



Internationalization of Molecular Medicine Companies: GenoMed's Case Study

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Abstract

An increasingly global marketplace, combined with a deep internal economic crisis, forced Portuguese technologic firms to turn into foreign countries in the pursuit of maintaining its competitive. For a small enterprise, an international expansion needs to be carefully planned, and so it is objective of this work to develop an internationalization strategy for GenoMed, a Portuguese molecular diagnostics firm, generalizing from this case study an approach which could stand as a framework for small Portuguese molecular diagnostics companies' internationalization process.

In this work, existing literature on distinct pattern models for firms internationalization is revisited, from economic approaches to the most recent "born-global" and "born-global again" firms. Also, the factors which influence the internationalization and the different market entry modes used by firms are reviewed. As research methodology, a case study approach was used, providing the structure to develop an extensive analysis of the molecular diagnostics industry, its market and to GenoMed, to evaluate its current strategy and competitive position.

According to the developed research, GenoMed should pursue a competitive advantage through differentiation, aiming the narrow niche market of molecular diagnostics. Its international competing approach should be global, however differentiating the strategic objective in three different segments: Eastern-Europe countries, where partnerships should be pursued for testing outsourcing (to GenoMed), fast growing economies like China and Brazil, where alliances should aim for crossed-shareholding and licensing, and the rest of the world, where GenoMed should try to improve its international network and develop an image of high quality laboratory for rare diseases diagnostics.

Key-words: GenoMed, molecular medicine, case-study, strategy, internationalization, born-global

Resumo

A internacionalização de uma empresa, uma necessidade cada vez mais premente dada a conjuntura económica do país, carece de um plano estratégico, para tornar o processo eficaz e eficiente. O objectivo deste trabalho consiste no desenvolvimento de uma estratégia de internacionalização para a GenoMed, uma empresa de medicina molecular e genética, pretendendo-se criar um modelo que possa ser generalizado a todas as pequenas empresas que operam no mesmo mercado.

Neste trabalho é feita uma revisão da literatura sobre modelos de internacionalização, desde as primeiras abordagens mais estáticas até aos conceitos extremamente dinâmicos mais recentes como as empresas “born-global” e “born-global again”. Os factores que influenciam o sucesso da internacionalização e os métodos de entrada em mercados externos são também abordados.

Para analisar a GenoMed e a indústria envolvente, uma metodologia de estudo de caso foi adoptada, tendo sido desenvolvida uma extensa análise ao mercado dos diagnósticos moleculares e uma análise interna à empresa, o que permitiu avaliar a sua estratégia actual e aferir a sua posição competitiva no mercado.

Como conclusão, um plano estratégico para a internacionalização da GenoMed foi criado, devendo a empresa apostar no mercado de nicho dos diagnósticos moleculares de forma diferenciada, internacionalizando-se de forma global e adoptando três abordagens distintas para: Europa de Leste, onde deve investir em parcerias para a realização de testes, países com economias em forte desenvolvimento, onde deverá privilegiar o *cross-shareholding* e o licenciamento de conhecimentos científicos e procedimentais e o resto do mundo, onde deverá investir numa especialização em doenças raras.

Palavras-chave: GenoMed, medicina molecular, estudo de caso, estratégia, internacionalização, *born-global*

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List of Abbreviations

ANF	Associação Nacional de Farmácias
APCER	Associação Portuguesa de Certificação
CEO	Chief Executive Officer
CGC	Centro de Genética Clínica
CHLN	Centro Hospitalar Lisboa Norte
ddNTP	Dideoxynucleotide Triphosphate
DNA	Desoxyribonucleic Acid
EMN	European Medical Network
EMQN	European Molecular Genetics Quality Network
ESS	Espírito Santo Saúde
FMUL	Faculdade de Medicina da Universidade de Lisboa
FMUP	Faculdade de Medicina da Universidade do Porto
GDPN	Genética Médica e Diagnósticos Pré-Natal
HSM	Hospital de Santa Maria
IAPMEI	Agência para a Competitividade e Inovação
IBMC	Instituto de Biologia Molecular e Celular da Universidade do Porto
IMM	Instituto de Medicina Molecular
INSA	Instituto Nacional de Saúde Ricardo Jorge
INV	International New Venture
IPATIMUP	Instituto de Patologia e imunologia Molecular da Universidade do Porto
IPO	Initial Public Offering
IVD	<i>In Vitro</i> Diagnostics
KSF	Key Success Factors
MNE	Multi-National Enterprises
NCCN	National Comprehensive Cancer Network
NEST	Novas Empresas de Suporte Técnico
NGS	Next-Generation Sequencing
OCDE	Organization for Economic Co-operation and Development
PCR	Polymerase Chain Reaction
PESTL	Politic, Economic, Social, Technologic and Legal Factors
QCMS	Quality Control Monitoring System
R&D	Research and Development
SA	Sociedade Anónima
SME	Small and Medium Enterprises
SWOT	Strengths, Weaknesses, Opportunities and Threats
UKNEQAS	United Kingdom National External Quality Assessment Service
UAE	United Arabian Emirates
USA	United States of America

1. Introduction

Due to an increasingly globalization of the marketplaces, combined with an internal economic crisis, forced Portuguese technologic firms to turn into foreign countries in order to increase revenues and continue to be competitive. This internationalization needs to be carefully planned and follows very clear objectives: broadening its clients' portfolio, so small firms become less dependent of specific buyers, therefore spreading the risk on more than one country, and to use its home market-leadership abroad to increase its sources of revenue. The objective of this work is to develop an internationalization strategy for GenoMed, a Portuguese molecular diagnostics firm.

Existing literature deeply strengthens the necessity of a pre-internationalization phase during which firms develop an entrepreneurial motivation into the international expansion and a solid network of contacts across foreign countries, together with an improvement of its marketing and international knowledge.

Two distinct internationalization pattern models arise in the literature: economic approach, based in the natural development of internal competitive advantage into an exportation phase, and a behavioral approach, where firms develop a dynamic attitude towards internationalization, by increasing firms international commitment in an incremental evolution. However, none of these schools of thought about international operation was able to describe an increasingly global phenomenon: the "born-global" or "born-again global" enterprises. These firms try to enter the international marketplace since its inception, or in a specific timeframe, in order to make the most of its competitive advantage. This internationalization pattern is especially relevant in fast-paced industries like health and high-technology, where products life cycle and its commercialization window is, usually, much narrowed. The different possibilities for entering foreign markets, as well as its advantages and disadvantages, are also scope of analysis in this work.

Molecular diagnostics industry and internal GenoMed's analysis were performed, through a case study methodology. The most important sources of information were structured interviews and documentation analysis. From this study, it was possible to assess the great potentiality of this industry, which is developing at a huge pace, as well as some perks hampering its growth, like regulatory, legal and political hurdles, combined with economic times of crisis, which lowers the needed investment to further develop its technologies and prove its clinical validity. With the conclusions obtained in the industry and firm analysis, it was possible to develop a strategy for this company.

According to the developed research, GenoMed should pursue a competitive advantage through differentiation, aiming to the narrow niche market of molecular diagnostics. Its international competing approach should be global, however differentiating the strategic aim for three different scenarios: Eastern-Europe countries, where partnerships should be pursued for testing outsourcing to GenoMed, fast growing economies like China and Brazil, where alliances should aim for crossed-shareholding and licensing, being GenoMed responsible for scientific knowledge and technical know-how introduction, and rest of the world, where GenoMed should try to improve its international network and develop an image of high quality laboratory for rare diseases diagnostics.

2. State of the Art

2.1 Introduction

2.1.1 Definition of internationalization

Internationalization can be defined, in a literal meaning, as making something international (Oxford Dictionaries, 2010). In the business world however, the definition is explained as *“a sequential and orderly process in which firms gradually increase their international involvement”* (Johanson & Vahlne, 1977).

2.1.2 Importance of internationalization and strategic planning

The factors leading firms to pursue their internationalization process are often diverse. According to (Thompson, Peteraf, Gamble, & Strickland III, 2012), this strategic move may pursue:

- Enlargement of the target market, gaining access to new costumers which offer opportunity to earn higher revenues and return on large investments more rapidly. This reason is particular important for R&D-intensive industries, where development of new products is faster than usual, what tends to contract products life cycle;
- Achievement of lower costs through economies of scale, higher bargain power near suppliers and to increase the experience accumulated, moving down the learning curve and boosting profits;
- Expand home market-leadership to other countries, taking advantage of its core capabilities and resources or to access resources and capabilities located in foreign markets, learning from possible partners and acquiring its knowledge, resources and distribution networks;
- Risk spreading across a wider market base, since it allows balancing probable local downturns with other countries good performance.

Competing in different countries of the world is naturally more difficult and complex when compared with home market competition only. Several issues may take a part in this higher market complexity:

- Unpredictability of different factors influencing industry's competitiveness;
- Potential for location-based advantage;
- Differences in government policies, economies, culture, demography and market conditions;
- Risks of currency exchange rates shifts.

This arise in complexity reinforce the importance of strategic planning in the analysis of firms current situation, possible benefits with internationalization and the definition of how this objective is going to be achieved, since *“the better conceived a company's strategy and the more competently it is executed, the more likely that the company will be a standout performer in the marketplace”* (Thompson et al., 2012).

2.2 Factors that lead towards internationalization

As suggested by Welch (1977), in (Tan, Brewer, & Liesch, 2007), to understand why and how an internationalization orientation begins within a firm, the decision-making process and factors that impact it need to be explored. Also different other authors (Wiedersheim-Paul, Welch, & Olson, 1975) approached this pre-internationalization motivations problematic, being however an area with notably lack of investigation ((Lamb & Liesch, 2002; Luostarinen & Welch, 1990) in (Tan et al., 2007)). Therefore, an overview of relevant elements identified in (Tan et al., 2007) will be presented.

2.2.1. Internal and external stimuli

Central to a firm's internationalization decision is the key role of stimuli factors providing information input that drive the company to internationalization commencement, decision-making process and subsequent development.

Internal stimuli, like interested managers with required market experience and strong network, have the potential to present opportunities and encourage international consideration. The desire to achieve corporate goals, proactive risk control and high competitiveness in marketplace also influence the internationalization readiness.

Regarding external stimuli, factors as foreign demand and its impact on scale economies achievement and relative factor costs, government supports and competitive pressures in domestic markets, may also lead firms into internationalization. Other external stimuli include foreign orders receipt and costumers' contacts, as well as the possession of information through international partners.

New breeds of firms that tend to be international from inception, named born global firms, are also influenced by a new set of external stimuli, such as globalization forces, high levels of competitiveness, advances in technology, liberalization of trade around the globe and unattractive domestic markets.

To a correct employment of these informational inputs and opportunities exploitation on internationalization decision, it is necessary a previous learning process. Therefore, only when sufficient information pointing towards international expansion has been assimilated and translated into usable knowledge and resources required are gathered, a firm is ready to move abroad.

2.2.2. Psychological commitment

Psychological commitment appears on an individual level, not only on motivation and involvement, but also as a decision-maker's aptitude to accept changes in organizational levels and the utilization of new methods. The psychological commitment triggers the decision-maker to research more information and evaluate opportunities related to foreign markets, therefore opening the possibility for resources allocation to internationalize.

2.2.3. Firm resources

The available resources of a company will also influence decision-makers about firm's readiness to internationalization, as they play an important role in its long-term sustainable competitive advantage. In this category, tangible and intangible resources related to firm's financial capacity, product nature and

quality, human-related skills and knowledge and firms' technological level are allocated and strongly determine the degree of commitment a firm is allowed to pursue, consequently having impact in the decision-making process.

2.2.4. Lateral Rigidity

Lateral rigidity refers to limited capacity of perception of stimuli factors and existing resources, as well as limited available information, which biases and confines the decision-making process due to uncertainty and risk avoidance from managers. It is the process of stimuli factors acceptance or rejection, regarding firm's resources, from the decision-maker. This factor explains why certain companies, despite the information gathered and knowledge creation, choose not to pursue international markets: inelasticity in its decision-making behavior.

2.3 Role of knowledge in internationalization process

During the internationalization process of firms, the accumulation of experimental knowledge is one of the most important factors that positively stimulate the rate of expansion. In small firms that are international from inception, the existing lack of experimental knowledge can usually be replaced through knowledge acquisition and prior management learning, hiring already experienced professionals to their managerial team.

The international expansion of this new born global enterprises is determined by how fast, efficiently and holistically they discover and exploit foreign market opportunities (Nordman & Melén, 2008).

According to (Brennan & Garvey, 2009) study, born global firms tend to compensate the organizational history lack with knowledge stored within individuals starting the firm, using as their advantage not needing to unlearn established routines and procedures when changing firms market scope. It is the eclectic collection of competences born global founders possess the reason why these firms internationalize from inception. Therefore, in a high technology, knowledge-based market, different types of knowledge and their intensity emerge as preponderant to firms' international success (Brennan & Garvey, 2009). The accumulation of knowledge through high levels of R&D (technological knowledge) and hiring individuals with prior international experience (international knowledge) will leverage the internationalization pace and pattern in a positive relation. These relations are illustrated in **Error! Not a valid bookmark self-reference.1**.

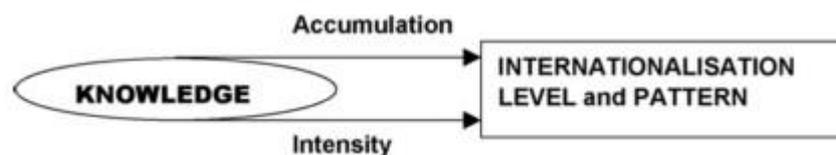


Figure 2.1. The role of knowledge in firms internationalization (Brennan & Garvey, 2009).

2.3.1. Technological Knowledge

Technological knowledge is proved to be positively related to international growth and high financial performance, being defined as experimental knowledge about firms' products and their process of production (Brennan & Garvey, 2009). This knowledge diverges from business components, only

concerning on technological issues related to technical competences, and plays a major role in opportunities discovery, agility and speed in their exploitation, technical problems resolution and innovative products development. Consequently, founders unique backgrounds, knowledge and networks allow for opportunities exploitation that may eventually lead to high returns in international markets otherwise impossible to detect.

2.3.2. International Knowledge

International knowledge is defined as experimental knowledge about conducting business within an international setting (Nordman & Melén, 2008). This concept comprises specific international industry, managing relationships with foreign counterparts and international marketing expertise. Accordingly, initial incorporation of experienced managers with this kind of knowledge from previous background revealed to be a preponderant factor in firms' success.

The definition of international knowledge also suggests the understanding about competitive situations in specific markets and clients in foreign countries, as well as information about governance structures and foreign specific rules, regulations, norms and values (Brennan & Garvey, 2009).

This type of knowledge allowed firms to strategically define their internationalization process, by performing focused search activities to better position themselves and take advantage of every external market opportunity that appeared. This better positioning on international market environment enhanced the possibility of foreign markets opportunities discovery, which lead to higher profits (Nordman & Melén, 2008).

The international knowledge of the founders and managers usually implies greater financial resources investment from venture capitalists, which perceive less risk in their investment due to credibility rise.

According to (Brennan & Garvey, 2009), as consequence of the last developments in information technology and internet, higher degrees of international knowledge were achieved, decreasing the costs of internationalization and enabling the born global firms phenomenon.

According to (Calantone, Kim, Schmidt, & Cavusgil, 2006), information and knowledge about foreign markets need to be materialized in industry adaptation of firms strategy in order to produce results and increase international performance.

2.3.3. Marketing Knowledge

In high technological markets, firms face a shorter life cycle of their products due to their presence in knowledge-intensive markets, where new discoveries substitute old products quickly. The contraction of these products commercialization window drives to an increasing importance in marketing expertise, assuming prior marketing knowledge a preponderant role in firms' international success.

In order to succeed, the managerial team of these firms needs to create marketing strategies to abbreviate the product life cycle initial stages and maximize its final stages, with the purpose of maximizing revenues. The product life cycle is defined as one of the most important marketing concepts, dynamically guiding the competitiveness of the product through its different selling stages (Kotler, 1994). This concept offers different strategic approaches, trying to respond to the problems and opportunities the different stages of the product life cycle specify.

Product life cycle is commonly understood as an S shaped selling curve, as represented in Figure 2.2, being divided in four different stages: *introduction*, *growth*, *maturity* and *decline*.



Figure 2.2. Product life cycle of revenues and profit. Copyright © 2009 Pearson Education, Inc. Publishing as Prentice Hall.

The *introduction* stage is characterized by a slow raise on product sales after market introduction. The profit is negative or very low due to advertising and marketing related costs. During this phase, firms seek to build up product awareness and develop the product market. Product consumers are early adopters and, normally, it is a stage when firms offer a basic product with high prices, distributing selectively and using high sales promotion to educate potential consumers.

The *growth* stage occurs when a period of rapid market acceptance takes place, substantially improving profits, and with the arrival of crescent competitors. During this phase, marketing strategy aims to maximize market share, offering extensions and warranty of the product. The price is maintained high with intense distribution and promotion, aiming to build brand preference.

During *maturity* stage, the most profitable one, products achieve wide acceptance and maximum sales. The price is reduced in response to competition and marketing strategies aim to maximize profit and defend market share. Subsequently, a brand diversification takes place with even more intense distribution, promoting the differentiation of the product. This strategy aims to build brand loyalty and stimulate competitors' costumers to switch brands.

The last stage of product life cycle is its *decline*, when sales start to decrease as the product becomes obsolete. The costs during this phase are low and profits tend to contract. The objective of marketing strategy is to reduce expenditures and prices to preserve profitability longer. The weaker products are harvested from market and distribution becomes selective. Marketing and promotion are reduced to a minimum with the objective to maintain only the loyal customers.

Nevertheless the broad acceptance of this theory, it is also the target of some criticism. The definition of a constrained life cycle implies lack of flexibility to different industries and products, as well as to variable stages length. Therefore, this model should not be used to forecast product sales, but as a tool to help

marketing managers to plan different marketing strategies suited to face the challenges predicted to each product stage.

Also, marketing knowledge will help firms to choose between adaptation strategies in different international scenarios (customization) or a globalized strategy (standardization), depending on industry environment, in order to build competitive advantage (Lampel & Mintzberg, 1996). This implies special attention to the different marketing-mix components, studying which have greater impact on firms success in foreign countries and how to gradually adapt firms marketing strategy to better suit the specific target market (Albaum & Tse, 2001).

2.4 Pre-internationalization phase

When studying different models created for company's internationalization patterns, which are extensively described in section 2.5, a lack of understanding about when the internationalization process begins is flagrant (Tan et al., 2007). It was even referred, regarding born global companies, by (Madsen & Servais, 1997, p.573), in (Rasmussen & Madsen, 2002) that "...when studying a Born Global firm, the time perspective should be extended beyond its birth".

In the different traditional models for firms international expansion, the pre-internationalization phase can be perceived either as the behavioral changes before the first exportation takes place or as the earlier stages of export development process, when a non-exporting firm is stimulated by the awareness of new opportunities abroad and becomes interested in exportation (Tan et al., 2007).

This way, pre-internationalization phase may be defined as "a state all firms experience before their initial commitment to a foreign market" (Tan et al., 2007, p. 296) and a model positioning it in internationalization pattern can be created, as represented in Figure 2.3.

The application to born global firms of a pre-internationalization model is obvious, becoming this phase

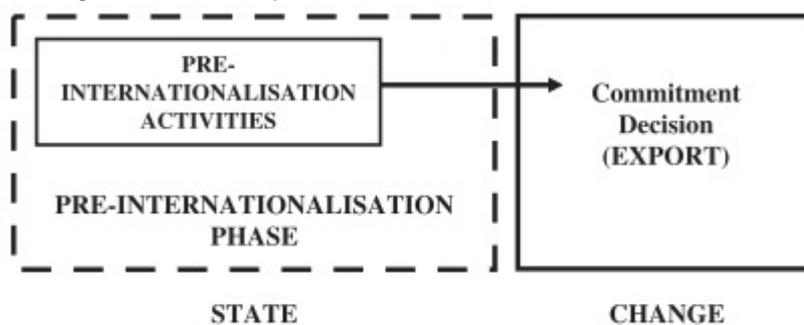


Figure 2.3. Positioning the pre-internationalization phase, adapted from (Tan et al., 2007).

even more important when compared to home-market well established companies, as they experience a shorter process of learning prior to foreign market commitment. In their case, readiness level is achieved at a much faster pace due to their internationalization at inception point (Tan et al., 2007).

According to (Styles & Genua, 2008), in firms created through the commercialization of university-developed technology, precise internationalization models could be constructed, being strongly influenced by the managerial pattern of behavior, entrepreneurial orientation and international networks. Therefore, in the analysis Styles & Genua (2008) performed to academic start-ups, evidence was found on the preponderant role international expansion assumed on the successfulness of these firms. The

major differences they found regarding patterns of behavior of their founders, international networks influence and their entrepreneurial orientation are presented hereafter and propose pre-internationalization phase has a significant role in the preparation of their attempt to enter global market.

2.4.1. Pattern of behavior: preparation and awareness creation

The successful firms from that study recognized international expansion was essential for their achievements and faced their market as inherently global. One first step replicated through both companies, was the decision to hire someone with managerial background as CEO of their team, with intention to complement the technological knowledge they already have and to smooth the interaction with business world (Styles & Genua, 2008). Managers had a fundamental role in deadline settlement. Additional importance was recognized to management role as they advertised and raised awareness of the technology within academic and commercial communities, attending and speaking at conferences during the pre-internationalization phase. As result of this alertness increase, industry approached firms interested in their technology, even before they tried to negotiate with potential investors or costumers. The industry recognition and interest also proved to be preponderant in credibility built up, improving negotiation power near investors, a fundamental factor within born global start-ups financing difficulties.

2.4.2. Networks influence

International firms investigated by Styles & Genua study (2008) established and maintained international networks by attending and speaking at local and international conferences, dedicating plenty of time and effort on this matter. In fact, authors like (Castells, 2000) consider that companies are living in a network society, only possible to new information and communication enabling technologies, with knowledge sharing.

Concerning networks, a new categorization appeared: fundamental/strong and secondary/weak ties. Fundamental networks combined academic contacts pre-established with well-known individuals from the industry, regarding to their technologies, with the commercialization of its applications in mind. These strong ties were fundamental to gain industry's credibility, as well as helping on the identification and exploitation of initial market opportunities.

Secondary networks emerged from university relationships and managers' actions that from inception endorsed efforts on the already identified opportunities exploitation and commercialization, therefore playing an important role on later stages of the international process.

As nowadays companies live in an era of information and knowledge intensive industries, collaboration between firms has become mandatory, with fragmented ownerships and partnerships between firms being one of the most common solutions to increasingly competitive marketplace (Mcgee & Bonnici, 2002). To respond to this industry frame, a strong network is likely to allow a better firm performance.

2.4.3. Entrepreneurial orientation

Regarding an entrepreneurial focus, it was possible to confirm a need for certain autonomy within some parts of the organization (Styles & Genua, 2008). One critical factor of success to internationalization and to gain support and encouragement for the product, was the existence of a product champion. A

product champion was defined by the Materials Advisory Board Study as “an individual who is intensely interested and involved with the overall objectives and goals of the project and who plays a dominant role in many of the research-engineering interaction events through some of the stages, overcoming technical and organizational obstacles and pulling the effort through its final achievement by the sheer force of his will and energy” (Chakrabarti, 1974, p. 58), study where the author assessed the product champion importance through empirical evidences.

