercados automóveis tradicionais assim como Europa e América do Norte são um desafio a ter em consideração. Consequentemente, novos empreendimentos em mercados significantes como China, Índia e eventualmente Sul da Ásia (Indonésia e Vietname) serão cruciais no caminho internacional da MD, visto que existem várias distâncias psíquicas, desafios competitivos e a possível necessidade de adaptação de produto.

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# 1. Introduction

## 1.1. Problem Statement

In an increasingly globalized world, businesses are compelled to seek opportunities beyond their domestic borders to sustain growth and enhance competitiveness. According to Pordata, the Portuguese exporting market registered around 52 billion euros in 2023 reaching record levels, and it has been growing ever since the COVID-19 pandemic in 2020.

In reality, several industries in Portugal are destined to compete abroad as the local market is scarce. One of these industries is the injection moulding industry, and its practices of mouldmaking manufacturing and plastic injection parts production. Mostly composed by small and medium-sized enterprises (SMEs), the injection moulding industry is an essential pillar in the national economy and a generator of growth and dynamism, as the Portuguese market consolidates as an important worldwide player (CEFAMOL, 2024).

This research focuses on MD Group, a one-stop-shop Portuguese supplier of injection moulding solutions, and the nuances of its internationalization strategy, mainly global competitive factors, market trends, foreign entry modes and future opportunities and challenges that the company may face as it continues to build its international brand.

## 1.2. Research Questions

In order to provide a solution to the problem previously stated, a set of research questions are proposed:

1. *How would you describe MD Group's international entry modes in the scope of the theoretical frameworks presented (Uppsala Internationalization Process Model, Network Approach, IPLC Model, etc.)?*
2. *Describe MD Group's internationalization strategy in terms of sustainable competitive advantage and standardization vs adaptation.*
3. *How would you describe MD Group's decision to expand to India? What are the main opportunities and challenges? Propose a CAGE Model analysis to the Indian market.*
4. *What factors should the MD Group consider in the near future regarding internationalization? Are markets such as China, Indonesia and Vietnam viable strategic choices?*

## **1.3. Methodology**

A qualitative research approach was adopted with the aim of obtaining information to the proposed research questions.

Firstly, the collection of literature on internationalization strategies was the baseline for this study, and therefore the subject of most of the analyses in the proposed research questions.

Most of the data and insights needed about MD Group was facilitated by the company either by sharing reports or collected by conducting interviews, in which a script of questions was prepared.

Finally, reports about the markets and its trends were a key aspect of the findings in this dissertation, as well as other available information.

## **2. Literature Review**

### **2.1. Internationalization**

The concept of internationalization can be defined as the process of developing a firm's involvement in international activities (Welch & Luostarinen, 1988). Furthermore, Cardeal (2015), states that internationalization strategy is the way the company approaches operations outside of its country of origin. The dynamic and fast-changing nature of competitive environments have driven companies into a more global approach in recent decades (Andersson, Gabrielsson & Wictor, 2004). Consequently, for most firms internationalization embodies a crucial part of their strategic process (Melin, 1992). Sapienza et al. (2006) suggest that internationalization in the earlier stages of the company may have a negative effect on short-term survival probability, but simultaneously increase growth prospects.

According to Gupta & Govindarajan (2000), becoming global is no longer a discretionary option, but rather a strategic imperative, due to various reasons:

- *The Growth Imperative.* Companies are required to explore emerging markets for new opportunities, as a contrast of developed country markets, whom are often quite mature.
- *The Efficiency Imperative.* In cases where the minimum efficient scale of their operations surpasses reasonable local sales' volumes, international presence might generate a cost advantage compared to domestic competitors.
- *The Knowledge Imperative.* Businesses must adapt products and operations to each specific internal background, which generates local know-how that have the capability to create global competitiveness.
- *Globalization of Consumers.* As domestic customers begin their internationalization process, firms are compelled to keep pace, in order to establish global harmonization of products and services, and avoid the risk of replacement from different supplier(s).
- *Globalization of Competitors.* Competitors can utilize their global valences to damage non-globalized companies, by exploiting first-mover advantage or leveraging global presence to stage a local strike.

Additionally, internal factors such as the firm's employees education level, the investment in product innovation and marketing, and the company's size play a role on whether to internationalize and to what extent (Olmos, 2011).

### **2.1.1. Liability of Foreignness (LoF)**

Before the internationalization process, firms should be familiar with the concept of Liability of Foreignness (LoF) and the businesses expanding globally experience (Hymer, 1976; Zaheer, 1995). The LoF is caused by three main factors:

- Unawareness of local context, requiring time and resources to adapt to new circumstances.
- Lack of formed local networks, as well as inner processes of newly established branches.
- Possible governmental resistance, with discriminatory acts, such as incentives provided only to local businesses.

### 2.1.2. Early Internationalization Firms (EIFs) vs Born Global Firms (BGFs)

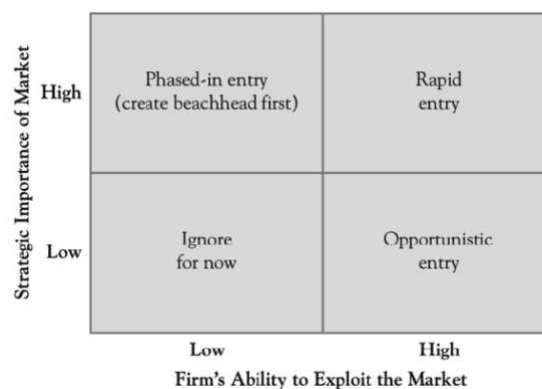
EIFs are described as companies that become international in their first three years of life, through export or any other mode of entry (Madsen & Servais, 1997). This early internationalization process is often the outcome of intricate changes in the international markets environment (Evans & Wurster, 1997).

In contrast, BGFs are companies formed with the target to serve international markets from day one. Moreover, BGFs internationalize early from the beginning via geographic expansion to international operations, often with low resources (Hashai, 2011). However, and despite the limited resources, BGFs seek international success through knowledge-based resources and diversification of sales outputs in different markets (Oviatt & McDougall, 1994).

## 2.2. International Market Selection

According to Sakarya et al. (2007), the selection of the foreign market impacts considerably international success, and the authors underline the importance of cultural and economic aspects for market evaluation. Gupta et al. (2008) state that the strategic role of market and the resources available to compete in such market are two factors to take into consideration before the decision making process. Additionally, Gupta et al. (2008) propose a framework for choice of markets that combines these two factors (Figure 1).

Figure 1. Framework for Choice of Markets



Source: Gupta et al. (2008)

Papadopoulos & Denis (1988) have presented two traditional methodologies for international market selection (IMS): a systematic approach, which relies on various statistical methods to analyse the potential of target markets; and an unsystematic approach that exploits the use of qualitative factors such as perceived psychic distance of markets. Moreover, Papadopoulos & Martín Martín (2011) address the integration of macro and micro-level analyses and the need for a comprehensive approach that includes both quantitative and qualitative factors.

One third approach raised is related to customer relationships, and how the analysis of the foreign customer impacts IMS (Andersen & Buvik, 2002). Furthermore, O'Farrell & Wood (1994) stress the importance of business relationships and firm-specific factors in the market selection process.

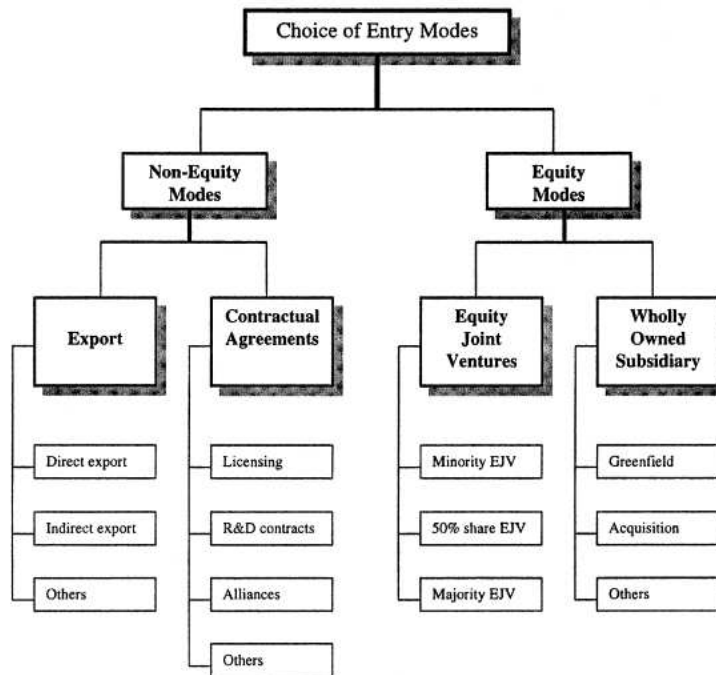
The market dimension for a specific product or service is often defined by economic, demographic and cultural aspects such as the country's gross domestic product (GDP), per capita income, economic development stage, total population, demographic characteristics, population density, and cultural norms and preferences (Locajono, 2020). Due to the pace of economic development, the average GDP per capita growth rate, increasing disposable incomes, significant populations of young consumers and stability of a free market system, emerging markets represent long-term growth opportunities when compared to saturated developed markets, which are often characterized as highly competitive (Sakarya et. al, 2007).

