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APPRAISING THE INFLUENCE OF THE EXTERNAL ENVIRONMENT ON THE TYPE OF INNOVATION INTRODUCED IN THE MARKET BY THE ENTERPRISE

Evidence from Portuguese Management Consultancy Enterprises

BRUNO MIGUEL LOPES DE JESUS

Dissertação

Mestrado em Gestão Empresarial

Trabalho efectuado sob a orientação de:

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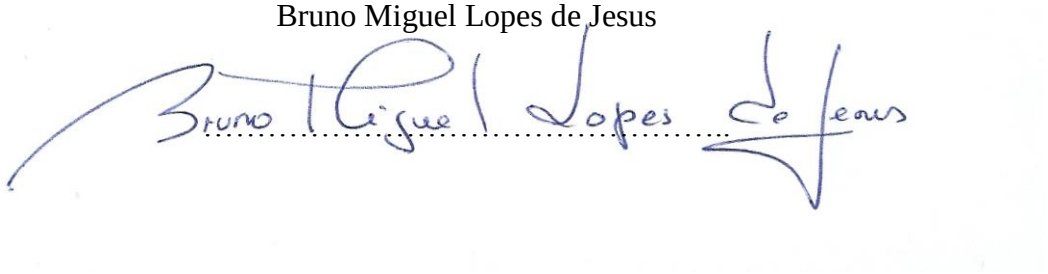

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RESUMO

O objectivo principal desta dissertação é abordar questões importantes sobre o efeito do ambiente externo em diferentes tipos de inovação nas empresas de consultoria de gestão, com fundamentação no paradigma de "Inovação Aberta" de Chesbrough. Outros estudos baseiam-se frequentemente num conceito geral de inovação. Esta dissertação distingue o conceito de inovação em quatro tipos diferentes: (1) produto / serviço, (2) processo, (3) organizacional, e (4) marketing. Esta distinção prende-se pela necessidade de abordar questões relevantes sobre o efeito do ambiente externo em cada tipo de inovação, analisando se um determinado tipo de fonte de informação ou agente de cooperação, estimula com maior intensidade as atividades de inovação da empresa do que outro. Tendo em conta a densidade do objectivo principal foi necessário diferenciá-lo em três complementares, de forma a responder adequadamente ao proposto. Primeiro, avaliar a propensão para a utilização de fontes externas de informação e de cooperação no tipo de inovação apresentada ao mercado, por parte destas empresas. Segundo, identificar quais as fontes de informação e agentes de cooperação que foram mais utilizados para alcançar um certo tipo de inovação. Por último, segmentar as empresas tendo em consideração o tipo de inovação que apresentaram ao mercado.

Este estudo utiliza dados secundários provenientes do Inquérito Comunitário à Inovação CIS 2010, referente à informação sobre inovação das empresas, para os anos 2008, 2009 e 2010. O questionário foi dirigido directamente às empresas, a fim de reunir dados sobre o seu desempenho na inovação, bem como sobre uma variedade de fatores que podem influenciar as atividades inerentes. De acordo com o próprio CIS trata-se de uma amostra seleccionada de forma aleatória, sendo cada empresa representativa de empresas com a mesma actividade económica, classe de dimensão e região a que pertence. Para este estudo foi considerada uma sub-amostra de 374 entidades representativas do comportamento inovador das empresas pertencentes ao setor da consultoria.

De acordo com os objectivos pretendidos, a técnica *Chi-square Automatic Interaction Detection* (CHAID) foi utilizada para analisar a amostra, a fim de criar modelos de classificação baseados em árvores de decisão. A escolha centrou-se na capacidade da

técnica gerar segmentos capazes de descrever da melhor maneira possível a variável dependente. As quatro árvores obtidas através do CHAID, uma para cada uma das quatro variáveis dependentes consideradas (inovação de produto/serviço, inovação de processo, inovação organizacional e inovação de marketing) permitiram obter evidências consideráveis no sentido de dividir a amostra em dois grandes grupos - empresas inovadoras e não inovadoras. Segmentos com diferentes características surgiram a partir da análise das tabelas *crosstabs* estabelecendo padrões comportamentais em relação à utilização de agentes de cooperação e de fontes de informação nas atividades de inovação.