According to (Styles & Genua, 2008), innovativeness was also perceived as critically important in internationalizing firms, not only technological but also product-market. High risk-taking behavior in initial entrepreneurial stages was positively correlated with internationalization success too, but in later stages this attitude did not affect the rate of failure of the firm. Also, according to (Calantone et al., 2006), openness to innovation and the adaptation of product strategy positively influenced the performance of the companies in international markets.

One last element was found to deeply interfere in the internationalization success of high technology firms: Proactiveness. This characteristic of internationalizing firms allowed for problems foreseen, which enabled their minimization by acting accordingly. It also steered these firms towards emerging markets (Styles & Genua, 2008), therefore not facing fierce competitiveness already established but creating a new industry segment with new demand, positioning the firm in uncontested market space that offers superior opportunities for profitability and growth – Blue-Ocean Strategy, from W. Chan Kim and Renée Mauborgne (Thompson et al., 2012).

With all the elements formerly explained, it is possible to construct a model representing the international behavior patterns, as exemplified in Figure 2.4, where the influence of patterns of behavior from the entrepreneur, network relationships, entrepreneurial orientation and firms’ environment and characteristics is well patented.

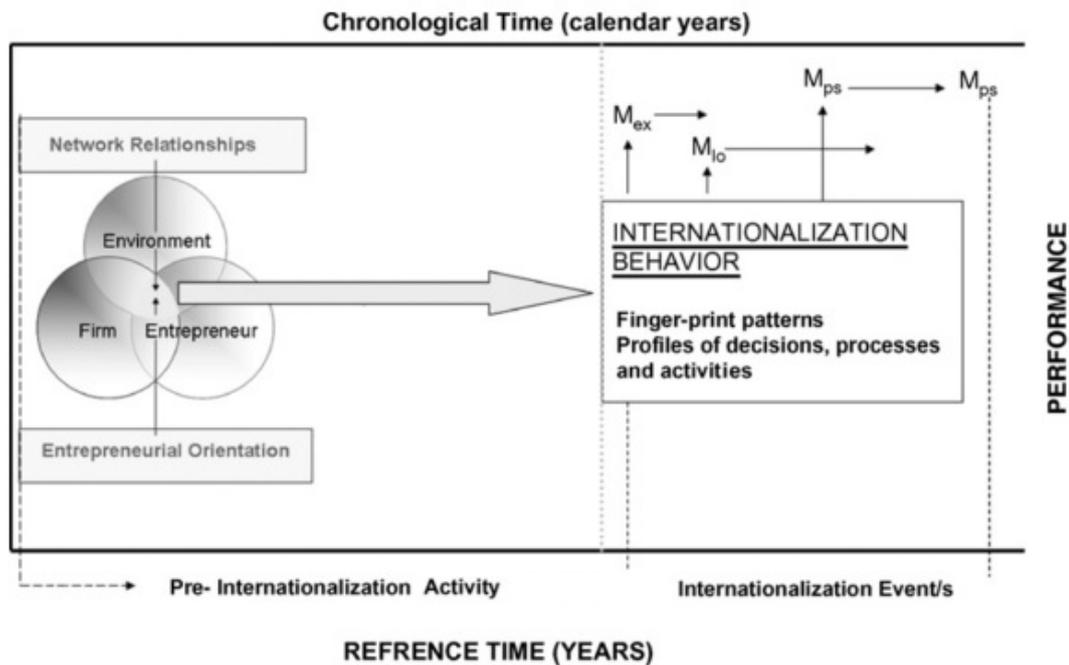


Figure 2.4. Model for Pre-Internationalization Activity adapted from (Styles & Genua, 2008).

(M) Market entry mode, exportation (ex), production subsidiary (ps) and licensing (lo).

2.5 Internationalization pattern models

After the anterior factors push a firm into an internationalization behavior and the initial steps of knowledge acquiring, awareness creation and network are complete, companies initialize the international expansion, selling their products in foreign markets. Companies' internationalization patterns have been researched over the last few decades, from different points of view, in the pursuit of generalizing theories that explain why and how different firms internationalize their products. From this extensive research emerged two major approaches to models creation, centered on economic benefits or with a behavioral basis. These two schools of thought cover different points of view over the internationalization process of firms and have different research models. Consequently they should be seen as complementary rather than mutually exclusive in the comprehension of firms' international expansion.

2.5.1 Economic approach

In the 1960s, the need for a unifying theory which gathered concepts as international trade, international investment, timing of innovation, economies of scale and the roles of ignorance and uncertainty gave birth to an economic approach to the internationalization process of a company (Vernon, 1966). This framework creation had the multinational enterprises (MNEs) international activities as model (Dunning, 2001; Vernon, 1979). From this theoretical approach, two important deficiencies arise: the absence of dynamic considerations along the process, which narrows the scope of theories application (Dunning, 2001), and the lack of applicability to small-medium enterprises (SMEs).

2.5.1.1. Product life cycle theory

This theory states that the firm's internationalization process is explained by the product life cycle and the creation of a competitive advantage due to markets' flaws. According to (Kotler, 1994), there are four stages in products commercial cycle. The first one occurs when there is a new product being manufactured and sold broadly in home market (USA) until a point when exportation to other markets begin. When the product reaches a mature state, a second stage takes place as the product starts to be manufactured in foreign markets by subsidiaries, partners and, later, by rival companies. The third and fourth stages are linked with a standardized product when foreign production becomes competitive in exportation markets, as well as in home market through importation.

This pattern gives the opportunity to home producers, using global marketing strategy, to extend its products life cycle after home market saturation, as well as deal with the internal concurrence problem once home competitors learn how to manufacture the same product with lower costs (Kotler, 1994).

2.5.1.2. Eclectic Theory

The need for a new theory, which was able to combine several visions from different currents of thought about firms' internationalization process, led to the creation of the Dunning's model. According to (Dunning, 2001), this model attributes different extent and pattern of international production on MNEs and country selection for foreign investment on three sets forces: (1) internationalization competitive advantages, (2) ownership-specific advantages and (3) location attractiveness. Different problems have been pointed to the generalization of this theory and its scope of application.

2.5.2 Behavioral approaches

Research into the internationalization of SME firms progressed, since 1970s (Tan et al., 2007), into more dynamical approaches, based on the behavior theory of the firm and concept of growth (Pinho, 2007). The Uppsala School research studied the international operations of Swedish enterprises and found incremental processes on firms' internationalization, giving birth to a stage theories: the Uppsala internationalization model (Johanson & Vahlne, 1977; Johanson & Wiedersheim-Paul, 1975). Simultaneously, some studies were being conducted in the U.S. by Bilkey and Tesar (1977) and Cavusgil (1980), which lead to the development of a similar theory: Innovation-related models (Brennan & Garvey, 2009). According to (Bell,1995; Lindqvist, 1988), as in (Pinho, 2007), a new theory, the Network model, aroused from the study of the interrelated web of relationships. All these models highlight the role of managerial learning in the internationalization process (Coviello & Munro, 1997).

2.5.2.1. Uppsala internationalization model

This model suggests that the process of internationalization is founded on a sequential evolution, building up the firm's foreign commitment over time (Morgan & Katsikeas, 1997). During the 1970s, Johanson and Wiedersheim-Paul studied the international operation of four large Swedish MNEs, discovering a growth in small incremental stages in the internationalization pattern.

According to (Johanson & Wiedersheim-Paul, 1975), the internationalization process is initialized by changes in the attitude inside the firm's management team, caused by a learning process that builds-up the international markets knowledge and confidence. Therefore, a distinction can be seen between state

aspects, the market commitment and knowledge, and change aspects, the business activities and commitment decisions (Johanson & Vahlne, 1990). However, these aspects will mutually affect each other, creating a causal cyclic process in firms' internationalization, as explained in Figure 2.5.

This model assumes that market knowledge, including perception of problems and opportunities, and market experience, which generates business opportunities, are acquired previous to firm's commitment of more resources, reducing market's risk and uncertainty. Thus, in one specific foreign country, this model implies that additional market commitment will be made through small incremental steps, as the firm gains experience from current activities in that specific market (Johanson & Vahlne, 1990).

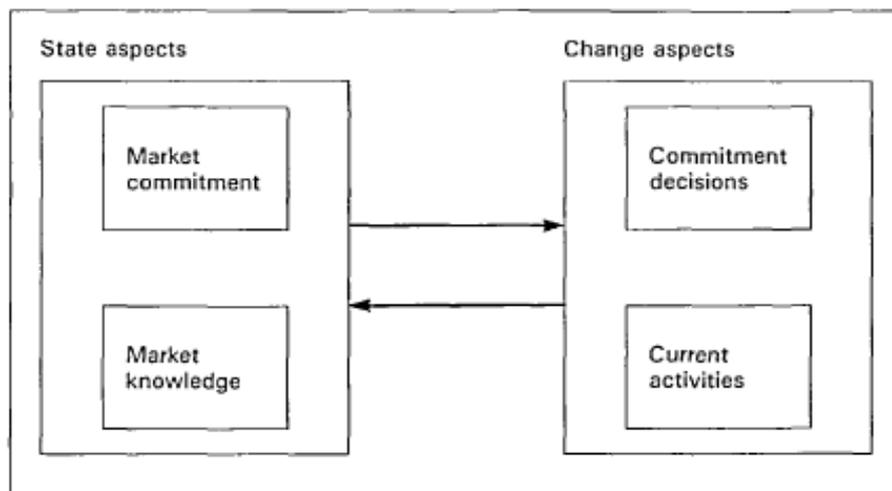


Figure 2.5. Aspects affecting firms' internationalization process (Johanson & Vahlne, 1990).

The internationalization process model created by the Uppsala School explains the pattern of internationalization of the firm as an established chain of predetermined stages, where the commitment of resources to the market increases gradually (Johanson & Wiedersheim-Paul, 1975). At the beginning, (stage 1) no regular export activities are performed in the market. As the markets knowledge is built-up and information channels are established, exportation starts to take place through independent agents (stage 2). Later, when market experience is acquired by business activities being performed in the market, the firm establishes one or more sales subsidiary (stage 3), which may lead to manufacturing facilities in foreign countries (stage 4). To better perceive this internationalization pattern, Figure 2.6 shows the different stages against the resources commitment needed.

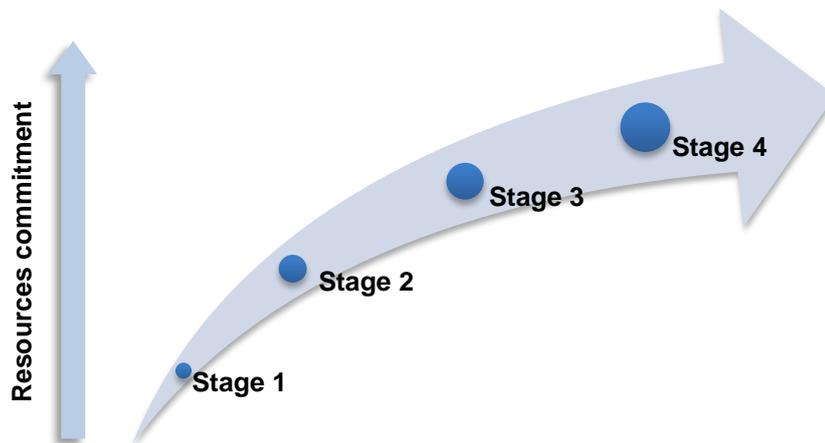


Figure 2.6. Uppsala internationalization stages vs. resources commitment (adapted from (Kotler, 1994)).

Another pattern of internationalization explain firms foreign commitment by an increasing psychical distance, which may disturb the flow of information between market and firms (Vahlne & Wiedersheim-Paul, 1973), in (Johanson & Vahlne, 1990). Therefore, there is a tendency to first internationalize to similar markets, with comparable language, cultural and political system, where opportunities can be seen and the risk perceived is low.

According to (Brennan & Garvey, 2009), this model received strong support due to the emphasis on market experience in international business decisions, as well as wide empirical studies support in several countries, thus validating this theory. The time frame of the pattern of internationalization will change between different countries and industries due to environmental and development differences, as stressed out by Welch and Luostarinen in (Brennan & Garvey, 2009).

Since its publication, this model has received different kinds of critics, according to (Johanson & Vahlne, 1990). Some arguments used were against “stage theories”, considering the model too deterministic and not leaving enough room for some other valid strategic choices in modes of entry and expansion patterns. The lack of applicability was also argued for a later stage of internalization, when market resources and knowledge are no longer a problem, since all the enterprises were studied in an early state of internationalization. Some studies also revealed lack of assertiveness for fast paced internationalization firms in a globalizing world market where psychic distance is no longer a barrier.

2.5.2.2. Innovation-related model

This model for internationalization involvement of firms derived from Roger’s “stage of the adaptation process” and, similarly to the Uppsala model, uses a sequence of stages during the internationalization process (Morgan & Katsikeas, 1997). The main difference to the previous model is the nature of stages, which are related to innovations adoption as a response to environmental changes. Implicit between each set of stages are stable periods when firms consolidate and accumulate enough resources to respond to the next innovation stage (Morgan & Katsikeas, 1997).

Numerous innovation-related models emerged, differing mainly in the number of stages and how the stages are described. However, all these models represent a gradual pattern of internationalization from a purely domestic oriented firm, to gaining export-information, through various degrees of export, until

the firm is an experienced exporter (Brennan & Garvey, 2009). The pattern of internationalization is influenced by psychic distance and is faced as a cyclic learning process.

According to (Morgan & Katsikeas, 1997), empirical evidence suggested that several firm-specific characteristics and managerial factors were important factors when helping or inhibiting the progress of the firm's internationalization process. Some of the taxonomies created to explain internationalization pattern as an innovative-related model are presented in the following table:

Table 2.2.1. Review of selected innovation-related internationalization taxonomies (Morgan & Katsikeas, 1997).

Bilkey and Tesar (1977)	Cavusgil (1980)	Reid (1981)	Czinkota (1982)
Stage 1			
Management is not interested in exporting	Domestic marketing: the firm sells only to the home market	Export awareness: problem of opportunity recognition, arousal of need	The completely uninterested firm
Stage 2			
Management is willing to fill unsolicited orders, but makes no effort to explore the feasibility of active exporting	Pre-export engagement: the firm searches for information and evaluates the feasibility of undertaking exporting	Export intention: motivation, attitude, beliefs and expectancy about export	The partially interested firm
Stage 3			
Management actively explores the feasibility of active exporting	Experimental export involvement: the firm starts exporting on a limited basis to some psychologically close country	Export trial: personal experience from limited exporting	The exporting firm
Stage 4			
The firm exports on an experimental basis to some psychologically close country	Active export involvement: exporting to more new countries – direct exporting - increase in sales volume	Export evaluation: results from engaging in exporting	The experimental firm
Stage 5			
The firm is an experienced exporter	Committed export involvement: management constantly makes choices in allocating limited resources between domestic and foreign markets	Export acceptance: adoption of exporting/rejection of exporting	The experienced small exporter
Stage 6			
Management explores the feasibility of exporting to other more psychologically distant countries			The experienced larger exporter

2.5.2.3. Network approach

According to (Mcdougall & Oviatt, 2003), networking have long been used by firms to gain access to resources, to improve their strategic positions, to control transaction costs, to learn new skills, to gain legitimacy and to cope positively with rapid changes.

The previous theoretical models received growing critics due to its inadequacy as the global communication and transportation infrastructures improve and markets became progressively homogeneous (Bell, 1995). According to Hedlund and Kverneland (1985), in (Bell, 1995), the faster-paced internationalization process of new firms collided with gradual and slow internationalization models, leading to the establishment and growth of more direct and rapid entry mode strategies on foreign markets. Also, traditional stage models failed to predict how the movement between stages takes place and therefore how process of internationalization happens, according to Andersen (1993), in (Bell, 1995).

From all the concerns expressed above and the growing importance of networking in acquiring competitive advantage, a new approach emerged, emphasizing the network role in the internationalization process of the firm.

According to (Bell, 1995), the process of internationalization does follow an incremental nature and incorporates psychic distance, but also considers the process much more complex and less structured. This approach proposes that interconnected exchange relationships evolve in a dynamic manner, building knowledge and trust, which leads to greater commitment between foreign markets and firms (Bell, 1995; Coviello & Munro, 1997).

The network approach states that firm's strategy arises as a pattern of behavior biased by its network of relationships, which presents new opportunities and threats, therefore driving, facilitating or inhibiting the firm's international development, influencing its entry mode and foreign market selection (Coviello & Munro, 1997). This kind of behavior is presented in (Bell, 1995), where evidence was found of client followership and export initiation through contacts with foreign suppliers.

2.6 “Born Global” paradigm

Today's world economy is globalizing at an accelerating pace. In the previous section, different approaches on internationalization pattern of firms were presented, theories where firms pursue their position on the international scene after a stable home-market operation is reached. Both economic and behavioral approaches try to explain the internationalization process as a gradual and sequential chain of events, in which companies experience a process of international and market learning through their progression. However, as geographical distance becomes less important due to all the advances in information technology and communication and as historically closed borders open their markets to foreign companies, new opportunities and threats start to drive ambitious firms to compete in the global market faster (Thompson et al., 2012).

Under these circumstances, firms begin to internationalize in a very early stage of development, sometimes from inception, with especial impact in advanced technology industries (Oviatt & McDougall, 1994). For these reasons, a relatively new phenomenon is attracting attentions of international research – “born global” firms – being this concept worth of attention and hence explored, together with a relatively new companies' concept: the “born-again global” firms. These enterprises are forced to reinvent themselves in the international picture due to low internal demand for their products.

Both these types of firms are very similar and internationalize in analogous patterns, being distinct only on the timing of internationalization.

2.6.1. The definition of “born global”

The fast paced internationalization process of start-up firms attracted attentions since about 20 years ago. Such firms entered very distant markets right from inception in multiple countries at once, sometimes forming joint ventures without any prior experience. According to (Rasmussen & Madsen, 2002), scholars gave different names to this phenomenon, such as International New Ventures (INV) (Oviatt & McDougall, 1994), High Technology Start-Ups and Born Globals.

The concept “Born Global” was invented by the consultants McKinsey, in a survey for The Austrian Manufacturing Council, and was first defined in a scholar article by Tamer Cavusgil in 1994, who stated that a new breed of exporting companies was emerging, reflecting two fundamental phenomena: small is beautiful and gradual internationalization was dead (Rasmussen & Madsen, 2002). According to

(UNIDO, 2006), the survey showed that two main type of exporters could be identified: (1) firms that built a solid base in domestic-market over the years and used exportation as a strategy of grow following the traditional patter of internationalization of MNEs; and (2) firms, normally SMEs, that are export oriented from inception, being the world their marketplace and using home market as a support for an international business.

The INV was defined as “a business organization that, from inception, seeks to derive significant competitive advantage from the use of resources and the sale of outputs in multiple countries. The distinguishing feature of these start-ups is that their origins are international, as demonstrated by observable and significant commitments of resources (e.g., material, people, financing, time) in more than one nation” (Oviatt & McDougall, 1994, pp. 4, 5), being this definition enough accurate to perceive what a born global firm is, although it might not be homogeneous enough to assemble all the different theories regarding this phenomenon.

2.6.2. Different types of Born Global

According to (Oviatt & McDougall, 1994), there are four different types of INVs regarding the number of countries involved and the coordination of activities of value-chain across countries: export/import start-ups, multinational traders, geographically-focused start-ups and global start-ups. These different typologies of INVs are represented in Figure 2.7.

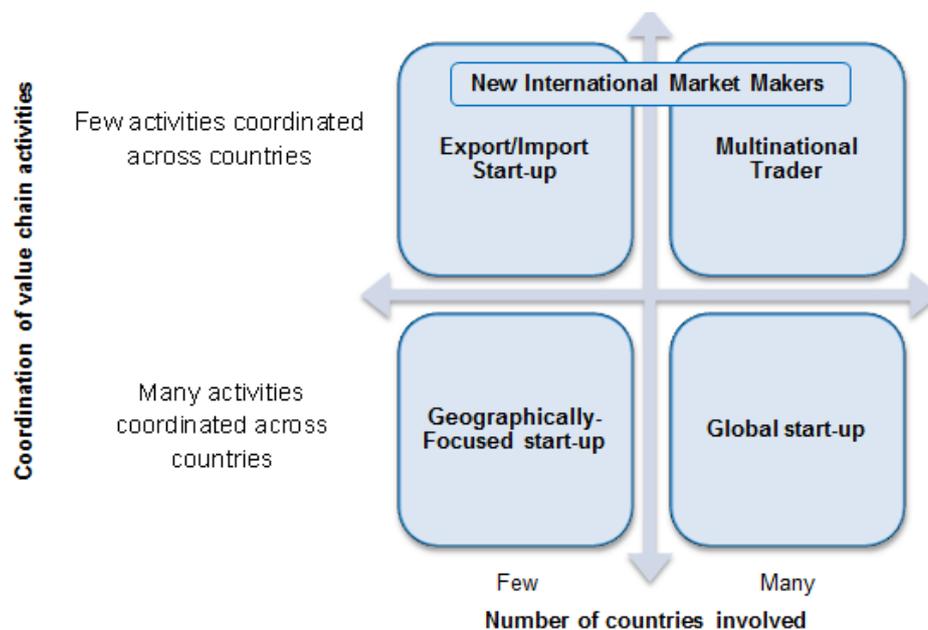


Figure 2.7. Types of International New Ventures ((OVIATT & MCDOUGALL,1994), in (RASMUSSEN & MADSEN, 2002)).

According to the referenced research, New International Market Makers can be understood as the traditional type of firms operating both as exporters and importers, being their most important competitive advantages the knowledge about logistics and their founders’ contacts network. These companies profit from the imbalance between countries in production costs and market prices, creating new markets to expand.

The geographically-focused start-ups gain competitive advantage on the specialized niche market, with low but highly specialized demand, in a selective set of countries. More specifically, this advantage

stems from the, often socially complex, coordination of a number of value-chain activities in regard to technical development, knowledge and production. They also preserve their networks and relations closed to the outsiders in order to protect their knowledge.

The last category of firm the research paper describe are the global start-ups. These companies are the most radical new internationalization firms as they coordinate almost every activity of their value-chain across different countries. These firms tend to not only react to international opportunities to expand their actions global, but anticipate proactively different strategies to gain access to global resources and markets. The global start-ups are characterized by a unique usage of socially complex knowledge, which is tightly related with several networks spread all over the globe.

The existence of Born Global firms is therefore strongly connected to their managers and founders' personal experience, networks and knowledge, as these factors minimize risks and abbreviate the learning curve on the internationalization process. Therefore, (Madsen & Servais, 1997, p.573), in (Rasmussen & Madsen, 2002), stated that "...Probably, many of its "genes" have roots back to firms and networks in which its founder(s) and top managers gained industry experience."

All these characteristics connected with born global firms, as the network importance, the international entrepreneurial orientation and the preparation and proactive search of international markets, are seen as a pre-internationalization behavior, playing a preponderant role in the success of these companies, as previously explained in section 2.4.

2.6.3. Internationalization Model

According to (Bell, 2003), as previous formulated theories fail to predict and model the internationalization pattern, pace and intensity of the born global firms, a re-conceptualization on the internationalization process of SMEs was needed.

The model proposed attributes the quest for international market motivation to a more committed management, trying to conquer "global niches" on a proactive attitude. This global market strategy has the objective of gaining "first mover" advantage, achieving rapid penetration of the desired market segment, therefore locking-in clients and protecting proprietary knowledge. This fast-paced global market penetration is especially important on high-technological industries, where products tend to have shorter life cycles, with constricted windows of commercial opportunity.