### **2.3. Entry Modes**

Once targeted the foreign market in which a business desires to compete, it comes into play the mode of entry that can guarantee a higher degree of success. In fact, Root (1994), states that the selection of entry mode is one of the most important decisions an aiming international company must carry out.

Pan & Tse (2000) conceived the Hierarchical Model of Market Entry Modes, in which it is stated that entry modes can be divided into equity-based versus non-equity-based. The equity-based modes comprise a choice between wholly owned subsidiaries and equity joint ventures, while in non-equity-based modes the selection is between contractual agreements and export, following a further process of decision making (Figure 2).

Figure 2. The Hierarchical Model of Choice of Entry Modes



Source: Pan & Tse (2000)

Several factors influence the choice decision of the entry mode approach, such as locational factors in the host country, risk orientation, power distance, host country contextual risk (i.e. political risk, ownership risk, operations risk and transfer risk), industry-specific factors, and the extent of interaction between host and home countries.

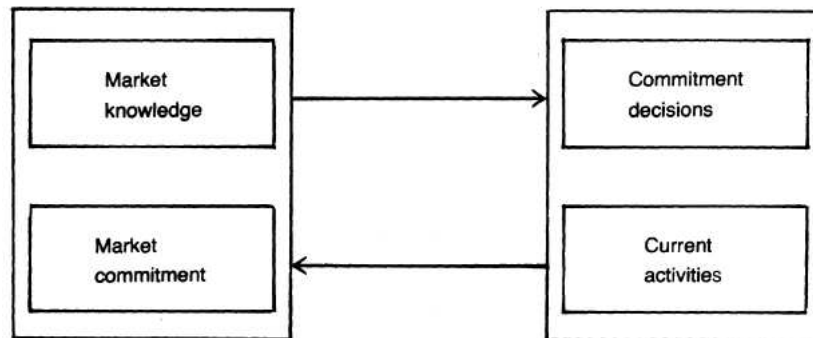
In this section it will be addressed several relevant studies regarding international market entry modes, and the factors that influence a firm's decision making during the process of establishment in a foreign market.

**Uppsala Internationalization Process Model (Johanson & Vahlne, 1977)**

According to Johanson & Vahlne (1977), internationalization of the firms is a gradual process, in which its pattern and pace are affected by the respective characteristics. This theoretical model focuses on a company's continuing acquisition, integration, and application of knowledge about external markets and operations, as well as its growing commitment to such markets. The basic mechanism considers that the resource commitment to the foreign markets – market commitment – and the knowledge about foreign markets are state aspects, while the

change aspects are commitment decisions and current business activities' performance (Figure 3).

Figure 3. The Basic Mechanism of Internationalization - State and Change Aspects



Source: Johanson & Vahlne (1977)

Johanson & Vahlne (1977) refer that multiple establishment of foreign operations follow a pattern of beginning exportation via an agent, later form a sales subsidiary, and, in some cases, establish production in the host country. This acquired experience is a way to surmount the psychic distance factors such as language, education, business practices, culture, and industrial development. Consequently, firms tend to begin their internationalization journey in geographies with the lowest market uncertainty and distance, which are most likely to be neighbouring countries (Johanson & Wiedersheim-Paul, 1975; Vahlne & Wiedersheim-Paul, 1973).

### **Network Approach to Internationalization (Johanson & Mattsson, 1988)**

Johanson & Mattsson (1988), argue that important business transactions are often leveraged by well-established relationships. These relationships between a firm and its customers, distributors, suppliers, competitors and governmental agencies are defined as business networks. The existence and therefore importance of long-term relationships are explained by the necessity from both clients and suppliers to acquire extensive knowledge about each other, regarding price, quality and the services provided before, during and after delivery. In fact, most of this knowledge can only be obtained through transactions. Engagement for such relationships can be commenced both by the seller or the buyer. A new network for the supplier can be established through the buyer's initiative.

Furthermore, Johanson & Mattsson (1988) define internationalized companies according to the respective degrees of internationalization of the firm and of the market (Figure 4).

Figure 4. Internationalization and the network model: the situations to be analysed

		Degree of internationalisation of the market (the product net)	
		Low	High
Degree of internationalisation of the firm	Low	The Early Starter	The Late Starter
	High	The Lonely International	The International Among Others

Source: Johanson & Mattsson (1988)

### Resource-Advantage Theory (Hunt, 2002)

According to Hunt (2002), the international entry mode of a company should be defined by the characteristics of its resource advantage. Hodgson (1993) describes the Resource-Advantage Theory as a “*process theory of competition, in which innovation and organizational learning are endogenous, firms and consumers have imperfect information, and in which entrepreneurship, institutions, and public policy affect economic performance*” (Hunt & Arnett, 2003). The venture into international markets of a company takes place when it can explore and build on its comparative advantage, capabilities, and societal resources as a way to establish sustainable competitive advantage (Andersen, 1997).

### International Product Life Cycle (IPLC) Model (Vernon, 1966)

The IPLC Model (Vernon, 1966) states that internationalization is dependent on the product life cycle, and proposes four stages: innovation, growth, maturity and decline. Several factors such as the type of the product, competition, degree of specialization and governmental regulations influence the length and shape of the different stages. Throughout the introduction phase, operations are often local, as international activities start to take place during the growth phase. The model suggests that as the life cycle moves on to the maturity and decline phases, production is relocated to markets with lower labor costs (Vernon, 1966).

### The Eclectic Paradigm (Dunning, 1988, 2000)

First put forward by Dunning in 1976, the Eclectic Paradigm presents a framework that intends to identify and evaluate the role of the factors that influence both the initial stage of production outside of the country of origin, and its respective growth (Dunning, 1988). The model argues that international production and its degree, shape and pattern are established by the

characteristics of three sets of advantages (OLI Paradigm): ownership advantages (O), localization advantages (L), and internationalization advantages (I). Ownership advantages are referent to competitive advantages that compensate setting up foreign operations, and therefore competing with domestic or potential producers (Dunning, 2000). Localization advantages increase a company's competitive advantages while going abroad, through the creation of synergies between movable intermediate products from the home country, and immobile factor endowments in another country. Internationalization advantages relate to companies being able to adapt their core capabilities to the different countries or regions' local benefits.

## **2.4. Strategic Frameworks**

### **CAGE Model**

According to Ghewamat (2001), most risks that pertain to internationalization result from barriers created by distance. It is important to note that distance is not exclusively related to geographic separation, although it is one element of it. Aspects such as cultural, administrative (or political) and economic elements are also part of Ghewamat's definition of distance. In fact, the CAGE Model takes into consideration these exact four dimensions: Cultural, Administrative, Geographic and Economic (Figure 5).