As empresas que declararam ser inovadoras têm uma propensão para cooperar com outros agentes nas suas atividades de inovação. Quatro formas de cooperação foram identificadas como sendo significantes para a distinção entre inovadoras e não inovadoras, uma interna e três externas: (1) "cooperação dentro da própria empresa ou grupo a que esta pertence noutros países da Europa", (2) "cooperação com fornecedores de equipamentos, materiais, componentes ou software noutros países da Europa"; (3) "cooperação com laboratórios ou instituições privadas de I&D em Portugal"; e (4) "cooperação com universidades ou outras instituições de ensino superior em Portugal". No que diz respeito a fontes de informação utilizadas destacaram-se três tipos: (1) "informação disponibilizada dentro da própria empresa ou grupo a que esta pertence"; (2) "clientes ou consumidores"; e (3) "laboratórios ou Instituições privadas de I&D em Portugal".

A análise da árvore CHAID referente à inovação de produto/serviço revelou dois segmentos de empresas inovadoras. O primeiro desenvolve atividades de cooperação "dentro da empresa ou grupo de empresas" e considera importante "clientes/consumidores" como fonte de informação. Este grupo é composto principalmente por grandes empresas cuja sede está situada num país fora da Europa, promove os serviços a nível nacional e tem uma elevada percentagem de colaboradores com formação superior. O segundo grupo compreende empresas que utilizam agentes de cooperação (mas não dentro da própria empresa ou grupo a que esta pertence) e também atribuem importância a "clientes/consumidores" como fonte de informação e nas suas atividades de inovação. O perfil resultante enquadra principalmente médias empresas com sede em Portugal, dirigidas ao mercado nacional e com uma taxa elevada

de funcionários com diploma universitário. Relativamente à inovação de processo, um segmento distinguiu-se na árvore CHAID, evidenciou-se o grupo que coopera com "fornecedores de equipamentos, materiais, componentes ou software noutros países da Europa" e simultaneamente confere importância à fonte de informação "dentro da empresa ou grupo de empresas". Este segmento é constituído por médias empresas focadas no mercado nacional, com alta percentagem de colaboradores com grau académico e com sede num país da Europa. Apenas um segmento se diferenciou na árvore CHAID respeitante à inovação organizacional. Estas empresas optam pelo agente de cooperação "laboratórios ou instituições privadas de I&D em Portugal" e atribuem importância à fonte de informação "dentro da empresa ou grupo de empresas". No que respeita ao perfil, este grupo é constituído maioritariamente por médias empresas com sede em Portugal, que promovem os serviços a nível nacional e têm uma elevada percentagem de colaboradores com formação superior. Dois segmentos importantes surgiram na árvore CHAID relativa à inovação de marketing. A utilização do agente de cooperação "universidades ou outras instituições de ensino superior em Portugal" e da fonte de informação "dentro da empresa ou grupo de empresas" corresponde ao primeiro. Este segmento apresenta um perfil característico de empresas de grande dimensão com alta percentagem de colaboradores com grau académico, estão direcionadas para o mercado nacional e têm a sua sede num país Europeu. O segundo confere importância às fontes de informação "clientes ou consumidores" e "dentro da empresa ou grupo de empresas". O perfil resultante enquadra principalmente médias empresas com sede em Portugal, dirigida ao mercado nacional e uma taxa média de 50% de funcionários com diploma universitário.

Por último, cerca de 50% das empresas da amostra, em cada uma das quatro análises, não apresentaram uma inovação ao mercado durante o período referido. Este grupo não inovador não atribuiu qualquer importância às fontes de informação, quer internas quer externas e ignorou qualquer tipo de cooperação com outros agentes. Em termos de perfil, este grupo é composto sobretudo por pequenas empresas com sede localizada em Portugal, está mais orientado para um mercado local/regional e emprega uma pequena percentagem de trabalhadores com estudos superiores.

Palavras-chave: Inovação, Inovação Aberta, Ambiente Externo, Cooperação, Consultoria de Gestão, CHAID.