To born global firms, the international expansion is normally concurrent, even sometimes precedent, to home market establishment. This pattern of internationalization is explained by the pursuit of "lead" markets on the global industry, yet constricted by intellectual property protection, avoiding these firms markets where their patent rights are not completely protected. Companies born global tend to have diversified and flexible entry modes in the global market. Exportation, licensing agreements, joint ventures and alliances with costumers and/or suppliers, strategies carefully explained in the next section, are the most common methods to penetrate the selected markets, existing as well evidences of domestic client followership and important network relationships with suppliers and other channel-partners.

The internationalization process tend, as it is possible to perceive, to adopt a very structured and planned approach, in contrary to traditional pathways, much more reactive to markets opportunities and risk aversion (Bell, 2003).

The born global enterprises usually lack the managerial and financial resources required for internationalization process and global marketing, resources which are difficult to accumulate for this type of firms which haven't proved its profitability nor credibility yet (Gabrielsson & Manek Kirpalani, 2004). According to (Bell, 2003), financial basis for this fast paced international expansion, normally expensive and needing high capital investment, is often provided through venture capital or self-financed via rapid growth. Initial public offerings (IPO) are also one tactic companies use to achieve the capital resources required for their internationalization strategy, being however a risky one due to the uncertainty to predict how much investors will offer by their stocks.

2.7 International market entry modes

According to (Thompson et al., 2012) when a firm decides to expand internationally, a strategic decision must be made on choosing the entry mode that best suits each specific foreign market. In this subsection, the various strategic options that a firm may use will be presented and discussed in detail. The decision on which one to apply will depend on a variety of factors, but generally higher levels of investment and risk offer superior revenues and control. This way, when entering an international market, firms tend to adopt a risk crescent internationalization pattern, which allows learning through the process and built trust and confidence. Firms may adopt six primary approaches (Thompson et al., 2012):

- Exporting;
- Licensing;
- Franchising;
- Alliance and Joint Venture;
- Acquisition;
- Greenfield Venture.

Usually, companies start their international enterprise by exporting activities, which allows them to form networks in foreign countries with local producers, learning and raising their competitiveness to a point they might become international by themselves (UNIDO, 2006). Therefore, a firm is not confined to a single market entry mode, being able to apply the most suitable strategies for selected countries.

2.7.1. Exporting

Exporting activities assume the most common enter strategy into foreign markets due to its low risk character and low investment requirements, which allows a conservative way to test international markets (Thompson et al., 2012). In this approach, domestic production is used as a base for exporting products to external markets, emerging two different strategic options. Depending whether the firm relies distribution and marketing functions to contracted country experienced intermediaries, or the firm establishes its own distribution and sales organizations, it will be considered as an indirect or direct approach respectively.

In indirect approach, the intermediary might be a domestic buyer or an export agent who buy the firms product and export it into foreign markets (international distributors) or an agent working under

commissions (international agents) (UNIDO, 2006). These intermediaries are normally responsible for delivering the expertise and services needed to create a relationship with foreign customers. They offer market knowledge on competitive conditions, existing sales network, business contacts, evaluation of local costumers and product acceptance. They also provide information on transportation services, distribution, logistics assistance and help when dealing with local regulation.

The export strategy can be used for long periods of time, being the duration of this approach determined by how long the advantages created justify it, for example, in cost competitiveness, scale-economies or learning curve benefits in centralized production (Thompson et al., 2012).

Some known disadvantages of this market entry strategy are related to loss of competitive advantage to rivals (when manufacturing costs are lower in foreign countries), possible lack of control over products marketing and distribution, high costs of transportation, existence of high trade barriers from host government against foreign products and possible shifts in currency exchange rates.

2.7.2. Licensing

The second entry mode firms tend to adopt to start their internationalization process is through licensing, used when a firm owns a valuable patent, technical know-how or an appealing brand, but doesn't have the necessary resources or organizational capability to enter a foreign market on its own (Thompson et al., 2012). According to (Kotler, 1994), licensing is an agreement in the external market where the licensed acquires permission to use a manufacturing process, brand or patent atwart royalties' or fee payment to the licensee.

The advantages recognized to this entry mode are the possibility of a revenue source through low resources commitment to an unfamiliar, politically or economically unstable market, therefore reducing initial costs and risks to a minimum (Thompson et al., 2012). This strategy also allows to the licensee to rely costly market studies or costumers involvement marketing actions to the licensed firm (UNIDO, 2006). On the downside of this strategic option is the risk associated to know-how and property rights transfer, which are the basis of the firm's competitive advantage. This implies a loss of control over its use and might turn to be very expensive in monitoring and safeguarding firm's property. This risk may become a special turnover in countries with unstable politics and that normally fail to provide intellectual capital protection, since licensees might be potential competitors in the future that could bring substantial damage to the company.

All the problems mentioned before result in licensing agreement as a long and methodical process of confidence-building, many times resulting from long-term relationships (UNIDO, 2006). This kind of approach is especially attractive when licensee firms are trustworthy and reputable, being the strategy often used by pharmaceutical and software companies due to high royalty potential and extensive market information (Thompson et al., 2012).

2.7.3. Franchising

The third entry mode used by firms to go international is franchising, a strategy similar to licensing but best suited to service enterprises (Thompson et al., 2012). In franchising, the contract attributes the responsibility, risks and costs of construction in the foreign country to the franchisee and the administration costs related with recruitment, training, support and monitoring to the franchisor. The

franchisee is also responsible for a fee payment to the franchisor. As in licensing, the low investment needed and the possibility of rapid revenues are important advantages (Kotler, 1994).

The major contradictions to this international expansion strategy are the difficulty to control and maintain quality and the possible lack of commitment of local workers due to cultural differences (Thompson et al., 2012). It might also be an important issue if the firm should allow for product modifications to best suit local needs, which implies more loss of products quality control.

2.7.4. Alliance and Joint Venture

The forth entry mode used by firms to move abroad is strategic alliance or joint venture (Thompson et al., 2012). Companies internationally expanding tend to form partnership with a foreign company to share the ownership and control of the firm (Kotler, 1994) and is mostly used when the internationalizing firm has limited resources (venture might require high investment), wants to share risks, lacks market knowledge or needs to satisfy this requirement from the host country's government (specially frequent in less developed countries) (Thompson et al., 2012). According to (UNIDO, 2006) equity alliances can be defined as a form of collaborative agreement where at least one of the collaborative companies assumes ownership position in the other company, for example by shares buying or swapping. Joint ventures should be understood as a long-term participation of two or more firms in a new enterprise (usually a new legal entity) in which each company participates as owner, contributes with assets and shares part of the risk.

According to (Thompson et al., 2012), a firm can have great benefits from a partnership with a foreign company when moving to its country. The exchange of knowledge is immense, from buying habits and product preferences, local regulations and distribution channels network to added expertise, technological know-how and joint research. Through partnerships it is also possible to achieve performance improvements from each other's manufacturing methods study. All these advantages and learning are often used in home markets by international enterprises, upgrading their competitive position. This kind of agreement often allows the company to maintain independence, autonomy and operating control, also permitting certain flexibility do disengage after its purpose is reached or problems start to appear.

However, different risks arise from this strategic option (Thompson et al., 2012). Several times, dissimilarities need to be overcome in order to truly engage and profit from partnerships. Different language, cultural barriers, diverse operating practices, conflicting objectives and strategies may lead to problematic communication, costly coordination and slow trust building. These factors may turn partner monitoring costs higher, lead to built-up tension and cause management conflicts and slow paced strategic adaptation to fast-changing markets, which sometimes imply that firms involved never profit from the relationship. As seen in licensing, there is also the risk of technological expertise and intellectual property sharing, which may cause the loss of competitive advantage and high expenses in legal concerns. This way, agreements are normally achieved after long periods of meeting and negotiations, always under the principle of good faith, which might cause suspiciousness and difficult communication and coordination.

This way, cross-border alliances are normally advised to the establishment of an initial position that may open the way to new opportunities in foreign countries, but not as a weapon in the battle for global

market leadership. Also, as described by (Lau & Wong, 2001), nowadays firms increasingly live in a network of enterprises, many times outsourcing certain parts of its businesses in order to gain competitive advantage. Therefore, the careful selection of partner, the decomposition of the firm's value chain activities and the correct structuring of an information flow infrastructure arise as preponderant factors for advantage achievement when crafting a new alliance with a foreign company.

2.7.5. Acquisition

Acquisitions are the fifth entry mode in international markets presented. This strategy might also be used internally when a firm aims to strengthen its market position, being however an expensive ownership option. According to (Thompson et al., 2012), an acquisition is a combination in which the acquirer firm purchases and absorbs the operations of the acquired one, therefore closing its activity.

This market approach is especially suited in markets with high entry barriers (difficult access to local distribution network or in the establishment of relationships with local government), possibility for local economies of scale or strong rivalry market position (Thompson et al., 2012). This strategy reveals particularly useful when a firm wants to gain access to core capabilities or technologies of a foreign firm. The advantages that justify this costly entry mode are related to the high levels of control, speed conclusion and large scale of entry it permits. Nevertheless, higher benefits also imply higher risks in the form of high resources commitment due to the payment of premium over the share-price value of the purchased company (Thompson et al., 2012). The high capital resources needed by the acquiring company may lead to an increased debt, rising bankruptcy risk and hindering other investment options in, for example, research and development (R&D).

According to (Thompson et al., 2012), this strategic option to move into a foreign market may face harsh international negotiations, burdens with legal and regulatory requirements and problems with the integration of the culturally and psychologically distant acquired firm.

2.7.6. Greenfield Venture

The last entry mode a firm can use to go international is a Greenfield venture, which is also an ownership option. When internationalizing via this approach, a firm creates a new subsidiary business in the selected foreign market, setting up the entire organization from the ground up (Thompson et al., 2012). The advantages recognized to this market entry mode are high revenues potential and, since it is possible to set up every firm's aspect from the scratch, high activities control, opportunity to learn the market characteristics, local regulation and costumers' preferences (Thompson et al., 2012). To increased benefits, a firm can usually hire local managers with local knowledge and know-how and incorporate them with senior managers from parent company, thus magnifying technology transfer, business best practices and company's culture implementation.

The disadvantages related to this foreign market entry mode are high capital investment, as well as several other company resources requirement (Thompson et al., 2012). The major turnaround regarding acquisition strategy is the very slow-paced implementation of firm's new subsidiaries, which may interfere if the firm's objective is to achieve sizable market share. This strategy is especially unsuited when the selected foreign country doesn't provide strong and stable markets, with competent institutions to protect foreign investors' legal rights.

3. Research Questions

As previously mentioned, there is not much research on the internationalization of small firms in the increasingly globalized marketplace we are living today. Since small high-technological enterprises need increasingly more to take leverage of its home competitive advantage in foreign countries due to economic crisis and quicker products life cycle, a necessity of framework creation for internationalization patterns and best practices for GenoMed, and other firms operating in this industry under similar conditions, is becoming utterly important.

Therefore, the present work was developed with the purpose of answering the following research questions:

1. How well is the current GenoMed's strategy working? What are its most important resources and capabilities?
2. How should GenoMed prepare its internationalization process?
3. What strategy and competing approach should GenoMed follow in order to strive in the international panorama?
4. What geographic areas should GenoMed pursue and how should the strategy fit these different target areas?

4. Methodology

In this chapter of the dissertation, the scientific method used, the research strategy and data collection will be presented. It will also be presented research quality, particularly its reliability and validity.

4.1. Research purpose

According to Yin (2009), there are three major classifications of research in social sciences that normally occur separately, which are:

- Exploratory;
- Descriptive;
- Explanatory.

These different classifications are not exclusive, occurring sometimes overlap between them. The differentiation will arise from the type of research questions the study tries to respond.

4.1.1. Exploratory

The purpose of exploratory research is to answer “what” questions, giving a comprehensive insight view of the problem area. Therefore, and being an exploratory research, every type of questions might be answered, since the gathering of as many information and data about the problem for the development of pertinent hypotheses and propositions is its main objective.

This research approach is normally used to assemble knowledge for further investigation, often dealing with undiscovered topics with little pre-existing research done, as it is an attempt to understand what happened in a case by studying the surround context of the problem, beyond descriptive features (CAPAM, 2010).

4.1.2. Descriptive

A descriptive research has the purpose to answer “who”, “where” or “how many/ how much” types of questions, since it attempts to describe the incidence or prevalence of a certain phenomenon and the predictive outcomes of it (Yin, 2009). The research purpose it to describe the main characteristics of a real world problem about which some ground of knowledge is already gathered, with the objective of clarifying an idea or reinforce an argument (CAPAM, 2010).

4.1.3. Explanatory

According to Yin (2009), the objective of explanatory research is to understand the reasons for a certain situation or behavior occur, answering the “why” and “how” questions upon a considerable amount of theoretical knowledge already developed. Therefore, an investigator will formulate hypothesis about causal links, which he will empirically test (Baxter & Jack, 2008), determining its causes and effects (CAPAM,2010).

4.2. Research method

When conducting research in social science area, there are several strategies possible to use. However, Yin (2009) suggest the most commonly used five methods: experiment, survey, history, archival analysis and case study. Among these different strategies, each one has certain advantages and disadvantages, depending on three conditions: the type of research question, the investigator control over behavioral events and the time frame the research focuses (historical or current event). These conditions, as suggested by Yin (2009), should also be used to determine the best possible strategy for a certain research.

Table 4.4.1. Strategies for research methods depending on different criteria.

Method	Form of Research Question	Requires Control of Behavioral Events?	Focuses on Contemporary Events?
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	No
Case Study	How, why?	No	Yes

As seen in Table 4.1., and due to the lack of existing theories in this specific case, the most pertinent strategy for this thesis is the case study approach since the investigator conducts an exploratory research, has no control over events and mainly focuses on contemporary events of the organization.

4.2.1. Research strategy: Case Study

A case study was defined by Schramm (1971) as: *“The essence of a case study... tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result”* (Yin, 2009, p. 17).

According to Johansson (2003), a case study should capture the complexity of a single case and is being applied not only in social sciences, but also in several practice oriented fields, as business studies. This author defends that the case study methodology is a combination of different research methods, so that the case studied can be perceived from different points of view.

The single case study approach offers an in-depth analysis of one organization, lacking however background for arguing validity of the empirical findings achieved. This background could be reached conducting multiple cases. Still, being the scope of this master thesis the development of an internationalization plan for one enterprise, it is a necessary trade-off so a complete study about the organization’s characteristics is created to support the strategic plan to its internationalization process.

4.3. Data collection method

When conducting a case study, evidence can come from various methods of collecting data and, according to Yin (2009), to a better validity and reliability construction, multiple sources of evidence are recommended.

According to the same author, there are six different methods most commonly used when doing case studies:

- Documentation;
- Archival records;
- Interviews;
- Direct observations;
- Participant-observation;
- Physical artifacts.

In the present study, data was collected through a mixed-method approach whenever it was possible. However, as stated by Denscombe (2010), a researcher should choose the most appropriate data collection method for each specific study, so he can obtain certain empirical data type he needs. Therefore, the preferential sources of evidence used in this study were documentation, archival records and interviews.

4.3.1. Documentation

According to Yin (2009), this type of information is relevant to case studies, being increasingly available over the internet. It encloses letters, e-mails and personal documents, agendas and reports of events, administrative documents such as progress reports and internal records, studies and evaluations of the same specific study and, finally, news and other articles from mass media and newspapers.

The main purpose of this evidence type is to corroborate and augment data collected from other sources, since it may contain unreliable and misleading information.

4.3.2. Archival records

Archival records sometimes have a preponderant role in case studies, being object of extensive retrieval and quantitative analysis. These evidences are, for example, public data as census or other statistical data, service records, organizational records, such as budget and personnel records, and survey data previously collected.

Some caution must be taken when archival evidence assumes relevance in a case study, since the conditions of production and accuracy need to be confirmed in order to ascertain its validity.

4.3.3. Interviews

The interviews, when collecting data to case studies, are mainly based on a standardized interview guide, organized in key areas of interest, but conducted in a semi-structured form. This kind of interviews have short duration (between sixty minutes and two hours), allowing however open-ended questions to the interviewee. To the interviewer, it permits to make adjustments to the question-guide if some topic need more enlighten or reflection (Yin, 2009).

In order to check internal accuracy and corroborate other sources of evidence, revalidation questions may be asked during the interviews.

For data collection, four interviews were conducted with company's collaborators from different areas and with different influence levels. At the end of the interviews, information was transcribed and sent back to interviewees for review, in order to grant its validity and correction. Tape recorders were not used due to intimidation and responses inhibiting from interviewees.

4.4. Research quality

To judge the quality of the research endorsed in this thesis, some concepts need to be tested, such as its trustworthiness, credibility, confirmability and data dependability (U.S. Government Accountability Office, 1990, as in Yin, 2009). These concepts might be summarized in two factors that are consequently analyzed: *validity* and *reliability*. For this analysis, four specific criteria's have been suggested by Yin (2009):

- i. Construct validity;
- ii. Internal validity;
- iii. External validity;
- iv. Reliability.

4.4.1. Validity

4.4.1.1. Construct validity

According to Yin (2009), the construct validity might be defined as the identification and establishment of the most accurate operational measures for the subject under study.

In order to attain a high level of construct validity, a study should use multiple sources of evidence so that cross matches appear and triangulation of information is possible, as well as establishing a chain of evidence between data from different sources, therefore validating its trustworthiness and credibility. During the process of interviews, drafts should be reviewed by participants, thus confirming its validity. In this study, interviews drafts were sent to interviewees for content confirmation.

4.4.1.2. Internal validity

This criterion can be defined as the establishment of logical and valid casual relationships within a study. It is especially preponderant when conducting explanatory or casual, not exploratory, studies. However, some actions could guarantee high internal validity of a study of this nature. Interviews subjects should be top managers of the company under study, so the information given is more close to the reality since they are not afraid to give their truth opinion. Also, interviews should be conducted in private and not recorded, so the opinions are real and not constrained by the interpretation media could make on it if they gain access to the audio file.

Some other analytic tactics to address internal validity to a study are the employment of logic models, explanation buildings and address rival explanations.

In this study, people in charge of the different GenoMed's units and the Technical and Executive director were interviewed.

4.4.1.3. External validity

The external validity of a study refers to the definition of the domain of generalization by the study's findings and, according to Yin (2009), it is the major problem in doing case studies, since critics always argue the lack of basis for generalization this research type guarantees. Nevertheless, case study research external validity is improved by analytic generalization, using theory support in single-case studies.

In this study, existing theoretical framework and scientific studies on the entire industry were used as basis for generalization of this study conclusions.

4.4.2. Reliability

According to Yin (2009), the reliability of a given study refers to the possibility of replication of results and conclusions obtained by a second investigator conducting the exact same study, following the same procedures described by the previous investigator. The objective of reliability is, therefore, the minimization of errors and biases in a study.

Two different tactics should be used in order to assure the study's reliability: the use of a case study protocol and the development of a case study database, both during the data collection period of research. These tactics assure the operationalization of as many steps as possible during the research, thus being replicable.

In this study, all interviews followed a given protocol and were conducted in separated, thus operationalizing the process and avoiding certain biases that peer pressure might cause.

The interview scripts might be found in attachment 9.5.

5. Case Study Analysis: GenoMed, S.A.

5.1. Introduction

5.1.1. GenoMed - Diagnósticos de Medicina Molecular, S.A.

GenoMed - Diagnósticos de Medicina Molecular, S.A. is a spin-off company of Instituto de Medicina Molecular (IMM), located in the campus of Lisbon Medical School and Santa Maria Hospital, and its prime offer are diagnostic services in the Molecular Medicine field (GenoMed S.A., 2014).

The firm was created in October of 2004 by the vision of Professora Carmo Fonseca. The mission of GenoMed is to provide the transfer of scientific knowledge in the field of Molecular Medicine into clinical practice. For that purpose, the molecular genetics services provided are complemented with a R&D unit that cooperates with clinicians, researchers and industry, for disease diagnostics and innovative product/tests development.

The company was created through the NEST program (Novas Empresas de Suporte Tecnológico) in a joint initiative of Portuguese Ministry of Economy and Ministry for Education and Science.

At the present time, the enterprise has both public and private financing, being the main stakeholders:

- Espírito Santo Saúde - SGPS, S.A.- 24%;
- Associação Nacional das Farmácias (ANF) - 24 %;
- Instituto de Medicina Molecular - 15%;
- IAPMEI, I.P. - Agência para a Competitividade e Inovação – 15 %;
- Espírito Santo Capital - Sociedade de Capital de Risco, S.A – 11%;
- FARMACOOOP - Cooperativa Nacional das Farmácias – 6%;
- Private shares – 5%.

The enterprise main sources of revenue are molecular genetic tests. When the company was created, a full department focused on virology was formed but, as the tests related to this field were internalized by HSM and other major public hospitals, it was closed due to very low demand.

Nowadays, GenoMed, S.A. is composed a multidisciplinary team, composed by 3 PhDs, 4 MScs and graduates of different academic degrees of the health sciences. Its structure and fields of action can be seen in the organogram of the company presented in Fig. 5.1. The main medical areas covered include Oncology, Hematology, Cardiology, Neurology, Gastroenterology and Hepatology, Nephrology, Endocrinology and Metabolic diseases, Obstetrics/Gynecology, Pneumology, Dermatology, Ophthalmology, Otorhinolaryngology, Pediatrics, Urology and Pharmacogenetics through more than 350 different molecular tests. Additionally, GenoMed provides parental and ancestry DNA testing.

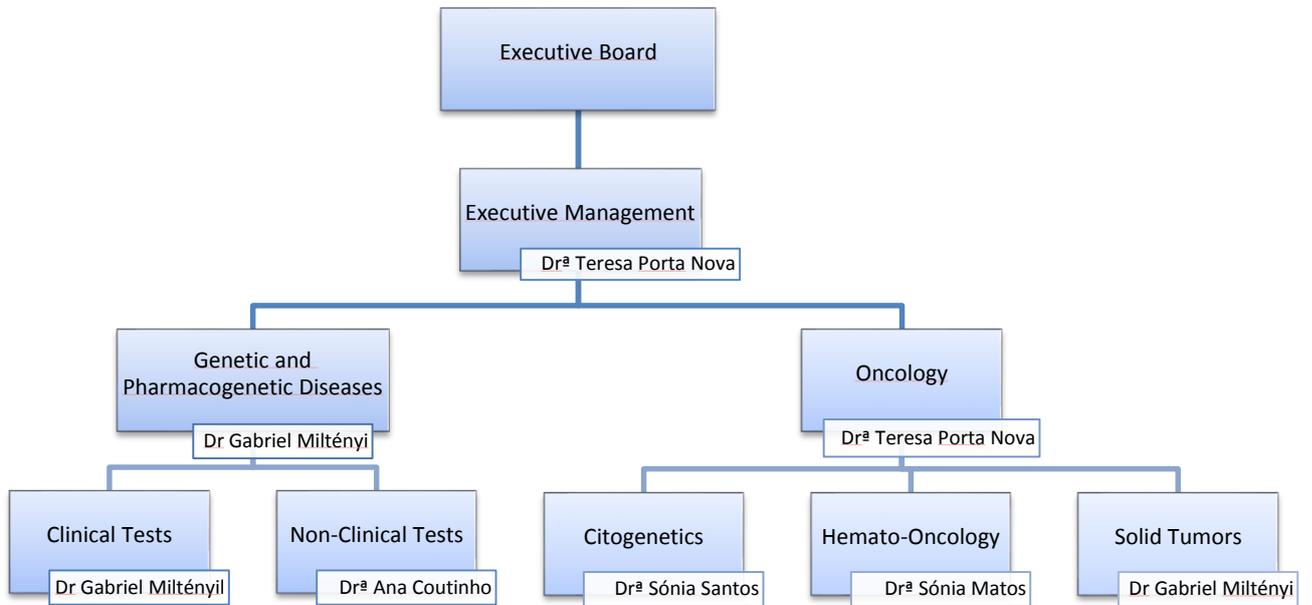


Figure 5.1. Organogram of GenoMed, S.A.