Figure 5. The CAGE Distance Framework

	Cultural Distance	Administrative Distance	Geographic Distance	Economic Distance
attributes creating distance	different languages	absence of colonial ties	physical remoteness	differences in consumer incomes
	different ethnicities; lack of connective ethnic or social networks	absence of shared monetary or political association	lack of a common border	differences in costs and quality of: • natural resources • financial resources • human resources • infrastructure • intermediate inputs • information or knowledge
	different religions	political hostility	lack of sea or river access	
	different social norms	government policies	size of country	
		institutional weakness	weak transportation or communication links	
industries or products affected by distance			differences in climates	
	products have high linguistic content (TV)	government involvement is high in industries that are: • producers of staple goods (electricity) • producers of other "entitlements" (drugs) • large employers (farming) • large suppliers to government (mass transportation) • national champions (aerospace) • vital to national security (telecommunications) • exploiters of natural resources (oil, mining) • subject to high sunk costs (infrastructure)	products have a low value-to-weight or bulk ratio (cement)	nature of demand varies with income level (cars)
	products affect cultural or national identity of consumers (foods)		products are fragile or perishable (glass, fruit)	economies of standardization or scale are important (mobile phones)
	product features vary in terms of: • size (cars) • standards (electrical appliances) • packaging		communications and connectivity are important (financial services)	labor and other factor cost differences are salient (garments)
	products carry country-specific quality associations (wines)		local supervision and operational requirements are high (many services)	distribution or business systems are different (insurance)  companies need to be responsive and agile (home appliances)

Source: Ghewamat (2001)

- *Cultural Distance*. Cultural attributes such as religious beliefs, race, social norms and language have the capability of forming distance barriers between companies. In fact, activities between countries that share a language have to be potential to be three times greater than between countries without a common language, all other things being equal. Additionally, cultural distances are recognized as one of the main obstacles when it comes to human resource management (HRM) abroad, due to adjustment difficulties of expatriates or less effective HRM practices such as recruitment and selection procedures, performance appraisal policies, compensation management, and training activities, which leads to increased costs (Beugelsdijk et al. 2014).
- *Administrative Distance*. Countries are most likely to engage in trades when historical and political associations are shared between them. In fact, countries like Great Britain, France and Spain still keep business ties with former colonies, taking advantage of the colony-colonizer links.
- *Geographic Distance*. Geographic attributes are not exclusive to how far countries are between them. The physical size of the country, distances to borders, access to waterways, topography and the country's infrastructures (man-made attributes) are often factors that influence geographic distance.

- *Economic Distance*. Local consumers economic strength creates distance between countries, when it comes to degrees and types of patterns of trading. In fact, studies suggest that highly developed economies partake in relatively more foreign economic activities.

### Competitive advantage vs Sustainable competitive advantage

Porter (1986), defines competitive advantage as “*a function of either providing comparable buyer value more efficiently than competitors (low cost) or performing activities at comparable cost but in unique ways that create more buyer value than competitors and, hence, command a premium price (differentiation)*”. Furthermore, Porter (1985) proposes a framework of 4 generic strategies that takes into consideration the competitive advantage and the competitive scope (Figure 6).

Figure 6. Porter’s Generic Strategies

		COMPETITIVE ADVANTAGE	
		Lower Cost	Differentiation
COMPETITIVE SCOPE	Broad Target	1. Cost Leadership	2. Differentiation
	Narrow Target	3A. Cost Focus	3B. Differentiation Focus

Source: Porter (1985)

On the other hand, it is often seen how competitive advantage collapses as competitors replicate original success (MacMillan, 1989). In order to reach the definition of sustainable competitive advantage, it should be added one more premise: the other firms must be unable to duplicate the benefits of this strategy (Barney, 1991).

The VRIO Framework helps companies analyze internal resources and capabilities with the objective of determining if they can present as a source of sustained competitive advantage. According to this model, such resources and capabilities must be: Valuable, facilitating a company to take advantage of opportunities and defend against threats; Rare, and are in reach

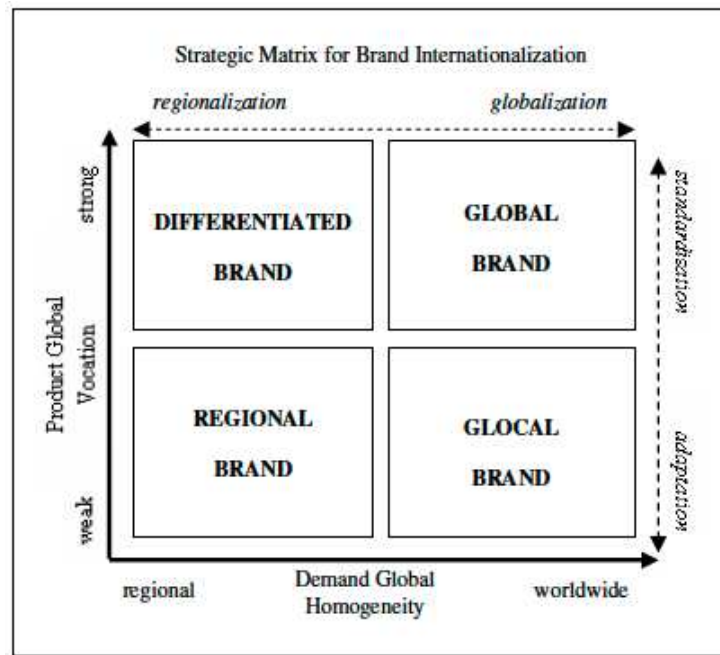
for only one or very few firms; Inimitable, i.e. not possible to imitate, acquire or replace at a reasonable price; Organized, i.e. a company's management systems, processes, policies, organizational structure and culture must be organized in order to extract all potential from its valuable, rare and inimitable resources and capabilities.

### **Standardization vs Adaption**

Throughout the internationalization strategy, many firms face the question of following a standardized or adaptive approach to its marketing mix: the 4 Ps – Product, Price, Place and Promotion. According to Dimitrova & Rosenbloom (2010), standardization proposes that all the different global markets where a company operates can be tailored by one individual marketing mix, while a strategy of adaption consists in adjusting the marketing mix to diverse infrastructure, cultural and behavioural dimensions within different markets. Furthermore, a strategy of standardization generates economies of scale and scope in production and marketing, cross-subsidization and more straightforward marketing activities in terms of control and coordination. On the other hand, proponents of adaption state that standardization fails to take into account national value systems and traditions, as market trends differ between countries, which forces changes in the marketing mix.

Ghantous (2008) proposes a model of four different strategies for brand internationalization, based on the dimensions of product global vocation and demand global homogeneity (Figure 7):

Figure 7. Strategic Matrix for Brand Internationalization



Source: Ghantous (2008)

- *Global brand strategy*: Product categories with strong global vocation that target a globally homogeneous public. Brand strategy is to greatly standardize both brand essence and executions.
- *Glocal brand strategy*: Products with low global vocation targeting a globally homogeneous public. The brand strategy is to standardize brand essence while adapting its executions to regional and local circumstances.
- *Regional brand strategy*: Products characterized by weak global vocation and regional demand homogeneity. Distinct brand lines should be created for each region, while adaptations must take into consideration global brand consistency.
- *Differentiated brand strategy*: Products with high global vocation, and demand homogeneity is regional. Brand executions should be standardized, in particular back office and process, with the goal of achieving economies of scale, as brand essence should adapt to meet regional targets.

## 3. Case Study

### 3.1 Introduction

Founded in 1989 in Leiria, Portugal, the MD Group began its life as MD Moldes, an engineering company specialized in tools and project management. Three decades and a half later, the group is composed by MD Moldes and MD Plastics, and is a one-stop-shop supplier of injection moulding solutions, for both moulds production and plastic injection, with an expected turnover of around 55 million euros for 2023.

The injection moulding solutions industry is an internationalized one, and the MD Group is no different with its global presence, where the major markets are Spain, France, Germany, Poland and Mexico (these last two establishing as emerging markets for the sector in Portugal). Moreover, the European market represents around 74% of MD's exports, while the American market amounts to around 25%, and the Asian market is still somewhat residual, accounting for 1% of exports. Additionally, the group expanded MD Moldes operations in Shenzhen, China in 2012, and most recently established the MD Plastics North America in Queretaro, Mexico in 2023. Both of these product sites were set up through partnerships with local enterprises.

Given the process of the automotive industry, MD Moldes is mainly a manufacturer to Tier 1 suppliers (first of the line suppliers to the brands), while MD Plastics works with Tier 1 suppliers and also Original Equipment Manufacturers (OEMs).

Moulds production is still the group's main segment, constituting around 56% of revenues. Furthermore, MD Moldes exports 95% of its production. In order to position the company ahead in terms of technology, cost competitiveness and time to market, the group inaugurated in 2021 the MD Campus: a 60,000 sqm complex for the new MD Moldes facilities (13,600 sqm allocated for production) and the group's headquarters. This project was designed to be the largest and most advanced moulds factory in Europe, with state of the art production technologies and features, that enables MD to compete in a highly technical sector.

Established in 2002, MD Plastics has a production plant of 10,000 sqm (inaugurated in 2016) and represents around 44% of the group's turnover, with its production's destination being split between Europe (50%) and Mexico (50%). However, MD Plastics's major client is Volkswagen Autoeuropa automotive assembly plant in Palmela, Portugal, for which the company was considered a top supplier in 2020. A summary of MD's most relevant milestones can be seen in Appendix 1.

