“Remembering correctly”

A market opportunity analysis for a new forensic technology

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Abstract

Eyewitness misidentification is the main cause of wrongful convictions, and is mainly due to false memories and lacking police procedures. False memories can be said to have occurred when people believe they have seen or experienced an event that did not occur or, at least, not in the way they remembered. This is a common problem in witnessing crime. A group of researchers at Lund University developed a software implemented algorithm capable to detecting false memories. This algorithm is intended to be used as the core of a new product, a forensic technology, which the police can use to minimize eyewitness misidentification.

The thesis first describes a generic theoretical framework to analyze a market opportunity for new product concepts. When applying this framework to this particular forensic technology, PEST analysis shows low influence of external factors, although uncertainty is fairly high. Porter’s five force analysis suggests that the industry is less attractive due to high buyer's power, a large number of competitors and high rivalry. Finally, SWOT analysis shows an equilibrated number of positive and negative elements in both internal and external features. Therefore, in order to successfully enter the identified market, some issues must be addressed, such as the need of a viable prototyping process and an understanding of the ethical and public aspects of the technology. Two different strategies are proposed for market entry. The first one is a lead-user approach that seeks early consumer involvement of the, and the second is a cooperation/licensing strategy with integration of the technology into a pre-existing industry solution.
Preface

This thesis is the result of an intense and challenging work process, the last months of which was conducted in Lund. Throughout the writing of the thesis, I have learnt much. Especially I have complemented my academic profile as engineer with knowledge in innovation, management and entrepreneurship. Additionally, the opportunity of researching and writing the master thesis in another country has allowed me to experience another educational system, learn a new culture and see things from new points of view.

This thesis would have been impossible to accomplish without the support of many people. First of all, I would like to thank to the supervisor, Tomas Hellström, for his advise and comments during the working process of the thesis. Furthermore, this thesis would not have been possible without the cooperation of the CIRCLE institute and LU Innovation at Lund University, especially Sven Olsson. Thanks also go to Sverker Sikström and Farhan Sarwar, the inventors of the technology, for their patience answering my many questions.

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1. INTRODUCTION

This chapter introduces the reader to the purpose of this thesis. The aim is to assess the potential of a particular invention developed at Lund University before launching the product into the market. Therefore, the chapter defines the concept of innovation and the inherent process to move from an invention to a marketable product. It contains a brief description of the case study that will be later analyzed, the general purpose of the thesis and delimitations.

1.1 BACKGROUND

Innovation is a very complex and broad concept that has become very popular in recent years. Many authors have written about innovation, creating extensive literature in this field. Indeed, the importance of innovation in today’s highly competitive world is undisputed. However, the main goal of this thesis, which will be described in detail later, is not to review the innovation process. Therefore, only a brief description will be presented as follows.

Innovation is usually defined as the creation of a new product in the market, or as the commercialization of a product in a new way, open to new customers and uses. As innovation is present in many different fields, this general definition can be adapted to each profession. For example, innovation could be the substitution of a cheaper material in an existing product, or a better way of marketing, distributing or supporting a product or service (Webber, 2000). The OECD (2005), for example, describes in the Oslo Manual four types of innovation: product, process, organization and commercialization innovation.

Any of these four types of innovation may arise from two different sources. On the one side, innovation can be driven to fulfill a particular need, being a process guided by demand. The need can be detected by either the company or explicitly requested by the customer, usually due to demographic, economic or cultural changes. On the other side, innovation may arise from a new potential technology, being guided by supply. In this case, the invention needs to look for what uses it can serve and which is the best target group, two steps already completed in the demand-based innovation (Tidd et al., 2001).

So innovation is more than invention. Whilst innovation is a process that requires time to assess the market and consider commercialization, distribution, funding and many other factors, inventing is only one part, the first part, of the innovation process. Porter (1999) observed that innovation is a new way of doing things that are commercialized.

Additionally, to be successful, the innovation must align with both the competences of the firm and the product market opportunities. According to Jones (1992 cited in Westland, 2008, p.37), "innovations will not come about by R&D staff inventing whatever they fancy, then throwing it over the fence to production to make, and marketing to sell." Therefore, an invention needs to be assessed according to the market features and the firm capabilities. After this analysis, one will be able to decide whether to start the next process, the commercialization design, and develop a strategic plan to launch the product into the market.
1.2 PROBLEMATIC DISCUSSION

The connection between invention and innovation is a big challenge that firms need to address. When the invention has been finished, an extensive study should be conducted before launching the product into the market. This thesis attempts to assess a real invention developed by a group of researchers at Lund University.

The invention that will be analyzed corresponds to demand-based innovation. The group of researchers developed an algorithm, implemented in software and based on a psychological theory with the aim to detect false memories made by witnesses in criminal cases. The main processes behind the research such as the methods used to obtain data for the algorithm, the design of the invention and the check operations, were conducted to fulfill a particular need. The aim was to develop a software able to detect false memories in eyewitness statements. Therefore, both the consumer and the uses of the product have already been defined by the research group. What has not been totally defined is the commercialization and product form, which can be modified according to the market characteristics and consumer's features.

The difficulty, hence, is how to move from this invention to a marketable product. As pointed out before, the first required step is to analyze the market in order to predict the success of the product. If entering the market place, the next step implies defining the best way to commercialize the invention. But this process is not easy, as it depends on a variety of elements. The consumer's behaviour, which is one of the most difficult factors to forecast; the competitors, which implies a thorough analysis of competition; the industry rivalry; the market characteristics; and other external factors that may influence the success of a new product. Moreover, there is no single methodology widely cited in the literature that can be used globally. Most authors define this process in different ways, emphasizing different aspects.

1.3 DELIMITATIONS

Assessing the potential of an invention for becoming a marketable product is a very large process. Not only a product form is needed to launch a new product, it is further necessary to evaluate the industry and the market, assess consumer and competitor behaviour, define an economic plan, conduct a patent study, and even evaluate new markets and different uses. Therefore, I had to limit with a specific area of research. The first necessary step to move from an invention to a marketable product is a market opportunity analysis. Thus, the thesis is focused in this. Other important areas such as business models, entrance strategies and assessing capabilities have already been included in the opportunity analysis conducted in this thesis.

1.4 PURPOSE

The aim of this thesis is to assess the market potential of a forensic technology developed at Lund University in order to support decisions about launching a product into the market based on such technology, by applying methods such as Porter’s five forces, SWOT analysis and PEST.
The invention consists of a new well-defined algorithm developed in a software, plus a commercialization proposal. Therefore, the thesis focuses first in analyzing elements that may influence a market. With this analysis I expect to obtain useful information about whether it is appropriate to enter the market and which would be the best commercialization form to do so. If the decision is to enter, the results of such an extensive analysis enable one to define the best business model for launching the new product and which strategies should be taken.

1.5 Outline of the Thesis

Chapter 1 introduces the reader to the purpose and context of this thesis. It contains an introduction to the thesis, explaining the goal and objectives of the project, a justification of the structure, a delimitation of the study, and what I expect to obtain with this thesis.

Chapter 2 explains the methodology used to elaborate the thesis. It describes how the information has been gathered, which approach was been taken, what type of information has been used in the study and how critical I have been with this information.

Chapter 3 represents the theoretical framework and is where all the theory chosen for the thesis is contained. It describes how to define the market, how to scan the environment, three well-known analysis tools and how to create a competitive strategy. These theories will later be used as the basis for the analysis.

Chapter 4 refers to the analysis. Here is where the generic theory described in the previous chapter is applied to a particular case. The invention is evaluated according to the theory. The chapter defines the problem in detail, identifies the market including competitors, studies the consumer's behaviour and analyzes all the elements that may shape the market, i.e. internal, micro and macro external environment factors.

Chapter 5 contains the reflections and conclusions drawn from the analysis. According to the theoretical framework and the analysis of the case, one can make conclusions as to the appropriateness of entering the market and propose a guideline of how to do so.
2. GENERAL APPROACH AND METHODOLOGY

The goal of this chapter is to clarify how the data and analysis of this thesis have been elaborated. That is, describe the methodology of gathering information, the source of the data, and the procedure and criteria to select useful information according to the goal of the thesis.

The aim of the thesis, as described in the first chapter, is to assess the potential of a particular invention to support decisions about entering into the marketplace. Therefore, the thesis contains an inherent duality of elements that need to be examined. On one hand, a theoretical framework based on general theories found in a literature review is required. On the other hand, information regarding to a particular invention has been gathered through interviews.

As a result, the thesis contains different types of information and covers various subjects as technology, business and psychological science to understand the problematic that the technology wants to solve. Therefore, different approaches and methods have been used to gather and evaluate each type of data collected.

2.1 RESEARCH DESIGN

In the initial stage of the thesis, general research about the process of launching a new product into a market was conducted through books on economics, business administration, marketing and innovation. This preliminary investigation resulted in an overview of the process, and a start in defining which structure the thesis should follow in order to present a clear and understandable analysis for the reader which is also useful and sufficiently detailed.

After this preliminary investigation, I had enough background information to decide which methodology could be used in conducting the research. There are mainly two different research approaches: deductive and inductive.

Deductive theory represents the most common view of the relationship between theory and research. This approach illustrates how researchers study theories and thereafter apply them in reality. Inductive theory works in the opposite way, moving from particular observations to broader generalizations. The idea is to detect patterns and formulate hypotheses to finally develop some general conclusions or theories from a specific case.

The main approach used in this thesis is deductive. However, most research, including this thesis, involves both inductive and deductive reasoning processes somehow. Indeed, the two approaches can be easily combined into one that cycles from theories to observations and again to theories. This approach is known as abductive methodology.
2.2 GATHERING INFORMATION

After collecting some general information about the field, an in-depth study of literature about specific methods, including strengths and weaknesses, was conducted. This information is elaborated in the third chapter of this thesis where the theoretical framework is described. This theory was later applied in the fourth chapter as the main tool for the analysis of the invention.

Notice here the difference in nature of the information required for the theoretical framework, and for the description of the technology. For this reason, the different ways of gathering the information used have been described separately.

2.2.1 Theoretical data collection

Theoretical data collection refers to the information needed to develop the theoretical framework. This information was gathered, as a first stage, from text books regarding management innovation, marketing analysis and strategic planning. According to the characteristics of the invention, I had enough background information to begin delimiting the goals of the thesis and its structure. With this structure, the next step was to consider which theories and methods could be used in the thesis.

The preliminary sources of data were books, to obtain a general idea of the theory used in similar situations. Afterwards, articles from business and economic journals were consulted from a critical point of view. Each article was analyzed in terms of strengths and weaknesses to assess the utility and validity of each theory according to the invention's characteristics.

2.2.2 Case study data collection

A case study is a method based on a comprehensive understanding of a particular situation through a description and analysis of the case. The most common forms of a case study either concern a certain organization, a certain location, special person or a specific occurrence. A case study usually focuses on the surrounding environment or the current incident in question.

Accordingly, the case study data refers to the information needed to understand the invention and the problematic to be addressed. This information has been gathered in two different ways: through written documents elaborated by the researchers used to patent the invention, and also through personal interviews of the researchers, to have direct information in understanding the researcher's point of view.

Once the idea of the invention, its basis and the desired need to be fulfilled had been understood, the next step was to define the market. This requires three main definitions: the product, the competitors and the consumer. The first element has already been well-defined by the researchers. The competitors were not yet identified. Consumer were only identified as police officers. Therefore, an in-depth analysis of the last two elements was carried out before starting to analyze the market.

To identify competition and its behaviour, a qualitative approach was used. To define the consumer, both qualitative and quantitative approaches were employed. The qualitative approach
defined the structure of the Swedish Police system and identified the consumer and the customer. The quantitative approach aided the collection of statistics in order to both better understand the current economic situation of the customer and predict future behaviour.

2.2.3 Selection of data

Thanks to the Internet, a huge amount of information can be easily consulted. From government documents and reports to online journals, statistics, books and many other types of information. Despite the many advantages of these resources, one has to be careful of several different aspects:

• First the veracity and credibility of the information found. As many of this information is not controlled, it is very important to evaluate the information according to trusted sites as journals, academic sources and text books.

• Another negative point of the Internet is that sometimes there can be too much information. Thus, one can easily forget what information was looking for. It is important to focus on the aim of the project and have a clear idea of the chapter's structure in order to seek the specific information required and know when this information exceeds the scope of the work.

• Finally, even if the information is reliable, one always has to be critical. It is important to seek different points of view for theories, always analyzing their strengths and weaknesses. From such an analysis, an assessment of the utility of these theories according to the aim of the project and our personal opinion can be made.

2.3 Conclusions

Three different methodologies have been used in the elaboration of this thesis due to the various types of information required to do so.

• A deductive approach to seek general information about theories and methods commonly used when launching a new project. This approach is always critical, assessing strengths and weaknesses and, thus, utility.

• Empirical data collected from interviews of the researchers to understand the invention, its utility and the problematic to be solved.

• A case study where the theoretical framework provided the guideline for assessing the potentials of the invention.
3. THEORETICAL FRAMEWORK

The launch of a new product into the marketplace is an important process that requires planning in order to avoid unnecessary risks. This process has been widely reviewed in academic literature (e.g., Beard and Easingwood, 1996; Thölke et al., 2001; Chandy et al., 2006), where most of the authors enumerate the following steps in moving from an invention to a marketable product: (1) identify applications of the invention, (2) identify the customers, (3) determine the market, (4) scan and analyze the environment to finally (5) define strategies.

According to the case study presented in this project, several of the above steps have already been completed. The forensic technology emerged from a guided process to find a product that solves a particular unfulfilled need, as will be explained in detail in the chapter four, thus the consumer and applications of the technology are defined by the researchers. Therefore, this chapter will focus on the following issues: First, definition of the market, including the competitors, and a discussion on which method will be applied in the case study. Second, the importance of scanning the environment to analyze and understand the market. Third, examine the techniques that will be used to analyze the environment. And lastly, understand how to develop a successful strategy from the result of the analysis. The focus here will be on a selection of central approaches, i.e. Porter's five forces, SWOT analysis and PEST.

3.1 IDENTIFYING THE MARKET

3.1.1 Introduction

Before any analysis or marketing decision can be made, a clear conceptual definition of the product category and of the market is required. Market is defined as an organized exchange of commodities (goods, services or resources) between buyers and sellers within a specific geographical area and during a given period of time. Markets are the exchange between buyers (or consumers) who want a commodity, and sellers (or the industry) who posses it. Consequently, an industry is a set of companies that compete with one another, including suppliers as well as current and future competitors. The relationship between industry and the consumer is shaped by micro and macro external environmental factors, as will be explained in the following section.

Identifying the correct market when launching a new product is a very awkward process. The history of technological innovation is replete with examples of firms which have introduced their innovations to inappropriate markets initially, and met success only after a shift in the focused market (Reddy, 2007). The common process is to first link the technical principle represented by a breakthrough to a range of customer functions. Second, the needs of the customer must be connected with the physical features of the product. However, in the case study the application of the technology and the target group is already defined by the researchers. The process, therefore, needs to focus on defining the industry, mainly the competitors. Thus, the issue moves from identifying the market to identifying the competition.
3.1.2 Competitor identification

Competitor identification is a major component of any approach which seeks to formulate marketing strategy and hence, it is an essential task prior to scanning the environment, an issue reviewed in the section 2.2 of this work. According to Clark and Montgomery (1999), competitor identification is an important area of study because it is both a necessary precursor to competition analysis and allows to determine the market structure and its boundaries. Indeed, an ambiguous definition of the competition creates uncertainty in the market definition and therefore ambiguity in the environment.

Competitors can be defined using a set of many different criteria. Costumer-based competition can exist in terms of budgets, utility, need fulfilled, and use of the product, for example. There is also competition in terms of marketing activities, product features, distribution or resource-oriented. In other words, competition exists across several dimensions (Lehmann and Winer, 2005). As a result, many approaches have been developed in order to address the task of competitor identification. The main approaches will be discussed as follows.