In addition to the genetic diagnostic tests and oncology, GenoMed additionally runs parental and ancestry DNA testing, DNA profiling and genealogy studies.

Due to IMM (health cluster) integration, which promotes a strong relationship with scientific and research environment and the contact with highly qualified professors, permanent ideas exchange and valuable projects development, giving rise to numerous scientific publications.

GenoMed is licensed by the Direção Geral de Saúde since 2007 (License number 0075L/2007) for Genetics and Molecular Pathology and certified for quality management according to the standard NP EN ISO 9001:2008 (2009/CEP.3390).

5.2. Market Definition

According to (Goverman, Jacoby, & Lester, 2012), molecular diagnostic products or services use specialized research technology with proved relevant therapeutic effect, applying it to a clinical laboratory activity. The market of *in vitro* diagnostics is becoming one of the most important players in the healthcare provision and patient care quality, by providing approximately 80% of the information physicians use to make medical decisions. Nowadays, clinical laboratories have managed to develop competencies and means to be capable of diagnosing a wide variety of diseases, from different fields such as immunology, cardiovascular or oncology.

5.2.1. Market Segmentation

According to (AdvaMedDx, 2013), molecular diagnostics is a relatively small portion of the overall diagnostics market, consisting only in 11% of the overall size. However, it is its fastest growing segment. The molecular diagnostics are, in the current days, used predominantly in developed countries, with United States of America and Western Europe accounting for about 80% of its full dimension.

The market of molecular diagnostic tests, due to its young age, is still evolving at a fast pace. What once was a specific market by its own is now part of the big market of clinical analysis and *in vitro* diagnostics (IVD).

The evolution this market is experiencing is explained, according to the interviews, by the gradual standardization of the test through commercial kits developed by the most important players of the field and by the emerging interest the genetics as a medical specialty is receiving. These factors arouse big clinical analysis groups' attention, which are able to easily achieve scale economies and compete by lowering their prices.

The genetic tests then become a niche inside clinical diagnostic analysis industry, being this integration reinforced by the present evolution of the market, since standardized kits usage increased in the future will neglect the need for specialized human resources, standardizing even more the prices of the tests.

GenoMed's market can therefore be considered as a *specialized niche market*, offering however a broad set of distinct molecular diagnostic test for almost every specialty of medicine.

The most important players of the clinical diagnostic analysis market are:

- Grupo Joaquim Chaves, which have a specific Genetic Service;
- General Lab, which belongs to the Labco European Group;
- Grupo Germano de Sousa, Centro de Medicina Laboratorial.

Operating in the specific niche of genetic tests market, the main rival firms of GenoMed are:

- Centro de Genética Clínica (**CGC**), which is based in Oporto and has a small sample collection lab in Lisbon, but operates in the entire country;
- Instituto de Patologia e Imunologia Molecular da Universidade do Porto (**IPATIMUP**), with focus in the North region but operating in the entire country;
- Genética Médica e Diagnóstico Pré-Natal (**GDPN**), belonging to General Lab group, this company is based in Oporto and its activity is more focused in the north region, although it has operations in the entire country;

- Instituto de Biologia Molecular e Celular da Universidade do Porto (**IBMC**), Faculdade de Medicina da Universidade do Porto (**FMUP**) and Instituto Nacional de Saúde Dr. Ricardo Jorge (**INSA**), mainly operating in the north and center of Portugal, but with low relevance in the overall industry.

5.2.2. Buying decision criteria

Although the users of genetic tests are the patients, as most of the tests are requested by hospital clinicians, which decide, together with hospitals management, which lab will run their sample, being therefore considered GenoMed's clients. For them, the most important buying decision criteria are:

- Lower prices, imposed by Hospitals Management;
- Quality and reputation of the laboratory;
- Quickness of answering;
- Previous relationship with laboratories and capacity to communicate (allowing for personalized treatment);
- Localization of the laboratory (which needs to be close and offer samples transportation);
- Trustworthiness of the laboratory, being an important factor maintaining low levels of outsourcing.

The factors enumerated above, according to the interviewed people from GenoMed, S.A., are homogeneous in developed countries, with exception of price, which loses importance in countries with more stable and rich economies.

5.3. External Environment Analysis

5.3.1. Macro-Environment: PESTL

Every firm operates inside an industry which is part of a bigger scale environment: the Macro-Environment. Changes in macro-environment factors may lead to significant alterations in firm's immediate industry, reason enough for them to be studied. In this section, the most strategically relevant macro-environment factors will be determined – **PESTL analysis** in Table 5.1 – in order to better anticipate how they can influence the company's objectives and strategic planning.

Table 5.1. PESTL analysis.

Issue	Impacts on the Market
Political and regulatory	
<ul style="list-style-type: none"> ➤ Molecular medicine and genetics lack most of the regulatory and legal frame; ➤ Persistently forgotten in the political measures regarding health issues; ➤ Prices public hospitals can pay for each test are established by the national healthcare system, with dramatic change last years; ➤ Low average knowledge on molecular medicine applications and importance for public healthcare; ➤ Regulatory environment doesn't know the right path to follow in molecular diagnostics industry; ➤ Differences in reimbursement policies among developed countries; ➤ Licensees attributed for molecular diagnostic testing by health division of Portuguese government; 	<ul style="list-style-type: none"> ➤ Low resources applied to co-funding of molecular diagnostic tests due to restrictions in public funding options; ➤ Dramatic change on prices established by healthcare system, in some cases lowering 70% of previous payments; ➤ No economic incentives alignment to invest in diagnostics and failing to provide favorable conditions to this industry firms to generate evidence of clinical utility and cost-effectiveness proofs of their techniques; ➤ Regulatory environment doesn't follow the rapid changes in this medicine field; ➤ Different degrees of penetration of molecular medicine between different countries; ➤ Although GenoMed is the only Portuguese laboratory licensed by Direção Geral de Saúde, several other companies run the same tests;
Legal and Ethical	
<ul style="list-style-type: none"> ➤ Need for signed informed consent for genetic testing; ➤ Constant overlook of signed consent by physicians; ➤ Ethical concerns on potential utilization of genetic information; ➤ Ability to identify individuals predisposition for certain diseases; 	<ul style="list-style-type: none"> ➤ Ethical concerns hurdle the development of this medical field, mainly due to the possible usage insurance companies might do of the information genetic tests provide on future diseases prediction; ➤ Blockage of regulatory and legal frame development by policy makers;
Economic	
<ul style="list-style-type: none"> ➤ Economic crisis in Europe and, in particular Portugal; ➤ Internalization of some areas of molecular tests by public hospitals; ➤ Tests reimbursement is complex, requiring a responsibility term which, in some hospitals, need four signatures; ➤ Continuously evolving co-payments rules; 	<ul style="list-style-type: none"> ➤ Deep constraints on public funding for this field of medicine; ➤ Decrease in the number of tests requested, as well as public payments by health division of Portuguese government; ➤ Lack of reimbursement stability limits market expansion; ➤ Low investment conditions the physicians adoption of new techniques;

<ul style="list-style-type: none"> ➤ Payers' coverage calculated based on medical-economic value and clinical validity of tests; ➤ Delays on tests payment; 	
Social	
<ul style="list-style-type: none"> ➤ Comprehension on molecular diagnostics and genetics is growing; ➤ Much faster evolution of genetics and its application on medical and biotechnology fields compared to public knowledge and understanding; ➤ Ability to detect the presence of genes that might increase the probability of a currently health individual to suffer from diseases in the future; ➤ New breed of physicians coming out of the academy prepared and willing to understand the importance of genetic testing; ➤ Raise in public awareness by internet and media provision of information; 	<ul style="list-style-type: none"> ➤ Social acceptance and awareness is becoming a reality; ➤ Sensitive issues concerning genetics are being raised and need social decision; ➤ Need for socially aware and with tests interpretation and patients counseling ability physicians; ➤ Willingness of clinicians to incorporate molecular testing in its everyday practice will raise diagnostic testing adoption; ➤ Raise in public awareness will increase the number of requested tests;
Technologic	
<ul style="list-style-type: none"> ➤ Late years transition of molecular biology from purely academic into profitable and innovation driven industry for biotechnology, life sciences and pharmaceuticals; ➤ Use of knowledge of molecular genome to prove clinical practice utility and better diagnose ill patients, as well as predict future diseases in health people; ➤ Uprising usage and clinical application of NGS technologies; ➤ Rise of molecular medicine follows a classic technology-based transformation; ➤ Sequencing costs are decreasing and the speed of information generation is quickly increasing; ➤ NGS costs are now close to cost-effectiveness tipping point 	<ul style="list-style-type: none"> ➤ Human Genome Project conclusion unlocked new world of possibilities and applications for molecular medicine; ➤ Creation of molecular diagnostic need in medicine, by providing potent and more accurate tools for medical diagnostics and treatment; ➤ Five years revolution in genetic testing industry; ➤ Transformation of industry with potential to trigger a change comparable to the digital information era (NGS is causing technology improvements to double every six-months); ➤ Increasingly more molecular data is being generated, enabling new insights on diseases at a molecular level; ➤ Quicker NGS testing, complemented with Sanger Sequencing more accurate tests, will provide cost-effectiveness solutions to molecular diagnostic tests industry.
Demographic	
<ul style="list-style-type: none"> ➤ The population of the most developed market for molecular diagnostic markets, Europe and United States of America, are aging. ➤ Global trend of life expectancy increase at birth; ➤ Increasing prevalence of oncologic diseases; ➤ Growingly elder population increases prevalence of chronic and oncologic diseases, with monitoring and testing needs; 	<ul style="list-style-type: none"> ➤ Increase of one of the target population for molecular diagnostic tests: elder people; ➤ Increase in the prevalence of diseases like cancer, rise the need of molecular and genetic tests for diagnosis, treatment and monitoring purposes; ➤ General increase in molecular testing demand;

5.3.2. Industry's Dynamics Analysis

As important as the knowledge on the nature and intensity of its competitive forces, is the understanding of its dynamic and continuously changing attractiveness. The constantly changing competitive forces and environment of the industry by new developments and trends often require strategic response, either if they represent opportunities for growth and profit or threats to the firm's position. Therefore, it is important to correctly identify the drivers of change and how they are affecting industry and its competitive conditions.

According to (Raskin & Casdin, 2011), a team responsible for identifying secular changes in the drivers of economic or industry growth, a game-shift disruption is beginning to occur in the healthcare industry. These changes will have implications in drug research and development and in diseases diagnosis and treatment, with repercussions across every stage of healthcare and technology sector.

5.3.2.1. Drivers of change

The most important drivers of change, therefore the important ones to focus, are those which greatly reshape industry's scene and its competitive conditions.

One first factor to take into account is the **increase of life expectancy** in the world. (Raskin & Casdin, 2011) (Prweb, 2013) As fewer people die from infectious diseases, the growing prevalence of chronic diseases like heart disease or cancer drives the demand for molecular diagnostics.

According to the interviews, as the **scientific knowledge** and deep understanding of the molecular processes involved in specific diseases develop and diseases heterogeneity, more effective diagnostic tests and treatments will be possible, which will impulse survival rates and life expectancy further, boosting molecular diagnosis demand (Kulkarni & Ma, 2013; Raskin & Casdin, 2011).

The **technological development of NGS** will deeply influence the capacity to strive of molecular diagnostics market firms, according to the interviewees, as their ability to capture its value will represent a key competitive advantage, not only for instruments industry but also for services companies (Kulkarni & Ma, 2013).

As the establishment of greater clinical relevance of diagnostic screening and testing is achieved and as treatments become more expensive, payers (in Portugal, the government through its healthcare system and insurance companies) will tend to ask for diagnostic tests to ensure proper use of therapeutics by providing more information to the physicians. These diagnostic tests are often referred as **companion diagnostic** and are also used by pharmaceuticals to increase the use and penetration of new drugs (Kulkarni & Ma, 2013).

According to (Kulkarni & Ma, 2013), the late developments in the biomarkers and companion diagnostics have become increasingly relevant in the medicine practice, heading the development of more sophisticated diagnosis, treatment and disease monitoring, thus driving the scientific knowledge development about molecular processes in human body. It is estimated that 30 to 40 percent of novel drugs in pharmaceutical industry firms' pipeline are being developed in conjunction with a biomarker, increasing the importance of molecular diagnostic tests for physician's information for better treatment decisions.

Driving the demand for molecular diagnostics are the progressively more informed and active patients, increasingly demanding best informed physicians, and the constant progresses in digital and information technology.

On the down side stand **economic** factors, especially relevant in Portugal, as pointed out during the conducted interviews. The crisis affecting Europe has constrained molecular diagnostic implementation and development. According to (Kulkarni & Ma, 2013), a deep reimbursement reform will be critical to encourage innovation and to accelerate molecular diagnostics and personalized medicine adoption.

5.3.2.2. Impacts

The determination of the combined impact of the different drivers of change previously presented is the most crucial part of the industry's dynamic analysis. From this study, industry's demand and profitability evolution will be assessed, leading the management team to make better decisions, based on the probable industry behavior in the foreseeable future.

Driven by the aforementioned factors, with particular emphasis to the raising life expectancy and molecular information for better management of scarce healthcare resources, the demand for goods and services will suffer a dramatic change on the consumption patterns (Raskin & Casdin, 2011).

The developments on molecular medicine will transform currently acute, potentially deadly diseases into chronic, livable conditions, therefore raising the demand for better disease diagnosis, treatment and monitoring. The potential increase in life expectancy expected due to the incorporation of molecular diagnostics in healthcare industry, according to different adoption scenarios, might be seen in Fig. 5.2:

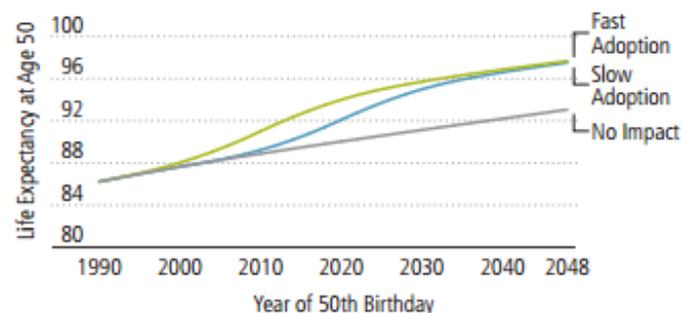


Figure 5.2. Life expectancy of a 50 year old individual according to different adoption scenarios for molecular medicine. The slow adoption scenario assumes that the benefits from molecular medicine only begin in 2030, with full benefit around 2050, contrary to fast-adoption scenario where full benefits are attained in 2040 due to an early beginning, in 2020. (Raskin & Casdin, 2011)

According to (Raskin & Casdin, 2011), three areas deserve especial attention:

- The usage of patient's genetic information for more precise prediction of diseases and risk assessment, which has the potential to generate great revenues as it is possible to see in Fig. 5.3.

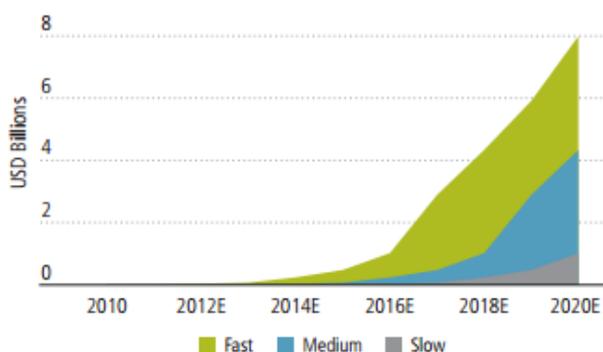


Figure 5.3. The risk-prediction market revenue forecast, assuming a fast-adoption scenario with 20 million tests sold in 2020 costing \$400 each. Predictions from December 31, 2010. (Raskin & Casdin, 2011)

- It will be possible to use molecular information for oncological diagnosis and prognosis, improving therapies effectiveness and outcomes;
- Molecular diagnostic tests known as companion tests will become routine in healthcare, potentially redefining drug industry and dramatically improving productivity and profitability by reducing development costs and expanding drug pipeline. Drug markets, today of large spectrum, will be transformed into small niche markets disease focused. This represents high potential revenues for molecular diagnostic firms.

In 2013, the United States of America and Europe account for around 60% of the diagnostic tests market, with the Asia Pacific countries, especially China and Japan, growing faster during the next few years (AdvaMedDx, 2013). According to (Prweb, 2013), United states of America is the number one player in molecular diagnostic market, followed by Europe in second position, China, Japan and India in third, fourth and fifth places respectively.

In the developing countries, market growth is being propelled mainly by growing population access to healthcare and significant government investments for healthcare development, in contrast with developed countries where market's growth is being restrained by economic restrains, regulatory and ethical issues and evidence expectations from payers, either governments from European countries where public healthcare systems exist or insurance companies (AdvaMedDx, 2013).

Although no consensus on the compound annual growth rate for IVD and molecular diagnostics for next years was found, a clear tendency was possible to understand: tremendous growth.

According to several studies, an average growth of about 7% for IVD and about 15% for molecular diagnostic tests is expected for these markets, with the infectious diseases and oncology testing, together with new emerging markets, leading this growth (AdvaMedDx, 2013; Prweb, 2013; Raskin & Casdin, 2011).

As it is possible to understand from Figure 5.4, the expected revenue and penetration of molecular diagnostic tests is expected to grow quickly, from \$4.4 billion in 2010 and about 11% market penetration to \$21 billion and around 80% of market penetration by 2020. This will represent an increase from about 11% of global \$40 billion IVD industry to about 31% of an estimated \$67 billion industry by 2020 (Raskin & Casdin, 2011).

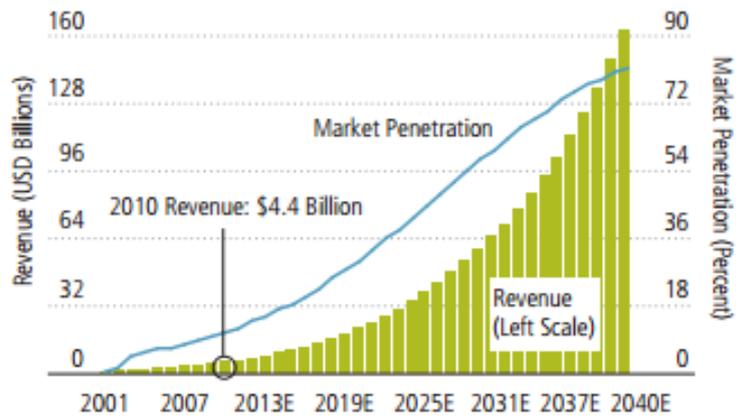


Figure 5.4. Global molecular-based diagnostics revenue and market penetration estimative, as of January 5, 2011 (Raskin & Casdin, 2011).

Although infectious diseases and oncology are the most prominent fields today and will continue to be the leading playgrounds for molecular diagnostics, all disease areas present potential for this new field of medicine in the next five years (Kulkarni & Ma, 2013). The potential for personalized medicine therapies across disease areas is represented in Fig. 5.5.

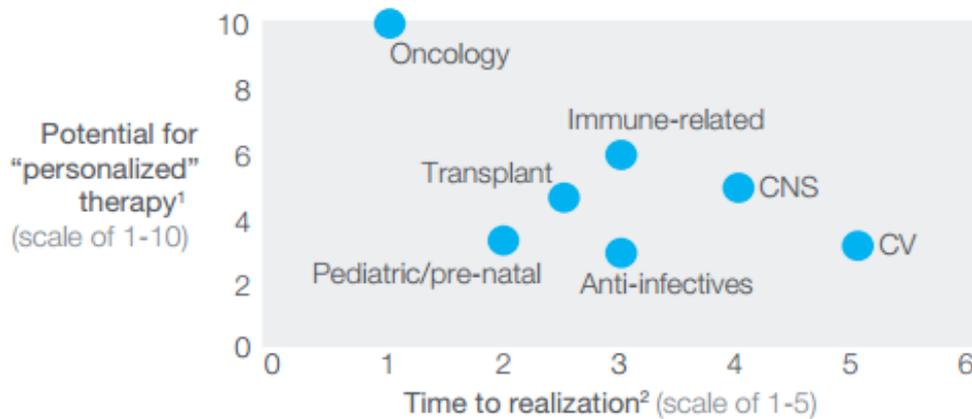


Figure 5.5. Potential for personalized therapies in different disease areas, being the potential based on the understanding of disease heterogeneity, clinical relevance of personalized diagnostics and economic attractiveness and the time to realization based on disease understanding, technical feasibility and development timeline for therapeutics, measured in years. Legend: CNS – Central Nervous System; CV – Cardiovascular (Kulkarni & Ma, 2013).

5.3.3. Market Attractiveness: Porter's Five-Forces Model of Competition

To better understand and analytically study the different competitive forces acting in the firm's industry, using a systematic method, the **Porter's five-forces model** of competition is one of the most powerful and generally accepted tool (Porter, 1979) .

The suggested model takes into account five different forces which directly influence industry's profitability through different competitive pressures: rival companies, potential new entrants to the industry, competition from firms producing substitute products and supplier and customer bargain powers. The attributed ranking was encompassed between 1 and 25.

5.3.3.1. Rival Firms competition

The main rival firms of genetic tests industry were described in section 5.2.1. As it is possible to understand, there are several companies performing these tests in Lisbon and Oporto, which increases the competition for clients. Also, the entrance of big clinical analysis groups in the genetic testing niche raised the already high competition. Therefore, and according to the information collected during interviews, industry is growing fast, the markets competition between rival firms is high and could be ranked as 18.75.

5.3.3.2. Potential new entrants

The general risk of new companies entering the industry might be considered low, due to its already high competitiveness and high investment needed to open a new laboratory. The operating firms competing in the molecular and genetic tests in Portugal completely fill the demand of this market. However, a small opportunity might exist for new micro companies specialized in some specific technology or methodology (average ranking for the risk of new entrants was 10).

5.3.3.3. Potential Substitute Products

The new technologies arriving to genetic tests, which will revolutionize the industry, will open the possibility for a whole new set of products able to sequence selectively certain coding regions of the genome (Exome Sequencing) and the entire genome much faster using different methodologies and technologies. Therefore, and according to the information collected in interviews, the risk for substitute products is very high (ranked as 18.75, in average).

5.3.3.4. Suppliers Bargain Power

According to Dr^a Teresa Porta Nova, most of industries suppliers have great control over the prices they practice. Although some new companies are commencing the commercialization of lower prices products, most of the industry's suppliers are the only companies selling their kind of products (for example, in the sequencing products market), therefore almost fully controlling the prices practiced. This fact, together with commercialization exclusivity some distribution firms achieved for Portugal market, causes increases the prices of the products and gives these enterprises great bargain power (ranked as 22.5).

5.3.3.5. Buyers Bargain Power

The prices practiced by this industry's companies are deeply influenced by the high bargain power its clients achieve.

According to the interviewees, the prices paid by the most important clients (public hospitals) are indirectly established by Portuguese Government (which establishes the prices for public entities, being however this prices used as template for every test public hospitals request) at very low values, withdrawing firms' power of negotiation. Therefore the company's buyers have complete bargain power (ranked as 25).