Similar to most of the moulding business in Portugal, the MD Group focuses its operations in the automotive industry. Although the company has a diversified portfolio of products for the automotive industry (see Appendix 2), MD targets a niche inside the global automotive supply base: the automotive lighting parts, which requires a strongly detailed and precise production. The strategic shift to automotive lighting started in 2019, after the moulding industry's decline in 2018, which was anteceded by a year of records numbers in terms of production and sales. For this reason, the group does not compete with any local players, and its reality is a global one, as there isn't much market domestically for lighting automotive products other than Autoeuropa. Nevertheless, MD Group is still a fairly modest player in the sector, facing strong competition technologically in Europe (main competitors are from Germany and Italy) and North America, as well as competition in pricing from China.

## **3.2. The Injection Moulding Industry**

### **3.2.1 Manufacturing Process**

Injection moulding is one of the most common methods for plastic parts manufacturing, due to its capability of large production of identical outputs. In order to endure the heat and pressure exerted by the plastic when injected, the material of the mould is a key aspect of production. Plastic injection moulds are often constructed from hardened or pre-hardened steel, which is a more expensive material but offer higher durability. It is also important in the conception of an injection mould that its design enables to be split apart in order to easily remove the plastic product once it is cooled.

The production process of injection moulds often comprises two main fabrication methods of Computer Numerical Control (CNC) machining and Electrical Discharge Machining (EDM). Furthermore, there is five stages to the course of action: CNC rough milling, drilling, CNC finishing, EDM and assembly.

In the first phase, the pre-hardened steel get precisely shaped to the specifications by CNC milling machines that employ high-speed cutting tools. Afterwards, holes are drilled to hold screws, for assembly purposes or even aesthetic constraints. The CNC finishing step is arguably the most precise part of the process, as the surface of the mould part goes through a meticulous machining that will determine the shape of the plastic outputs. Subsequently, the EDM finalizes the shape of the mould part through a non-contact electric process. Lastly, all the parts get assembled in an often handmade method that brings the injection mould together.

Figure 8. The Injection Mould Manufacturing Process

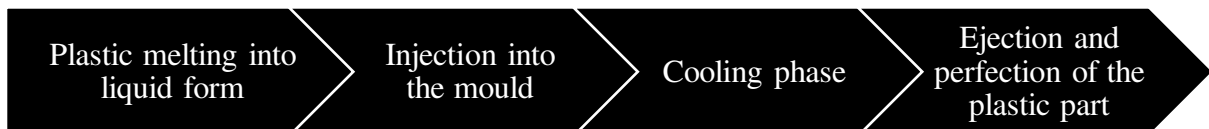


*Source: Author's elaboration*

Once the mould has been manufactured, the plastic injection process takes place. This procedure is more easily-repeatable and consists in producing a high number of identical parts, although engineering, tooling, precision and quality control are factors that also play a big role in the production process.

Injection moulds are typically designed in two clamshell-style pieces, and when these two plates are compressed together, the injection can begin, where the plastic, in the form of granules or pellets, is melted down into a complete liquid. That liquid is then injected into the mould at a high temperature, and pressure is applied to the mould to guarantee the plastic in its liquid form fills every cavity and the product comes out as intended. Subsequently, the plastic part and the mould itself go through a cooling phase, followed by the mould opening and final ejection of the product, which will be then perfected by elimination of waste material either by an automated process or the operator.

Figure 9. The Plastic Injection Process



*Source: Author's elaboration*

### 3.2.2. Injection Moulding Market

The injection moulding industry has been a staple in the Portuguese manufacturing industries, not only through added value and wealth generation, but also as an enabler of development and dynamism.

According to the Associação Nacional da Indústria de Moldes (CEFAMOL), the Portuguese mouldmaking industry accounts for 472 companies, essentially small and medium enterprises (SMEs), and is the third largest European producer of plastic injection moulds, and eighth worldwide. Though business have been slowly diversifying production to escape its

dependence, the automotive sector is still responsible for around 73% of injection mouldmaking production in Portugal (CEFAMOL, 2024) – for reference, the second largest client is the packaging sector, accounting for around 9% of mould production (see Appendix 3). In fact, due to new mobility paradigms, the Portuguese injection moulding industry reached a record production turnover of around 947 million euros in 2023, bouncing back from a period of steady decline between 2017 (year in which the industry stagnated after consecutive years of growth) and 2021, while 2022 was a year of stabilization of the market (see Appendix 4).

Exporting to 86 countries worldwide, Portugal is considered a global player in the mouldmaking sector, with around 80% of production (close to 758 million euros in 2023) being destined to exports (CEFAMOL, 2024). The European Union is still the preferred market for Portuguese companies in the industry, accounting for around 83% of exports, as Spain (21%), Germany (16%) and France (15%) are the traditionally most relevant buyers. However, countries in Central Europe, such as Romania (6%), Poland (6%) and Slovakia (5%), are starting to register increases in exports weight in the sector in Portugal. North America, and mainly Mexico, have also grown its importance in the Portuguese mouldmaking industry (CEFAMOL, 2024). The figures for the industry exports are represented in Appendices 5 and 6.

According to CEFAMOL (2024), there are a few factors that have influenced the success of mouldmaking companies and will continue to impact the industry in the near future:

- Reconfiguration of the automotive industry;
- Disturbances in the geopolitical scenario;
- Rising inflation and consequently the increased cost of raw materials;
- Disruptions in international logistics chains;
- Sustainability questions that require strong investment in R&D;
- Constant effort towards the digital transition of operations;
- Pressing concern with the circularity of the economy.

### **3.2.3. The Niche of Automotive Lighting Parts**

#### **Automotive Industry**

As stated before, mouldmaking and plastic injection productions are highly susceptible to fluctuations in the automotive industry. The volume of new models to be launched often

determines production of new moulds, as well as vehicle production affects manufacturing quantities of plastic parts.

In the last decade, the automotive industry had its biggest negative impact in 2020 due to the COVID-19 pandemic, which was consequently followed by other factors such as chip-shortage, ongoing supply-chain disruptions, economic downturn and geopolitical conflicts. All of these circumstances generated a long-lasting impact on the automotive production. In fact, global light vehicle (LV) production decreased 16% in 2020 year-over-year (YoY), according to S&P Global Mobility (2023). The sector has been registering a recovery through growth in production yearly since 2021, but it is expected to reach, and exceed, the level of production of 89 million vehicles in 2019, during the year of 2025 (see Appendix 7). However, this forecast is not homogeneous across the globe. While markets like Greater China (largest global LV producer) and South Asia bounced back from the COVID-19 impact in 2021, traditional markets like North America, Europe and Japan/Korea are not forecasted to return to pre-pandemic levels (see Appendix 8).

Within LV production, OEMs are shifting rapidly their portfolios to increase production of Battery Electric Vehicles (BEV) as emission targets become more significant. In reality, BEV production forecasts point to a Compound Annual Growth Rate (CAGR) of approximately 34% between 2020 and 2030, while LV production as a whole is forecasted to grow at a rate of around 3% yearly for the same period. It is expected that BEVs will represent 46% of global LV production by 2030, a significant increase when compared to the historical 3% in 2020. Yet again, Greater China stands as the biggest manufacturer of BEVs, with more than 50% of global sales in 2022. However, North America's rise in number of electric vehicle owners should not be understated, as according to PwC (2022), the number of EVs in the US is expected to grow at a rate of around 32% annually between 2022 and 2030, reaching 27 million units, compared to 3 million in 2022, and a further CAGR of 13% between 2030 and 2040 (approximately 92 million EVs by 2040). The evolution of the number of EVs in the US can be seen in Appendix 9.

### **Automotive Lighting**

As the automotive industry goes through major shifts in its models, along comes innovations and developments around new and existing features. The lighting of a vehicle is one of those areas that have undergone enhancements, and is expected to continue to grow in production volume and technologically.

Nowadays, the modern automotive lighting is quite different and more complex than the classic system. Instead of the traditional arrangement of front and rear lighting, in which both served functional safety and signaling purposes, current lighting in a vehicle performs multiple functions. Both front and rear lighting play roles of communication, individualization and design, while the front lighting is also a safety feature and the rear provides brand perception. Additionally, interior lighting is now a third element of the automotive illumination, contributing to the design, experience, information and individualization of the vehicle (see Appendix 10).

With lighting being applied in more areas of the vehicle, production is expected to increase at higher rates than the ones forecasted for LVs in general. In the near future several trends are expected to occur in the automotive lighting sector:

- Increase of front exterior illumination in the grille, front bar and logo of the vehicle;
- Upsurge of the intelligent front lighting, or Adaptive Driving Beam (ADB), with penetration reaching 24% of all LVs in 2029, against 6% in 2020 (see Appendix 11). As a first legalization of ADB in the United States is expected to take place in late 2024/early 2025, global penetration might increase 3-4 p.p. in 2029;
- Growth of vehicle rear bar application;
- Near field projection technologies to illuminate the surroundings of the vehicle;
- Increase of interior ambient lighting, as smart functions become less exclusive to the premium segment of vehicles and enter volume brands.