3.1.3 Methods

The industry method identifies competition when companies produce same or similar products or provide the same or similar services. The strategic groups method establishes competition when companies have similar strategies, resources and customers, even if the product and the need fulfilled is very different. Finally, in the market method the competition is defined as those companies that fulfill the same customer needs. This is the most widely accepted method in both academic and business community, a customer-based model where competition is defined by the products competing for the same customer.

Not all authors agree with this approach. Abell (1980), for instance, believes that competition is better defined as a decision made by a marketing manager. However, in reality, competitors do not care how a company defines competition. Competitors are free to compete against any firm, even if the organization has not recognized the other firm as a competitor.

Despite this critique, the customer-based approach will be used in the case study, as it is the best option in identifying competition according to the customers' viewpoint. But how exactly can an organization define its competitors? Lehmann and Winer (2005) developed a framework based on the following levels of competitors, where each level can be analyzed using a specific customer approach criteria.

- The narrowest perspective of competition is called product form, where products pursue the same market segment and features, i.e. those products that look the same.
- The second level is based on products with similar features but not the same target group. In fact, this is the traditional way of defining competition known as product category.
- The third level, called generic competition, focuses on substitutable product categories that fulfill the same customer need. This need-based approach is essential to avoid overlooking threats and opportunities, as Levitt argues in his article Marketing Myopia (1960).
- The last level of competition, budget competition, includes a product that can replace any other product, even if the fulfilled need is different.
Other techniques, however, seek for an external definition of the market. For example, the Standard Industrial Classification (SIC) code defines competition based on physical product similarities, but consequently overlooks both generic and budget competitors. Other more elaborated methods exist but these are also more complicated to understand. Levinsohn and Feenstra (1990) developed a highly mathematical-based technique that identifies competition when products are multi-dimensionally differentiated. This technique has been amended and extended by Waelbroeck in 1995. Other authors have developed methods based on correlate data from a complete system demand model (Rothschild et al., 1991) or non-linear optimization's models that determine complementary products (Lattin and McAllister, 1985).

The majority of these methods define too many competitors. This complicates the analysis rather than simplify decision making. The goal of the competitor identification process is not to list many competitors but rather to define the relevant ones in order to have a balanced view of the competition. This is precisely what I expect to obtain by using the levels model. The aim is to classify competition according to a consumer-based model and in each level of competition define the competitors by different criteria.

3.2 Scanning the Environment

3.2.1 Definition

When the market is clearly defined, including consumers, the product, competitors and the environment, the next step is to analyze the market through a scan. Environmental scanning is the process of gathering and analyzing information from an organization's external environment. One of the first authors to notice the importance of this process in strategic planning was Aguilar (1967). He describes the environmental scanning as the acquisition and use of information about events, trends and relationships in an organization’s environment to assist management in planning the organization’s future course of action. The aim is not only to scan but also to identify, interpret and understand both current and potential changes taking place in the external environment (Sutton, 1988).

Literature usually defines external environment as those elements contained in the macro-environment, i.e., external and uncontrollable factors that influence an organization's decision making, its performance and strategies (e.g., Hambrick, 1982; Beal, 2000). These factors are usually analyzed by PEST technique that assesses political, economical, social and technological factors among others. However, an organization can also be influenced by factors not included in the macro-environment. These are called micro-environmental factors and are those elements close to an organization that have a direct impact on it. These elements are the current and future competitors, the suppliers and consumers, often analyzed using Porter's five forces technique. The external environment shall herein refer to both micro and macro environmental factors.

3.2.2 Literature review

The importance of environmental scanning has been emphasized by several economists in recent years. A number of articles have been written about this field, yet not all the authors have given
enough attention to this process, specially in the management books\(^1\). Nevertheless, Kourteli (2000) does state that scanning is of vital importance to the viability of organizations, although there are still a few managers trapped by the faulty assumption that the external environment does not matter so much, since it cannot be controlled. What these managers fail to realize is that without the information from scanning, an organization cannot respond effectively to changes in the environment.

The scanning process is characterized by its versatility, in the sense that the information obtained can be used for many purposes. The three main ones are described as follows:

- As a first step for new company to analyze the market, its attractiveness and to support decisions about entering in the marketplace.
- To modify existing strategies according to the environment. This can be realized occasionally, when an organization seeks to make a big change, or periodically to revise its strategies according to market trends.
- When an organization is collecting data systematically, to continuously anticipate competitor’s move and forecast new markets before a competitor does.

**3.2.3 Appropriate use of scanning**

It may seem that continuous scanning is the best option for any organization because is always receiving external information to anticipate competitor’s moves. In our opinion this is not true, as the way of scanning depends on the characteristics of the environment, the organization’s features, as well as the firm’s strategy and its objectives. Kourteli (2000) argues that the scanning process should be examined on the basis of contingency theory, which nucleus is the relationship between an organization and its environment. Kourteli notes that there is no one best way to direct an organization, because all depends on the characteristics of the specific environment. Many authors have endorsed this assertion by analyzing different parameters that may determine the way of scanning. Since not only the environment shapes the internal structure of an organization, but also the way to scan must agree with the organization’s features.

Duncan (1972) and Dess and Beard (1984) state that the macro-environment can be classified as stable, unstable or dynamic and, in each scenario, the scanning process must emphasize different factors. By contrast, a survey conducted by Daft et al. (1988) of 50 CEOs concluded that customers and competitors generate greater strategic uncertainty than technological, regulatory and sociocultural factors. In other words, micro elements were more uncertain than macro elements. Other authors suggest sector complexity as a crucial factor to consider when scanning (Beal, 2000). Trumbach and Elofson (2007) define a framework for environmental scanning and analysis based on degrees of organizational flexibility and environmental turbulence, considering both internal and external elements of the environment.

Finally, Jennings and Lummpkin (1992) analyzed the insights between environmental scanning activities and Porter’s generic strategies to find that organizations with different strategies apply different scanning approaches, that is, they emphasize different factors. More specifically, differentiation strategy places importance on evaluating opportunities and customer attitudes, while cost leadership strategy tends to evaluate threats from competitors and regulators.

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\(^1\) Research by Burt et al. (2006) found the average of content given to environmental analysis to be 1.75%.
The aim of this project, however, is to analyze the environment in order to support decisions about entering the market when launching a new product. So, in addition to external information, an internal analysis method is required to complete the process. A SWOT analysis seems to be the adequate tool.

### 3.2.4 Internal, micro and macro environmental factors

The text considers scanning as the process to analyze internal, micro and macro environmental factors. For this analysis, I propose three methods that seem appropriate for the three types of information required: SWOT analysis for internal scanning, Porter's five forces for micro environmental scanning, and PEST analysis for macro environmental scanning. The next chapter will focus on describing these three methods and provide a discussion about each method's suitability according to the characteristics of the product and the environment.

Finally, there are two important considerations to clarify in order to achieve the desired results. First and foremost, adequate information must be sought, both qualitatively and quantitatively, because too often information is driven by what is available rather than by what is needed (Trumbach and Elofson, 2007; Davenport and Beck, 2002). Secondly, as has been previously noted, the information sought must be linked with the strategic needs of the organization. That is, an organization should adopt a scanning method according to the organization's features. With the appropriate tools and a correct procedure, I expect to have enough information about any element that can influence the launching process of the product. This information will support decisions concerning whether to enter into the market or not.

### 3.3 Analyzing the environment

This section describes and analyzes three well-known methods commonly used in macro, micro and internal environmental scanning by reviewing literature about the techniques, assessing their strengths and weaknesses, explaining alternative methods and concluding about the suitability of each method according to the case study, including the product's features and the market's characteristics.

#### 3.3.1 PEST Analysis

##### 3.3.1.1 Introduction

PEST analysis, which stands for Political, Economic, Socio-cultural and Technological factors, is a common tool in environmental scanning process used to guide strategic decisions through the results of the market analysis, since the external context of strategic decisions is very broad. In other words, PEST is used by managers to analyze a company exposure to a set of potential macro external factors that shape the market. These factors may include governments, the economy and social changes (Thomas, 2007).

PEST analysis is usually applied before a SWOT analysis, since PEST examines external factors in the market that can be included as opportunities and threats in a SWOT analysis. However, SWOT and
PEST have certainly two different perspectives. While SWOT assess a business unit or a product, PEST is used as a market analysis tool to understand the dynamics of a market, its growth and its attractiveness (McGee et al., 2005). The idea is that an organization will be able to assess its current environment and forecast potential changes to be better placed than its competitors in responding to those changes.

While the origins of PEST are completely uncertain, the earliest reference found in literature was made by Aguilar (1967) in the book *Scanning the business environment*. Aguilar introduces the four elements as a technique to scan an organization's environment. Over time, many authors have made changes to the model through the introduction of new elements or deletion of obsolete ones (Fahey and Narayanan, 1986). Currently, the most extended version, yet not necessarily the most complete one, is STEEPLED which presents additional issues of current concern: Sociological, Technological, Environmental, Economic, Political, Legal, Educational and Demographic variables.

### 3.3.1.2 PEST model

PEST methodology can be seen as a list of external factors that may affect, more or less, the market. According to the characteristics of each market, it is necessary to assess which factors are more relevant to choose which version of PEST is better. The main factors are described as follows.

Economic conditions at any level, be it local, national or international, affect consumer behaviour, demand, and thus the organization. Unemployment, the cost of living, economic growth or decline, interest rates, taxes and inflation are some of many examples of such conditions. These are usually influenced by political decisions, government policies and legal changes. It is important to forecast the effects of any political change that may occur, including laws, reforms, environmental regulations or new restrictions.

In another way, socio-cultural factors also determine demand. They vary significantly from each country and include a wide range of factors that may modify consumer behaviour including cultural norms, language characteristics, behaviour against imported products, environmental factors as ecological consciousness or the majority religion. These are also related to educational and ethical factors, as the educational level can affect consumer preferences. Additionally, demographic characteristics can directly affect demand as every age group has different needs.

Lastly, technology can reduce entry market barriers promoting new business, changing the structural foundations of the market. As the technology is quickly evolving, is necessary to forecast how this evolution will impact an organization.

### 3.3.1.3 Strengths and weaknesses

PEST is frequently used mainly due to its versatility. The tool provides highly helpful information about the external environment that can be used for many purposes. For product development, the analysis provides a view of the external world, so one knows where and when to enter or leave a market. When looking to make a strategy change, the analysis can be seen as an audit. For business or marketing planning, the management team receives useful background about the market and target groups. For research projects and reports, PEST is used as a framework to predict what may happen in the future and therefore enable an organization to anticipate future business threats. The organization can then take actions to avoid or minimize the impact of such threats while also exploiting opportunities.
Additionally, it is easy to combine and complement this technique with other types of analysis such as a SWOT analysis or Porter’s five forces method. Indeed, PEST is rarely applied alone, as the information provided is more useful while complementing another analysis. Combined with SWOT, for example, PEST helps to understand the risk associated with launching a particular product into a market (Schildhouse, 2006).

As with any scanning tool, some conditions are necessary in order to be effective. The process needs to be executed on a regular basis because it is difficult to predict the future without a historical overview. The factors are captured under too generic headings that do not help in understanding the forces because are simple list of elements. It is also difficult to systematically explore the interactions between variables because, undoubtedly, changes in one variable will impact other variables.

The best way to conduct the analysis is by involving many people, each with a different perspective. This will provide a wider range of opinions to increase the quality of the analysis. The more elements there are, the more likely it is to have the key ones. Lastly, it is important to have access to quality external data sources, even though this is time consuming and costly.

Despite these critiques, literature does not contain any real alternatives to PEST analysis. Most authors propose alternative versions of PEST, such as PESTLE or InSPECT, or propose not to use this tool and rather analyze the environment with SWOT.

3.3.1.4 Conclusions

PEST analysis is a useful tool, specially when combined with other external and internal analysis frameworks, in examining the macro environmental factors that shape the market and thus, the success of a product. Although it is only a list of elements under a heading, PEST provides the necessary information about the market and represents the first step of the main objective of this project; to scan the environment for adequate information to know if is worth launching the product into the initially planned market. Moreover, there are no real alternatives to scanning macro external factors, as most economists refer to PEST when analyzing the environment.

PEST obtains useful information from an uncertain industry based on highly technological products hardly influenced by legal, political, cultural and economic factors. As it plays an important role in the case study market, uncertainty will have to be considered not only in the PEST analysis but also in the remainder of analysis. Therefore, I think that PEST is a useful tool for the case study, as can analyze effectively one of the three types of described elements that shape a market: the macro environmental factors.

3.3.2 Porter’s five forces

3.3.2.1 Introduction

Michael E. Porter is a professor at Harvard Business School and a leading economist on competition and company strategy. He is generally recognized as the father of the modern strategy field, and his work has been widely used by governments, companies and universities around the world. Porter’s focus is how an organization can build a competitive advantage and develop a competitive strategy. He is author of many well-known methods such as the five forces analysis,
value chain and the diamond model among others. Porter has published numerous books and articles including "Competitive strategy" and "How competitive forces shape strategy", both of which are reference books in the strategy field.

Porter's five forces analysis is a framework for analyzing industry competition that can also be used to predict the eventual profitability of an industry. It was developed in 1980 to understand both the current competitive intensity and thus attractiveness of a market, and also reveal insights about the potential future attractiveness of an industry. The technique is mainly used in the following situations:

- To understand the forces that influence the industry and, consequently, to determine the attractiveness of the industry.
- To develop a competitive advantage.
- To detect an industry with a good future before this good future is reflected.
- To analyze the strategic position of an organization and find which decisions can improve the current situation.

3.3.2.2 Porter's model

Porter (1979) states that "the state of competition in an industry depends on five basic competitive forces, and the collective strength of these forces determines the ultimate profit potential of an industry". Whilst many managers concentrate only on their current direct competitors in the fight for market share, Porter proposes a new way to understand competition where customers, suppliers and future competitors are also considered. The five elements of competition are: threat of entry, replacement products, supplier's power, buyer's power and competitive rivalry.

**Threat of entry:** Rivalry not only depends on current competitors in the market, but also on future firms that may enter to compete. Theoretically, any firm should be able to freely enter and exit a market, but this is not what happens. In reality, industries possess certain characteristics that protect high profit levels of firms in the market, and inhibit additional rivals from entering. Thus, barriers are more than simple nominal equilibrium adjustments made by a market, they are created or exploited to enhance a firm's competitive advantage. Porter has identified six major sources of barriers to entry: Economies of scale, product differentiation, capital requirements, cost disadvantages independent of size, access to distribution channels and government policy.

**Powerful suppliers:** Any product requires raw materials and this leads to the formation of buyer-supplier relationships between the industry and firms that provide materials. The power of suppliers in an industry may be strong or weak depending on market conditions and the importance of the product that they offer. Suppliers have power over the market when the items offered are limited and in high demand by customers. This leads customers to a weak bargaining position, especially if there are no suitable substitutes or the switching cost is too high. In contrast, a supplier's bargaining power decreases when the goods and services are not differentiated and there are many substitutes available.

**Powerful buyers:** The power of buyers is the impact that customers have on the market. In general, when the buyer's power is strong, the relationship to the producing industry is what an economist terms a monopsony, a market in which there are many suppliers and only one buyer. Under such market conditions, the buyer sets the price. Although few pure monopsonies exist,
frequently there will be some asymmetry between the producing industry and the buyers. A buyer group is powerful when it is concentrated or purchases in large volumes, the product purchased is undifferentiated or represents a significant fraction of its cost, earns low profits, is unimportant to the quality of the buyers' products, or the buyer has a credible threat of integrating backward to create the industry's product.

**Replacement products:** These products are from other companies or even other markets and can replace one product due to similar applications or characteristics perceived for the user. Consequently, it is necessary to know who the competitors are, what their current strategy is, how they are going to react, and what their competing product's features are. It is important to avoid a narrow view of the market to conduct a satisfactory analysis of the competitors.

**Jockeying for position (or rivalry):** The degree of rivalry among existing competitors is characterized by competitor's strategies and the effort that firms realize in order to try to overcome the actions of the others. The intensity of rivalry is influenced by the following industry's features: number of competitors, industry growth, switching costs, fixed costs, capacity, exit barriers and competitor diversity.