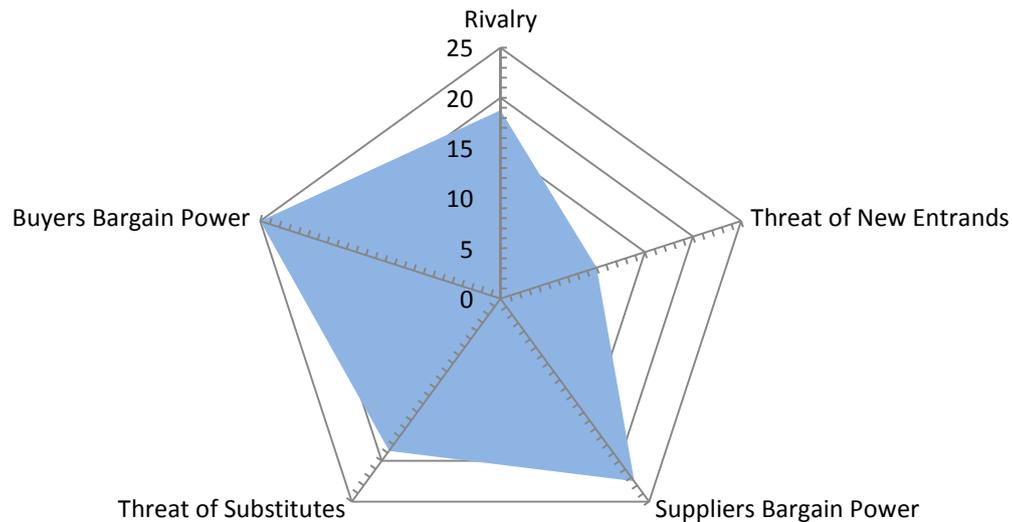


Figure 5.6. Radar-Graph representation of Porter's Five forces Model for industries attractiveness.

The average rank obtained was 19.25, or 77% of the 25 total points, which indicates the overall unattractiveness of this industry. The great part of the forces were ranked high, with exception for the threat of new entrants, which might be an outcome of the high competition existing among rival firms and low bargain power of industry's players when negotiating with either suppliers or buyers.

5.4. Internal Environment Analysis

5.4.1. Value Chain

The value chain of a company, illustrated in Fig. 5.7, represents a collection of all the activities performed internally, from the designing and production of the product to the marketing, delivering and product's supporting activities. The focus of this analysis is to examine all the value-creating activities and how a company delivers on its customer value proposition. For this analysis most of the information was obtained from interviews.



Figure 5.7. Porter's value chain of a company, based in Michael E. Porter, *Competitive Advantage*, as in (Gallaughier, 2012).

5.4.1.1. Primary Activities

A company's primary activities are the most important in creating value for the customer, encompassing all the activities directly related with product production, distribution, sales, marketing and service assistance, as well as supply chain management.

Inbound Logistics

The inbound logistics refer to raw materials handling and warehousing.

In Genomed, the two most important types of biological samples received or collected are:

- Blood samples, which could be sent by physicians or collected by Genomed's specialized technicians;
- Solid tumors samples in paraffin
- Aspirated bone marrow samples, sent by doctors.

The samples are received, identified and cataloged under a specific code system, so anonymity of patients is maintained and sample tracking is possible. After this cataloging step, samples are stored in the laboratory at room temperature or inside fridges at 4°C.

After DNA extraction, the remaining samples are stored in freezers at -20°C or -80°C, depending on its specific needs.

The quality of these biological samples is maintained by storing in cold temperatures inside fridges or freezers with temperature sensors.

Regarding chemical reagents, when received are stored in a fridge at 4°C or at ambient temperature, in order to guarantee its preservation and to avoid contamination. To ensure its quality, only small quantities are bought and reagents are only used until its due date.

Operations

Operations allude to the conversion of the raw materials into final products. In Genomed, biological samples are treated and results interpreted and analyzed to produce a final report. All the transformations occur inside GenoMed's laboratories under controlled environments.

The quality of the final result is ensured by following pre conceived and validated protocols for each test, with double-check by a second operator of every sample transference between tubes.

The final reports produced are double-checked and signed by the unit director and by the technical director, in order to ensure its clinical validity.

Outbound Logistics

Outbound logistics are the processes behind final product warehousing and the distribution of the finished products. In GenoMed's case, the samples, or the most stable stage of the transformation, are stored in freezers. Therefore, DNA, blood and tumoral tissue samples are stored at -20°C or -80°C, being the temperatures continuously monitored by very sensitive sensors.

The final reports are distributed to physicians via password-protected e-mail, fax, mail or in-hand when the physician who requested the test is from HSM.

Marketing and Sales

For marketing and sales, actions for advertising, promotion, pricing policies and channel relations to impulse sales are analyzed. In 2011, GenoMed went by a process of rebranding and new website creation. New pamphlets, promotional kits and advertising to Genealogy and Paternity tests were created by specialized firms: Electricity (CAETSU) and Cegedim.

For services promotion, the firm had during 2011 and 2012, two commercials networking with physicians of Portugal's hospitals, from north to south. The results obtained were not the expected, therefore discontinuing this kind of approach.

For scientific divulgation and awareness creation on the medical corps, GenoMed's representatives participate in several medical and scientific congresses, either as speakers, poster presentations or training courses. Scientific articles in medical specialty magazines also used as promotion channel. For commercial divulgation, sponsorship of scientific meetings by handing promotional materials in congresses kits is performed, being these kits distributed to physicians and other participants from the industry.

For 2014, a concrete plan was created in order to:

- Identify the most interesting hospitals and clinics for services divulgation, detecting the specific medical specialties and physicians to approach;
- More interactive and updated website, with new tests or latest scientific news of the field on a regular basis;
- Newsletter distributed on a quarterly basis;
- Identifying the most interesting medical specialties congresses to attend.

The pricing policy of GenoMed's services is indirectly imposed by public institutions, currently the *Portaria de Abril de 2013*, being however the prices very low. This factor leads to the need of individual determination of order feasibility.

Service

For clients follow up, satisfaction surveys are conducted in parallel with telephone contact to guarantee physicians accompaniment and to clarify any doubts physicians might have. In addition, Professor Gabriel is currently asked to directly contact patients for genetic counseling.

5.4.1.2. Support Activities

The support activities of a company are related with the enhancement of the primary activities performance. Therefore, every aspect of product and process R&D, technology and system development, human resources management and general administration is covered by this category.

Firm Infrastructure

In this section, firm administrative and finance infrastructure are analyzed by taking into account legal, accounting and financial management. According to the interviews, treasury is controlled on a daily basis by Dr^a Teresa Porta Nova and monthly compiled for financial control. The monthly billing corresponds to diagnostic test performed in the current month, which often represents previous month requested and initiated tests that suffered delay due to regulatory hurdles with statement of responsibility.

The financial management is Dr^a Teresa responsibility, being approved by the executive commission composed by three executive administrators, each representing one of the three most important stakeholders: IMM, Grupo ESS and ANF.

For costs estimation and provisioning, monthly estimations for executed tests is performed, in order to take into account tests which are not billed yet but already originated expenses.

The person in charge of the quality management in GenoMed is Paula Mimoso, responsible to ensure the compliance of NP EN ISO 9001 norm (certified number 2009/CEP.3390) and to compile information for external quality assessment entities to acknowledge GenoMed's best practices.

Human Resources Management

Human resources management encompasses not only personal management but also recruitment, training and staff planning.

In GenoMed, new human resources need is identified on an annual basis and, for recruitment, the following procedure is followed:

- Firstly, an internal estimation and a team reorganization attempt is performed, in order to eliminate the need for new hiring;
- If it is not possible to suppress the need with internal reorganization, a public announcement is published and most of the spontaneous candidatures are forwarded to the recruitment process.

For staff formation, at the point of hiring, the following steps are mandatory:

- Manual Host reading and Quality management system documentation reading in the first day in GenoMed;
- Initial induction by the responsible of safety and hygiene at work is made, with laboratory good practices procedures and hygiene explanation;
- Training plan with tasks learning scheduling by department chief;

- Initial period of learn by seeing and, on a second phase, by doing under supervision until supervisor approval;
- When new collaborator is considered ready to perform tasks, he is integrated in internal competence matrix, where all collaborators proficient in each test are designated according to three distinct types of skills:
 - Analytical execution;
 - Analytical validation;
 - Post-analytical validation – this skill is only for department coordinators and nominated substitutes (defined in internal rules).

In order to develop collaborators competencies, formation in areas as quality, security and hygiene at work, as well as specific technical areas is offered, individually identifying each collaborator needs.

Technology Development

The technological development refers to product and processes design, production and engineering performed inside GenoMed.

Until now, most of diagnostics tests development was performed in a reactive approach by responding to specific physician's needs. Nowadays, the most important investment on research and development activities is towards the development and integration of new methodologies in NGS for identification and research of new genetic modification linked to diseases.

Also, existing methodologies are studied and in-house techniques are developed to achieve similar results without the need to use expensive procedures.

In association with several laboratories across Europe and pharmaceutical companies, validation for biomarkers kits is performed in GenoMed, in order to research on its influence and importance in disease diagnosis and treatment.

For processes improvement, regular participation in external quality evaluation is performed by international entities as, for example, EMQN, UKNEQAS, QCMS and EMN. At the same time, internal quality control procedures for tests' results validation are executed, following international guidelines like Eurogentest (OCDE Guidelines for quality assurance in molecular genetic testing and Cytogenetic guidelines and quality assurance), EMQN (Best practice guidelines for laboratory internal quality control) and NCCN (National Comprehensive Cancer Network's clinical guidelines in oncology), among several others.

Currently, internal measurement of collaborators competencies is performed, comparing the obtained results with standards. Also, in order to develop internal procedures and processes effectiveness and trustworthiness, a performance evaluation for personal and technical competencies is being implemented, clearly defining the expected goals and quantifying the objectives and activities to complete by each collaborator.

Procurement of Resources

For procurement analysis, supplier management is considered. In the company, two different approaches depending on materials expected consumption are used:

- For materials and reagents which usage is guaranteed in a short term, need estimation is performed and renegotiation occur at each periodical order to supplier;
- For more specific reagents which current use is not ensured, orders are requested as needed, renegotiating and making price prospection to a minimum of 3 suppliers whenever it is possible.

5.4.2. Financial Analysis

When studying how well a company's strategy is working, it is very important to make quantitative assessments. This evaluation will allow not only to understand how well conceived and well executed the strategy is, but also to better plan how, in the future, the company is able to invest in its international endeavors.

According to (GenoMed, 2013), a strong evolution on the diversity of clients occurred, with an increase of almost 10% in the total number of clients, mostly due to private sector new clients.

A more complete financial analysis might be consulted in attachment 9.6 (Confidential Attachments).

5.4.3. Resources and Capabilities

When analyzing if a company is strong enough for sustaining a competitive advantage over rival firms, resources and capabilities analysis offer a deep comprehension of firms most important competitive assets. Therefore, a basic understanding of these basic concepts and which resources and capabilities the firm possesses is fundamental.

5.4.3.1. Resources and Capabilities

Resources could be defined as productive input or competitive asset that is owned or controlled by the firm. These resources can be split into two different categories: tangible resources, which can be quantified and assume a material form, and intangible resources, without material existence. A capability, in contrast, is not owned by a firm, being instead a capacity the firm possesses to perform an activity expertly. It is, therefore, a knowledge-based expertise in the usage of firm's resources. The capabilities of a company are within people and firm's intellectual capital or processes and systems proficiency. The most important resources and capabilities from GenoMed, according to the interviewees, are summarized in Table 5.2.

Table 5.2 Most important resources and capabilities. Legend: (IMM) – Equipment provided by IMM for members shared utilization.

Resources		Capabilities
Tangible	Intangible	
Avant 3130, Applied BioSystems	IMM partnership	NGS results analysis and interpretation
Cobas 4800 HPV Test, Roche	Qualified human resources	Genetic tests result analysis and interpretation expertise
Biomarkers testing kit	Scientific knowledge	Procedures optimization
Ion Personal Genome Machine (PGM) System (IMM)	HSM physicians' proximity	Technical knowledge on NGS operation and Biomarkers, K-RAS, B-RAF and K-RAF testing kits operation
RotorGene 6000, Corbett (IMM)	Developed and parameterized software	HPV diagnostic testing
NanoDrop Lite Spectrophotometer - Thermo Scientific (IMM)	Brand	Sanger sequencing results interpretation and analysis
	Organizational culture	In-house developed methodologies

5.4.3.2. Which of them are sustainable competitive advantages?

After all the resources and capabilities of the company are identified, a test needs to be made in order to analyze which of them are able to support the firm's search for sustainable competitive advantage against market rivals.

In order to find these advantages, The Four Tests of a Resource's Competitive Power should be performed. These tests consist in assessing the strength of a resource or capability by answering four different questions, the first two in order to identify competitive advantage and the last to determine if the competitive advantage can be sustained against active competition.

1. *"Is the resource (or capability) competitively valuable?"*
2. *"Is the resource rare – is it something rivals lack?"*
3. *"Is the resource hard to copy?"*
4. *"Can the resource be trumped by different types of resources and capabilities – are there good substitutes available for the resource?"*

The resources and capabilities, categorized by question and competitive implication in the market, are represented in Table 5.3.

Table 5.3. Resources and capabilities organized by question and competitive implication.

Question	Replaceable?	Valuable?	Rare?	Difficult to Imitate?
Competitive Implication in market	Temporary Competitive Advantage	Normal Competitive Advantage	Temporary Competitive Advantage	Sustainable Competitive advantage
	Sanger Sequencing operation, results interpretation and analysis	NGS Equipment operation	NGS Equipment operation	Biomarkers testing kit operation
	RotorGene 6000	Cobas 4800 HPV Test Operation	Biomarkers testing kit operation	NGS Equipment operation
		Biomarkers testing kit operation	K-RAS testing operation	IMM partnership
		K-RAS testing operation	Technical expertise	In-house developed methodologies
		Organizational culture	Organizational culture	Organizational culture
		Technical expertise	IMM partnership	
		IMM partnership	In-house developed methodologies	
		In-house developed methodologies		
		Qualified human resources		
		RotorGene 6000		

5.4.4. GenoMed's stakeholders

As previously mentioned in section 5.2, GenoMed is not alone in the marketplace. Along with the identified most important rivals, GenoMed's industry network is composed by shareholders, clients and suppliers.

In order to better understand how the studied firm is surrounded and interacts with its peers in the marketplace, an industry network was created and is presented in Fig. 5.8.

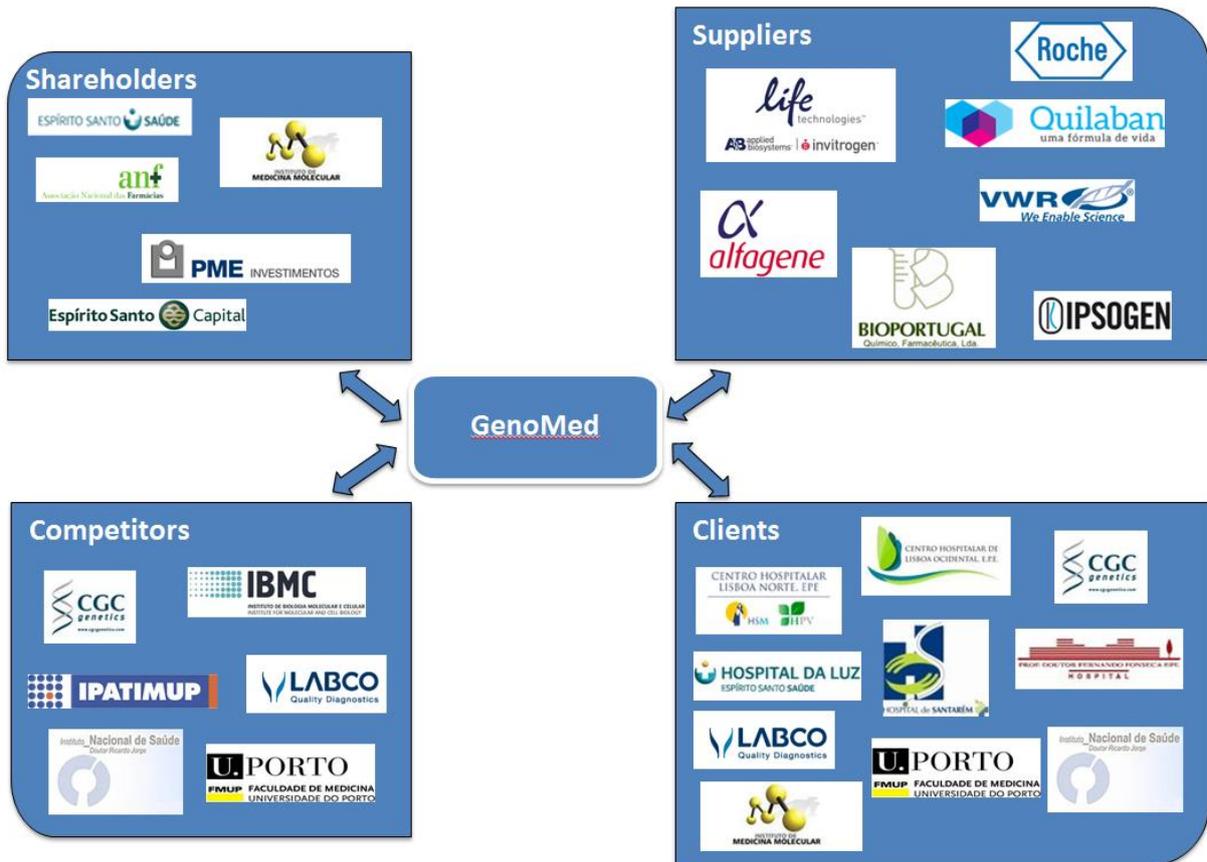


Figure 5.8. GenoMed's industry network.

Regarding GenoMed's clients, a great part of its incomes are still from Centro Hospitalar Lisboa Norte, but the trend is to increase the importance of other clients in the company revenues. The relative importance of the clients of GenoMed in the firm's profits is represented in attachment 9.7 (Confidential Attachments).

5.5. Company's Competitive Position Analysis

5.5.1. Key Success Factors

The key success factors (KSFs) are the most important competitive factors in the industry, affecting its members' aptitude to survive and succeed in the marketplace, therefore differentiating between firms' profit and loss. The capacity to measure up the company's strategy to the KSFs of the market will determine how competitive and financially successful a company will be.

For the molecular diagnostics testing industry, according to the interviewees, the most important factors firms need to concern are:

- **Pricing competitiveness**, being growingly one of the most important, if not number one concern, in clients buying criteria, therefore differentiating a firm's ability to growth and strive in the market;
- **Quality of the offered services**, regarding not only the final quality of the reports produced, externally evaluated, but also other factors as the quickness of response and diversity of diagnosis tests provided;
- **Clients loyalty**, attained through strong branding and by maintaining a healthy and trustworthy laboratory-client relationship, with low outsourced tests by the market's firms;
- The **human resources** of the firms, composed by highly qualified collaborators from different backgrounds and with constant scientific and technical knowledge refreshing through trainings;
- The existing **scientific knowledge** in the firm, either in collaborators or processes;
- **Research and Development (R&D)**, not only for new diagnostics tests development, but also for constant process innovation. The development of NGS techniques is one of the most relevant areas of development;

5.5.2. Benchmarking

Benchmarking is defined as the comparison of different value-chain activities among different firms, making cross-company comparisons of the cost, effectiveness and efficiency of these activities. By comparing different companies' processes and methods, best practices might be identified and imported.

5.5.2.1. Weighted Competitive Strengths Rating

It is utterly important to understand not only how competitively strong a company is against its key rivals, but also how does the company rank relative to competitors on each KSF, in order to have an overall evaluation of firm's competitiveness through a weighted competitive strength assessment.

From it, conclusions can be made about how strong or weak the firm is compared to its rivals in each factor, directing to the best actions to endorse in order to maximize its competitive strengths and minimize its competitive vulnerabilities.

In Table 5.4 a classification, according to the information collected during the interviews, of GenoMed and its most important rivals in the molecular diagnostics market is performed on the above identified as the key success factors for the firms of this industry.

Table 5.4. Weighted Competitive Strength assessment. Rating Scale ranges from 1 (very weak) to 20 (very strong).
*Rating attributed by value estimation through interviews and documentation analysis.

		Competitive Strength Assessment (SR: Strength Rating ; WS: Weighted Score)									
KSF in the Industry	Weight ¹	GenoMed		CGC		IPATIMUP		GDPN		IBMC	
		SR	WS	SR	WS	SR	WS	SR	WS	SR	WS
Price	0.18	13	2.34	16	2.88	16	2.88	15	2.7	18	3.24
Quality	0.18	18.5	3.33	15	2.7	15	2.7	15	2.7	15	2.7
Clients loyalty	0.15	17.2	2.58	11.4	1.71	12.5	1.88	15	2.25	15	2.25
Human Resources	0.17	20	3.4	15*	2.55	18*	3.06	15	2.55	18*	3.06
Scientific Knowledge	0.17	20	3.4	10	1.7	15	2.55	15*	2.55	18*	3.06
R&D	0.15	18	2.7	16.7	2.5	13.5	2.03	15*	2.25	15	2.25
Overall rating	1	17.75		14.04		15.09		15		16.56	

From the analysis of the previous table it is possible to conclude that all the firms closely compete in this market, confirming the previously indications of the Market Attractiveness in section 5.3.2. However, the most prominent firm in the overall context of the industry is GenoMed, mostly due to strong client loyalty, human resources, research and development, scientific knowledge and quality.

The weakest performance in the KSF by GenoMed is its price, where rivals reach better competitive positions.

5.5.2.2. Strategic Group Mapping

In order to better understand which firms can be considered close competitors and which are distant competitors, strategic group maps are used. This technique displays the different competitive and market positions that each firm occupies in the industry.

From the strategic group maps presented in Fig. 5.9 it is possible to conclude:

- A. GenoMed's strategy is based in prices somewhat higher than its competitors, offering however a higher quality service;
- B. The diversification in the portfolio of tests offered by GenoMed did not compromise its quality, in contrast to some rival firms;
- C. The slightly higher price/quality ratio of GenoMed's services allows to achieve higher levels of client loyalty, one of the most important factors in this market, as physicians are usually very averse to changes;
- D. Rival firms like IPATIMUP, GDPN and IBMC offer a highly focused service, not only on the diversity of tests offered but also in the geographic coverage of their service, in contrast with GenoMed and the best established firm of this market, CGC.