### **3.3. Internationalization of MD Group**

#### **3.3.1. International Strategies**

Strategically based in Portugal, the MD Group is an internationally oriented business, and the company considers that all the production is exported, whether direct or indirectly, since its domestic clients usually resell their products abroad (e.g. Autoeuropa). With business operations in 15 countries, the group has been strongly investing in non-European markets as a strategy to vary from the region's stagnated market. This shifting process started in 2019, after 2018's industry decline, with a venture into North America. The North American market is more dynamic, reactive and less fragmented than Europe and highly tied with Mexican businesses. In fact, Mexico is already the most important client for MD, accounting for 17% of

sales of MD Moldes (see Appendix 12), and around 50% for MD Plastics. Traditional markets such as Spain, France and Germany are still in the top-5 buyers.

When it comes to costs from international distribution, its weight is not significant in the injection moulding value chain, as the production itself is highly expensive, and therefore, centralizing production in the country of origin is only natural. On the other hand, such is not the case for injection plastics, as it is a mass production process and requires more expensive logistics. As a result, the strategic route for MD Plastics is setting up operations internationally, which should also present as an opportunity to capture new clients, thus the establishment of MD Plastics North America.

### **International Market Selection**

With the expansion to other non-European markets, the potential for the exploration of new countries is important for MD Group. In this sense, the nuances of recognizing and approaching emerging markets are crucial, as cultural and economic factors are critical elements of the decision-making process (Sakarya et. al, 2007). However, available quantitative and qualitative data available may be scarce for emerging markets, which represents a challenge in the process of identifying markets to target.

MD's market selection strategy starts with an investment in outlook reports on the industry, which provides insights about the current and future situation of the automotive lighting sector since keeping up with the trends in such a fast-paced setting is key.

On the other hand, the company participates regularly in events such as fairs and symposiums, in order to obtain information about the reality of the market. Additionally, such events present as opportunities to establish commercial relationships abroad. This broadening of the network allows MD to form connections that are occasionally unsolicited in a more opportunistic manner. It is the case of the entrance in the Indian market, in which the company was approached by local firms, and is now working on starting operations in India, through a technical agreement with a local partner.

### **Entry Modes**

First and foremost, well-established partnerships are a key factor in MD's strategy of approaching a new market. The company's first international contact with a specific market often starts with travelling to the desired country for market assessment. As a matter of fact,

most of these physical interactions often occur through global clients that operate in Europe, MD's most traditional market.

With this network formed, the company is capable to leverage connections and leap inside the supply chain. In effect, MD have been strengthening bonds with automotive OEMs, such as Tesla, Rivian, Ford, Volkswagen and BMW (see Appendix 13). This brings two advantages to the business: for the injection moulding stream, it is a way to guarantee contracts with Tier 1 suppliers, as OEMs often have influence in the choice of Tier 2 suppliers, which in this case would be MD Moldes; and for the injection plastics segment the company is capable of asserting not only the continuation of production for the existing markets (e.g. Autoeuropa), but also the expansion to new markets, as it is the case of Tesla, in which MD Plastics secured a deal of manufacturing lighting parts in Mexico for the North-American automotive company. Furthermore, MD is a contracted supplier to all the constituents of the top-5 exterior automotive lighting players, which represent around 70% of the market. The establishment in the exterior automotive lighting sector also meant for MD to enter in Japan, a not so relevant direct market but crucial to be successful in the European and American markets, since 2 of the top-5 players are Japanese.

### **Critical Success Factors**

In a very demanding and highly technical competitive environment, MD Group's international success is driven by four main factors: customer relationship, technology development, quality control and human resources know-how. Furthermore, the automotive lighting sector is already quite advanced, with plenty technology available to the high performance of the parts.

The proximity with the client is a matter of extreme importance to the company. In fact, MD considers that an investment in the commercial area, by providing a premium service, with fast and efficient communication, is fundamental in order to tailor to the buyer's specifications and consequently obtain global customer satisfaction.

As stated before, the MD Campus (the largest and most advanced moulds factory in Europe) and MD Plastics' production plant are important assets for the company's technological improvement. The high optical precision center in MD Moldes allows quality production capable of responding to the clients' complex and demanding requirements. On the other hand, with the constant implementation of innovative productive processes, such as automatic and multi assembly lines, end line testers, visual management systems and advanced metrology and photometry capabilities, the company performs a thorough inspection in every product. Quality

control is a vital component of the firm's operations, since it's not only tied to the client's satisfaction, it improves production efficiency, as the company often mentions the importance of "getting it right the first time".

Last but not least, human resource management plays a significant role in the company's life. Attraction and retention of qualified personnel is a challenge for the company, since the local competitive environment is fierce, but for MD the engineering know-how to develop new product concepts and execute production processes is a way of achieving the highest customer satisfaction.

### **3.3.2. Next Steps**

The group has aspiring ambitions of reaching a turnover of approximately 120 million euros by 2027, which represents a CAGR of 22% between 2023 and 2027. Most of the contribution to this objective is due to the growth of MD Plastics North America, which should be responsible for around 38% of revenues in 2027, making it the largest company of the group (see Appendix 14).

MD Group intends to stabilize and reinforce operations in the Mexican market, by leveraging and potentially increasing production with the local partnership established. Additionally, there is the possibility of creating a production site in the country in the next three to five years.

Furthermore, there is a partnership with an Indian mouldmaking manufacturer in progress, which should be finalized during 2025. The MD Group sees the Indian automotive market as one with extraordinary potential and extremely dynamic at the moment. With several production clusters in the country, in which the largest ones are Delhi, Pune and Chennai, the local automotive market is growing exponentially, and, according to the India Brand Equity Foundation (IBEF), the country is on track to become the largest EV market in 2030. Furthermore, the forecasted growth in the light vehicles market is driven by the increase of middle class and young population (IBEF, 2024). However, the Indian market is still looking for products typically low-cost and not as developed as the ones MD usually designs.

The Asian markets are also targets for the MD Group. With activity already established in Shenzhen, China, the company is looking to strengthen its presence in the country, by leveraging current MD Moldes local relationships and also setting up operations for MD Plastics to support its customers on a global basis through a partnership with a domestic

supplier, already identified. Moreover, MD Plastics will look to Indonesia and Vietnam to access opportunities, understanding the trade agreement with China.

In terms of product development, the objective is to invest not only in products that are synergic with lighting, but also in substitute manufactured goods, as clients are often the same for both. Mouldmaking manufacturing and engineering cluster are expected to remain in Portugal, while the production plant in China will manufacture less complex tools.

## **4. Teaching Notes**

### **4.1. Overview**

This case study covers a set of aspects regarding strategic management and internationalization, thus the possibility of a pedagogical use to discuss a real-life case of strategic internationalization of a Portuguese company that exports around 95% of its production and has ambitions of competing in new markets.

In order to prepare the case, students should be familiar with the models presented by studying the literature review and read the case study to obtain more insights on an industry and a company that are not typically part of common knowledge, and their processes, international trends, opportunities and challenges, and most prominent and emerging markets.

It is expected with the following case questions that students can explore strategic management resources, apply internationalization frameworks and discuss MD's international strategy, as well as provide recommendations regarding factors in the near future.

### **4.2. Case Questions and Suggested Resolution**

**1. How would you describe MD Group's international entry modes in the scope of the theoretical frameworks presented (Uppsala Internationalization Process Model, Network Approach, IPLC Model, etc.)?**

In light of the theoretical frameworks discussed, MD Group's international entry modes are in fact driven by many factors. Firstly, the physical distance of markets was a key aspect of the

global journey of the company, as uncertainty is less and allowed to obtain knowledge and experience, and mainly global connections. Those well-established relationships are now at the core of MD's international strategy, with the leverage of exiting partnerships to other parts of the world. As the company grows and reaches a stage of maturation, it is tending to approach new countries through product differentiation, while also aiming to compete in markets that are more cost efficiency oriented.

The way MD Group approaches international markets can be matched to the Uppsala Internationalization Process Model. By first establishing international operations in markets that are psychically close, such as Spain, France and Germany, the company began its international path in markets with low uncertainty and distance, which then generated knowledge that allows MD to approach foreign countries such as Mexico or India and overcome their psychic distance factors. Additionally, its internationalization process of beginning exportation through a commercial relationship, and then later establishing partnerships and potentially setting up production is consistent with the Uppsala Internationalization Process Model.