Once all the forces affecting competition have been assessed, a plan of action can be developed. This plan will include positioning, influencing the balance of the forces through strategic decisions or anticipating competitors' reactions.

### 3.3.2.3 Strengths

The value of Porter's model is that it offers a new perspective of the industry, introducing several elements that shape strategy. With this analysis, competitive forces can help the firm to identify its strengths and weaknesses relative to the actual state of competition and to adjust them, and take advantage if possible, when developing a business strategy. Porter's main argument to support this is that if a firm knows the effect of each competitive force, it can take defensive or offensive actions in order to place itself in a suitable position against the pressure exerted by these five forces. However, the firm can also affect the competitive forces through their own actions. In other words, the balance of forces is partly a result of external factors and partly in the company's own control. Indeed, there are a number of reasons for using Porter's model to evaluate rivalry and create competitive strategies:

- Its clarity in analyzing the industry and how a firm can attain competitive advantage. Also its simplicity and generality to apply the method for different types of industries, all without reducing details.
- Its well-defined structure. The model presents a detailed explanation of the elements, main sources of each threat, and the factors that increase supplier or buyer power.
- Its ability to simplify micro-economic theory into just five major influences, showing how rivalry is very much a function of the other four forces. It also prevents managers from focusing only on today's direct competitors.
- It highlights the importance of bargaining power and also focuses managers on the external environment more than a traditional SWOT analysis would.
- It offers a detailed but easy overview of the industry that can be used for many purposes: to analyze the rivalry, to evaluate the attractiveness of a market before entering, or develop a competitive strategy.
3.3.2.4 Weaknesses

In a changing world, some aspects of the 30 years-old model have inevitably become outdated. Many economists have criticized Porter's model and have argued its weaknesses mainly based in three points (Kevin and Somu, 1996; Grundy, 2006):

- Buyers, competitors and suppliers are unrelated and do not interact.
- Uncertainty is sufficiently low to predict participants behaviour and choose a strategy accordingly.
- The model is too static for the current changing world.

Although Porter’s original model explains some of the interdependencies between the five forces, the explanations are underdeveloped and implicit. Competitive forces are highly interdependent. For instance, buyers may actively encourage new entrants, thus reducing entry barriers, or suppliers may seek to leapfrog over existing industry competitors by marketing and selling substitutes (Grundy, 2006). The bargaining power of the buyer, for example, is increased by the availability of substitutes, low entry barriers and a high level of rivalry. Each force is thus not a separate element to consider, but should be understood in relation to the other forces. This means that a deep and rigorous analysis of all elements and their relations is needed.

Another criticism, considered widely by many economists, is the assumption of a sufficiently low uncertainty so that one can accurately predict a competitor's behaviour. In some traditional industries this is still valid, but there are many others where the future is much harder to forecast. The secret is to know how uncertain the environment really is and develop strategies according to this. Four levels of uncertainty can be defined (Kevin and Somu, 1996): low uncertainty, where Porter's traditional microeconomic model is useful; few discrete scenarios, where strategy can be built around two possible scenarios; continuous uncertainty, where many factors can affect market acceptance; and true ambiguity, the highest level of uncertainty possible. However, this parameter is much more important after the five force analysis is done, as it is a critical element to consider when developing a competitive strategy, but not so critical when analyzing the forces.

The last of the three most criticized aspects of Porter's model is its static nature, whereas the competitive environment is changing constantly. Competitive dynamics come both at the macro level, where the interdependencies between the forces can change the power of each force, and at the micro level due to individual business changes. Therefore it is important to consider how industry structure can change in the future in order to have a complete overview of the industry.

These critiques and others have already been reviewed by Porter in his article “The five competitive forces that shape strategy” in 2008. Here, he reaffirms, updates and extends his model published in 1979. Porter also addresses common misunderstandings, provides practical guidance for users of the framework and offers a deeper view of its implications for strategy today.

One of the most relevant contributions of these revisions is the introduction of factors, not forces, that influence each force in different ways. In contrast to other economists that introduce government as the sixth force, Porter argues that government involvement is neither inherently good or bad for industry profitability. Rather, government definitely affects the five competitive forces, so must be present in the analysis.
The revision made in 2008, however, does not justify some of the previous critiques, specially the institutional underpinning of the model. Narayanan and Fahey (2005), for example, found evidence that emerging economies restrict the applicability of the five forces model and other dominant strategy models. Others criticize its ethnocentric American way of looking at the world (Dunning, 1993; Rugman and Verbeke, 1993). Further, the impact of national culture has been noted as a missing element in Porter's analysis (van den Bosch and van Prooijen, 1992).

In a previous revision of the model, Porter (2001) outlines the impact of the Internet on business. The Internet has both created new industries and also reconfigured existing ones. Because each industry is different, the Internet has also affected industries in different ways: Some of the trends are positive, but most are negative. For example, the Internet facilitates access to distribution and eliminates powerful existing channels. By contrast, the Internet also provides an easy channel for suppliers to reach end users, reducing the leverage of companies. These arguments are supported by Karagiannopoulos, Georgopoulos and Nikolopoulos (2005) who claim that Porter's five forces model is still valuable but, depending on the occasion, companies should use some of the traditional rules in new ways to overcome these challenges.

### 3.3.2.5 Alternatives

Porter's five forces analysis is only one of many frameworks used to analyze the competition of an industry. Several models have been developed, mainly based on some of the above criticisms. One of the most popular alternatives is the model called Value Net, introduced by Brandenburger and Nalebuff (1996, 1997). Value Net is a tool for competitive analysis based on Porter's five forces that introduces a new and important concept: Cooperation between companies. The model is based in four forces of potential competition surrounding the firm: complementors, competitors, suppliers and customers. Complementors are those firms who integrate or provide a value-add service into the own product. Therefore it is important to consider them in a competitive analysis because, like rivals, they are also involved in the fight for customer's attention.

PEST analysis is also used to evaluate the environment in order to develop a competitive strategy. But PEST analysis, or the extended version STEEPLED (Social, Technological, Economic, Environmental, Political, Legal, Educational and Demographic analysis) is more a list of external factors that may influence the industry's future and is therefore a useful tool for complementing Porter's analysis, rather than as an industry analysis technique.

Other economists state that Porter’s model is not valid and have develop a new strategic planning method called Digital Strategy, that shares little in common with traditional strategy other than its objectives (Downes and Mui, 1998). They argue that technology is not the solution but the problem. Therefore, the method is based on a continuously revised planning system, with the following new forces shaping the strategy: digitalization, globalization and deregulation. However, the success of the method seems limited, at least according to the few academic references found in publications and journals.

### 3.3.2.6 Conclusions

In recognition of the above considerations questioning the validity of Porter's model and proposing new models like Value Net, is Porter's five forces model still valid, or an alternative method should be use in this case? The aim of this part of the thesis is to scan the industry's structure to find

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2 For further information consult also Yoffie and Kwak (1996).
support for decisions about entering into the market and, if entering, take the best strategies in order to gain a profitable position in the market. To achieve this, there are three main options: apply Porter’s revised and updated five forces model, apply another model, or incorporate to Porter’s model some criticisms according to the characteristics of the industry.

Porter's contribution to the field of industry analysis and modern strategy is enormous, mainly because of the three new important elements introduced. First, the model suggest that rivalry is only one of several factors that determine the attractiveness of the industry. Second is its focus not only on competitors but also on suppliers, buyers and their bargaining power. Third is the model's emphasis on today’s competitors and assessment of entry barriers for future competitors. Indeed, this vision completely changed the modern strategy field. Many subsequent models and criticisms have continued to use the basis of Porter's model, only modifying or adding some forces. Moreover, Porter's model is the most popular tool for industry analysis employed by both the academic community and industries. Therefore, I consider the model to be the best option for basing this industry analysis. I will, however, incorporate some criticisms to improve validity and adapt to the industry in question. These considerations are described below.

First of all, the industry that will be analyzed should be classified as part of the quaternary sector. This is a relatively new type of knowledge industry focused on technological research, design and development such as computing, ICT, consultancy or R&D. As such, some important elements should be introduced to the model. One of them is co-operation, as information is costly to produce but cheap to reproduce. In the information economy it is hard to keep proprietary information, and consequently it is difficult for a company to survive standing alone. Therefore, the importance of considering cooperation should be key factor in Porter's analysis.

Another key element is that the competitive environment is continuously changing. It is necessary to consider how innovation could expand the industry, and how the evolution of the market could change the importance of each force and their influence. Both, the micro and macro level can change the power of each force over time.

As the market is not mature, there is a high level of uncertainty that makes it difficult to predict the reaction of the forces and may hinder the analysis. Some authors (Coyne and Subramaniam, 1996) propose alternative models for use in highly uncertain scenarios such as game theory or latent demand score (LDS) analysis. Game theory is used for strategic processes than industry analysis. LDS is a technique used to estimate potential demand according to a mathematical formula where a high number of incomes are needed, and is more useful in discrete scenarios. Therefore, uncertainty is a relevant element to consider in the analysis, but I do not think that another method is needed to be applied.

Finally, three additional considerations should be integrated in the analysis in order to improve its efficiency. Examine forces' interdependencies, weight each force according to their real influence, and complement the method with a market analysis and environmental scan.

With these considerations, the results of applying Porter's model should give a rigorous and accurate picture of the industry to facilitate the decision of whether to enter the industry and, if entering, provide enough information to make the best decisions for developing a competitive advantage. The usefulness of the method is that, once industry's scenario is scanned, firms can take advantage of the forces, or build defense against competition, and find positions in the industry where the competitive forces are weaker.
### 3.3.3 SWOT Analysis

#### 3.3.3.1 Introduction

SWOT is a method used in strategic and market analyses to examine products or business units. It provides a solid framework for reviewing strategy, decision-making, positioning and the direction of ideas or organizations. Although its origin is uncertain (King, 2004), SWOT is often credited to Albert Humphrey, who conducted research at Stanford University during the 1960s. Humphrey sought to find out why corporate planning failed, using data from Fortune 500 companies. The work of Kenneth Andrews has also been influential in popularizing the idea that good strategy ensures a fit between organization's internal characteristics and the external situation.

The original goal of SWOT is to find the internal and external factors that affect the achievement of objectives, which is an essential step for strategic planning. The success of a product or an organization depends on factors, both internal and external, that can be either positive or negative, specifically: Strengths, Weaknesses, Opportunities or Threats. After SWOT, one can develop a solid business plan, based on reality, to see where the company needs to go a year from now, among many other applications (Adams, 2005).

It is often claimed that a SWOT analysis can assess a company, a product or brand, a business idea, an investment opportunity, a potential partnership, a strategic option, or outsourcing a service. However, SWOT is not limited to companies. It has been readily applied by nonprofit organizations, governmental departments, and even individuals due to its simplicity, effectiveness and popularity.

#### 3.3.3.2 SWOT model

A SWOT analysis simply consists of creating lists of strengths, weaknesses, opportunities and threats that organizations ought to employ when strategizing in order to maximize their particular situation, i.e. internal factors, according to the reality of the industry, i.e. external factors.

Strengths and weaknesses are the results of an internal analysis of an organization or a product, while the opportunities and threats are based on an analysis of the environment. The main difference between those factors is the degree of control that managers have. Whilst it is possible to control internal strengths and weaknesses, managers may have more difficulties to control opportunities and threats. These factors will now be described.

- **Strengths:** The resources or capabilities that an organization can use to achieve its objectives. They provide a good way for knowing which elements should be promoted in order to maintain a competitive advantage.

- **Weaknesses:** The limitations or weak points in the company that may compromise its objectives. It is absolutely necessary to eliminate them or, at least, to minimize them. They are determined through failures, defeats, losses and the inability to follow the dynamic situation and rapid change. The weaknesses may be rooted in a lack of managerial skills, insufficient quality, technological backwardness, inadequate systems or processes, slow deliveries or resources shortages.

- **Opportunities:** Favourable situations in an organization's environment that can increase benefits for the company, for instance, increase demand or improve positioning. Therefore, a formula or action plan to help define what should come within an opportunity to focus on those areas is needed. This formula should include the required capabilities, resources to
be employed, the target market, the returns expected and the level of risk allowed.

- **Threats:** Unfavourable situations in an organization’s environment that are potentially damaging for an organization. They can, for example, reduce the effectiveness of a strategy, increase the risk or reduce the expected incomes.

It is worth noting here that these factors are related to each other as all may represent problems. Weaknesses are problems to prevent, strengths must be maintained, opportunities arise from the problem of exploitation and threats must be avoided. Additionally, the outputs should be enhanced by weighing and commenting them.

A SWOT list, however, is not the end but rather the first step in the formulation of a strategic planning in the resource-based view. The next step should combine the listed factors through a SWOT Matrix, which is a conceptual framework for a systematic analysis that facilitates such work (Weihrich, 1982). Columns in the SWOT matrix contain external factors and rows contain internal factors. The crossing of these factors generate an internal 2x2 matrix where four different possible strategies are contained: WT or survival strategy, to minimize both weaknesses and threats; WO or reorientation strategy, to minimize weaknesses and maximize opportunities; ST or defensive strategy; and SO or offensive strategy. The goal of the firm must be to leverage strengths, overcome weaknesses, explore opportunities and face threats.

### 3.3.3.3 Strengths

SWOT placed strategic thinking at the core of many companies as it was the first structured method to analyze internal and external factors together. The aim of SWOT is to evaluate both the environment and the company in order to make the best decision, which is probably the reason for its popularity.

This confers two fundamental questions. First, why did SWOT become so popular in the beginning? Second, which are the characteristics that have allowed this technique to endure through time so far? It appears that the answers to both of these questions should be found within its simplicity and effectiveness, when SWOT is correctly applied.

SWOT can be considered simple because it only requires creating a list of elements that, with a correct analysis, can provide valuable insights for later analyses. It is not difficult to understand how SWOT works, yet solving the problems it represents does require a high level of rigour. If the inputs are correctly chosen and the elements in the analysis are appropriate, SWOT will give very useful information that can be used in many subsequent processes such as: to set objectives, to analyze existing strategies, to plan future strategies or to monitor results. This versatility and simplicity make SWOT a highly effective tool in providing useful information from a straightforward procedure.

When analyzing any organization or product, one tends to see only the problems and weaknesses rather than the strengths and opportunities. SWOT introduces positive elements into the analysis underlying the need to leverage and maintain them. Furthermore, SWOT requires that ideas must be put in order, classified and thought about in relative importance, which is an essential process for any analysis. It is also an integrative tool where anyone can participate in promoting the diversity of their ideas for a better analysis.

SWOT can be used at any corporate level, where it offers a wide range of visions for each level. The importance of conducting a SWOT analysis at the various levels of an organization is reflected in an organization’s strategies. These can be particularized for each department or functionality of a
product. Thanks to its flexibility, SWOT can be executed, for example, from the perspective of a competitor to reveal how they think and subsequently provide ideas for how to effectively compete against them.

Finally, SWOT has a static nature because the factors displayed in the matrix pertain to an analysis at a particular point in time. Yet, both internal and external environments are dynamic. Therefore, the analysis should consider changes over time. SWOT is easily adaptable to dynamic situations by creating, different matrices varying points in time, i.e. SWOT matrix for the past, for the present and for different time periods of the future (Weihrich, 1982). A more sophisticated method is to combine the analysis with fuzzy cognitive maps (FCM), a tool that relates the factors to a "mental landscape" for computing the relative impact of these elements (e.g., Jasinevičius and Petrauskas, 2006; Ghazinoory, Zadeh and Memariani, 2007). For some authors, however, these strengths have been pointed to as the main reason why SWOT analyses are not valid enough, which shall be discussed here next.