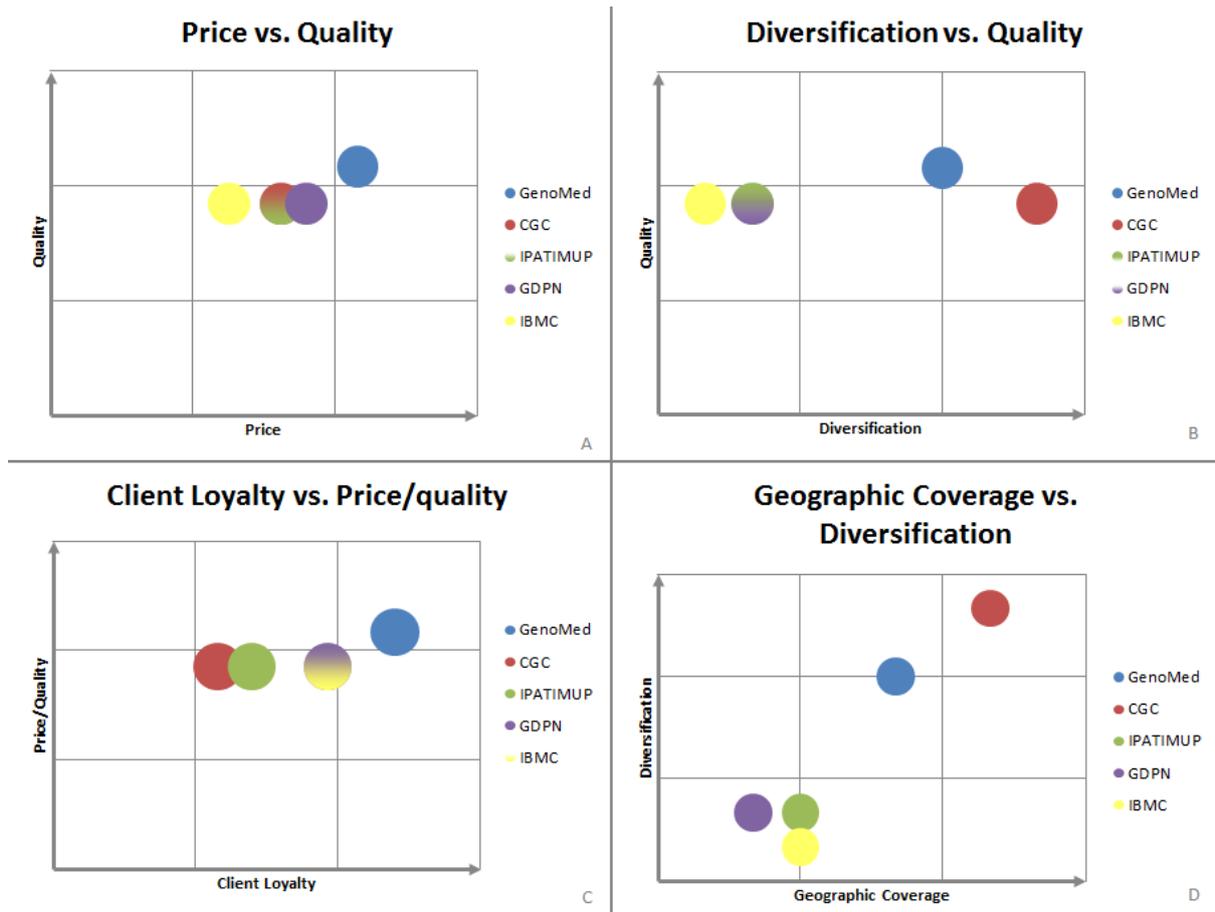


Figure 5.9. Strategic group mapping of the most important firms of the market.

5.6. SWOT Analysis

An essential element for a deep evaluation of the firm's overall situation is the SWOT analysis. It consists on an examination of the company's strengths and weaknesses versus its market opportunities and threats. From this diagnosis, it is possible to draw conclusions on the company's actual situation and the best actions for strategy improvement that all the four components imply.

According to (Peteraf, 1993), as in (Thompson et al. 2012:156), *"A company's internal strengths should serve as the basis of its strategy – placing heavy reliance on a company's best competitive assets is the soundest route to attracting customers and competing successfully against rivals"*.

The SWOT analysis of the internal and external factors of GenoMed, as well as the recommended general strategies to respond to these factors is represented in the Table 5.5:

Table 5.5. SWOT analysis and the recommended strategies for each factors conjugation.

		Environmental Factors	
		Opportunities	Threats
Internal Factors	Strengths	<ul style="list-style-type: none"> Increasingly global market, with easier market penetration on international markets; Increasing life expectancy; Increasing molecular diagnostic tests demand; NGS systems and techniques improvement towards clinical practice introduction; Companion diagnostic test for proper therapeutics prescription; Biomarkers development for diagnosis, treatment and disease monitoring; Increasingly higher chronic diseases prevalence; 	<ul style="list-style-type: none"> Increasingly global market, with easier market penetration from international firms; Progressive development of standardized test kits by pharmaceutical companies; Lowering demand of technical and operational expertise; Ethical hurdles on genetics and molecular knowledge and its potential implications; Regulatory and legal frame by governments; Economic crisis might affect molecular diagnostic investments and demand; Due to services internalization by old clients, new rivalry arises;
	Weaknesses	<ul style="list-style-type: none"> High scientific knowledge and technical expertise; Good international network; Proximity relationship with physicians; Strong brand; Highly qualified human resources and good organizational culture; Proximity to IMM and HSM; High process and products quality; High capability of adaptation and evolution; Solid R&D on NGS and Biomarkers; 	<ul style="list-style-type: none"> Make use of the strong international network to take profit from an increasingly global market; Leverage the proximity and the existing good relationship to physicians to explain and aware for molecular diagnosis potentialities; Take advantage of the high scientific knowledge, R&D in NGS and biomarkers and highly qualified collaborators to be a first mover in the usage of new technologies in everyday processes and methodologies; Use the strong brand, recognized quality and the deep connection with IMM and HSM to raise international awareness and find possible alliances with pharmaceutical industry; Take leverage of high technical expertise and scientific knowledge, together with the connection to IMM and HSM, to create alliances through knowledge share; Adapt to an increasingly elder population with chronic diseases prevalence through high adaptability capability;
		<ul style="list-style-type: none"> Broaden client diversity and improve financial situation by advantage of increasingly demand on molecular diagnostics and life expectancy; Make use of possible partnerships to outsource part of the tests, in order to support increasing demand; Increase international activity through increasingly global market; Take advantage of NGS potentialities to achieve more competitive services' price; Take profit of potential alliances with pharmaceutical companies, usually highly competent in marketing and commercial areas, to develop internal commercial and marketing capabilities; 	<ul style="list-style-type: none"> Focus on developing molecular diagnostic tests for rare diseases, where standardization will lately reach; Make use of good international network to lower the impact of economic crisis, by spreading the risk on more countries; Make use of highly qualified human resources, scientific knowledge, strong brand, IMM and HSM proximity, technical expertise and solid R&D to form alliances in rich developing economies by providing knowledge and know-how; Avoid regulatory and legal frame hurdles by taking leverage of solid R&D and continuously adapting and evolving to broaden the offered portfolio of tests; Make use of strong brand, recognized quality and IMM and HSM connection to increase collaborations and market penetration, in order to spread the risk on a broaden customer portfolio; Develop international commercial and advertising actions, in order to raise awareness to firms capabilities and services' quality;
		<ul style="list-style-type: none"> Broaden the client portfolio, since high dependence on CHLN, a government health facility, will certainly lower firm's revenues due to politic and economic problems; Increase marketing and sales capabilities in order to lower the damage of a possible decrease in the near future of molecular diagnostic tests; Increase international alliances in order to increase international revenues and avoid regulatory and ethical hurdles in hosting countries' governments; Maintain relatively low number of collaborators in order to adapt to a progressively standardized and unspecialized operation market; Possible partnerships for tests outsourcing to respond to demand peaks 	

6. Discussion: International Strategy Definition

6.1. The Five Generic Competitive Strategies

When studying how to operate its business, win a market position and delivering value to a customer, five different competitive strategies might be chosen, depending on the firm's market width and if it is trying to achieve competitive advantage through low prices or product differentiation:

- Low-cost provider strategy;
- Broad differentiation strategy;
- Focused low-cost strategy;
- Focused differentiation strategy;
- Best-cost provider strategy.

The relation between these strategies and the factors affecting it might be seen in Figure 6.1.

According to Fig. 6.1, it is possible to conclude that the best generic competitive strategy for Genomed



Figure 6.1. The five generic competitive strategies. Source:(Thompson et al., 2012, p. 184)

is a **Focused Differentiation Strategy**. A differentiation strategy works best in cases where there are many possible forms of product differentiation, through wide variety of medical specialties, few rivals are using this differentiation approach and there is a fast-paced technological change, with rapid product innovation. In turn, a focused strategy is best suited for the market niche of molecular diagnostics, where industry leaders like big clinical analysis groups don't see it as crucial to their success, particularly because it's costly and difficult to specialize in this specific target market, where technical expertise and deep scientific knowledge is necessary.

A focused differentiation strategy strives to maintain and secure a competitive advantage based in specifically designed products to appeal to unique preferences or needs of a particular group of buyers, demanding for precise product characteristics. Firms operating under this strategy usually have small-

scale or custom-made products, which require specific resources, technical capabilities and scientific knowledge, in order to meet highly specific market niche members' needs.

To be successful, the firm is required to commit to best serve clients' necessities than rivals, never distorting the firm's image. Therefore, GenoMed's strong brand and recognized quality, as together with the IMM integration, play a dominant role on the creation of a highly competent and trustworthy image of firm, which offers high quality differentiated services.

For GenoMed, one good win bet would be to continue the investment in rare diseases and personalized diagnostics, where the company's image is already strong, and where tests standardization will lately take place.

6.1. Pre-Internationalization Phase

The internationalization process of one Portuguese molecular diagnostic tests company like GenoMed follows, among several other goals, pursue four ground objectives:

- **Broadening of clients portfolio**, decreasing narrow segment of clients dependence and spreading risk;
- **Strengthening of financial overall situation** of the firm, by increasing revenues from other countries;
- **Achievement of scale economies**, in order to lower prices and increase bargain power against suppliers;
- **Take advantage of its core competences and capabilities**, grounded on solid scientific knowledge and technical expertise.

The Fig. 6.2, two possible progressions of strategic positioning in the molecular diagnostics market into diagnostic market establishment are presented.

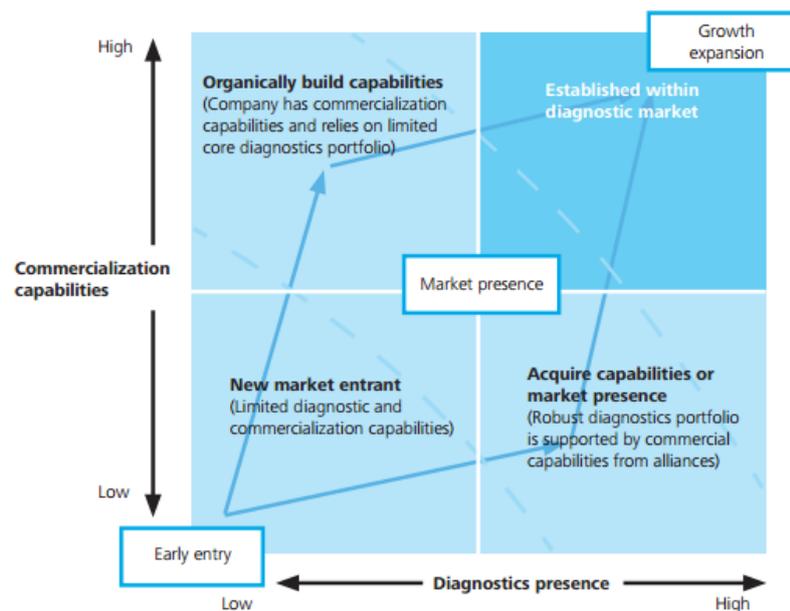


Figure 6.2. Strategic evolution of molecular diagnostics market firms (Goverman et al., 2012).

Currently, GenoMed has a strong diagnostics presence, with a broad portfolio of tests to offer, however clearly lacking commercialization capabilities to push the company a step further into growth expansion.

In order to achieve this goal, a successful transition strategy needs to address every aspect of the current business and to predict possible impacts of changes on current operations.

During a pre-internationalization phase, as described in section 2.4., the patterns of behavior of the firm's collaborators and managerial team need to change, clearly positioning GenoMed to an increasingly international market.

First, actions towards **awareness creation** around GenoMed's operations need to be accomplished, not only on academic and medical environments as it is already being done, but also in industry congresses where possible allies might be present. In this field, not only **traditional sales and marketing**, but also **medical affairs capabilities** need to be improved, in order to maintain and create

new relationships with physicians which might lead to collaborative research and sponsorships for R&D. In addition, **marketing campaigns** providing a platform for clients and healthcare participants' education might be needed, with the purpose of influencing buyers purchasing decision.

The development of **partnerships with pharmaceutical companies** around biomarkers and companion molecular diagnostic tests will allow the development of new services to provide through **shared investment in R&D**. However, these relationships might be beneficial not only in the scientific and technical field, as the collaborative development of these products might lead to **co-marketing and sales** by both companies, providing cheaper advertising and deep learning on commercial and marketing knowledge.

As defended in section 2.3, not only technological understanding is important, as international and marketing knowledge also plays a major role in firm's overall success during an internationalization process. As it is pointed in section 5.5, one of the weaknesses GenoMed presents is its commercial and marketing skills, which could be surpassed through direct acquisition of one commercial manager with prior knowledge in these areas. On advantage would be prior pharmaceutical industry experience, for network purposes.

As explained in section 2.4 pointed out in the previously mentioned tactical moves, one relevant underlying factor during the internationalization is the firm's **network of contacts** abroad and in several companion industries., which need to be taken care and expanded continuously.

6.3. Internationally Competing Approach

One of the foremost strategic issues that international companies need to address when operating in foreign countries is how should the firm vary its competitive approach to fit the different markets' needs. Different strategic approaches might be used, being extremely important to understand how markets abroad are characterized and how the client specific needs differ between different countries, in order to best suit its strategic approach.

Three different options for operating abroad arise: the **multidomestic strategy**, in which a company varies its products and competitive approach in the different to respond to different buyer preferences and market conditions, the **global strategy**, characterized by the use of the same competitive approach in all the countries the firm operates, and the **transnational strategy**, wherein a mixture of elements from the two previous strategies is used. Finding the right balance on how much to standardize and how much to adapt is utterly important for the international strategy success (Ghemawat, 2003).

As a general internationalization pattern to follow, **GenoMed will fit in "born-again global"** category described in section 2.6. For this type of firms, a committed managerial team should pursue "global niches" on a proactive attitude, in order to gain first mover advantage and gain rapid penetration of the target segment of the market.

From the analysis of the clients' decision criteria in section 5.2.2 and the information collected during interviews, it is possible to assume that client needs in different countries are very homogeneous. Also, strategic standardization across different areas becomes truly beneficial for efficiency and quality control purposes, one of GenoMed's competitive advantages, beside the fact that transportation of biological material (blood samples) does not imply high costs. It is possible to conclude, from the previous motives, that the strategic approach that best suits these characteristics is the **global strategy**.

Through this strategic approach, GenoMed will try to achieve scale economies in diagnostic tests, powered by the NGS techniques standardization, so it might not only lower the prices of its services, one of the weaknesses identified in the competitive analysis of section 5.5, but also increase its bargain power against suppliers (by buying in bigger quantities) and broadening the clients portfolio of the firm, currently highly dependent on CHLN, as stated in section 5.4.

Global strategies have relatively centralized value chain activities, allowing for great efficiency, economies of scale and added expertise. Also, by spreading the risks and fixed costs over a higher output volume, it allows for higher resources commitment in R&D. However, although the general global approach, a certain degree of adaptation is needed in order to adjust the international strategy of the firm to the different needs of distinct international settings. This strategy of difference is also called arbitrage (Ghemawat, 2003), residing the variances in geographical locations, developing index and economic characteristics of the target countries.

6.4. Strategic Option for Entering International Markets

According to the most important factors on the internationalization decision making process, different entry modes might be chosen to better fit the necessities of each market, as previously seen in section 2.7. Therefore, depending on the available resources, the control necessity of the firm, the transaction barriers and the network of contacts in the company, the best market entry strategy was crafted for three different sets of countries: Eastern-Europe countries, fast growing economic countries and rest of the world.

6.4.1. Eastern-Europe Countries

In countries from Eastern Europe like, for example, Hungary and Czech-Republic, the main target of GenoMed would be to form alliances with local firms for samples collection and posterior sending to GenoMed's laboratory for molecular diagnostic tests to be performed.

In these countries, increasingly developed laboratories and health facilities, increasing access from population to healthcare and lack of technological support, as well as scientific knowledge and technical expertise, would provide the firm a window of opportunity to establish important **partnerships** and **alliances** with local laboratories.

This entry mode, as explained in section 2.7, would allow entering foreign markets without financial investment, requirement impossible to fulfill due to the financial status of the firm. Also, as GenoMed would not be collecting samples or directly contacting patients, all regulatory and legal hurdles would be responsibility of local laboratories and clinics.

The main competitive competencies grounding this GenoMed's international approach would be:

- Scientific knowledge, technical expertise and highly competent human resources;
- Firm network of contacts and cultural familiarity in this region, mainly through Dr. Gabriel previous international experience;
- Company's strong brand and quality certification and recognition;

The downfalls of this strategic approach for international markets, as previously mentioned in section 2.7, are connected to dissimilarities between the two markets and, more specifically, between firms from different countries. Different language and cultural barriers might cause communication problems and slow trust building, being one of the important factors stated in the interviewees when considering moving abroad. Also, diverse operating practices and conflicting objectives and strategies may cause friction between both firms.

6.4.2. Countries with Fast Growing Economies

A different approach would be taken for countries with fast growing economies like Brazil, China, United Arab Emirates (UAE) and India, for example. In these countries, excellent health facilities and highly developed laboratories are being assembled for private-pay clients, with access to top of the range technology and products. However, since money does not constitute a problem in these regions, firms starting to operate in the market are trying to acquire scientific knowledge and technical expertise, not being interested in outsourcing molecular diagnostic tests to foreign firms like GenoMed.

As some of the GenoMed's core competitive advantages identified in section 5.5 are highly qualified collaborators, strong scientific knowledge and technical expertise in performing molecular diagnostics, it would be possible to take leverage of these competencies through different strategic approaches:

- **Licensing** of technical expertise in operational processes through thoroughly prepared contracts with royalties payment in exchange;
- **Cross-shareholding**, with exchange of capital between two countries firms, being foreign firms responsible to provide technological equipment and the laboratory, as well as attracting customers and develop foreign markets penetration and activities, and GenoMed responsible to provide the scientific knowledge and technical expertise through human resources formation and knowledge share;
- **Alliances** with foreign labs for rare diseases diagnostic tests outsourcing to GenoMed, a more difficult area of expertise to develop and already highly competent in the Portuguese firm;

The different strategic approaches above mentioned could have different advantages and setbacks, as mentioned in section 2.7. For Licensing, non-patented technologies or processes are difficult to control, being especially risky to transfer technical know-how to firms to countries with unstable politics and low intellectual capital protection, the basis of GenoMed's competitive advantage. Still, a meticulously written contract would allow new revenue sources with very low resources commitment and confined contact with unfamiliar and many times unstable markets.

As for cross-shareholding between two firms from different countries, it would allow to tightly connect the two businesses, benefiting from the potential revenues foreign firms generate in highly developing markets, where healthcare access of population and its purchasing power increase at very high rates. However, it would also imply sharing the ownership of GenoMed and, by deeply tying the two firms, require deep commitment from both managerial teams to make the partnership work.

In order to attract foreign businesses to form partnerships of different kinds where GenoMed would be responsible to provide scientific knowledge and technical proficiency, high investment in awareness creation in industry and medical conferences would be essential. There, the strong brand and certified and recognized quality of the laboratory would have to be publicized, together with the deep connection GenoMed has with IMM, a highly recognized international scientific institution, and Faculdade de Medicina de Lisboa and Hospital de Santa Maria physicians.

6.4.3. Rest of the World

For the rest of world, the strategic approach to different markets would pass by continue the existing strategy of sporadic tests requirement, either by punctual partnerships or through international rare diseases portals like Orphanet.

As developed countries markets like **United States of America** and **Western and Central Europe** countries are already saturated with highly competent similar molecular diagnostic tests service providers, it would not justify concentrating strengths and resources in these areas, since no opportunities are expected to be found.

Markets from recently emerging economies like **Angola** and **Mozambique** should be taken into account, but as future possible internationalization markets, since no demand for this kind of services exists yet.

A few years from now, when health facilities, healthcare quality and the index of development of these countries rises, the cultural connection and language similarity could mean great benefit for first mover advantage when entering these countries markets. Therefore, **strengthening of the existing network of contacts** and new connections would be recommended, in order to smooth the market penetration when the right timing comes.

A summary of the most important factors affecting the strategic options GenoMed should adopt for the three different sets of countries are presented in Table 6.1.

Table 6.1 –Summary of the market entry modes and factors influencing GenoMed's internationalization approaches.

Eastern-Europe Countries (Hungary and Czech-Republic)	
How?	Competitive advantage
1. Alliances	<ul style="list-style-type: none"> • Scientific knowledge, technical expertise and highly competent resources; • Firm network of contacts and cultural familiarity in this region; • Company's strong brand and quality certification and recognition;
Why?	Advantages
Increasingly developed laboratories, health facilities and access from population to healthcare	<ul style="list-style-type: none"> • Entering foreign markets without financial investment; • Regulatory and legal hurdles responsibility of local partners;
	Disadvantages
	<ul style="list-style-type: none"> • Dissimilarities between the two markets and firms; • Possible communication problems and slow trust building; • Diverse operating practices and conflicting objectives and strategies
Countries with Fast Growing Economies (Brazil, China or UAE)	
How?	Competitive advantage
1. Licensing 2. Cross-shareholding 3. Alliances	<ul style="list-style-type: none"> • Highly qualified collaborators; • Strong scientific knowledge; • Technical expertise; • Company's strong brand and quality certification and recognition;
Why?	Advantages
Excellent health facilities and highly developed laboratories are being assembled for private-pay clients, with access to top of the range technology and products, however lacking scientific knowledge and technical know-how	<ul style="list-style-type: none"> • Very low resources commitment ; • Confined contact with unfamiliar and many times unstable markets; • Potential revenues in highly developing markets; • Shared ownership of GenoMed;
	Disadvantages
	<ul style="list-style-type: none"> • Non-patented processes are difficult to control; • Risk in transference of technical know-how to firms to countries with unstable politics and low intellectual capital protection
Rest of the World	
How?	Competitive advantage
1. Sporadic tests 2. Network strengthening	<ul style="list-style-type: none"> • Scientific knowledge, technical expertise and highly competent resources; • Company's strong brand and quality certification and recognition;
Why?	Advantages
No significant opportunities are expected to be found, except in emerging economies like Angola and Mozambique, where future opportunities might arise	<ul style="list-style-type: none"> • Very low resources commitment ; • Cultural connection and language similarity; • Regulatory and legal hurdles responsibility of local partners;
	Disadvantages
	<ul style="list-style-type: none"> • Potential loss of focus for more important markets;

7. Conclusions and Future Recommendations

From the analysis of the literature available on internationalization process, it is possible to conclude that, when expanding its operations to foreign countries, a very organized, structured and planned approach should be followed, in order to prepare the internationalization process and make the most of the home-based competitive advantage a firm possess. This preparation and planning becomes utterly important for companies in fast-paced evolving industries like high-tech and health, where the competitive advantages are replaced quicker and small firms often don't possess strong financial arguments to invest in its international operations.

For GenoMed, and most of similar Portuguese medicine small firms, this is an present-day problem, reinforced by the decrease of internal demand caused by economic crisis, which is forcing these firms to expand its operations abroad in order to surpass the high dependence of specific clients.

From the molecular diagnostic industry analysis, it is possible to conclude that an evolution is occurring at fast pace, which will culminate with the introduction of NGS techniques in the day-by-day practice of this field, completely revolutionizing molecular research, its clinical applications and the medicine in general in a five years period. With the introduction of these technologies, standardization will be a reality and will allow the entrance of big clinical analysis groups, contrasting to the highly specialized niche we found today, therefore increasing an already highly competitive market. Also, regulatory and legal frames should be created, so firms have the needed stability to develop their processes. Political measures regarding economic investments for co-payments of these tests should also be taken, so clinical validity and economic-value of molecular diagnostic tests can be proved and its utilization becomes regular.