On the other hand, one of the cornerstones of MD Group's internationalization journey is the relationships developed. This way of leveraging the network of connections to firm business operations is consistent with the Network Approach to Internationalization. In fact, the framework mentions the importance of previous transactions to strengthen bonds, and MD Group utilized its set of ties in Europe among partners with global presence to the benefit of venturing into new markets. Furthermore, MD builds and boosts its network by investing in individually tailored products and offering quality service. In effect, the model mentions the importance of establishing business relationships due to the necessity to obtain knowledge regarding price, quality and services provided. According to the internationalized companies definitions provided by the Network Approach model, we can classify MD Group as an "*International Among Others*" firm, due to its high degrees of internationalization of both the firm and the market.

Finally, MD's international strategy shares similarities with both Resource-Advantage Theory and the IPLC Model. Although the company faces very intense competition in both product and pricing, product quality and MD's resources and capabilities such as technology advances and engineering know-how are crucial when approaching foreign markets. One can argue that the

firm's product life cycle is still in its growth phase, however we can already identify MD's trend into markets with lower labor costs, which is typically a consequence of the maturity phase. However, this shift into such countries is more market driven rather than for cost saving purposes.

In conclusion, MD Group's international entry modes are usually established by the existing network of business relationships. However, the company's resources and capabilities are also critical since product differentiation plays a role in market penetration.

## **2. Describe MD Group's internationalization strategy in terms of sustainable competitive advantage and standardization vs adaptation.**

Creating sustainable competitive advantage in the injection moulding industry as a whole is definitely a challenge. As stated before, companies compete mainly on product differentiation and quality. Taking into consideration Porter's Generic Strategies, MD can be defined as a "*Differentiation*" one, as the company's target (automotive industry) is a quite broad one, and competitive environment is defined by the differentiation aspect of the product.

The capability to satisfy customers' specifications is an aspect in which MD Group heavily focuses on, through investment in technology, processes enhancement, quality control and human resources know-how. Therefore, the role of MD's facilities, mainly the MD Campus, cannot be understated in the company's strategy to sustain international competitive advantage. Nonetheless, attracting and retaining talent, primarily in the engineering part of the operations, is a key aspect in the company's path to success and is something to be mindful of. One of the factors is in fact tied with technological advances, since such investments are usually a source of motivation and attractiveness for engineering personnel.

When it comes to standardization vs adaptation, one could argue that MD Group employs a mix of both strategies. Firstly, MD Moldes centralizes production to maintain high quality and control costs, aligning with a standardization strategy. On the other hand, MD Plastics international future is propelled by setting up local operations in foreign markets like North America to meet logistical demands and capture new clients, demonstrating adaptation. Furthermore, by applying Ghantous' Strategic Matrix for Brand Internationalization, MD's strategy is consistent with a "*Differentiated brand strategy*", since the company's products are characterized by containing high global vocation, with regional demand homogeneity.

In conclusion, production aspects are of extreme importance for MD Group to sustain international competitive advantage, while the product is typically globally oriented with regional specifications.

**3. How would you describe MD Group's decision to expand to India? What are the main opportunities and challenges? Propose a CAGE Model analysis to the Indian market.**

Being the third largest automotive manufacturer in the world, expanding to India is a natural decision for MD. Additionally, not only is India one of the largest players in the industry, growing trends forecast a CAGR of over 9% between 2022-27 (IBEF, 2023).

The Indian Government has been strongly encouraging foreign investment in the automotive sector, with several initiatives such as the Automotive Mission Plan 2026. Although MD's expansion to India is not exactly foreign investment in the automotive sector, nothing indicates barriers to entry and operate in a market with such potential. The local partnership established by the company is also an advantage, since it mitigates some risks on venturing into this new and distinct market.

One other opportunity for MD Group lies in the substantial two-wheelers market. This segment dominates the Indian automotive sector due to a growing middle class and young population. Thus, the market dimension shows attractiveness and could be a prospect to secure some contracts with domestic clients, since many local manufacturers for passenger vehicles often produce two-wheelers as well. With the synergies in production between passenger vehicles and two-wheelers, the investment in developing and designing this new line of products is a strategic opportunity for MD.

However, there are challenges to take into consideration in this journey into India. The Indian automotive market is not as technologically developed as the ones MD usually operates. Moreover, global OEMs such as Volkswagen and Kia Motors have adapted themselves to cater to the large Indian middle-class population by changing their usual structure and designs (IBEF, 2023). In the case of MD Group, the products are essentially in the middle-high quality bracket, something that contrasts with the Indian reality. Adapting designing and production to accommodate these needs is something that the company needs to be aware of, as the local

partnership should certainly present as an asset in this field, with local knowledge about the market and technical know-how to meet the customers' needs.

By applying the CAGE model in the relationship of exporting from Portugal to India, we obtain the following analysis of each dimension:

#### *Cultural Distance*

There are significant differences in social norms, including attitudes towards hierarchy, gender roles, and collectivism. India tends to have a more hierarchical society with a strong emphasis on family and community, while Portugal has a more individualistic culture.

Additionally, business practices and etiquette can differ, with India often requiring more relationship-building and patience in negotiations compared to the more straightforward business culture in Portugal.

#### *Administrative Distance*

India is characterized by a more complex bureaucracy and regulatory framework, which can pose challenges for foreign businesses. However, due to the governmental initiatives in the automotive sector, it is unlikely that MD will face many barriers to entry, especially taking into consideration the local partnership in place.

Historically, India has had more protectionist policies compared to Portugal, which is part of the European Union (EU) and follows its trade regulations. This can affect tariffs, import/export regulations, and ease of doing business.

#### *Geographic Distance*

The physical distance between Portugal and India is substantial, affecting transportation costs and time. Although transportation is not a crucial aspect in MD's strategy, moulds logistics from Portugal to India should be optimized to compete in this market.

Furthermore, there is a significant time difference (typically 4.5 to 5.5 hours), which can affect communication and coordination.

#### *Economic Distance*

Portugal has a higher GDP per capita compared to India (World Bank), indicating different levels of consumer purchasing power. The Indian market, however, is larger in terms of

population, with a significant increase in consumers with a growing middle class and young population.

While Portugal has a more developed economy with a higher proportion of services, while India has a large agricultural sector and a rapidly growing industrial and service sector, mainly developing to support agricultural activities.

As part of the EU, Portugal has a more stable financial environment, while India's financial system is developing but can be volatile, with currency fluctuations and varying access to capital.

To conclude, despite India's cultural, administrative, geographic and economic distances, the market potential is significant and the availability from local partners to work with MD presents a strategic opportunity to expand.

#### **4. What factors should the MD Group consider in the near future regarding internationalization? Are markets such as China, Indonesia and Vietnam viable strategic choices?**

As MD Group looks forward to broaden its geographic horizons, it is important to be aware of some factors in order to be successful internationally. Much of the literature discussed before helps to comprehend and analyse many internationalization components, such as the Liability of Foreignness, Entry Modes and International Strategies.

MD Group's international presence is expanding into typically less traditional markets (i.e. outside of Europe). However, penetrating into these countries can have obstacles. The lack of knowledge about the market trends and local competition is one of them. Furthermore, governmental initiatives that promote local businesses are a risk in which MD should be prepared for. Finally, as the automotive industry suffers technological innovations, it is expected that suppliers that can better keep up with the developments will prevail. Therefore, continuous investment in technology and innovation will help MD maintain a competitive edge.

Additionally, CEFAMOL (2024) already defined some of the industry's biggest challenges, and that can be applied to MD's international strategy:

- Reconfiguration of the automotive industry;
- Disturbances in the geopolitical scenario;
- Rising inflation and consequently the increased cost of raw materials;

- Disruptions in international logistics chains;
- Sustainability questions that require strong investment in R&D;
- Constant effort towards the digital transition of operations;
- Pressing concern with the circularity of the economy.

Finally, due to designing innovations, the automotive lighting sector is expected to have an increased growth when compared to the general automotive industry. Automotive markets such as Greater China and South Asia however are forecasted to grow at a much higher rate than traditional markets (North America, Europa and Japan/Korea), which are looking to stagnate in the upcoming years.