3.3.3.4 Weaknesses

SWOT's simplicity often results in incorrect usage and, consequently, generates poor and meaningless results with a narrowed vision and weak structure. This renders SWOT ineffective and generates useless outputs that do not describe the reality of an organization. Apparently, the common flaws of SWOT are based on misconceptions about its role (Hill and Westbrook, 1997). Scare analytical skills of those involved in the process, inadequate database or an insufficient amount of information may be the cause, since SWOT cannot, by itself, ensure the necessary rigour required in any strategic analysis. If SWOT is not used properly, it may produce unreliable inputs for strategy generation processes, a main criticism of the technique.

Furthermore, the results of SWOT are sometimes never used as inputs into the strategy generation process. Hill and Westbrook (1997) analyzed the usage of this technique in 20 UK manufacturing companies from 1993-1994. They found that no one used the outputs within the later stages of the strategy process. SWOT was not being used as a true mode of analysis, thus they recommend a revision. But what should be revised, in our opinion, is not the technique in itself, but rather the procedure and the usage of the outputs generated.

Mintzberg (1994), in his classic book *The rise and fall of strategic planning*, rails against what he considers to be an excessive formalization of the strategy making process. Mintzberg points to SWOT as the main cause, stating that "The whole nature of strategy making, dynamic, irregular, discontinuous, calling for groping, interactive processes with an emphasis on learning and synthesis, compels managers to favour intuition. This is probably why all those analytical techniques of planning felt so wrong.... Ultimately, the term *strategic planning* has proved to be an oxymoron." Leaving aside the issue of over-formalization, which will lead to a very extensive discussion, it is a mistake to pinpoint SWOT as the main cause of the over-formalization because SWOT is not a very formalized technique, especially in comparison to alternative methods such as TRIZ or RBV that will be explained later.

Another difficulty when applying SWOT is how to classify the factors that can belong to all four categories. For example, a specific location of a firm can be seen as a positive factor for some users while negative for others and can both leverage an opportunity while being threatened by an impediment. Indeed, there is a certain level of ambiguity in some elements that make the analysis more complicated.
Since the effectiveness of the technique depends on the elements contained in the list, it is important to choose the most representative elements. This process is usually not easy, as there is no systematic way to find them. Actually, it is an unstructured process that depends on the person or group who generates the factors and weighs their influence. In any case, this is a common difficulty for all techniques used to scan the environment, as the generation of inputs for the analysis is always a required yet delicate process.

The real problem comes after the SWOT list is created. Once all the factors have been classified, the next step is to find relationships between the factors which leverage opportunities. But how do these factors really interact one another? How are each of the strengths and each of the weaknesses linked? It is really difficult to move forward from this point, as is a not guide process. This is the reason why some authors claim to use a cause-effect model instead of a list of items under each SWOT factor. Systematic innovation and problem-solving processes like P-TRIZ can go beyond the basic SWOT procedure to provide a comprehensive approach for mobilizing a strategy for action (King, 2004).

Finally, SWOT analysis is commonly used in a very general, categorical way. Factors are often described in few words and the analysis is not very extensive. Valentin (2001) argues that a solution to this may be the resource-based view explained in the previous chapter.

In any case, literature does contain a high number of criticisms and models proposed to improve SWOT. However, not all of these are valid according to the invention and, if valid, they may have more weaknesses that SWOT itself.

### 3.3.3.5 Alternatives

Most criticisms of SWOT are due to the simplicity of the method, arguing that a simple list of attributes is not enough to understand the market and generate appropriate strategies. If this is true, the issue becomes how to extract useful knowledge from that list.

Some authors have proposed models completely different from SWOT. Armstrong (1982), for example, suggests a formal strategic plan consisting of a five-step procedure. Other experts have developed a technique called PRIMO-F, which is no more than a guide useful only in the professional field to analyze internal factors based on seven relevant areas: people, resources, innovation, marketing, operations and finance. Finally, many authors support SWOT as a useful technique for listing attributes and instead propose new models to generate strategies systematically.

Three common alternatives are found in literature for generating strategies from the outputs of SWOT, although few impact in the academic community. The first alternative is the problem solving process called P-TRIZ. King (2004) presents, in his paper, a new framework for improving SWOT analysis and consequently, strategic planning using TRIZ and the bipolar conflict graph. TRIZ facilitates the systematic identification and elimination of physical and technical contradictions within organizations. The second alternative is the RBV of SWOT analysis. This reduces the shortcomings of a traditional SWOT analysis not by eliminating checklists, but rather by focusing on systematic causal issues that afford more perceptive and reliable insights (Valentin, 2001). The final alternative combines SWOT with a popular oriental theory called The Five Changes which describes the complete process of all the things: birth, growth, harvesting, storage and transformation (Wang, 2007).
3.3.6 Conclusions

Although there are many criticisms of the SWOT analysis, I still consider this method as a valid tool for scanning internal and external factors, as well as for having an overview of the market which the invention seeks to enter. However, some corrections should be included in order to eliminate or at least minimize the weaknesses described above. This could be done by using alternative methods (e.g., Armstrong, 1982; King, 2004; Jasinevičius and Petrauskas, 2006) that provide systematic solutions to generate competitive strategies, but this is not the main objective of this work.

The aim of the project is to realize an opportunity analysis, including an industry and market analysis, in order to assess the profitability of the market and support decisions about entering the market. If, as a result of the analysis, the decision is to enter, the next step would be to describe the best generic strategies that should be taken to leverage the opportunities. This second step will come later, after the opportunity analysis.

Accordingly, I propose to use SWOT, but with the following considerations. First, use the technique properly. This means using the adequate database and right amount of information, being rigorous, precise, unambiguous and considering the many factors that may affect the company. Second, once the list is completed, weigh the elements, prioritize them and delete those that have a low impact on the product in order to avoid long lists of elements described in few words. Third, find the existing relations between elements and think how each of the factors affect each other in the present and future to introduce dynamics to the analysis. Finally, conduct the analysis from a resource-based view to later develop strategies according to this viewpoint.

With these considerations, I expect to obtain an overview of the current market situation and to assess the product in relation to this situation. The goal of the analysis is to know which opportunities can be leveraged, which threats to be aware of, how the weaknesses can be limited, and how to exploit and maintain the strengths.

3.4 Defining strategies

3.4.1 Definition

After scanning and analyzing both the environment and the product, the next step should be to develop strategies to achieve success in the market. According to the aim of this thesis, these strategies will be only a generic guideline to maximize the benefits of external factors described in the environmental scanning. A brief description of strategic theory will now be outlined.

Strategy has become an important part of business management. There is, however, a certain vagueness associated with its meaning, where no single clear definition seems to exist. This problem has been widely analyzed by Steven French (2009). According to several authors (e.g., Chandler, 1962; Mintzberg et al., 1998; Anon., 2009) strategy can be defined as the necessary moves a company must take in order to achieve its future goals and be faster and better than its competitors. Therefore, after analyzing the industry and the market through the three methods proposed above, the next step is to use the results of the analysis to plan adequate strategies for a successful entrance into the market.
However, planning the future in a turbulent environment is not an easy task. This is perhaps why there exists an enormous volume of literature regarding strategic planning. Nevertheless, the main goal of this project is not to define a specific strategy but to conduct an extensive analysis for understanding profoundly the environment in order to support decisions about entering the market. Therefore, next will follow a brief literature review describing the main models and their critiques. After, a description of the model chosen according to the case study and the expected results will be given.

### 3.4.2 Literature review

While the historical concept of strategy can be traced to early Chinese military, the concept arose in the business environment during the sixties mainly due to Igor Ansoff's book, Corporate strategy (1965). Ansoff designed a matrix with two sides; one with markets and the other with products, where both can be existing or new. Four different strategies result: (1) **Market penetration**, which seeks to sell existing products into current markets, (2) **Product development**, based on selling new products into current markets, (3) **Market development**, which focuses on selling current products into new markets, and (4) **Diversification**, where both products and markets are new. But since it appeared, strategic planning has had a cyclical popularity as the rapidly changing business environment has caused uncertainty which brings into question the appropriateness of strategic planning in changing scenarios (Mintzberg, 1994).

McKiernan (1997) classifies four schools of strategy. **Planning and practice**, underlying the need to position an organization to fit the business environment. **Learning**, where De Geus (1988) describes planning as a learning process for adapting an organization to a complex and unpredictable environment. **Positioning**, following Porter’s five forces model for fitting an organization to the environment. And **Resource-based**, focused on analyzing the organization’s resources to develop a competitive advantage.

Other economists, for instance Mintzberg et al. (1998), propose ten schools, where each school focuses on a particular aspect of strategy formation. The design, planning and positioning schools are concerned with how to formulate strategy. The entrepreneurial, cognitive, learning, power, cultural and environmental schools focus on the strategy formation process. The last school combines the previous two school families into the configuration school. Mintzberg also describes a model that incorporates all ten schools, since strategy is a complex process that requires elements of all approaches to be truly successful.

### 3.4.3 Critiques

Despite the extensive literature in the field, strategic planning has been often conducted in an incorrect way, giving poor results, causing confusion and wasting both time and money. Pennington (1972) identifies two reasons for the failure of planning. First, planning has been correctly conducted in only a few organizations because the uncertain future is difficult to forecast. Second, is expected to change the way that business is conducted, a difficult change of mentality in most of the managers. Later, Glaister and Falshaw (1999) claimed that strategic planning lost its popularity because it was not delivering satisfactory results, at least during the 1980s. Other authors have criticized the model for failing to integrate into the management system, being costly...
and time wasting, neglecting to focus on the overall environment and being suboptimal in fast changing environments (e.g., Simpson, 1998; Taylor, 1997).

The best known critique of strategic planning is the HBR *The fall and rise of strategic planning*, by Henry Mintzberg (1994b). In his article, Mintzberg describes two fallacies of strategic planning. The fallacy of prediction, because the world is not quiet while the plan is being developed. And the fallacy of detachment, being difficult to separate the process of collecting information and the decision making. He further presents empirical evidences which suggests that strategy making often occurs irregularly, is unexpected and frequently informal, yet provides no solid evidence to assert that the strategy making process is not valid. Furthermore, according to Noel Capon's review (1996), Mintzberg omits two important studies of planning practice in which, from over one hundred Fortune 500 manufacturing firms, the authors do demonstrate a performance advantage for those firms practicing corporate strategic planning.

In parallel, a new strategic approach called the Blue Ocean Strategy (Kim and Mauborgne, 2005) has appeared. The Blue Ocean strategy aim is to create uncontested market spaces and make the competition irrelevant, as described in the subtitle of the book itself. However, according to Kumar (2008), this idea is in fact not new, and has generated intense debate about its usefulness. While a review of this theory would lead to an extensive analysis beyond the scope of this thesis.

### 3.4.4 The three main approaches

Despite the various approaches and schools of strategy cited in the reviewed literature, only three approaches have survived over time. Each approach focuses on a different element of the market: the industry, the organization's resources and the macro external environment (Carter el al., 2008). They will now be outlined as I consider these methods the best way to define a strategy.

#### 3.4.4.1 Industry-based view

The most influential strategy theorist from the end of the twentieth century has been Michael Porter, Professor at Harvard Business School, with numerous valuable publications in this field that will be used in the section 3.2.1 of the present project. In his well-known book *Competitive Strategy* (1980), Porter states that the potential of an organization is determined by the structure of the industry and the market it is operating in. With this industry-based view, the aim of strategy is to understand and exploit industry weaknesses and opportunities. Porter proposes a five forces technique to scan the industry for micro external environmental factors. With the results of this analysis, an organization is able to create a strategy focused on one of three possible strategies. It is important to focus only in one strategy, as the attempt at combining these strategies will too often bring "stuck-in-the-middle" and thus, not success in the market (Porter, 1980).

- **Differentiation strategy**, based on providing a unique or superior value to the customer through quality, features or service, that may be real or perceived.
- **Cost leadership strategy**, focused on having the lowest costs and cost structure in the industry through mass production or distribution, economies of scale or capacity utilization of resources.
- **Focus strategy**, where an organization targets a specific, often narrow, segment of the market, with a low cost approach.

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4 Consult the mentioned book for further information.
The main critique given by some authors is that Porter’s strategies are too generic. It is thus difficult to identify specific tactics associated with each of the generic strategies. However, this criticism has been recently amended by the research of Allen and Helms (2006a, b) by identifying specific strategic tactics. Miller and Dess (1993) have also assessed Porter’s model in terms of its generalizability, accuracy and simplicity. They conclude that even though it is a simple framework, it captures a great deal of complexity. However, they note that Porter’s model does not provide a completely accurate portrayal of strategy-performance relationships. Nevertheless, I think that the industry-based view is still valid and can provide a useful way for describing complex strategies according to the five forces model. Suppliers and competitors are important actors in the industry that have to be considered in the strategic planning process and this approach is the most appropriate one.

3.4.4.2 Resource-based view

The resource-based view (RBV) emerged to counterpoint Porter’s model and has since become one of the most influential approaches within strategic management. This school is grounded in the perspective that an organization’s internal environment is more critical to the determination of strategies than is the external environment. The RBV emphasizes the usefulness of analyzing the internal environment in terms of its resources and capabilities rather than from the product side (Wernerfelt, 1984). But the existence of resources is not enough to be successful. It is the efficient configuration of resources that provides competencies to an organization, that is, the required attributes in order to be able to compete in the market. Kay (2000) underlines the importance of identifying and developing distinctive capabilities as the characteristics of a company that either cannot be copied by competitors or can only be copied with great difficulty.

It is clear that an in-depth analysis of an organization, its strengths and its weaknesses, is required in order to develop strategies according to the results. This process is usually performed by a SWOT analysis. Some authors argue, however, that SWOT approach fails to truly integrate formalization (Herbane, 1997; Priem and Butler, 2001). Nevertheless, Grant (1991) proposes a five-step framework to develop strategies according to the RBV: (1) identify and classify the organization’s resources and assess opportunities for better resource utilization, (2) identify the organization’s capabilities, (3) identify or develop a competitive advantage according to the resources and capabilities, (4) select a strategy which best exploits this competitive advantage and (5) identify whether a resource gap exists and needs to be filled.

3.4.4.3 Scenario planning

Finally, the last main approach used in current strategic planning processes is scenario planning. Scenario planning is based on the recognition of those macro external environmental factors that may combine in complex ways to create unpredictable futures. The goal is to examine the environment’s future and identify scenarios that may need to be addressed. According to Ralston and Wilson (2006), scenario planning is more than a new methodology, because it entails a very different approach to strategic planning. Scenario planning examines not only one uncertainty but several, and further takes into account changes in many variables to create different scenarios and develop different strategies for each scenario (Schoemaker, 1995).

One of the first large companies to use this approach was Shell. Cornelius et al. (2005), after reviewing 30 years of Shell’s scenario planning, describe the process in the following steps: (1) decide drivers for change, (2) bring drivers together into a viable framework, (3) produce 7-9 initial
mini-scenarios, (4) reduce to 2-3 scenarios, (5) draft the scenarios and (6) identify the arising issues. Some experts have also questioned this approach, pointing out its inherent subjectivity and unrealistic expectations among other common pitfalls (Schoemaker, 1998; Kippenberger, 1999; Tevis, 2010). However, scenario planning reveals a range of possible scenarios difficult to find with another approach, thus I consider the techniques useful to be combined with the previous two techniques.

3.4.5 Conclusions

It is obvious that strategic planning is not an easy task. First because of its uncertain nature, it is difficult to make the correct decisions to achieve the defined goals. Second, there is an extensive amount of literature about this field with many theories, strategic models, critiques and different approaches that no clear best choice seems to exist. There is no right way of defining strategies. All of the models have their own strengths and weaknesses, and each industry and organization possess particular characteristics that may fit better with one approach or another.

In my opinion, the success of a new product in a new market depends on the three dimensions of the market. Specifically:

- Internal characteristics of the product and the organization, i.e. strengths and weaknesses pertaining to resources and capabilities, that can be examined by SWOT analysis.
- Micro external characteristics of the industry, so competitors, suppliers and rivalry among them, analyzed by Porter’s five force technique.
- Macro external factors such as social, political, economic and cultural elements that may shape the profitability and attractiveness of an industry, analyzed by PEST analysis.