Regarding GenoMed's current strategy, from the internal analysis conducted in this work, it is possible to assume it is not tailored to success, since no work is being done in order to fully leverage the most important resources and capabilities of the firm. This misfit strategy, which during many years was more directed to one single client, caused last year financial state of GenoMed to worsen, since some services were internalized by the client and the economic crisis caused a decrease in demand for new diagnostic tests. Also, since most of the divulgation has scientific purposes, no commercial benefits are being extracted from it.

From resources and capabilities analysis and most important factors for markets success study, it was possible to understand that GenoMed's most important advantages are its strong scientific knowledge and technical know-how, backed up by top-edge technology access and highly qualified human resources. Also, its integration on a health cluster like IMM and its proximity and relationship with medical corpse should ground a successful strategy for internal and international markets.

Using the acquired knowledge from the industry and internal analysis, combined with the information collected during literature review, a strategic approach for GenoMed's internationalization was created. It should maintain its market niche approach, but should also consider the internationalization of its activities. This strategy starts with a solid preparation prior to international operations, by creating managerial engagement to this objective and strategic awareness in industry related congresses and medical environments. At the same time, a strong investment in expanding and fortifying the company's network of contacts should be made, forming strategic partnerships with bio-pharmaceutical firms and

important scientific research institutes in geographic areas of interest, in order to strengthen the perceived credibility and trustworthiness of GenoMed in these areas. Knowledge acquisition in international marketing and commercial fields are also encouraged, mainly by hiring an experienced manager to lead these operations.

The strategy for the internationalization process of GenoMed should follow a global approach, with standardization of practices around the globe, with alliances formation in geographic areas of interest. The three main clusters of countries were formed:

1. **Eastern-Europe** countries, with strategic alliances formation for tests outsourcing to GenoMed, making use of professor Gabriel network of contacts in this region;
2. Countries with **fast growing economies**, like China, Brazil and UAE, where partnerships based in cross-shareholding and licensing could be made, providing GenoMed the scientific knowledge and technical know-how in exchange of royalties or participation in these firms;
3. Countries from the **rest of the world**, where no specific strategic moves are advised, unless the credibility and trustworthiness consolidation and network relationships development, especially in countries like Angola or Mozambique where, in the future, a preferential position will constitute an important competitive advantage.

In conclusion, although this internationalization strategy has been developed for GenoMed, since market conditions and industry environments are similar for any other small Portuguese academic start-up firm operating in the market niche of molecular diagnostic market, this internationalization strategy can be generalized and advised for them.

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9. Attachments

9.1. Molecular Diagnostics

Molecular is nowadays considered as an area of diagnostics undergoing one of the most dynamic and transformative changes (AdvaMedDx, 2013). The advances in research, diagnostics and treatment are already causing huge impact in health care, leading to a promise of revolution in medicine.

The ability to deliver effective health care depends on the ability of the health care provider to accurately identify the cause of the patient's problem or, in other words, to make the right diagnosis. Therefore, it is possible to assume that the foundation of a successful health system are the diagnostic tests, by providing objective, quantitative measurements that assist and inform on every stage of health care, from prevention to treatment. The roles of diagnostics along the different stages of care are presented in the following figure:

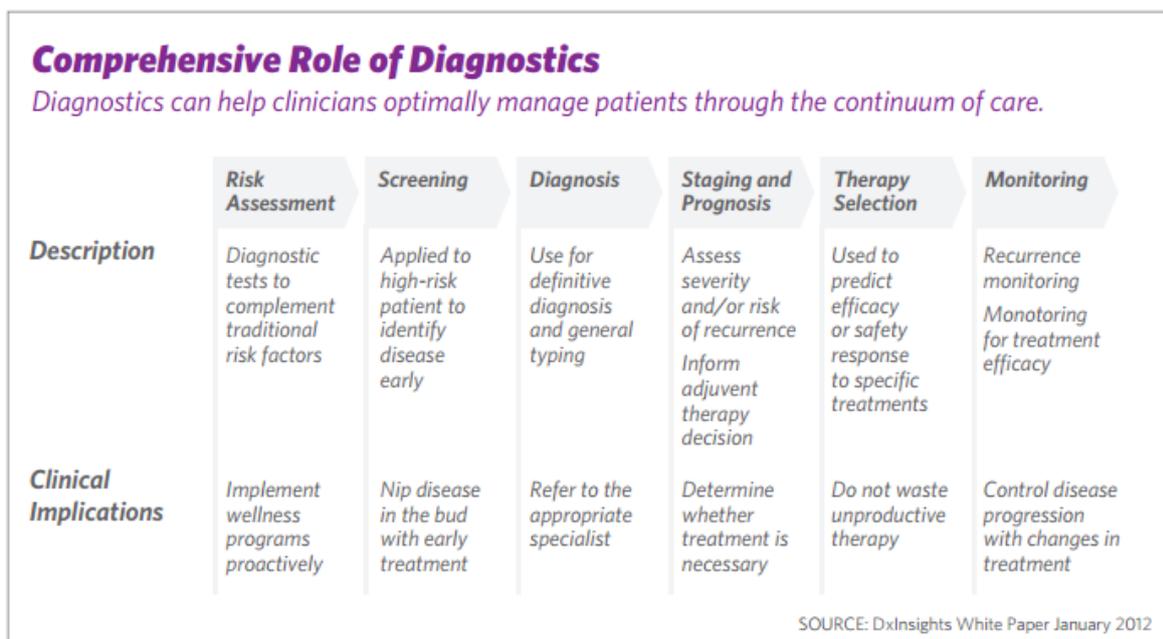


Figure 9.1. The role of diagnostics on the different stages of health care. (AdvaMedDx, 2013)

According to (AdvaMedDx, 2013), the term “molecular diagnostics” embraces a class of diagnostic tests that assess the health of one individual at molecular level by detection and measurement of proteins or specific genetic sequences responsible by those protein synthesis, from deoxyribonucleic acid (DNA) through ribonucleic acid (RNA). The relation between DNA, RNA and proteins is represented in Fig. 9.2:

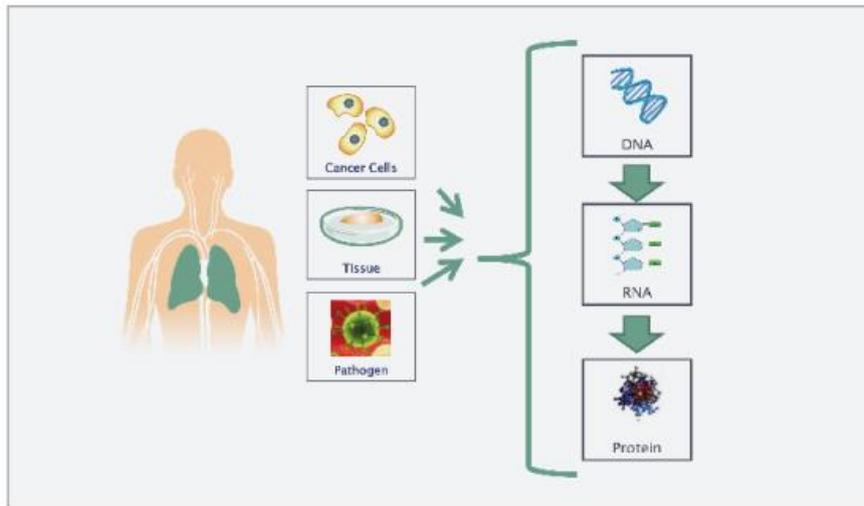


Figure 9.2. Relation between DNA, RNA and proteins. Molecular diagnostics examine the molecules in the cell and their role in human biology and disease. (AdvaMedDx, 2013)

To understand if someone carries a predisposition for a disease, if they suffer from a disease or if a treatment will be effective in a particular person, molecular diagnostics identify genes, RNA and protein variations that could help to explain normal and abnormal, health and disease states. It is the interaction between proteins, with specific functions within the body, and the genes responsible by its synthesis through protein synthesis, being therefore utterly important and of extreme utility the assessment of an individual's health at a molecular level (AdvaMedDx, 2013). Today, it is even possible to detect the presence of specific viruses, bacteria or other types of cells through molecular diagnostics.

The recent developments on the molecular field have made possible to treat small homogeneous groups of people with therapies tailored to the molecular profile of their individuals. The known association of a specific protein or genetic sequence with a specific disease or health condition leads to the creation of "biomarkers" of that specific condition, which is then used by pharmaceuticals to design treatments around those biomarkers and to encourage and invest in more accurate diagnosis of the exact nature of the individuals diseases, in order to ensure their new therapies are delivered to the right patients with maximum effectiveness. This new molecular diagnostic tests are often called companion diagnostics.

9.2. Technology of molecular diagnostics: Genetics

In the recent years, a great revolution and development pushed genetics to the highlights of medicine, giving arise to promising areas such as gene therapy, genetic engineering, diseases diagnostics and personalized treatments (World Medical Association, 2009).

The start of genetics as a discipline of study can be localized in the 1860s in a monastery in central Europe, when a monk decided to study for a decade how the traits of peas passed from parents to offspring. His conclusion on the influence of two genes, one from each parent, in the traits transmitted to the new plant were unknown until around 1900, when Carl Correns duplicated and confirmed Mendel's findings and gave rise to **Mendel's Laws of Inheritance**. This discovery led to the first Nobel Prize attributed to studies in the genetic field (Klug, Cummings, Spencer, & Palladino, 2012).

More recently, with the completion of the **Human Genome Project**, an international effort to determine the complete content and sequence of the human genome, medical genetics has become a recognized

medical specialty with extreme importance in diagnosis and management of several disorders. Genetics nowadays, in order to improve medical care of individuals and its entire family, include control of gene expression, human gene variation and interactions between genes and environment. The human genome project allowed the identification of all human genes and the understanding of the variation in the genome of entire populations and single individuals, either in health and disease situations, thus enlightening on the influence of single genes to health and sickness (Nussbaum, McInnes, & Willard, 2007).

Genetics, as a field in medicine, can be defined as the study of every aspect of genes, the fundamental units of biological information, composed by molecules of deoxyribonucleic acid (**DNA**). Genetics might be separated into two fields of research: the **molecular genetics**, which study genes into deep, therefore only dealing with few at a time, and **genomics**, which study sets of genes as a whole (genomes).

The DNA molecule contains biological information in its composition, being responsible by encoding proteins inside living beings in a process called **protein synthesis**. During this process, each three nucleotides (single units of the DNA molecule) encode one amino acid. Usually, **genes** are defined as a set of nucleotides responsible by encoding one protein (World Medical Association, 2009) (Griffiths, Wessler, Carroll, & Doebley, 2012).

Although DNA structure is able to replicate itself to ensure the persistence of its information through time, it allows for **mutations**, in which random changes occur during the process of replication. These mutations are in fact the source of the great diversity and **evolution of life**, being acted on by natural selection over time and giving rise to new species. However, these mutations can also cause diseases and malfunctions.

Therefore, the study of this field is of tremendous interest, especially since the technological evolution has allowed, through a series of methodologies and techniques, to isolate, study, understand and compare individual genes and genomes and how the function is normal and disease organisms (Griffiths et al., 2012).

No other scientific discipline has exploded in information and excitement in the past few years as genetics did. This fact is strongly enforced by the number of Nobel Prizes awarded to genetics related research since early and mid-twentieth century to the present (Klug et al., 2012).

The future is bright for genetics and its applications in biotechnology, which are developing in a much faster pace than public policies, laws and social conventions. However, as all technological revolution, they give rise to not only medical, but also social, ethical and legal implications and concerns that need to be publicly discussed and explained, so a genetics-related sensitivity is developed in general public (World Medical Association, 2009).

9.2.1. PCR

One extremely important discovery for genetic research and DNA knowledge was the DNA cloning, since DNA molecules are too large and complex to be analyzed as a whole. DNA cloning allowed for selectively replicate sequences of interest, producing very large numbers of copies of the specific gene of interest through amplification.

The **polymerase chain reaction (PCR)** is a rapid cell-free DNA cloning technique created during the 1980s which makes use of purified DNA polymerases to replicate specific DNA sequences. This method is quick, highly sensitive and robust, being widely used for **DNA amplification** and quantification of both DNA and RNA (Strachan & Read, 2010) (Griffiths et al., 2012). The discovery of this technique by Kary Mullis granted him the Nobel Prize in Chemistry of 1993 due to its importance (Klug et al., 2012).

PCR technique is composed by in vitro cycles of reactions, doubling the amount of DNA in each cycle. For amplification to take place, double-stranded DNA molecules are introduced in a tube with **DNA polymerase**, Mg⁺² (DNA polymerase co-factor), four **deoxyribonucleoside triphosphates** and two oligonucleotide **primers**, which are two distinct short single-stranded DNA sequence, one complementary to the 5' end of one strand of the DNA sequence to be amplified and the other complementary to the 3' end of the opposing strand of the DNA target sequence.

Each PCR cycle can be divided in three distinct reactions or steps, as represented in Fig. 9.3, each taking 2 to 5 minutes and able to be repeated immediately after the previous is completed:

1. **Denaturation:** during this step, through heating the solution to 92-95°C for about 1 minute, each molecule of DNA is denatured (separated) into two single strands;
2. **Annealing/Hybridization:** for this step of the cycle, temperature is lowered to 45-65°C. The oligonucleotide primers will bind to their complementary parts of the single DNA sequences in a process called hybridization or annealing;
3. **Extension:** in this last step of the reaction, the primers serve as starting points to the DNA polymerase initialization, which then proceeds to synthesize DNA strands complementary to the original strands, making use of the deoxyribonucleoside triphosphates present in the solution. At this step, the temperature of the reaction is lowered to 65-75°C for optimal DNA polymerase efficiency (Klug et al., 2012).

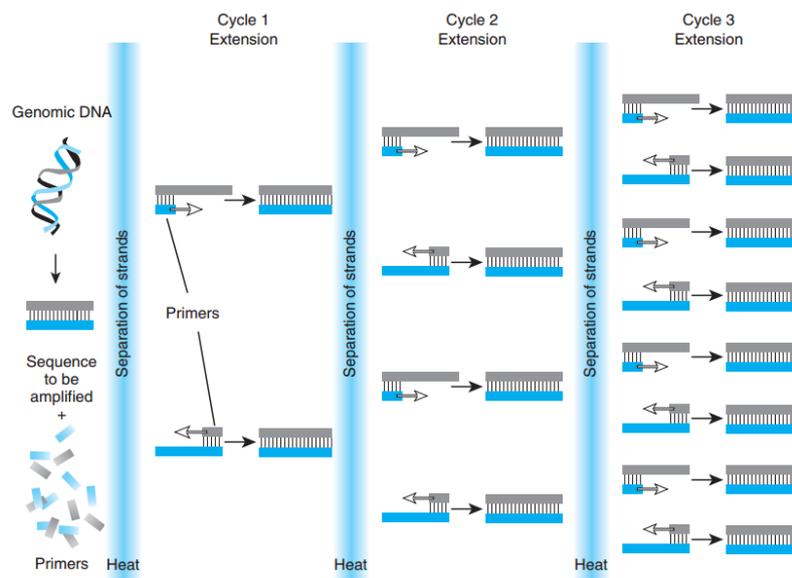


Figure 9.3. Representation of three cycles of the polymerase chain reaction (PCR) (Nussbaum et al., 2007).

Nowadays, PCR is automated by machines called *thermocyclers*, programmed to repeat these 3 steps for a certain number of cycles. PCR has, however, certain requirements and limitations:

- The DNA polymerase used in PCR reactions needs to be capable of withstanding several cycles of heating/cooling, so a thermostable form of this enzyme is mandatory. The solution was to use **Taq DNA polymerase** isolated from a bacteria living in hot springs of Yellowstone National Park;
- A prior knowledge of the sequence of interest in order to design primers specific enough so only the target part of the DNA is amplified;
- Minor contamination of the sample with strange DNA is usually a problem, which implies that this technique needs to be cautiously designed and conducted in very controlled environments;
- PCR isn't able to amplify long segments of DNA, since DNA polymerase only extends primers for a limited number of nucleotides.

9.2.2. Sanger Sequencing Method

After the target DNA is amplified it is necessary, in order to characterize it at a molecular level, to discover the **nucleotide sequence**. To do so, the most commonly used method and still routine at almost every lab in the world was developed by **Fred Sanger**, is known as **dideoxynucleotide chain-termination sequencing** or **Sanger sequencing** and gave him and Walter Gilbert the Nobel Prize in 1980 (Klug et al., 2012).

This technique uses chemical equivalents between the four nucleotides and the **dideoxynucleotide triphosphate** (ddAdenine, ddCytosine, ddGuanine and ddThymine, the **ddNTPs**) to sequence a molecule of DNA. Since these dNTPs lack a 3' – hydroxyl group on their deoxyribose, when they are incorporated into a new strand of DNA by DNA polymerase they block the enzyme capacity of adding new nucleotides by not providing a phosphodiester bond at its 3' carbon atom to the 5' phosphate group of the next nucleotide. This will cause the termination of the chain elongation (Nussbaum et al., 2007) (Griffiths et al., 2012).

In this methodology, the target DNA is sequenced by being used as a template for DNA synthesis after an oligonucleotide primer anneals. The DNA polymerase will then proceed to incorporate nucleotides from a solution containing both normal nucleotides and ddNTPs (at a much lower concentration), marked with different fluorescent dyes with specific emission. When one of these ddNTPs is incorporated, elongation stops immediately producing several fragments of different lengths of DNA strands. These DNA strands are later size/weight separated by electrophoresis and the last nucleotide of each strand, responsible for the DNA polymerase action termination, will be identified by the distinct fluorescent dye molecule it includes (Nussbaum et al., 2007).

In the last few years, this technology has been modified and enhanced to a point all reactions occur in a single tube inside a machine which produces cyclic reactions, increasing the read and run capabilities of such technique. The products of these reactions, the various fragments of DNA, are run through a single, ultra-thin-diameter polyacrylamide tube gel (capillary gel electrophoresis) and scanned with a laser, which stimulates fluorescent dyes on ddNTP of each DNA fragment and causes them to emit in distinct wavelengths of light. The emitted light is then captured by a detector that feeds the information into a computer and converts the light patterns into a DNA sequence – **electropherogram** or **chromatograph** (series of colored peaks corresponding to each ddNTP of the sequence) (Klug et al., 2012).

The full process of sequencing through this method is illustrated in Fig 9.4:

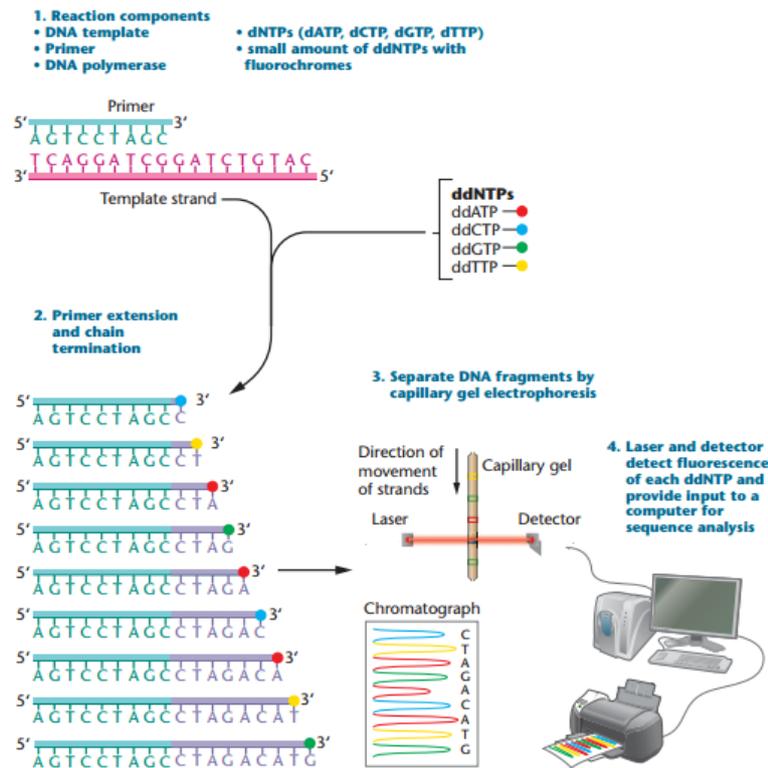


Figure 9.4. Computer-automated DNA sequencing through Sanger methodology (Klug et al., 2012).

9.2.3. Next-Generation Sequencing Techniques (NGS)

Although the previous method is still the most commonly used and will be around for many years, new techniques are being developed and will soon replace the standards of every laboratory around the world. In the fields of **genomics**, where full genomes are sequenced, Sanger sequencing is already becoming obsolete, mainly due to relatively high costs and not high enough output for the growing demand of sequencing data (Klug et al., 2012).

Compelled by this growth in genomics, new sequencers that are faster, capable of generating millions of bases of DNA sequences in a quick method were needed, which led to the development of NGS approaches. These NGS techniques process various reactions simultaneously, using state-of-the-art **imaging techniques** and generating **large volume of DNA sequence data** almost 200 times faster than before and for much lower prices. The relation between sequencing productivity and costs can be observed in Fig. 9.5:

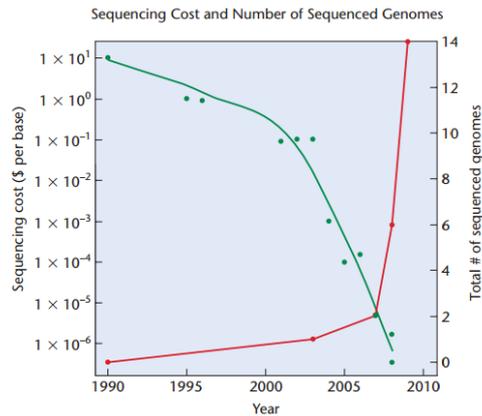


Figure 9.5. Relation between Sequencing cost and number of sequenced genomes (Klug et al., 2012).

Since first introduction of these new methodologies to the market in 2005, these technologies had great impact on genomics research (Morozova & Marra, 2008) and, over the last years with rapid technological advances, NGS fields of application and medical impact have been largely broaden. Nowadays, NGS is widely used for rare genetic variations discovery by whole genome re-sequencing or target sequencing, transcriptome profiling of cells, tissues and organisms and identification of epigenetic markers for disease diagnosis, just to name some of the possible applications (Xuan, Yu, Qing, Guo, & Shi, 2013). Several methodologies and technologies were developed for genetic sequencing:

- **Pyrosequencing** (using luminescence emission), by Roche/454 Life Sciences;
- **Sequencing-by-synthesis** (using reversible terminators labeled with fluorescent dye), by Illumina;
- **Sequencing by ligation** (using 16 dinucleotide combinations labeled by four different fluorescence dyes), by Life Technologies/Applied Biosystems;
- **Ion semiconductor sequencing**(measures pH changes for nucleotide ligation detection), by Life Technologies/Ion Torrent;
- **Single molecule sequencing**(using reversible terminator nucleotides labeled with fluorescence), by Helicos and Pacific BioSciences;

From the previous platforms of NGS, **Illumina** (mainly due to its cost-effectiveness) and **Ion Torrent** (data throughput/time per run and low overall error rate) assume leading roles (Morozova & Marra, 2008) (Xuan et al., 2013), being next explained in detail.

Illumina

The Illumina technology, based in sequencing-by-synthesis chemistry, uses reversible terminator nucleotides for the four bases, each one labeled with distinct fluorescent dye (Ansorge, 2009).