Taking this into consideration, the reinforcement in the until now residual MD presence in China, as well as the venture into Indonesia and Vietnam, are strategic choices that come into discussion. The Chinese market is traditionally quite aggressive, with strong competition that usually relies on pricing, and retains governmental backing in matters of exporting, materials subventions and job creation opportunities. At the moment, that is not the reality of MD, whose strategy differentiates through product. Thus, optimizing processes to become more cost efficient is a crucial step for the company in order to be successful in this market, process which already started by setting up production in China through a local partnership. Lastly, the Indonesian and Vietnamese markets could share similarities with the previously discussed Indian market: countries with significant population density that have a high ceiling, but could be characterized by a demand of lower quality products, especially in the first years of growth. As a result, the knowledge obtained from the Indian experience should be quite valuable while entering these countries.

In conclusion, MD Group should take into account technological, market competitiveness, and industry factors when addressing future international strategies. The regions of Greater China and South Asia represent natural choices to diversify the company's exports from the stagnated European market, but there are many competitive challenges to surmount.

## 5. Conclusions

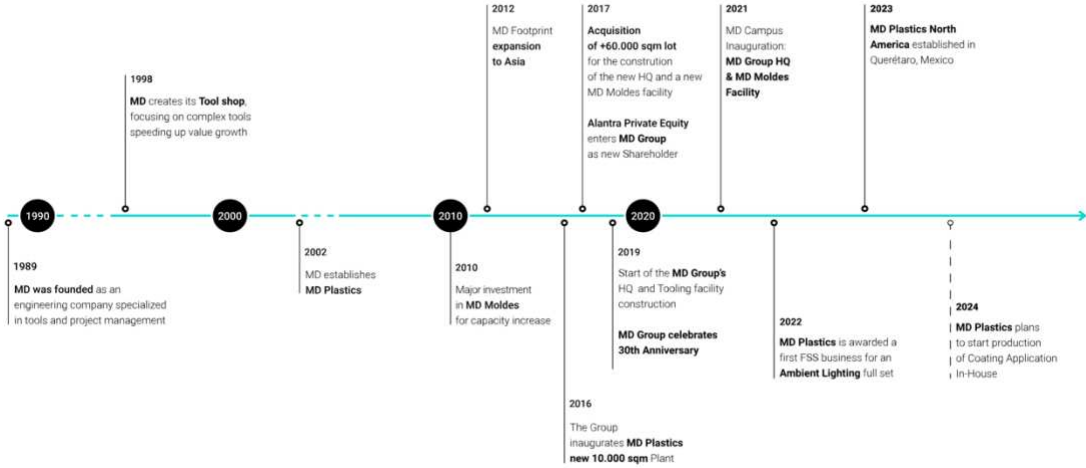
This dissertation provides the opportunity to dive into MD Group's international strategy and visibility on many factors. By analyzing the case study it is possible to identify the company's resources and capabilities, how it sustains competitive advantage, the foreign market selection approaches, international entry modes and strategies, what are the prospects looking into the future.

MD competes in a highly technical industry, where globalization is strong and competition is fierce. As a result, the company's resources such as technology and engineering solutions, production plants and constant improvement in processes are key to achieve competitive advantage. Additionally, MD was able to shift its focus to the niche of automotive lighting parts within the automotive industry that is somewhat stagnated, and identify opportunities in less saturated markets. Furthermore, the company relies positions its business relationships on the core of the international strategy. By leveraging connections with global partners already established in the traditional markets (i.e. Spain, France, Germany), MD was able to penetrate into a more dynamic and larger market, which is the case of North America. Such network of relationships is not only an advantage in entering a new market, it is also crucial to grow in incumbent countries.

In terms of new opportunities, the company is looking into a local partnership in an emerging market (i.e. India), which shows a large and rapidly growing market, but with product adaptation challenges for MD. On the other hand, China is part of the 5 year plan for the company, with the prospect of firming a partnership with a domestic player already identified. China is the largest automotive manufacturer and is expected to grow at a higher rate when compared to traditional markets such as Europe, North America or Japan/Korea. However, competition is quite strong in terms of pricing and governmental backing is a reality for which MD should be prepared for. Developing countries such as Indonesia and Vietnam are also in the company's radar in the near future, due to being in an early stage of growth and presenting an high ceiling.

# 6. Appendices

## Appendix 1 – MD Group’s Milestones



Source: Company’s website

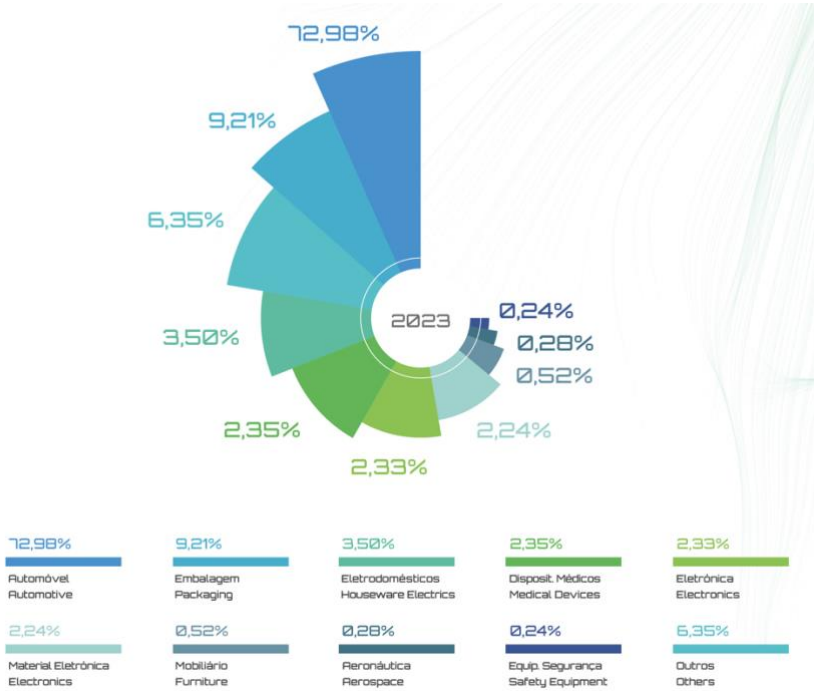
## Appendix 2 – MD Group’s Products





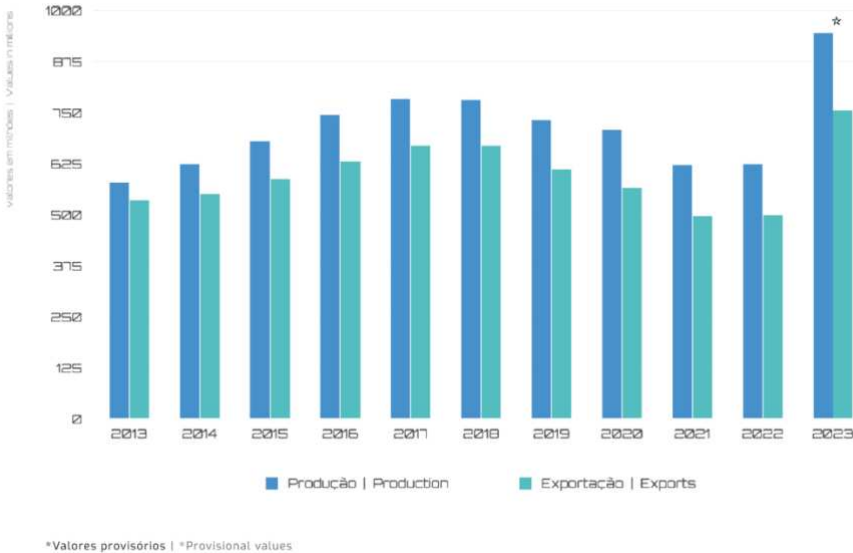


**Appendix 3 – Portuguese Moulds Industry Production Breakdown by Client Industry (2023)**



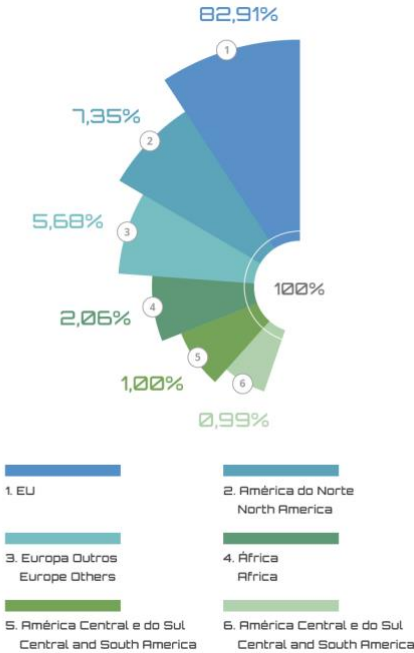
Source: CEFAMOL. Portuguese Moulds Industry Report 2024