According to the characteristics and aim of this project, I consider the best option to combine these three main approaches to analyze the case study. But first it is necessary to analyze the suitability of each method and the expectations of each analysis, which will be done in the next chapter. The idea is to develop one of the three main strategies proposed by Porter’s model according to characteristics of the industry, while taking into account the resources and capabilities of the organization, and also different scenarios according to the uncertainty of the macro external environment.

With the correct application of the previous stages, corresponding to the previous sections, I expect to obtain a guide line for the launching process of the product into the market. Furthermore, the goal is also to position and maintain the product in a competitive place in the marketplace by avoiding threats and leveraging opportunities.
This chapter analyzes a particular invention developed at Lund University according to the theoretical framework explained in the previous chapter of this thesis. Consequently, the analysis will follow the steps: (1) definition of the problematic, (2) definition of the market, including the product, competitors and consumers and (3) scanning and analysing both the product and the market with PEST, Porter's framework and SWOT method.

4.1 PROBLEMATIC

Eyewitness testimonies tend to be one of the most influential but also unreliable types of evidence in criminal case investigations and trials (Wells et al., 2006). Thus, the low veracity and accuracy of these statements can be fatal for innocent defendants. The forensic technology has been developed to solve this problem: detect the accuracy of eyewitness statements.

Eyewitness statements and their accuracy have been widely studied by many psychologists, doctors and experts. But false memories and their consequences are still unknown for most people. Therefore, the goal of this section is to describe in detail the problematic, its origins, causes and possible solutions. A good knowledge of the problematic is essential in order to conduct an accurate analysis.

4.1.1 The importance of eyewitnesses on trials

Eyewitness testimonies and their identifications are usually considered as persuasive evidence before a judge or jury, becoming a very powerful tool in determining a person's guilt or innocence. However, when an eyewitness is discredited, as could be with this technology, two contradictory results have been found. The experiments of Loftus (1974) and Cavoukian (1980) show that the percentage of the jury who decide guilty when an eyewitness is discredited is almost the same as before the discrediting. This is known as the discrediting failure effect. These results support the idea that jurors not only place too much weight on eyewitness testimony, but rarely regard eyewitness testimony with any degree of scepticism.

Many authors have obtained the opposite results through similar experimental conditions, affirming the discrediting effect (Hatvany and Strack, 1980; Weinberg and Baron, 1982; Saunders et al., 1983; Whitley, 1987; Kennedy and Haygood, 1992; Sigler and Couch, 2002). The claim that jurors are prone to over believing eyewitnesses is, at least, contradictory, as many experiments yield results inconsistent with this theory. Additionally, the validity of these studies should be questioned because a mock trial is not the same as a real case.

Despite the contradictions surrounding the discrediting effect, all of the above authors, and the scientific community in general, agree on the powerful effect of credited eyewitnesses on juror and judge decisions. Thus, if an eyewitness is wrong, the consequences of this mistake can be serious for a defendant.
4.1.2 Causes of wrong identifications

Wrong convictions can occur mainly for three reasons: deception, that is, intentional distortion of reality; faulty questioning and suggestion; and memory failures. However, eyewitnesses rarely lie, so lie detection is mainly used on defendants rather than to reduce misidentifications. Thus, the main two causes of wrong eyewitness identifications are memory failures and faulty questioning.

Wrong police procedures, as faulty questioning and suggestion, is the main cause of wrong eyewitness identifications, together with false memories. The reasons for this is that memory can easily be contaminated by the way of interviewing an eyewitness or by the procedure in lines-up, as has been demonstrated by Drivdahl et al. (2009) among other studies. As a result, many proposals have been suggested to improve police procedures. Some examples are: context reinstatement, criteria shift, cognitive interviews, perspective shift (Miller and Fremouw, 1995) and specially sequential lines-up presentation (Wells and Turtle, 1986; Cutler and Penrod, 1998; Greathouse and Kovera, 2009). It is important to notice here that some of the proposes have already been adopted in some American states such as New Jersey in 2001, Wisconsin in 2005 and more recently North Carolina, following the recommendations of the Innocence Project.

The forensic technology is focused in the last cause, memory failures and the fragility of the memory. The other two causes, and especially the proposed solutions, will be studied in detail in the section 4.4.4 as possible competitors of the technology.

4.1.3 Memory failures

Memory is generally accurate, yet distortions in remembering are almost unavoidable in normal situations. False memories occur when people believe they have seen or experienced an event that did not occur or, at least, not in the way remembered. Memory failure is a field widely studied in psychology and medicine.

The relationship between memory failures and the accuracy of eyewitness testimonies has been already studied by Münsterberg in the early 20th century, followed by Smith (1930), and Borchard (1932) who ensured that this problematic has prevailed since the 1800s. Indeed, literature in this field is very large (Radelet et al., 1994; Scheck et al., 2000; Roberts, 2002; Wells and Olson, 2002).

A study conducted by the Innocence Project revealed that 75% of DNA exonerations in the United States were due to the use of eyewitness misidentification as primary evidence to convict an innocent defendant. In other words, wrong identification is the primary cause of the conviction of innocent people.

One common failure is the so-called crashing memories effect. It occurs when people report highly detailed memories about public events which they have not witnessed or seen footage of. A study conducted on Swedish students by Sjödén et al. (2009) showed that 64% of participants asserted to have seen an impossible event with non-existent footage, but only 19% provided explicit details.

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5 A line-up is a process by which a crime victim or eyewitness confirms a suspect among several other similar individuals that stand in a line.

6 The full report can be consulted in www.innocenceproject.org/docs/Eyewitness_ID_Report.pdf

7 Innocence Project is non-profit legal organization in the United States dedicated to proving the innocence of wrongly convicted people through the use of DNA testing, and to the reform of criminal justice systems to prevent future injustices.
Dr Fiona Gabbert, professor at Aberdeen University, states that memories are very vulnerable to error. If one witnesses a crime and then reads a news report, all details can combine in the memory, making it difficult to distinguish between what was seen and what was not. But even without external influences, memory can be contaminated.

Stress, for instance, affects one’s ability to recall events accurately, causing the distortion of memories, a common problematic studied in detail by Christianson et al. (1987, 1991a, 1991b, 1992) and more recently by Dutton and Carroll (2001). Light conditions, movement, distance, time constraints, or the so called weapon focus effect are also causes of the memory fragility (Buckley and Kleiner, 2002). Furthermore, the veracity of statements decreases as time passes (Haber and Haber, 1998).

Many academics have demonstrated these theories with empirical studies and experiments such as: List (1986), Poole and White (1991), Brewer et al., (1999), Singler and Couch (2002), and Christianson et al. (2007). They argue that memory is a fragile element that can be influenced very easily by external factors like media power, the procedure in lines-up or faulty suggestions. Furthermore, testimony characteristics as age or sex also influence the degree of fragility (Aizpurua, 2009).

4.1.4 Awareness in law professionals

There seems to be a certain consensus among the scientific community asserting that memory is a fragile element which can be easily influenced and thus create false memories. However, many judges, prosecutors, attorneys and police officers still do not regard the problematic as such.

An interesting survey by Granhag and Strömwall (2005) examines the beliefs of Swedish legal professionals about eyewitness testimony. The results show that the knowledge of law professionals about eyewitness misidentification is rather similar to the rest of people. Particularly worrying is the fact that most attorneys and judges were unaware of the low correlation between a witnesses’ confidence in their testimony and its accuracy. This low correlation has been proved by Deffenbacher (1991) and Sporer et al. (1995) among others. Additionally, there is empirical evidence suggesting that jurors rely heavily on a witness' degree of confidence as an index of accuracy (Wells et al., 1979).

Recent advances in DNA technology, however, could lead one to think that eyewitness misidentification is no longer a problem because DNA provides incontestable evidence. But this is not entirely true, since in cases where no biological evidence is found, eyewitness identification will still be needed as primary evidence against a defendant. Therefore, the accuracy of the eyewitness statement is still a problem that need solving.

4.1.5 Solutions

The fragility of eyewitness memories and thus the uncertainty of eyewitness statements raises the question of what can be done to reduce eyewitness misidentification. The police can either invest in products to detect false memories or improve police procedures.
Many efforts have been made in the scientific field to develop technologies capable of distinguishing false memories from real. Some neuropsychologists found that different brain activity occurs depending whether the memory is true or false (Cabeza et al., 2001; Slotnick and Schacter, 2004; Kim and Cabeza, 2007; Faus et al., 2008). Others experts state that psychologists should give their opinion as to a statement's accuracy during trials, in order to help jurors discriminate between accurate and inaccurate eyewitness identifications (Cutler et al., 1989; Devenport et al., 2002). Yet, results are contradictory: jurors can be even more confused, sensitive or sceptic. There is no common agreement in the usefulness of experts, nor in the belief that a new technology could solve this problematic.

In any case, the solutions proposed to distinguish true and false memories, as well as generic solutions to solve the accuracy and veracity of eyewitness statements, will be discussed in detail in section 4.4.4 as possible competitors.

### 4.2 Market definition

A market is the exchange between consumers who want a commodity, and the industry who possess it. Consequently, identifying the market implies defining the commodity (the product), the consumer and the industry (current and future competitors).

#### 4.2.1 Product definition

A group of researchers at Lund University have developed a new algorithm to predict the accuracy of eyewitness statements. Yet, a commercialization proposal is needed to make a marketable product. Therefore, a definition of the product implies a description of the technology developed and how this technology, an intangible attribute, will be implemented and commercialized to define the final product.

##### 4.2.1.1 Technology

The idea by which this method has been inspired is the theory of latent semantic analysis, LSA (Landauer et al., 1998). Humans possess knowledge and express it through language (or words). How these words occur in text with relation to each other basically determine the meaning and communication of one’s knowledge. Based on experimental research, the group of researchers have developed an algorithm capable of distinguishing between correct and incorrect statements. More particularly, the aim is to provide a computer implemented method and a system that allows for the prediction of a statement’s correctness.

The method is performed on at least one computer and entails the steps of: collecting a text corpus comprising a set of words; generating a representation of the text corpus; creating a semantic space for the set of words; summarizing statements in the semantic space; training on a set of set statements where the correctness is known to identify a prediction model; applying the model to statements for predicting correctness. The main concepts are described below.

A text corpus is a large and structured set of texts which are typically stored electronically and may be electronically processed. The text corpus may contain texts in a single or multiple languages and
is collected using conventional methods and systems.

A semantic space is the result of a mathematical algorithm that takes a text corpus as an input and creates a high dimensional space. The dimensions in the space correspond to semantic qualities or features of the corpus' words. For example, one dimension may represent whether the words mean something that is alive, whereas another dimension may represent to what extent the word is an emotion. Synonyms are located nearby each other in the space, and the distance between words is a measure of how semantically close the words are. The distance between two words is typically measured by the cosines of the angel between vectors representing the words, although other distant measures may also be used. Semantic spaces are created by using information of co-occurrence, and examples of algorithms for creating semantic spaces include LSA and the random indexing (RI) method.

A location in the semantic space is a point in the semantic space which represents a word, several words or even set(s) of keywords. Hence, the value of the variable may be defined for some or each word of a subset of words in the semantic space. A semantic dimension is any judgment relating to the meaning (semantic) of a word (concept), such as positive or negative evaluations, trustworthiness, innovations, intelligence, etc. By statements, it means any set of words generated by humans. Statements can be written or oral, correct, incorrect, or partly correct. Comparing the statement with an external criterion can validate the correctness of the statement.

This invention predicts the degree of correctness of statements. The predictions are made by first converting the words in the statement to a representation in the semantic space. The relation between how correct a statement is and the semantic representation is identified by studying known examples. This relation can then be used to predict the correctness of new statements.

The invention has been validated in experimental studies and is undergoing the patent process in Sweden and the USA. For the moment, the algorithm developed is based on a Swedish text corpus but the technology may be implemented in other languages in the future.

The police has been chosen as the target group because the aim of the technology is to solve a particular unfulfilled need detected in police investigations. Thus, most processes behind the research were conducted to fulfill this particular need. Furthermore, the Swedish police seems to be more open to invest in new technologies than in other countries, as Sweden has always been regarded as an innovative country. Additionally, the fact that the inventors work at Lund University make this choice logical and natural.

However, it would be very difficult to adapt the algorithm to be used in new target groups for new purposes. The reason is that the algorithm based on LSA is developed to detect false memories through several psychological theories. If the algorithm should be used, for example, to detect false confessions or false claimants, the theory will totally change.

4.2.1.2 Product form

The technology will be implemented in the form of a software that can be run on any computer (workstation, desktop, laptop, netbook) using a fast Internet connection. Thus, the marketable product is software-based that can be easily downloaded online through a license. Notice that software is an intellectual property, like music or books, and the real cost of the product is not the software itself, but the license to use it.
The software will have an easy interface for the end user, and will be compatible with any operative system. The results of the analysis will be given by a percentage of accuracy of the whole statement and then divided by parts. That is, there will be a detailed description of the accuracy of each part of the statement in order to detect which parts of the story are most likely to be false.

The idea is to install a small unit of the program in the end user’s computer and perform the main analysis on remote servers. Additionally, a training course will be provided for the end users so that they can use the program more efficiently, increasing their understanding and correctly interpreting the results.

To ensure the security of the data transmitted, several combined techniques can be used such as RSA encryption, digital certificates and secure web access techniques. These are the techniques provided by the RSA enterprise, who is in charge of offering secure internal data transmissions through different computers and servers of the Swedish police system.

However, the final form of the product and its commercialization are not definitive, as the researchers have outlined. The form, the characteristics of the service offered, the interface and any other element can be modified to better adapt the product to the customer needs.

It is worth noticing that the aim of the product is not to substitute the capacity of a police officers in interpreting statements, or completely change the way they interview, but rather become a useful tool to help identify the veracity and accuracy of eyewitness statements. Therefore, the product acts as a complementor rather than a substitute.

4.2.2 Consumers

A consumer is a person who uses goods or services, while a customer is a person who purchases goods or services. Thus, the difference between the terms is based on the use of the product.

4.2.2.1 Consumer vs customer

First identify the consumers. As the technology determines the accuracy of an eyewitness statement, those responsible for conducting interviews on an eyewitness can best take advantage of the technology. Therefore, the generic consumers are police officers. But not all officers are involved in criminal investigations. When a crime is committed, the first to arrive at the scene are police officers who conduct brief interviews with people in the surroundings. These reports are later handed to the crime investigation squad of the County, CID. These specialized policemen are in charge of interviewing a victim’s family, friends, neighbours, witnesses and suspects. Thus, CID is the specific consumer. Notice the difference experience and training between users.

From a commercial point of view, the software may be sold through licenses that can be assigned either to each computer, to the whole police system or to each police station. In the last option, police stations can be considered as the consumer. There are 357 police stations across Sweden.

The consumers, however, are not the buyer since they will not be paying for the product nor deciding about purchasing it, although their opinion can influence the buyer. Defining the buyer is a little bit more difficult. The large amount of departments, agencies and authorities involved

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8 Source: Swedish Government, www.sweden.gov.se/sb/d/584/a/15825
make it difficult to identify who should make the final decision to introduce a new technology, according to the budget assigned by the government and their priorities. Therefore, a brief description of the Swedish police structure will facilitate the process of identifying and analyzing the customer, its behaviour and how the customer can be influenced.

4.2.2.2 Swedish Police System structure

The Swedish Police Service consists of the Swedish National Police Board (*Rikspolisstyrelsen, SNPB*) and 21 county police authorities. The SNPB is the central administrative and supervisory authority of the police service. It is headed by the National Police Commissioner who is appointed by the government and who is in charge of managing the national police budget. Among other tasks, the SNPB is responsible for the development of new working methods, technological and administrative support, as well as the maintenance of the IT infrastructure for the Swedish National Police.

Technological support and the IT infrastructure includes ICT architecture, hardware and also software license. Software applications are used to report incidents, criminal investigations and traffic surveillance among other activities. The annual IT-budget for the Swedish National Police is administered by the chief information officer (CIO). The CIO is in charge of making all relevant decisions concerning the National Police ICT infrastructure. The CIO’s office is directly connected to the SNPB and consists of seven staff members, who have a strong technical background and ensure that the Police have a reliable and efficient ICT system. Roughly 600 employees work in the Police ICT department.