ABSTRACT

Based on the open innovation paradigm of Chesbrough, the aim of this study is to address important questions regarding the effect of the external environment on different types of innovation introduced in the market by management consulting firms. Distinctively from many studies that make use of the general concept of innovation, this dissertation divides this concept, distinguishing four types: (1) product/service; (2) process; (3) organizational; and (4) marketing. The justification for this division lies in the need to address important issues regarding the effect of the external environment on each type of innovation, analyzing if a certain type of information source or cooperation agent, belonging to the external environment, stimulates the enterprise's innovation activities more than another. The main objective was divided it into three complementary goals in order to better address the subject. First, appraise the propensity to use external sources of knowledge and cooperation agents in the type of innovation introduced in the market by these enterprises. Second, identify which sources of knowledge and cooperation agents were most used during the innovation process of each type of innovation. Third, segmentation of Portuguese enterprises considering each type of innovation introduced in the market.

For this dissertation, a secondary dataset was used from the 2010 Community Innovation Survey, with reference to the years 2008, 2009 and 2010. The survey was based on a harmonized questionnaire directly addressed to enterprises in order to collect primary data on their innovation performance, as well as on a variety of factors that may influence the innovation activities. According to the CIS, the survey sample was selected randomly, being each firm representative of firms with the same economic activity, size, and region. The CIS 2010 dataset included 374 enterprises belonging to management consulting sector. This group of firms will be the study sample for innovative behavior of Portuguese firms.

According to the objectives, the Chi-square Automatic Interaction Detection (CHAID) technique was applied to the sample in order to create a tree-based classification model. The choice of this method was based on the ability to classify cases into groups of predictor values of a dependent variable. The Chi-square Automatic Interaction

Detection (CHAID) technique used on the sample created four tree-based classification models, one for each dependent variable (product/service innovation, process innovation, organizational innovation and marketing innovation). The results produced considerable evidence to divide the sample into two groups - Innovative and non-innovative enterprises. These models presented significant profile of segments, which emphasized the differences on the external sources importance in the enterprise's innovation activities.

The enterprises that declared being innovators have a propensity to cooperate with other agents in their innovation activities. Four forms of co-operation over innovation are distinguished, one internal and three external: (1) "cooperation with other enterprises within the enterprise group in other European countries"; (2) "cooperation with suppliers of equipment, materials, components, or software in other European countries"; (3) "cooperation with commercial labs, or private R&D institutes in Portugal"; and (4) "cooperation with universities or other educational institutions in Portugal". In terms of information sources appraisal, this group favors three forms: (1) "information within the enterprise or enterprise group"; (2) "clients or customers"; and (3) consultants, commercial labs, or private R&D institutes".

The product/service innovation CHAID tree presented two segments of innovators. The first is composed of firms that give importance to "clients or customers" and uses as cooperation agent "other enterprises within the enterprise group in other European countries". This group is composed of large enterprises which have their head office located in a country outside Europe, focused on the national market and has a high percentage of employees with a university degree. The second is composed of firms giving also importance to "clients or customers" and willing to cooperate but not with an internal partner. With reference to profile features, this group relates to medium-size firms selling their services at a national level and whose headquarters are located in the country. These enterprises have a high percentage of employees with a university degree. Concerning the process innovation CHAID tree, only one important segment emerged. It represents a group of innovators that depend on internal sources of information and are able to develop cooperation with European suppliers for innovation purposes. The profile was composed of medium-size firms, whose head office was based abroad (Europe). These enterprises are aimed at the national market and their

employees are qualified above average with regard to higher education. The organizational innovation CHAID presented a segment of innovative firms that besides using internal sources of information also preferred a Portuguese entity such as "commercial labs, or private R&D institutes" as their cooperation agents. The profile is composed of medium-sized firms exhibiting a focus on the national market and employing a considerable number of highly qualified staff. Lastly, their head office is located in Portugal. Two important segments emerged in the marketing innovation CHAID tree. The first segment refers to innovative enterprises that cooperated with national "universities or other higher education institutions" and gives importance to the internal source "within the enterprise or enterprise group". Regarding the profile, this group is composed of medium-sized enterprises whose headquarters are situated in a country outside Europe. These firms are focused on the national market and have a high percentage of employees with a university degree. The second segment comprises enterprises that give importance to both "clients/customers" and "within the enterprise or enterprise group" as information source, in their innovation activities. Concerning the profile, these are mainly medium-sized firms aimed at the national market, with their head office located in Portugal. This group has approximately 55% of workers with higher studies.