**Appendix 4 – Portuguese Moulds Industry Production Evolution in millions of euros (2013-23)**



Source: CEFAMOL. Portuguese Moulds Industry Report 2024

**Appendix 5 – Portugues Moulds Industry Production Breakdown by Region of Client (2023)**



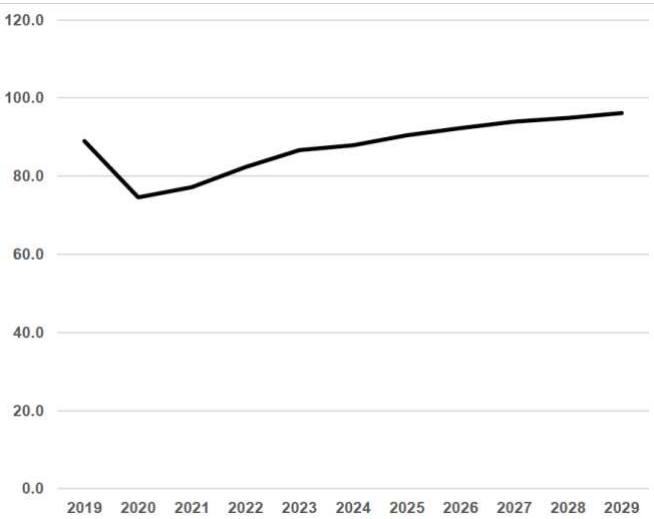
Source: CEFAMOL. Portuguese Moulds Industry Report 2024

**Appendix 6 – Portugues Moulds Industry Production Breakdown by Country of Client (2023)**



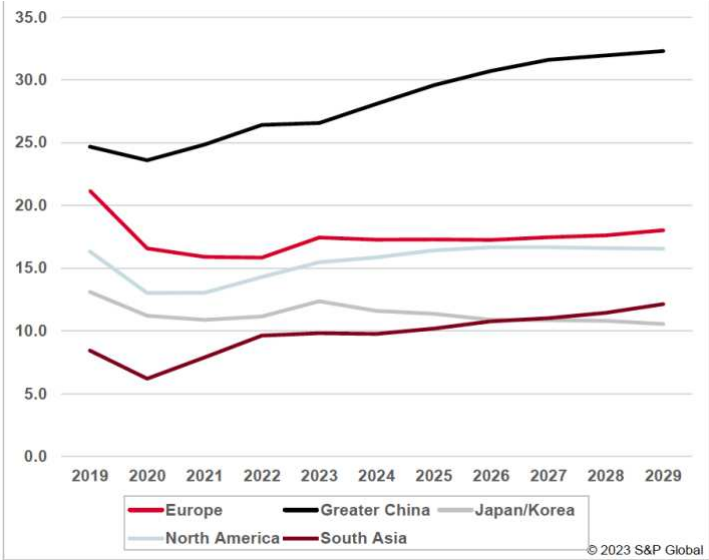
Source: CEFAMOL. Portuguese Moulds Industry Report 2024

**Appendix 7 – Global Light Vehicle Production in millions (2019-29)**



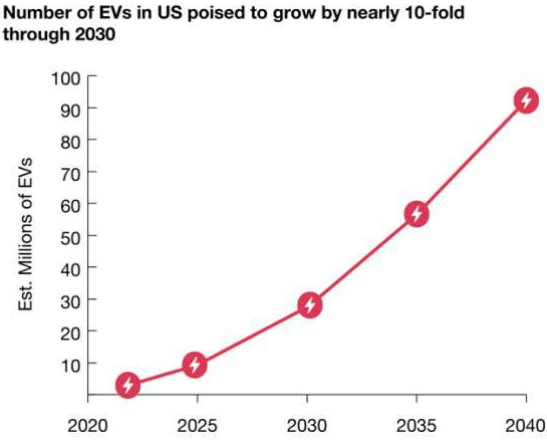
Source: S&P Global Mobility. *Automotive Intelligent Lighting Technologies & Designs 2023*

**Appendix 8 – Global Light Vehicle Production by Region in millions (2019-29)**



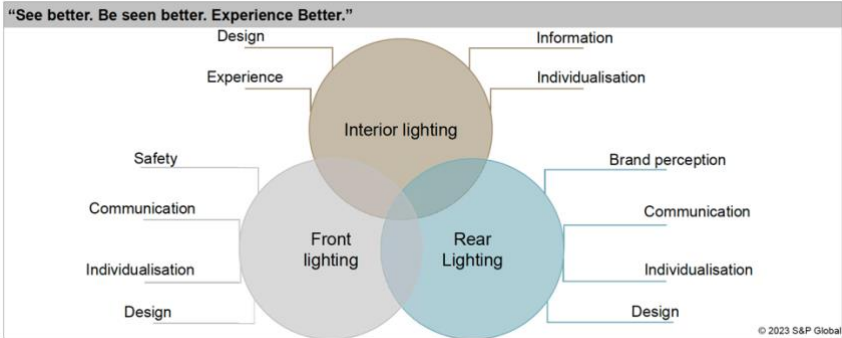
Source: S&P Global Mobility. *Automotive Intelligent Lighting Technologies & Designs 2023*

**Appendix 9 – Evolution of the Production of Electric Vehicles in the US in millions (2020-40)**



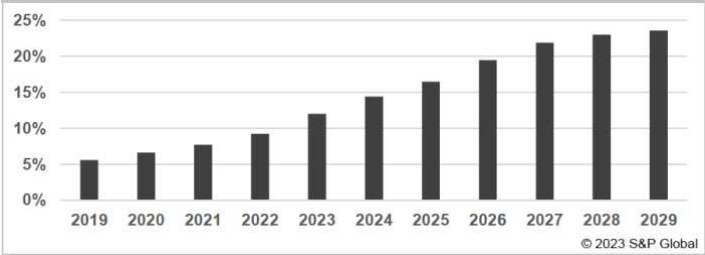
Source: PwC (2022). *The US electric vehicle charging market could grow nearly tenfold by 2030: How will we get there?*

**Appendix 10 – Modern Automotive Lighting**



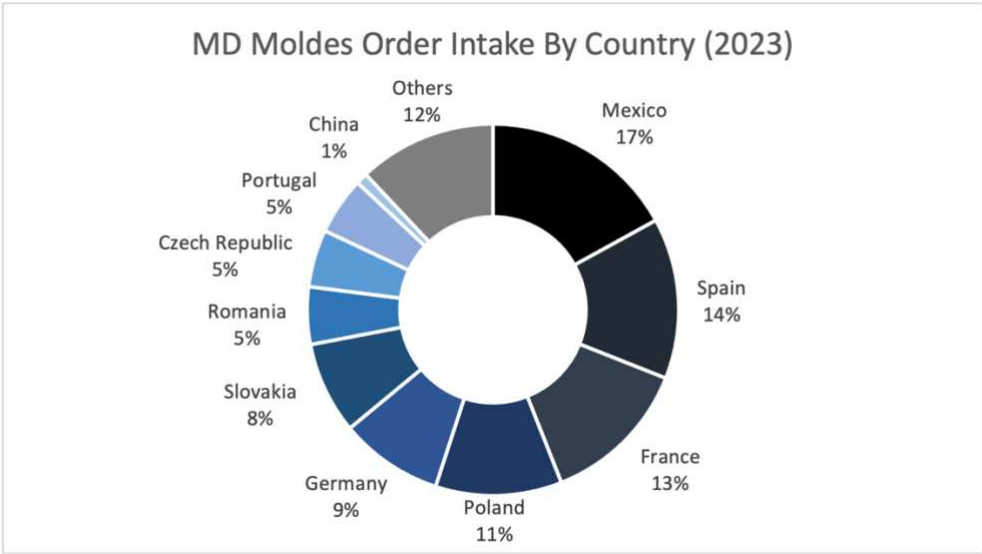
Source: S&P Global Mobility. *Automotive Intelligent Lighting Technologies & Designs 2023*

**Appendix 11 – ADB Global Penetration Evolution (2019-29)**



Source: S&P Global Mobility. *Automotive Intelligent Lighting Technologies & Designs 2023*

**Appendix 12 – MD Moldes Order Intake By Country**



Source: Company’s reports (Author’s elaboration)

**Appendix 13 – MD Group OEM Clients**

**Our OEMs.**



Source: Company’s reports

**Appendix 14 – MD Sales Evolution in millions of euros (2023-27)**



Source: Company’s reports (Author’s elaboration)

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