The latest and most relevant work by the CIO’s office has been the introduction of an Open Source server and database environment. The project, still running, started in December 2007 with the aim to minimize costs, increase the freedom of choice of technology, enhance the competition between vendors and minimize the dependency on one vendor. However, the software and hardware migration only occurred on the servers in the data centres, and not at the client computers. For the local police officers distributed across the country all the applications remained the same and nothing new had to be learned. Even more so, the desktop PCs at the Swedish Police are still running on a proprietary operating system⁹.

The product is a license that provides a software to help police to determine the accuracy of eyewitness statements and thus improve one part of criminal investigation process. Therefore, that responsible in deciding the appropriateness of incorporating a new software tool is the CIO, in charge of administrating the annual IT-budget for the Swedish National Police.

4.2.3 Competitors

To identify and classify the competition, the method applied will be the levels competition explained in chapter two. This method defines four levels of competition, described as follows and analyzed in detail in the section 4.4.4 of this chapter.

4.2.3.1 Product form competitors

_Those that pursue the same market segment and features._

According to the case study these competitors should be software-based products capable of examining a statement and determining its accuracy and detecting the presence of false memories. Although many software-based products detect deception, they cannot be considered in this level mainly for three reasons. First, the market segment is not the same: software lie detectors are often used in many areas, from personal affairs to pre-employee processes, whereas false memories detection is focused in criminal investigations. Second, the theory behind the two proposal is completely different, as many scientific investigations have proved that the lying process cannot be compared, psychologically, with memory failures. Third, deception detection is commonly focused in suspects and false memories detection in eyewitnesses. Therefore a lie detector can certainly determine the accuracy of suspect statements but not eyewitness statements as they are usually not lying.

However, there is a technique focused on distinguishing between true memories, false memories, and lies. It is called Criteria-based Content Analysis (CBCA) and is a part of the Statement Reality Analysis (SRA) developed by Udo Undeutsch in the 1950s. Although the technique has not been developed into a software, it can be considered as a product competitor as the aim and the market segment are the same.

4.2.3.2 Product category competitors
*Products with similar features but not the same target group.*

We consider here all the software applications that police use for several tasks, as they belong to the same category product as software. However the goals are different. The main software applications are used in incident reports, criminal investigations, traffic surveillance, forensic science and information exchange with other authorities.

4.2.3.3 Generic competitors
*Products that are different but can fulfill the same customer's need.*

In this level, I consider all the products and technologies that claim to reduce wrong eyewitness identifications through detecting false memories or improving police procedures. Lie detectors are not considered as generic competitors because they are focused on suspects more than eyewitnesses and thus the fulfilled need is different.

4.2.3.4 Budget competitors
*Products that can replace other products, even if the fulfilled need is different.*

We consider here all products able to detect deception as lie detectors, statement analyzers or brain scanners. Additionally, from an even broader perspective, any type of measure to improve the police system can be included in this category such as: an increase in the number of policeman, courses to specialize police officers, more resources for DNA research, etc.

4.2.4 Market structure

From the previous definitions of the three main actors in the industry, herein the text will consider the following concepts:
• The product, as the technology developed by the research group and the product form proposed above.
• The consumers, as the police officers involved in criminal investigations, and the customer as the CIO and the National Police Commissioner.
• The competition, focused on the generic and budget competitors, as they both may be seen by the customer as replacement products.
• The market, focused in Sweden but often generalized in a global way, as in Sweden the market is very small and there is very useful information regarding other markets, especially in the U.S.

However, as a result of the analysis, in the last chapter some of these definitions may be changed in order to better fit the market. For example, the product form, the features of the software or the way of giving the results can be modified. Also the specific consumers can be rethought, and the scope of the product may be extended to other countries.

4.3 PEST ANALYSIS

4.3.1 Economic factors

Sweden has achieved an enviable standard of living through a mixed system of a high-technology economy and extensive welfare coverage. This has brought Sweden to the lead of several rankings, for example, the 4th most innovative economy in the world (according to the Economist Intelligence Unit) and the 3rd most competitive country in the world (according to the World Economic Forum).

However, the global economic and financial crisis has also affected Sweden. Although the recession is expected to persist at least one more year, a gradual recovery is also expected to begin in 2010, according to the Swedish Government. The forecast is to move from a negative Gross Domestic Product in 2009 (-4.9%) to a positive one in 2011 (3.9%). To achieve this goal, the budget bill for 2010 contains specific measures to tackle the recession situation, which include:

• Incentives to start up, run and develop new businesses in Sweden, with 6.200 million SEK budgeted for 2010 - 2012.
• Improve the police and judicial system, increasing police presence, ensuring effective prosecutorial activities and increase the institutional capacity among other activities. The budget foresees to spend 2.590 (2010), 3.240 (2011) and 3.540 (2012) additional million SEK for the judicial and police system10.

The ordinary Judicial system budget for 2010 amounted to 35.840 million SEK, of which 19.000 for the Swedish Police Service. The forecast is (in million SEK): 19.720 SEK in 2011 and 20.010 SEK in 2012. The National Police Commissioner, appointed by the government, is responsible for managing this budget. Particularizing, the 2010 budget for IT support is 50 million SEK and 18 million SEK for IT forensic activities.

4.3.2 Sociological factors

Society has traditionally been sceptic of those technologies capable of detecting thoughts. Ignorance towards the scientific theory behind some products renders them undistinguishable from lie detectors and other technologies that detect false memories. Additionally, products known as lie detectors have become very popular thanks to novels, films and tv programs, minimizing its reputation. Indeed, there is some suspicion that any technology capable of revealing the secrets of the brain could even exits.

However, when the technology is supported by a robust scientific basis and focused on a narrow target group familiarized with the usage of similar products, this scepticism decreases. Indeed, although its accuracy and effectiveness have been widely questioned, the use of these technologies is far more extensive than may seem. Many police departments, for instance, are using these techniques to enhance their investigations. Therefore, a revision of the usage of products and techniques which can be confused with the forensic technology, and be seen as competitors by the customer, will be described as follows.

4.3.2.1 Brain scanners

The use of medical science, in particular neuroimaging, in assessing the veracity of interrogation responses has increased in recent years due to advances in this field. Most of the products are brain scanners based on functional magnetic resonance imaging (fMRI).

The use of brain scanners varies significantly depending on the country and their laws. For example, a brain scan was accepted as evidence in a murder trial in India in 2008 (Giridharadas, 2008). In the U.S, although their use is not recognized, Marks (2007) believes that fMRI is used in the interrogations of terror suspects, according to comments made by experienced U.S. interrogators deployed in the Iraq War. In Europe, the use of fMRI is still very uncommon.

4.3.2.2 Polygraphs

Polygraphing is the oldest and most well-known lie detector technology. It is based on physiological indices such as blood pressure, pulse, breathing ratios or skin conductivity. Polygraph examinations have been widely used in the 20th century and are still present in some countries such as the United States, Israel and Japan, mainly for three purposes:

- For pre-employment screening in agencies involved in national security. The Los Angeles Police Department, for example, uses a polygraph examination to confirm information obtained during the selection process of any aspirant, before being admitted as a police officer.
- For screening current employees in high security-sensitive occupations. For example, the U.S. Department of Energy mandated polygraph examinations for about 1.300 employees in sensitive positions in 1999, later expanding the program in the law P.L. 106-65 and /398.
- For criminal investigations, although there are many restrictions on the use of these techniques in courts, as explained in the section 4.3.3. Faller (1997) examined the usage of polygraphs in sexual abuse cases. The results expressed reservations about the polygraph's utility in sexual abuse decision making.
Although there are many critiques of polygraphs and its accuracy, Tory University offers a polygraph program with the American Polygraph Association and the American Association of Police Polygraphists.

4.3.2.3 Voice Stress Analysis, VSA

VSA is a technique used to detect deception through the analysis of microtremors in the voice. Since it appeared, VSA has become very popular, especially with police in the United States. Many intelligence agencies, including the CIA, FBI and private forensic psychologists, prefer VSA and its variants to polygraphs because it is cheaper, faster and more accurate, they argue. According to the National Institute for Truth Verification, who is the manufacturer proprietary of the patent of Computered VSA, over 1,700 agencies use VSA, mainly law enforcement agencies.

Additionally, VSA has also been used by several insurance companies, especially in the UK, by the U.S Department of Work and Pensions to prevent false claims and for personal issues in mobile phones, pocket PCs or via Skype.

4.3.2.4 Statement analysis

Several authors have developed statement analysis methods based in factors such as the structure of the text, the use of pronouns, the words used or the detail of the descriptions. The FBI has adapted statement analysis to focus on whether statements are accurate and complete, claiming its usefulness (Klopf and Tooke, 2003).

4.3.2.5 Linguist experts

In the last years courts have accepted linguists to testify as expert witnesses in civil and criminal trials. Linguists give their opinion on many issues such as speaker identification, discourse analysis or meaning of texts. However, this is also controversial, with some experts questioning its admissibility in trials (Tiersma and Solan, 2002).

Concluding, the scepticism among this type of technologies is not high, at least in some particular target groups that are familiarized to use similar products, as the police. However, the society is not used to these technologies and thus the scepticism certainly exists. And if the technology is going to be used in a governmental agency, the general opinion has to be considered as will influence on the decision of the purchaser.

Indeed, some ethical implications are inherent in this and other similar technologies. This technology is ‘ethical’ due to the fact that a machine appears to decide about the meaning of human behaviour, and the results obtained with the technology risks becoming more influential than a person’s opinion.

4.3.3 Political and legal factors

The above paragraphs show that many similar techniques are being used by several governmental agencies, and also by private organizations and particulars. But the use of these technologies in the courtroom as evidence in trials requires a step further. The admissibility depends on the specific law of each country, its culture and predisposition to introduce new technologies in the court
system. Therefore, a revision of legal factors is useful to understand how these technologies may cross the line from supporting police procedures to becoming evidence in trials.

In the United States there are more laws referring to the use of lie detectors and similar devices than anywhere else (Honts and Perry, 1992). The Supreme Court has deferred judgement to the courts of each jurisdiction to determine whether polygraph or other lie detectors are admissible in court. California, for example, permit the use of lie-detector results in court if all parties agree beforehand that they will be admissible, whether the technique has been accepted within the scientific community. In 2007, the polygraph testimony was admitted in 19 states and is since used extensively in post-conviction supervisions. In 2009, a court in Chicago accepted a brain scan as an evidence during a murder trial.

In Europe, lie detectors and other techniques are not considered as reliable evidence in court. However, any party can order a psychologist to write an opinion based on polygraph results to substantiate its credibility or claims, and the court will weigh the opinion like any other.

In other countries, the usage is very different. Canada uses polygraphs regularly as a forensic tool in the investigation of criminal acts. In Israel, polygraph results are inadmissible in civil trials. In India, a brain scan was accepted as evidence to convict a woman accused of murdering her husband (Giridharadas, 2008). However, in May 2010, the Supreme Court of India declared the use of brain mapping and polygraph tests on suspects as illegal without consent (Mahapatra, 2010). According to Barland (1999, cited in Grubin and Madsen, 2005), the polygraph continues to be widely used in at least 70 countries.

Apart from these polemic technologies, witness experts are commonly consulted in courts. In Sweden, psychologists, psychiatrists and doctors have been called upon, especially in trials involving child sexual abuse. However, this tendency has decreased considerably since the 1990s (Gumpert et al., 1999b). Among psychological experts, there are Content-Based Criteria Analysis experts, often called witness psychologists. Contrary to the legal rules of some other countries, these experts are allowed to both to present facts and give an opinion on these facts, such as to the reliability of a statement or the credibility of a particular child. However, the expert is not allowed to give an opinion as to the guilt of the suspect. It is not uncommon for an expert witness to interview the suspect as well as the alleged victim and other informants in order to collect data.

In the U.S. the use of expert witnesses testimonies during legal proceedings and its admissibility is regulated by the Daubert standard. Additionally, many authors have questioned the use of eyewitness experts in trials, assessing their influence on jurors and even witnesses (Groscup et al., 2002; Schweitzer and Saks, 2009; Levett and Kovera, 2009).

4.3.4 Other factors

Technological factors are also important to consider, as the technology is the base of the product and the main difference between competitors. The current techniques used to detect false memories are mainly based on experts who make a personal opinion of a text. However, the criteria could be computerized and become an algorithm, thus becoming a direct competitor.

Other factors, such as environmental or demographic elements, do not have a big impact in this market due to the characteristics of the product. The final product is a license that can be acquired
via the Internet, so there are no environmental impacts. Furthermore, the demographic structure of the population does not influence the market, as eyewitnesses can be any age.

4.3.5 Conclusions

The research on the external environment provides valuable new information:

- The apparent poor reputation among similar technologies is false, as police departments and other governmental agencies, lawyers firms and private companies have been and are still using similar products in many countries.
- Related to the previous point, many similar technologies have been accepted as evidence in criminal trials. Therefore, legal factors are not as rigid as one may think.
- The current economic situation of the customer is not the best for investing in new technologies due to the global economic crisis. However, the government asserts that the budget to improve the police system will continue to increase in the next years.
- Additionally, the market is not influenced by other forces such as demography, environment, and education. This is a positive fact as more independence of external forces means more control over the product and its success.

Therefore, I believe that the influence of external factors is lower and more positive than may seem at first sight. The many organizations using defined competitors, the use of them in courts, the recognition of other technologies among the scientific community and the independence of other forces make us optimistic about the success of the product. However, the economic situation can certainly have a negative influence on the success of new technologies into the market, such as with this product.

4.4 Porter's Five Forces

4.4.1 Entry barriers

The industry consists of many companies offering similar solutions in different forms: brain scanners, lie detectors software, statement analysis, etc. Therefore, choosing a product means also choosing the procedure associated with each solution. For example, in some products the police needs to record the voice, in others a written statement is required. Some analyses can be done in the police station, in others the analysis is external. As a result, the consumer becomes accustomed to each solution.

Consequently, the switching costs between competitors with different solutions are high, as changing the technology also involves changing habits and processes. However, the changing costs between competitors with the same product form, as false memories software detectors, are lower. The reason is that the procedure does not change. High changing costs are entry barriers for new competitors, as it is more difficult to convince customers to change to another product.

The capital required to start a new business may also be an entry barrier. The requirements are associated with the resources needed for infrastructure, equipment, capital and promotion among
others. The greater capital required, the greater the barrier to entry. For those companies competing in software products, capital requirements are very low, especially in comparison with the firms offering solutions based on brain scanners. The reason is because software products do not require a big infrastructure, equipment or large number of employees. Thus, the entry and exit barriers are low.

Distribution channels may also determine entry barriers. Although there are many different product forms in the industry, each firm tries to have a direct relation with the customer, avoiding intermediaries. Brain scanners as well as software lie detectors are sold directly to the customer. Thus, this direct relation with the customer represents a low barrier. However, if the customer is a governmental agency, such as the police, the access to distribution channels becomes more difficult for the following reasons.

First, it is difficult to determine who is the person in charge of choosing a new product. Once the decision maker has been identified, it is also difficult to access to this person and convince him about the need of a new solution, since they are not the consumer, a distinction explained before. Additionally, governmental agencies have the tendency to establish long relationships with only one seller firm, even if there is a new solution on the market that is better and cheaper. This is probably because governmental agencies have an overly bureaucratic structure and can be unprofitable.

However, this tendency seems to have reached its end. In 2006, the Swedish police started to migrate from an ICT infrastructure based on proprietary products to an ICT server and database platform based on open source software. The aim was to cut costs, avoid vendor lock-in and achieve better performance. According to the executive IT-Strategist at the CIO's office, with an open source environment it is much easier to find developers and support for the solutions because one can choose between many vendors. Therefore, access to governmental agencies seems to be easier than some years ago.