The DNA sequence of interest ligates do adapters complementary to its both ends and is denatured. The adapters will then hybridize to a solid support of a flow cell, which surface is coated with several adapters and complementary adapters, therefore immobilizing the single strand of target DNA in a “bridge” like structure. These adapters will serve as primers to the following solid-phase bridge amplification process and, when the amplification process is terminated, double stranded molecules are denatured but remain attached to the flow cell surface as single strands of DNA (Mardis, 2008).

Subsequently, the flow cell is flooded with the four fluorescently labeled and 3'-OH blocked nucleotides and DNA polymerase, and one nucleotide is incorporated to the DNA strand, being the process of elongation suspended by the 3'-OH group of the nucleotide (Mardis, 2008).

The extra nucleotides and DNA polymerase are washed away from the flow cell and a scan buffer is added, acquiring the fluorescence emitted by the last incorporated nucleotide. The cell is then flooded with chemicals which remove the termination group and the fluorescence dye from the nucleotide and the synthesis cycle is repeated several times (Ansorge, 2009; Mardis, 2008). The process is illustrated in Fig. 9.6:

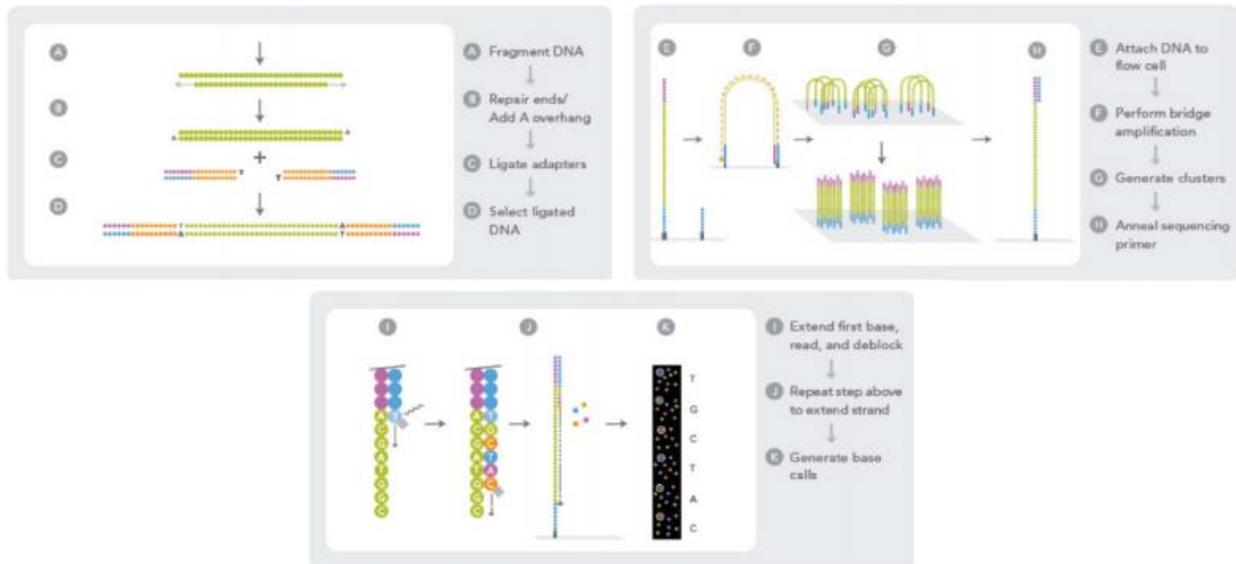


Figure 9.6. Schematic representation of the Illumina sequencing process.

Life Tech Ion Torrent

On the other hand, a methodology with remarkably simple chemistry principle, different from all the previous NGS technologies developed to date, was developed by the Life Tech Ion Torrent. This technology uses a semiconductor chip capable of translating chemical signals into digital information, exemplified in Fig. 9.7.

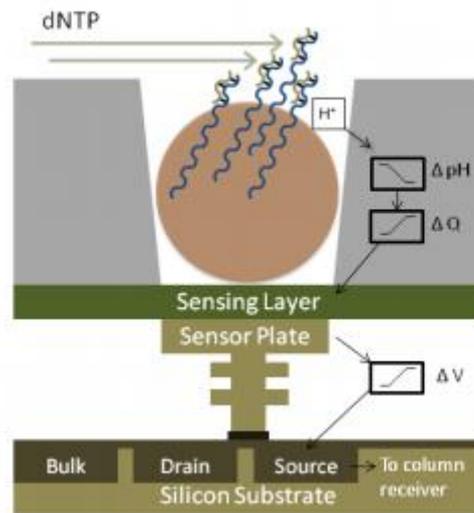


Figure 9.7. Graphic representation of the cross-section of a single well of the Ion Torrent chip, with an Ion Sphere particle containing the amplified DNA sequence of interest (Technologies, 2011) .

When a nucleotide is incorporated by the polymerase during the new DNA molecule synthesis, a proton (H^+ ion) is naturally released, which results in measurable pH change of the local environment. Each micro-well of the Ion Torrent semiconductor sequencing chip contains several copies of a specific fragment of a DNA molecule and is sequentially awash with each nucleotide. If the nucleotide added to the environment is integrated by DNA polymerase, protons are released, triggering a local pH drop proportionally to the number of nucleotides incorporated. This decrease in pH is then detected by the ion sensor and a potential difference is produced (Technologies, 2011).

9.3. Prices paid by methodology defined in Diário da República, 1ª série – nº 20 – 29 de Janeiro de 2014

Código	Designação	Preço (euros)	Pond.
II — BIOLOGIA MOLECULAR: Abordagem Analítica			
As abordagens <u>analítica</u> e <u>nosológica</u> são mutuamente exclusivas: a primeira destina-se às situações não contempladas na segunda.			
34199	Interpretação e elaboração de relatório (para uso nas análises registadas pela abordagem analítica)	9,90	1,9
34201	Extração de DNA de alto peso molecular	19,30	3,7
34202	Extração de DNA	13,40	2,6
34205	Extração de RNA	28,10	5,4
34210	Extração de proteínas	16,60	3,2
34215	Restrição enzimática	10,10	1,9
34220	Amplificação por PCR simples	2,20	0,4
34225	Transcrição reversa e amplificação por PCR (RT PCR)	10,10	1,9
34236	Eletroforese de alta resolução (eletroforese capilar, PAGE, outros), cada aplicação	3,40	0,7
34239	Eletroforese de baixa resolução ou preparatória (agarose, outros), cada aplicação	0,20	0,03
34241	Blot de ácidos nucleicos e hibridação	44,10	8,5
34242	Análise por array de alta resolução	770,10	147,8
34243	Análise por array de baixa resolução	682,40	131,0
34250	Western blot e imunodeteção	38,00	7,3
34255	Sequenciação de DNA, cada reação	6,20	1,2
34260	Amplificação por PCR composta (multiplex, nested, long-range, repeat-primed, outros)	5,70	1,1
34265	Análise densitométrica	9,80	1,9
34270	PTT	65,40	12,6
34276	Amplificação por PCR com deteção em tempo real, quantitativo (cada ensaio em triplicado)	55,90	10,7
34277	Amplificação por PCR com deteção em tempo real, qualitativo (cada ensaio em duplicado)	17,70	3,4
34278	Amplificação por PCR com deteção em tempo real, qualitativo de alta resolução (hrMCA)	3,10	0,6
34279	MLPA, cada reação	22,30	4,3
34280	Genotipagem com sondas FRET (por SNP)	16,20	3,1
34281	Análise por sequenciação em larga escala (~0,5Mb; cobertura >50x)	692,20	132,9

Figure 9.8. Prices paid by methodology defined in Diário da República.

9.4. Life expectancy at birth, according to (The World Bank, 2014)

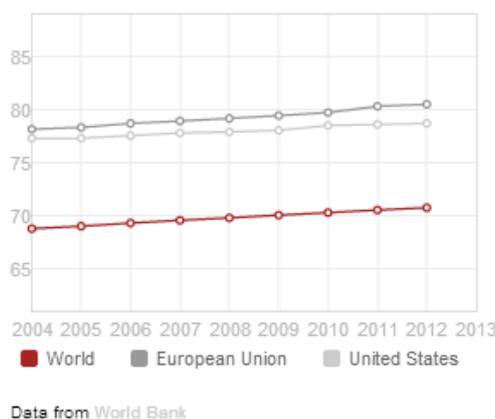


Figure 9.9 Life expectancy at birth.

9.5. Interview Scripts for data collection in GenoMed

Dr^a Teresa Porta Nova (CEO e C. Dep. Oncologia)

- 1.1. Faça uma breve descrição da GenoMed.
- 1.2. Que tipo de estratégia competitiva tem procurado a GenoMed? Diferenciação ou Low-Cost? De nicho ou mais de maior amplitude?
- 1.3. Quais as principais actividades geradoras de rendimento da empresa?
 - 2.1. Quais as principais áreas geográficas onde se localizam os vossos clientes? Os concorrentes actuam em zonas distintas?
 - 2.2. Qual é a percentagem de mercado da GenoMed em Portugal? Que percentagem de vendas representam as vendas internacionais neste momento?
 - 2.3. Considera que o mercado da GenoMed se pode considerar especializado? Existe possibilidade de especialização sem interferência das grandes empresas da indústria?
 - 2.4. Quais são os principais critérios de decisão de compra dos clientes da GenoMed? Poderiam ser considerados homogêneos entre diferentes países ou são relativamente homogêneos?
 - 2.5. Como é feita a pesquisa de mercado em Portugal? Considera que as condições de mercado noutros países podem ser substancialmente diferentes?
- 3.1. Quais as principais características legais, políticas, económicas e sociais a influenciar o mercado/indústria (da GenoMed) ?
- 3.2. São os factores culturais e demográficos importantes no mercado? Porquê?
- 3.3. Quem são os principais clientes da GenoMed? E fornecedores? Que poder negocial considera possirem (1-20)?
- 3.4. Quem são os principais concorrentes da GenoMed em Portugal?
- 3.5. Algum dos principais concorrentes da GenoMed possui actividade internacional?
- 3.4. Existe a possibilidade de entradas de novos concorrentes à GenoMed no mercado? Como classificaria este risco (1-20)?
 - 4.1. Como considera ser a reputação da GenoMed? Considera a imagem e marca um recurso valioso?
 - 4.2. Que vantagens tecnológicas possui a GenoMed relativamente à concorrência?
 - 4.3. Que produtos inovadores possui a GenoMed?
 - 4.4. A GenoMed possui algum conhecimento específico/patente passível de ser licenciado a uma empresa internacional em troca do pagamento de royalties? Se sim, qual poderia ser o valor?
 - 4.9. Que acções têm sido tomadas para publicitar a GenoMed? Como é gerida a imagem da empresa?
 - 4.10. De que forma são estabelecidos os preços dos produtos/serviços na GenoMed?
 - 4.11. Que relações foram estabelecidas para a promoção e venda dos produtos da GenoMed?
 - 4.12. Como é planeada e efectuada a compra de matérias primas e material laboratorial?
 - 4.13. Que acções de pesquisa e desenvolvimento tecnológico e para novos produtos existem em curso actualmente na GenoMed?

- 4.14. Que medidas são tomadas para melhorar os processos dentro da empresa? E para o desenvolvimento dos colaboradores?
- 4.15. Existem processos standardizados para recrutamento? Que formação é dada a novos colaboradores?
- 4.16. Como é feito o planeamento estratégico, controlo financeiro e a gestão de qualidade dentro da GenoMed?
- 4.17. Quais os recursos físicos/tecnológicos mais valiosos da empresa?
- 4.18. Quais os recursos intangíveis mais importantes da empresa? (activos humanos, capital intelectual, reputação/marca, parcerias, cultura da empresa)
- 4.19. Com base nos recursos anteriores, que capacidades desenvolveu a empresa a nível de processos e conhecimento? (ex: proeficiência/expertise num determinado processo ou sistema)
- 4.20. Que mais valias considera terem sido geradas pela colaboração de pessoas com diferentes backgrounds?
- 4.21. Dos recursos e aptidões referidas, quais considera:
- Valiosos do ponto de vista competitivo;
 - Raro (concorrentes não possuem);
 - Difícil de copiar;
 - Possível de ser substituído por produtos mais sofisticados num futuro próximo.
- 6.2. Que objectivos persegue a GenoMed com a internacionalização?
- 6.3. Que critérios considera mais importantes na selecção de um mercado externo? (localização, custos, semelhança cultural/legal,...)
- 6.4. Que mercados considera mais semelhantes ao nacional? Seriam também os mercados mais interessantes para internacionalizar? Porquê?
- 6.5. Em que países possui a GenoMed uma rede de contactos mais forte? Tem sido feito um trabalho de fortalecimento dos mesmos? Poderiam essas relações ser utilizadas para alavancar o processo de internacionalização?
- 6.6. Consideraria a utilização de agentes comerciais como forma inicial de estabelecimento num mercado externo? E a realização de uma parceria com uma empresa local?
- 6.7. Existiriam recursos suficientes para abrir uma subsidiária da GenoMed num país estrangeiro?
- 6.8. Que influência podem ter factores políticos, sociais, culturais ou económicos na internacionalização?
- 6.9. Quais as principais dificuldades que espera encontrar durante o processo de internacionalização?
- 6.10. Que acções têm sido tomadas pela GenoMed de forma a aumentar a “awareness” internacional para o seu produto?
- 6.11. Tenho conhecimento de uma experiência internacional com agentes que não correu bem. Em que mercados se focou esta acção? O que correu mal?
- 6.12. Que conhecimento sobre internacionalização adquiriu a GenoMed? Poderiam contactos desta experiência ser utilizados no processo de internacionalização da GenoMed?

6.13. Dentro das relações mantidas pela GenoMed com os seus parceiros, clientes e fornecedores, existiria possibilidade de as utilizar para facilitar o processo de internacionalização?

6.14. Que custo médio costuma estar associados ao transporte de amostras de um país estrangeiro? A qualidade é assegurada pela transportadora?

Dr Gabriel Miltényil (C. Dep. Doenças Genéticas e Farmacogenéticas e Resp. Unidade Testes Clínicos)

1.1. Faça uma breve descrição da GenoMed?

1.4. A investigação científica tem um papel revelante na empresa? Que resultados foram alcançados?

1.5. Considera a GenoMed uma empresa competitiva? Pensa existirem as condições necessárias para ser competitiva no plano internacional?

2.3. Considera que o mercado da GenoMed se pode considerar especializado? Existe possibilidade de especialização sem interferência das grandes empresas da indústria?

2.4. Quais são os principais critérios de decisão de compra dos clientes da GenoMed? Poderiam ser considerados homogéneos entre diferentes países ou são relativamente homogéneos?

2.5. Como é feita a pesquisa de mercado em Portugal? Considera que as condições de mercado noutros países podem ser substancialmente diferentes?

3.1. Quais as principais características legais, políticas, económicas e sociais a influenciar o mercado/indústria (da GenoMed) ?

3.2. São os factores culturais e demográficos importantes no mercado? Porquê?

3.4. Existe a possibilidade de entradas de novos concorrentes à GenoMed no mercado? Como classificaria este risco (1-20)?

3.5. Considera existirem no mercado produtos que possam substituir as funcionalidades da GenoMed? Como avaliaria esse risco (1-20) ?

3.6. Quais os principais factores de mudança na indústria? Descreva de forma breve como têm evoluído no passado recente.

3.7. Descreva de forma breve que oportunidades para crescimento oferece a indústria. (taxa de crescimento, dimensão do mercado)

4.1. Como considera ser a reputação da GenoMed? Considera a Imagem e marca um recurso valioso? (Poderiam ser utilizados como vantagem competitiva nos mercados externos?)

4.2. Que vantagens tecnológicas possui a GenoMed relativamente à concorrência? (Poderiam ser utilizados como vantagem competitiva nos mercados externos?)

4.3. Que produtos inovadores possui a GenoMed?

4.5. Como é feita a recolha, gestão e armazenamento das matérias primas (amostras e reagentes)? Como é assegurada a sua qualidade?

4.6. Descreva, de forma breve, onde é feita a conversão das matérias-primas em produtos. Como é assegurada a qualidade dos mesmos e que testes são efectuados?

- 4.7. Como é feito o armazenamento dos produtos finais e mantida a sua qualidade?
- 4.8. Como é feita a distribuição dos resultados? Que acompanhamento é feito posteriormente?
- 4.13. Que acções de pesquisa e desenvolvimento tecnológico e para novos produtos existem em curso actualmente na GenoMed?
- 4.17. Quais os recursos físicos/tecnológicos mais valiosos da empresa?
- 4.18. Quais os recursos intangíveis mais importantes da empresa? (activos humanos, capital intelectual, reputação/marca, parcerias, cultura da empresa)
- 4.19. Com base nos recursos anteriores, que capacidades desenvolveu a empresa a nível de processos e conhecimento? (ex: proeficiência/expertise num determinado processo ou sistema)
- 4.20. Que mais valias considera terem sido geradas pela colaboração de pessoas com diferentes backgrounds?
- 4.21. Dos recursos e aptidões referidas, quais considera:
- Valiosos do ponto de vista competitivo;
 - Raro (concorrentes não possuem);
 - Difícil de copiar;
 - Possível de ser substituído por produtos mais sofisticados num futuro próximo.
- 5.1. Quais considera serem os factores mais importantes para diferenciar uma empresa desta indústria?
- 5.2. Quais considera serem os recursos/aptidões mais importantes?
- 5.3. Como classificaria (1-20) a GenoMed nos KSF que enunciou? E os seus principais rivais?
- 6.1. Que factores considera críticos para a internacionalização de uma empresa desta área?
- 6.3. Que critérios considera mais importantes na selecção de um mercado externo? (localização, custos, semelhança cultural/legal,...)
- 6.4. Que mercados considera mais semelhantes ao nacional? Seriam também os mercados mais interessantes para internacionalizar? Porquê?
- 6.5. Em que países possui a GenoMed uma rede de contactos mais forte? Tem sido feito um trabalho de fortalecimento dos mesmos? Poderiam essas relações ser utilizadas para alavancar o processo de internacionalização?
- 6.8. Que influência podem ter factores políticos, sociais, culturais ou económicos na internacionalização?
- 6.9. Quais as principais dificuldades que espera encontrar durante o processo de internacionalização?
- 6.10. Que acções têm sido tomadas pela GenoMed de forma a aumentar a “awareness” internacional para o seu produto?

Dr^a Ana Coutinho (Resp. Unidade Testes Não-Clínicos - Dep. DGF)

- 1.1. Faça uma breve descrição da GenoMed?
- 1.4. A investigação científica tem um papel revelante na empresa? Que resultados foram alcançados?

1.5. Considera a GenoMed uma empresa competitiva? Pensa existirem as condições necessárias para ser competitiva no plano internacional?

2.3. Considera que o mercado da GenoMed se pode considerar especializado? Existe possibilidade de especialização sem interferência das grandes empresas da indústria?

2.4. Quais são os principais critérios de decisão de compra dos clientes da GenoMed? Poderiam ser considerados homogêneos entre diferentes países ou são relativamente homogêneos?

2.5. Considera que as condições de mercado noutros países podem ser substancialmente diferentes?

3.1. Quais as principais características legais, políticas, económicas e sociais a influenciar o mercado/indústria (da GenoMed) ?

3.2. São os factores culturais e demográficos importantes no mercado? Porquê?

3.4. Existe a possibilidade de entradas de novos concorrentes à GenoMed no mercado? Como classificaria este risco (1-20)?

3.5. Considera existirem no mercado produtos que possam substituir as funcionalidades da GenoMed? Como avaliaria esse risco (1-20) ?

3.6. Quais os principais factores de mudança na indústria? Descreva de forma breve como têm evoluído no passado recente.

3.7. Descreva de forma breve que oportunidades para crescimento oferece a indústria. (taxa de crescimento, dimensão do mercado)

4.1. Como considera ser a reputação da GenoMed? Considera a Imagem e marca um recurso valioso?

4.2. Que vantagens tecnológicas possui a GenoMed relativamente à concorrência?

4.3. Que produtos inovadores possui a GenoMed?

4.5. Como é feita a recolha, gestão e armazenamento das matérias primas (amostras e reagentes)? Como é assegurada a sua qualidade e que testes são efectuados?

4.6. Descreva, de forma breve, onde é feita a conversão das matérias-primas em produtos. Como é assegurada a qualidade dos mesmos?

4.7. Como é feito o armazenamento dos produtos finais e mantida a sua qualidade?

4.8. Como é feita a distribuição dos resultados? Que acompanhamento é feito posteriormente?

4.13. Que acções de pesquisa e desenvolvimento tecnológico e para novos produtos existem em curso actualmente na GenoMed?

4.17. Quais os recursos físicos/tecnológicos mais valiosos da empresa?

4.18. Quais os recursos intangíveis mais importantes da empresa? (activos humanos, capital intelectual, reputação/marca, parcerias, cultura da empresa)

4.19. Com base nos recursos anteriores, que capacidades desenvolveu a empresa a nível de processos e conhecimento? (ex: proeficiência/expertise num determinado processo ou sistema)

4.20. Que mais valias considera terem sido geradas pela colaboração de pessoas com diferentes backgrounds?

4.21. Dos recursos e aptidões referidas, quais considera:

- a. Valiosos do ponto de vista competitivo;
- b. Raro (concorrentes não possuem);
- c. Difícil de copiar;
- d. Possível de ser substituído por produtos mais sofisticados num futuro próximo.

- 5.1. Quais considera serem os factores mais importantes para diferenciar uma empresa desta indústria?
- 5.2. Quais considera serem os recursos/aptidões mais importantes?
- 5.3. Como classificaria (1-20) a GenoMed nos KSF que enunciou? E os seus principais rivais?

- 6.1. Que factores considera críticos para a internacionalização de uma empresa desta área?
- 6.3. Que critérios considera mais importantes na selecção de um mercado externo? (localização, custos, semelhança cultural/legal,...)
- 6.4. Que mercados considera mais semelhantes ao nacional? Seriam também os mercados mais interessantes para internacionalizar? Porquê?

Drª Sónia Matos (Resp. Unidade Citogenética – Dep. Oncologia)

- 1.1. Faça uma breve descrição da GenoMed?
- 1.4. A investigação científica tem um papel revelante na empresa? Que resultados foram alcançados?
- 1.5. Considera a GenoMed uma empresa competitiva? Pensa existirem as condições necessárias para ser competitiva no plano internacional?

- 2.3. Considera que o mercado da GenoMed se pode considerar especializado? Existe possibilidade de especialização sem interferência das grandes empresas da indústria?
- 2.4. Quais são os principais critérios de decisão de compra dos clientes da GenoMed? Poderiam ser considerados homogéneos entre diferentes países ou são relativamente homogéneos?
- 2.5. Considera que as condições de mercado noutros países podem ser substancialmente diferentes?

- 3.1. Quais as principais características legais, políticas, económicas e sociais a influenciar o mercado/indústria (da GenoMed) ?
- 3.2. São os factores culturais e demográficos importantes no mercado? Porquê?
- 3.4. Existe a possibilidade de entradas de novos concorrentes à GenoMed no mercado? Como classificaria este risco (1-20)?
- 3.5. Considera existirem no mercado produtos que possam substituir as funcionalidades da GenoMed? Como avaliaria esse risco (1-20) ?
- 3.6. Quais os principais factores de mudança na indústria? Descreva de forma breve como têm evoluído no passado recente.
- 3.7. Descreva de forma breve que oportunidades para crescimento oferece a indústria. (taxa de crescimento, dimensão do mercado)

- 4.1. Como considera ser a reputação da GenoMed? Considera a Imagem e marca um recurso valioso?

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