Finally, the industry is highly based on technological products. Thus, patents and copyrights are a key element. If a new firm offers a new product based on a new technology, as in the case study, it is this firm who is creating an entry barrier for future competitors. However, this option involves a bigger effort for developing such a new technology. By contrast, if a firm introduces a new product based on an old technology it will be very difficult to succeed, because the existing firm will be always one step ahead.

As a result, entry barriers in this industry are medium-high because: (1) the changing costs for the customer are high, (2) capital requirements can be very high, (3) it is difficult to get access to the customer and (4) all the products are based on well patented high technology. However, the forensic technology has special characteristics that give a certain advantage for access in the market because: (1) capital requirements for software products are lower, (2) the Swedish government seems to be open-minded in trying new solutions and new technologies, and (3) the product is based on a new technology not patented before. Therefore, although the industry has medium-high entry barriers, for the particular product these barriers are lower.

4.4.2 Supplier's power

The algorithm will be implemented by software hosted in servers that can be of either property or
in a host company. This is basically the main supply needed. It is also necessary to provide security in all the information transferred via the Internet. Thus, a supplier in charge of this encryption is also required.

In any case, the supplier's products and services are of low differentiation, easy to switch and offered by several companies. Consequently, the supplier's power is very low and is not a relevant force in the analysis.

4.4.3 Buyer's power

Although some competitors focus their products to several target groups, such as law firms or insurance companies, the forensic technology is focused only in one target group; the police. Thus, there is only one buyer and many sellers. This type of market is known in economics as a monopsony. As the buyer is the only purchaser of the service, their influence on the market is enormous. The customer can decide the features of the product, the required applications, influence the price, the services, the distribution channel, etc.

However, there are several positive factors in a monopsony. First, the product can be highly customized and personalized, according to the specific needs of the customer. Second, since the buyer belongs to the state, much of the information which would be difficult to find for private companies can be found. Among this interesting information, the economic situation of the customer is a relevant factor. If the buyer has a weak situation, it will be more difficult for the seller to convince the buyer to purchase their product. Accordingly, a brief description of the economic situation of the Swedish Police System and its size is described as follows.

The customer is the Swedish police system, as has been pointed out in the section 4.2.2.2. As it belongs to the state, the police system has also been affected by the global economic crisis. Yet, the forecast is to continue increasing resources and the budget. The total budget bill for 2011 is 19.720 million SEK, from which 68 are assigned to IT support and activities. The total number of workers in the Swedish Police Service was 25.838 in 2007, of which 17.457 were police officers, 6.284 were administratives and the rest were specialists. The prevision was to have 20.000 police officers in the current year 2010\(^{11}\). Additionally, 16% of the total crimes committed in 2005 were violent crimes (murders, assaults or violations) and 13% thefts (burglaries, car thefts, shoplifting).

According to this information, the following reflections can be made. The percentage of crimes in which the product could be used is quite high. However, although the government made a commitment to continue increasing resources for the police, it is clear that the current economic situation is not supportive of investing in new products, unless their price is significantly low. Additionally, the number of police officers is low, and further not all are involved in criminal investigations. All of this contributes to a high buyer power.

4.4.4 Replacement products

4.4.4.1 Product form competitors

Strictly speaking, there are no product form competitors in this market, as there is no software

\(^{11}\) All the information is contained can be found in the web www.polisen.se/Aktuellt/Rapporter-och-publikationer/Statistik/
able to analyze a text and detect false memories of eyewitnesses. However, in a broader perspective, the Criteria-based Content Analysis (CBCA) could be considered in this category, as the aim and the market segment is the same. Additionally, although CBCA is a technique conducted for specialists, it could be automatized in a software, becoming a direct competitor.

The CBCA was initially developed to distinguish children's truthfulness from fabricated allegations. Soon, the technique started to be applied also in adults (Landry and Brigham, 1992). Undeutsch (1989) asserts that statements of an experience will contain characteristics that are generally absent from statements of imagination. The technique must be conducted by an expert and involves the scoring of memory reports using 19 cognitive and motivational criteria such as: number of details, logical structure, spontaneous corrections or admission to memory failures among others (Bernstein and Loftus, 2009). The theory behind CBCA is that more of the 19 criteria present means a higher veracity. Research shows that true memory reports tend to contain more sensory and conceptual information, including visual, auditory, and olfactory details, as well as temporal details rather than false memories (Schooler et al., 1986).

Some authors conclude that CBCA can be useful when detecting deception but not false memories. For example, an experiment by Blando´n-Gitlin et al. (2009) showed that CBCA did not discriminate between accounts of the true and suggested false events. In other words, for the individuals who believed they experienced a suggested event, their accounts were more likely to appear real, and thus classified as being true by CBCA. Additionally, accuracy rates deviate between 55% and 80% over various studies (Ruby and Brigham, 1997).

Research also suggests truth biases, differences between white and black persons and strong dependencies on personal characteristics, make it difficult to standardize the methodology (Ruby and Brigham, 1998; Rassin, 1999). However, and despite its controversial effectiveness, low accuracy, and contradictory results, CBCA has been used in some courts around the world.

4.4.4.2 Product category competitors

Product category competitors consist of all software applications that police currently use and predict to use in the future. These software applications cover a wide range of activities, including incident reporting, criminal investigations, traffic surveillance, forensic science, human resources, and accounting. However, they do not represent a direct competitor because although the category is the same, the function of each application and the utility that the customer perceive is totally different.

According to Red Hat, the major Linux distribution vendor, the Swedish police board uses approximately 500 separate IT applications, 70 percent of which are developed in-house by the SNPB IT department. The rest of the applications are licensed by external firms. Most of these companies are specialized in offering a set of applications for police usage, and usually operate with police departments from several countries.

4.4.4.3 Generic competitors

Generic competitors are those products whose goal is to reduce wrong eyewitness identifications, either by detecting false memories or improving police procedures. I consider this level of competition to be the main group of competitors for the forensic technology.
The first group that will be described corresponds to those technologies and products seeking to detect false memories. This goal has been conducted mainly by neuroscientific techniques. Recent research has suggested that it is possible to distinguish between false and true memories through brain scanners. Fabiani et al. (2000), for instance, indicate a slower reaction time for false memories accompanied by frontal slow wave activity, which may reflect a differential ability of the two brain hemispheres with respect to semantic processing. Also Sederberg et al. (2007) discovered that different gamma oscillations occur when reporting true and false memories. But most studies were conducted through semantically related world lists that one has to remember in order to later list it again. Thus, the results were obtained in a very specific scenario difficult to generalize.

Maybe because of this limitation, no marketable products have been found based on these theories. The majority of the technologies are based on functional magnetic resonance imaging (fMRI). fMRI measures the hemodynamic response, that is change in blood flow, related to neural activity occurs in the brain. Using this technique, Slotnick and Schacter (2004) revealed that true recognition related activity in early visual processing regions (Broadmann area (BA)17, BA18), activity not found in false memories. But fMRI has also been used to detect deception instead of false memories. Thus, it is difficult to know if the product detects false memories or deception.

The main firm proving solutions based on neuroimaging techniques is No Lie MRI12. They offer their services to organizations, law firms and the government, including the department of justice, defense, energy, treasury and police among others. However, Bernstein and Loftus (2009) state that no one has developed a neurophysicological procedure able to predict whether a single real memory is true or false, as the results in the lab are not generalizable into reality. Additionally, there is some confusion as to the limits between distinguishing false memories and deception. The accuracy of fMRI-based detectors is estimated to range between 76 and over 90%, still too low to be widely accepted (Davatzikos et al., 2005; Kozel et al., 2005; Langleben et al., 2005).

Although there are many critiques of fMRI, the technology has one of the strongest positions in the market mainly due to two reasons, according to Langleben (2008). First, there is a strong demand for objective lie detection that is not met by the existing technologies. An example is the extensive use by the US government of polygraphs, despite its many weaknesses. Second, though there is still no clear combination of which cognitive evidences will become the better option in detecting false memories and lies, fMRI undoubtedly represents a qualitative leap forward.

There are other theories to detect false memories not based in neurological principles. Yet, the research is still in an embryonic stage and is very diverse. The source monitoring framework (SMF) was developed by Johnson in the 1980s (Lindsay and Johnson, 2000) as a method to differentiate between actual memories versus imagined experiences. Following this technique, Quin et al. (2008) argue that true and false memories should differ in qualitative characteristics. For example, true memories may contain more units of information than false ones. Ost et al., (2002) concluded that the SMF may be a useful tool in distinguishing between true and false memories, although further research is necessary. However, products developed based on this theory, as it seems, focuses on daily false memories rather than wrong eyewitness memories.

Finally, some psychologists examine individual differences to determine who is most likely to be a deceiver. Some measures are the Gudjonsson suggestibility scale, the creative imagination scale, the Marlowe-Crowne social desirability scale and the dissociative experiences scale. These scales

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12 No Lie MRI, http://noliemri.com, is one of the leading companies providing solutions to police to detect false memories.
have been empirically tested, but with contradictory results. Hyman and Billings (1998) found correlations between false memories and the results of some of these scales. By contrast, Laney et al., (2008) reported null correlations. Additionally, these scales are difficult to integrate on an accurate product to detect false memories. First, because of contradictory results. Second, because the scales examine a relatively low number of variables. Lastly, because it is only an individual measure of who is most likely to deceive. Thus, these scales do not detect false memories, and even less, the accuracy of a statement.

The other group of generic competitors are those proposals focused on improving police procedures to minimize eyewitness misidentifications. The most well-known is the cognitive interview (CI). This is used to elicit a more complete and accurate report from eyewitnesses by reconstructing the circumstances of a crime, recalling the events in a different order and changing the perspective. The efficacy, effectiveness and neutrality of eyewitness confidence of the CI has been widely supported by many authors (Geiselman et al., 1986; Granhag, 2004), producing between 35 and 60 percent more information than the standard interview (SI). The same utility has been proved for similar techniques as Enhanced and Modified CI (Wright and Holliday, 2007).

CI and its derivatives are being used in many police departments around the world. This technique requires police officers specialized in conducting CI, being costly and time consuming. Additionally, Dando (2009, 2009b) revealed that CI was poorly applied by police officers, who consider the method too complex and lengthy for the type of criminal cases investigated. Nevertheless, CI and its derivatives have to be considered as a strong competitor to the forensic technology as it is one of the few real alternatives to improve eyewitness memory. Notice here that even though they are totally different solutions with different forms and aims, they may become direct competitors.

Another technique is forensic hypnosis, yet research also shows contradictory results. Geiselman et al. (1985), for example, found similar results from both hypnosis and the CI. These techniques also elicited a greater number of memories and information than the SI. Geiselman points to memory enhancement in terms of memory-guidance as common to both procedures. Other authors, however, claim that errors and even new false memories may be introduced involuntarily during hypnotic interrogation processes (Register and Kihlstrom, 1988).

Finally, an other big claim is to change the lines-up procedure to a sequentially presentation (Wells and Turtle, 1986; Cutler and Penrod, 1998; Greathouse and Kovera, 2009). This proposal has been already adapted in some American states.

All the previous products and techniques are certainly direct competitors of the forensic product, as they fulfill the same need: to minimize wrong identifications.

### 4.4.4.4 Budget competitors

Budget competitors are mainly lie detectors, that can be seen by the the customer as an alternative to detect false memories of an eyewitness. Although lie detectors are mainly applied to suspects and the theory behind deception detecting is completely different.

The most well-known lie detector is the polygraph, which has been widely used, especially in the U.S, despite many critiques about its accuracy. One of the main weak points is that when a person is examined with a polygraph, they are likely to experience an inherent stress that can promote incorrect results (Iacono, 2008), a problematic that is not present in a statement analysis.
A strong competitor has appeared in the last years called voice stress analysis (VSA) based on microtremors. The idea is that deception can be detected through micro vibrations in the voice of the person whose answers are being reordered. This theory has been widely studied in literature with contradicting results (e.g., Lippold, 1970; Wain and Downey, 1987; Hays, 2003; Benincasa et al., 2005). The main firm commercializing a similar technology, called LVA, is Nemesysco. They offer a wide range of computer-based form products for many purposes such as: security, business, entertainment, psychological and medical solutions.

Two Swedish researchers have studied the scientific basis of VSA. They found no scientific evidence to support the manufacturer's claims. They concluded that the principles used in VSA where "charlatanry" and have demanded that responsible authorities not get involved in such practices (Eriksson and Lacerda, 2007). These allegations led Nemesysco to libel sue against the two researchers. This case demonstrates the importance of support among the scientific community, although these criticisms have not prevented the technology from being widely used in the U.S.

A less popular technique is a theory to detect deception based on facial microexpressions, especially inconsistent facial expressions exhibited by deceivers (Ekman et al., 1992; Porter & Brinke, 2008). Also, many techniques are based on brain scanners, that have been already described in the previous competition level.

A statement analysis (SA) based on few parameters has also been used to determine the truthfulness of a person. It studies three things: word definitions, rules of grammar and research and observations. Mark McClish, the father of the theory, has commercialized SA in a product software-based. McClish claims that the product assists in determining if a subject is being truthful or deceptive. The software detects keywords that indicate deception and describe why they do so. It further highlights sensitive areas within the statement needed to be deeply explored, areas where the subject may have withheld information, according to the manufacturer's own information\textsuperscript{13}. However, its usage and effectiveness has not been proved, and almost no references in literature or the internet have been found.

Finally, the last competitor that needs to be described is a computer-based technology developed by the professor Hancock at Cornell University (Hancock et al., 2008). Hancock studied changes in linguistic style across truthful and deceptive texts. The results reveal that, indeed, a liar tends to construct sentences in a different way than when telling the truth. The aim now is to create a language-based approach to detecting lies. The research group received $680.000 dollars from the National Science Foundation in 2005 to continue investigating this field. However, no product has been commercialized yet. A similar alternative to detect deception is an automated linguistic based cues system, studied at the University of Maryland (Zhou et al., 2004).

In a broader point of view, many other budget competitors could be considered, for example: increase the number of policeman, courses to specialize police officers or more resources for DNA research. However, their influence is much lower than the previous competitors.

Must notice again the importance of considering lie detectors as competitors, despite the many differences in targets and uses. A too narrow perspective of competition limit to choose the best strategy and does not allow a real market opportunity analysis.

\textsuperscript{13} www.statementanalysis.com
4.4.5 Rivalry in the industry

Competition is very large when the four levels of competition are considered and thus, the diversity of firms is inevitable. Diversity means that competitors can be differentiated by many factors: their goal, either if it is to reduce wrong eyewitness identifications or detect deception; their form, since a software product is very different from a brain scanner; the target group, focused on criminal investigations or general purposes; the emplacement of the analysis, either in the police station or external; the purchasing and maintenance costs; the scientific community recognition, etc.

The company does not only compete against product form competitors, but rather against many budget competitors. The greater the number of competitors, the greater the rivalry among them because more firms compete for the same customer. Moreover, if the market has a monopsony structure, the rivalry may be even stronger. The industry could become overcrowded, creating a situation of excess capacity with too many sellers and too few buyers.

Additionally, market growth is not constant nor easy to predict. This is not because there is a new market still growing, but rather because the demand is continuously varying. In some periods, police have made big efforts to integrate technologies capable of detecting deception or products to assess the behaviour of suspects and eyewitnesses when they are being interviewed. However, in other periods police have decreased their effort due to their economic situation, political factors or other external and internal influences.

The three above factors widely present in this market (a high number of competitors, very differentiated and inconstant market growth) make high levels of rivalry.

4.4.6 Other considerations

An additional element to consider in this analysis is cooperation. Although many of the competitors work on their own, some companies do collaborate with each other in order to combine efforts and maximize their chances to succeed in the market. This concept is even more important in this type of industry, classified as part of the quaternary sector, focused on technological design and development.

Cooperation can be in terms of shared research, integration of various software products into a single platform, exchange of target groups, etc. For example, one way to enter the market could be to integrate the forensic technology into an existing firm offering replacement products, such as Nemesysco, to name one. The final service offered would be a set of different technologies to detect both false memories and deception through different approaches. This and other business models will be examined in the final chapter of this thesis.

As highlighted in the theoretical framework, it is necessary to weigh each force according to their real influence and examine their interdependencies. Previous discussion shows that supplier power and entry barriers are low influential forces in this market. By contrast, the most important forces are competition and buyer power. The first one because it is very large and diverse, causing a high rivalry. The second because there is only one customer. Moreover, as the entry barriers are not high, the number of competitors may increase, and thus the power of the customer and the rivalry in the market may be even higher.
4.4.7 Conclusions

It may seem at first sight that the industry is new and that not many competitors exist. However, the previous analysis shows the opposite. There are many competitors, both direct and indirect, and they are very diverse. Additionally, the demand is not constant and there is only one buyer. Therefore, this is not an attractive industry.

However, the main three reasons for this state can be changed. Demand may stabilize if the customer is satisfied and the scientific community support the technology. The product can open its target group to avoid a monopsony situation. The product needs to differentiate itself from the high number of competitors and thus, competing in a narrower group. But this is not easy, as will be discussed in the last chapter.

4.5 SWOT Analysis

4.5.1 Strengths

The previous research shows that there are many products to detect deception but only a few to detect false memories. The few theories about false memories, such as CBCA, have shown contradictory results. Furthermore, CBCA is not automatized in the sense that it is simply a technique to be used by an expert, and not implemented into a marketable product. The marketable software-based products are focused on detecting deception. And the attempts to detect false memories through brain scanners are based on semantically related world lists, being difficult to generalize its usefulness in detecting false memories of eyewitness statements.

As a result, it can be said that the forensic technology may become the first software-based product capable of detecting false memories. However this is not necessary a competitive advantage because it cannot be assumed that the police wants to differentiate deception and false memories. Additionally, the technology is based on a scientific theory, LSA, widely recognized and studied by the scientific community although it has never before been used for this purpose. This may lead to higher support among researchers, especially in comparison with other theories such as the simplistic statement analysis proposed by McClish. Notice also that the origin of the research, conducted by professors at a well-known University in Scandinavia, may also facilitate complicities with other researchers and experts.

Needless to say, the algorithm, the core of the product, is patented and well protected from possible attempts to copy the idea. This is an essential step for this type of product, where much of its competitive advantage is due to the technology.

The characteristics of the product category, a software-base product, involve a low capital requirement to start a new business and facilitate the distribution that can be done by the Internet. The idea, as was explained before, is to install a small unit of the program in the end user’s computer. This can be downloaded online, and perform the main analysis on remote servers.

There are several positive consequences. The analysis is easy to conduct, as only a copy of the statement has to be sent online. It is easy to maintain growth due to the characteristics of the
product. The process is fast, eliminating long timeouts as a manual statement analysis would require. The purchasing and maintenance costs can be low, especially in comparison with other solutions such as brain scanners.

Additionally, the product is highly-customized, focusing all the features on the specific need of the consumer. Indeed, the origin of the research is already based on criminal investigations and the associated memories of eyewitnesses. Thus, all the process have been conducted thinking of police officers as the target group and with false memories detection as the unique use.

4.5.2 Weaknesses

Although it is the first software-based product capable of detecting false memories, it is difficult to differentiate from similar products, especially lie detectors. Usually society cannot differentiate between false memories and deception. However, as the product is focused in one particular consumer, it is important to be differentiated not by society but by the customer and consumer. In this case, as police is more used to this type of technologies, it may be easier, no easy, to differentiate.

Even if the customer is capable of differentiating the product, there is a preference to invest in a lie detector by customers rather than in false memory detectors. This is probably because of a supposed scenario in which both technologies have a very high level of accuracy, once the veracity of the suspect is known, the degree of accuracy of the eyewitness becomes irrelevant. This is why new technologies are focused on detecting deception and most resources of the police invest also in these products.

Despite the many efforts in detecting deception, still no product is exempt of contradictory results or critiques. Recall for example, polygraphs, VSA or brain scanners. Therefore, to focus on false memories can be a good strategy whether the consumer perceives that too many efforts have been done in lie detectors with no satisfactory efforts and may decide to detect false memories.

Another notable weakness of the product is the difficulty in convincing the customer of its high accuracy, which is difficult but absolutely necessary to demonstrate. Therefore, a prototype should be implemented for this purpose, as commented on in the last chapter.

Additionally, this is a new product with no firm. The process to commercialize the product is more difficult because one must know which is the best way to launch the product, via cooperating with an existing firm, creating a start up, etc. This issue will be commented on in the last chapter.

Finally, as it is based on a lexical analysis, the technology directly depends on language. For the moment, this language is Swedish, so the market is Sweden. If the product is to be offered in larger markets, it must be adapted to new language. The algorithm would be the same and the adoption basically consists of acquiring a new database and testing its results. However, it would be very difficult to adapt the product to be used in new target groups for new purposes, as seen before.

4.5.3 Opportunities

The analysis shows a real concern among police authorities to detect deception, which explains
the many technologies tried in the last decades. But this concern does not seem to be the same when solving wrong eyewitness identifications. Misidentification has been widely proved as the main cause of innocence people conviction, and the authorities and law professionals seem to have started being aware of this fact. Therefore, if this trend remains, an opportunity for the product can become, as the demand can grow rapidly. Additionally, police department are familiarized with the use of similar products, which have even been accepted in some courts as evidence in trials.

If the product receives enough complicities among researchers, experts, and the scientific community in general, the customer will be more likely to invest in the technology as the scientific opinion is a key element to support decisions for new technologies. However, there are many examples of criticized technologies also widely used by the police, such as VSA and polygraphs.

The fact that the technology has been developed in Sweden and that the initial market is the Swedish police is important to consider. Many authors have studied the influence of a nations culture on the success of innovations (e.g. Porter, 1990). Obviously this product can succeed more easily in an occidental culture than others. Within occidental countries, Sweden appears as the 4th most innovative economy in the world (according to the Economist Intelligence Unit).

Furthermore, the Swedish police seem to be open to new technologies and new firms. According to Sjöswärd, the aim of a shift to an OSS increases the freedom of choice in technology and minimizes the dependency on one vendor among other goals. Notice here that this migration has only taken place on the servers in the data centres, and not at the client computers. For the local police officers distributed across the country, everything has remained the same. Even more, the desktop PCs of the Swedish police are still running on a proprietary operating system. Therefore, if the forensic technology should be implemented in each of the desktop PCs, the software used is irrelevant.

Another opportunity is the chance to cooperate with another firm already established in the market. This could facilitate the entrance of the product into the market, as the firm would already be known, and would offer a wider range of services for the existing company. However, some inherent problems and other business models will be revised in the last chapter of this thesis.

Finally, if the product can be easily adapted to other languages, the service could be offered in emerging markets. In these markets, such as India or China, the number of competitors is much lower, as many of the American technologies have not been introduced, and there is also interest in this type of technologies. An example is the acceptance of a brain scanner as evidence in a trial in India in 2008 (Giridharadas, 2008).

4.5.4 Threats

The main threat that the product must face is the high amount of competitors in the market when including the four levels of competition. This fact increases the rivalry in the industry and makes success difficult. However, as a false memories detector, competition decreases significantly. Thus, the effort must be to convince the customer of the need for investing in false memories detection.

Another considerable threat is the economic situation of the customer. The police depend on the general budget of the state, and due to the global economic crisis, the Swedish government has
reduced the predicted increase for the next years. However this reduction, the budget for the police system over the next two years will continue to grow, according to government sources.

The product is focused in only one customer, the police. Therefore, there is only one customer in the market. This characteristic gives high power to the buyer. Additionally, the success of the product depends on many factors, but if the customer decides not to purchase the product, only this element is conducive for failure.

The market is focused for the moment only in Sweden. Although there are positive consequences of this, as seen above, the number of police officers here is not high, and even less when considering those involved in criminal investigations. Therefore, the small size of the market is a factor that should be considered by the researchers in order to try opening the product to other markets.

The demand is very irregular. In some periods, police face high demand for similar technologies and in other periods the demand decreases, for political, legal, sociological or economic reasons. Even more irregular is the market growth when focusing on the demand for specific solutions of false memories detection.

Finally, it has been shown that the entry barriers to the industry are generally high. However, if the product to enter is software-based, is easy to appear new substitute products. Therefore, in a scenario where the forensic technology could success in the market, other firms may seek to enter through similar software-based products. Thus, the need of well protect the technology with patents and copyrights against future competitors.
5. CONCLUSIONS

This chapter presents some conclusions drawn from the previous analysis. First, the appropriateness of entering in the market is discussed. Then, some general issues that need to be solved in order to enter into the market properly are described. Finally, two different business strategies are proposed, followed by some final considerations.

5.1 Appropriateness of Entering

The information obtained through the previous analysis addresses the appropriateness of entering into the market chosen. Thus, the results of the three analyses are briefly described below.

The PEST analysis suggests a low influence of the external factors, although uncertainty is fairly high. The Porter five forces analysis concludes that the chosen industry is less attractive, due to significant buyer's power, a large number of competitors and high rivalry. Finally, the SWOT analysis shows an equilibrated number of positive and negative elements in both internal and external features.

However, although the technology is already developed, changes in commercialization strategy and in product features can still be achieved in order to reduce some of the negative elements found in the analysis. Thus it is suggested here, that to maximize the market potential of this forensic technology, the following issues should be resolved.

5.2 General Issues

One of the main challenges for the product is to convince the customer (in this case the police) of the usefulness of the product. And since this is a market with only one customer, this is essential to success. The first step is to make the customer understand the functionality of the product and the unfulfilled need that the technology intends to solve.

Many police departments, especially in the U.S., are using similar types of technologies to detect deception, but few efforts have been done to detect false memories. A contributing factor may be that not enough is known about eyewitness misidentifications (e.g. that they are the cause of 75% of wrongful convictions, as pointed out before). However, even if the police become aware of eyewitness misidentifications and false memories, they will also need to detect deception. Thus, the product as it stands will probably not replace existing deception solutions. Part of the reason is that eyewitnesses can deceive or have false memories. And it is unlikely that the opinion of a police officer can be decisive in deciding if an eyewitness is likely to lie or not and, consequently, to apply a false memory detector or a lie detector. Furthermore, it cannot be assumed that the police wants to differentiate deception and false memories.
In effect, the four levels of competition, which are detailed in the section 4.4.4, must be considered. It is important to gain a historical understanding of technologies capable to detect deception, to understand their institutional and value base, the basis for acceptance among police officers and for use in governmental agencies and courts, and to reason about transfer of similar technologies to the Swedish legal and cultural context. For example, in commercializing this technology.

The specificity of the target group and their public and legal role implies some problematic consequences. Since the police is a public authority, financed by a public budget and accountable for its methods, the application of a ‘black-box’ technology into investigation procedures and possibly into courts will inevitably lead to public debate. Some ethical implications are inherent in this and other similar technologies which need to be understood and possibly tested to achieve successful commercialisation. This technology is ‘ethical’ due to the fact that a machine appears to decide about the meaning of human behaviour, and the results obtained with the technology risks becoming more influential than a person’s opinion. This debate can even go further if the technology is used in more controversial areas such as pre-employment processes or personal affairs. The problem here is that some ‘black-boxing’ must take place for commercial purposes since the operators cannot deal with the same level of complexity and uncertainty as the researchers in operating the technology.

The demonstration of the accuracy of the technology is another challenge. Here it would be necessary to develop a prototype in order to prove a high accuracy and reliability of the algorithm. A real demonstration would in fact be very useful for proving the accuracy of the product. For example, using a lead-user methodology a group of police investigators could participate in experimental application of the product at an early stage of commercialization.

In spite of the fact that the final interface of the program will be very easy to use, the inventors have considered special training for the police to improve the understanding of the results of the product and thereby its value. This is positive, but it is also important to note that apart from this technologically oriented training, the product will also imply a modification of the process of interviewing eyewitnesses. The product needs a written eyewitness statement report as an input. However, this text has to conform to certain qualities in order to be analyzed. Thus, it is important to understand what type of police interview formats are required for successfully applying the technology and compare to what is in use today. Possibly the feasibility of developing an algorithm capable to work with a less restrictive statement structure should be considered.

Finally, the way of interviewing eyewitnesses is important in order not to affect the memory of eyewitnesses, and to create false memories. All these are considerations that the police probably need to take into account as a customer, and should be considered in the market strategy.

5.3 Strategies

When launching a new product into the marketplace, the strategy and the business model must first be decided on. This process is essential to exploit strengths and opportunities, avoid threats and solve weaknesses. The aim here is to decide the best way to enter into the market in order to achieve the best possible results. The main two strategies, following the analysis in section four, are described below.
The following two strategies aim to suggest how to enter in the marketplace through exploiting strengths and minimizing weaknesses elaborated above. However, they are very generic and thus should be understood as potential guidelines for a more specific strategic plan.

### 5.3.1 Lead user strategy

The lead-user strategy consists in integrating a selected group of consumers, referred to as lead-users, to test and use the technology to assess its strengths and weaknesses, feed back to the developer and finally to influence the customer of the utility of the product. The goal of the lead-user strategy is twofold. On the one hand, to demonstrate to the lead-users the accuracy and reliability of the product, as well as the benefits that can bring to the police force. On the other, to integrate the lead-user into some design processes in order to adapt the characteristics of the product to the needs of the consumer.

Lead-user input is needed in several areas. The software interface must fit with the needs of the users; the type of analysis which the product is capable of should be matched to police requirements; the technical support structure, e.g. the location of servers and the transfer confidential data via the networks must agree with the security demands of the consumers, etc. This integration can be achieved either by going out to the users as well as by having them come to the firm.

This approach implies, first, to select and contact lead-users. The idea is to convince the procurement responsibles to purchase the technology via either the influence of the lead-users, or through using them as a ‘good example’ in the marketing process, i.e. to prove the practical use of the technology. After a lead-user group has experimented with the technology, one may move to limited experimental application in one lead-user environment, for example in a progressive district.

This strategy does solve some important issues raised in the previous section. First, lead-users can prove and demonstrate to themselves the accuracy of the product through a prototype, as described above. This can minimize scepticism among the police unused to such technologies. Second, training necessary to understand the technology may viewed police as an impediment, however once lead-users have first-hand experience with the technology, this impression may be reduced.

### 5.3.2 Cooperation/licensing strategy

A cooperation/licensing strategy involves reaching an agreement with an existing firm in the industry in order to sell or license the technology to integrate it into their existing package of services. The agreement can be a simple monetary deal where the patent is sold or licensed, or a cooperative technology transfer where the inventors keep gain a stake in the project and commercialize the product together with the partner, while keeping some rights on the technology. This depends on the maturity of the partner technology.

According to previous analyses, the best market for this strategy is the U.S., where most of the detection technologies are used and sold. This strategy would solve the problem of the small size of the current target group, and remove the cost of starting and running a new business. With a
cooperation strategy, the product would have a distribution channel already established and possibly consumers already in place.

Additionally, the negative effect of training can be reduced if the algorithm is integrated as a plug-in in a software package already being used by the police. The risk of public debate concerning the technology in Sweden would be eliminated, as the U.S market is already familiar with similar ‘ethical technologies’. Finally, but very important, the police would have a solution that integrates both deception detection and false memory detection, avoiding the delicate process of distinguishing between these two approaches.

Apart from the American market and the English language, other important languages should be considered to extend the scope of the product into emerging markets such as China or India. Also, new target groups for the same product, such as law firms and insurance companies should be taken into account.

5.4 Final Considerations

The aim of this thesis was to assess the market potential of a particular forensic technology in order to support decisions about launching a product based on such technology into the market. Hopefully the thesis has achieved some progress in this direction by offering suitable analysis and additional empirical information relevant for the inventors, to enable them to take the best decisions for market entry.

The information and analysis contained here intends to serve as a starting point for the inventors to choose which parts of the technology should be improved; increase awareness of potential competitors and consumer structure; understand the external factors that may influence the process including industry rivalry; and suggest general strategies to resolve the weaknesses detected in the analyses.


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