Finally, around 50% of the sampled enterprises recognize themselves as non-innovators in each one of the four analyses. According to the results obtained through the CHAID trees, this group of enterprises generally does not assign importance to the information sources, being these either internal or external market. In terms of profile characteristics, this group is principally composed of small firms with their head office located in Portugal. Furthermore, these enterprises are noticeably more oriented towards a local/regional market and employ a small percentage of workers with higher studies.

Keywords: Innovation, Open Innovation, External environment, Cooperation, Management Consulting, CHAID.

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LIST OF ABBREVIATIONS

CHAID - Chi-square Automatic Interaction Detection

CIS - Community Innovation Survey

EU - European Union

FEACO - European Federation of Management Consultancies Association

MC – Management Consulting

R&D – Research and Development

SME – Small and Medium-sized Enterprises

CHAPTER 1

INTRODUCTION

1.1 Background

In the current dynamic and knowledge-intensive economies, the MC (Management Consultancy) enterprises have achieved a strong economic and social influence as the new "market protagonist" (Faust, 2002) and are often classified as the "management fashion industry" (Kieser, 2002). Serving a diverse range of clients in business, nonprofit organizations and politics (Niejahr and Bittner, 2004) large consultancy enterprises compete with multinational corporations in both employment and turnover (Empson, 2007 Greenwood et al., 2006). Considered knowledge-intensive enterprises - e.g., Armbrüster, 2006; Empson, 2001; Morris, 2001 - consultancies provide a constant stream of innovations to clients in need of external expert knowledge in order to compete with current trends and achieve business success (McKenna, 2006). Exploiting desire for order, security and control of managers (Huczynski, 1993; Sturdy, 1997), MC enterprises have been able to create a steady demand for their services, through constantly introducing new management tools. Abrahamson argues that consultants create and diffuse management techniques and practices, which are defined "fashionable" at any point in time (Abrahamson, 1991, 1996). Researchers of management fashions suggest that MC enterprises reshape the market by means of criticizing concepts in order to set up their own innovations as sources of market success (Abrahamson, 1996; Benders and van Veen, 2001; Kieser, 1997; Suddaby and Greenwood, 2001).

In this line, the success of global economy is determined by enterprise's ability to offer solutions to changing needs, views, trends and structures. More and more enterprises acknowledge that change is not only important, but also compulsory due to the fact that they constantly face a dynamic and fast changing market. Therefore, enterprises are compelled to influence the environment through innovation (Damanpour, 1991), if they want to survive in the long run. Innovation can be achieved in a variety of elements such as products, services, operations, and processes depending on the enterprise's resources, capabilities, requirements and strategies. The process of developing an innovation may imply three types of strategy, "make", "buy" (Veugelers & Cassiman, 1999; Santamaría, 2001) and cooperate with other agents to acquire knowledge. Already in 1925 Alfred Marshall recognized that the firms' internal knowledge base should be conveniently complemented with external sources (Marshall, 1925: 335).

Studies concerning this subject support that firms boundaries requires porosity in order to absorb knowledge and capabilities from the external environment (Chesbrough, 2003b; Shan et al., 1994; Leonard-barton, 1995; Powell et al., 1996), which provide an extensive variety of novel ideas and innovation opportunities (Laursen and Salter, 2006; Powell et al., 1996) and access to complementary resources so as to turn an innovation into a market success (Teece, 1986; Hagedoorn, 1993).

In Portugal, innovation and new technologies are considered the main drivers of national consulting (Fernandes, 2011; Ferreira, 2011; Pereira, 2011). The current market consists on the one hand in large corporations, essentially multinationals, with large national and international companies as major customers, and on the other hand, there are the small and medium-sized Consultancy enterprises whose main clients are national SME. The Portuguese enterprises constantly demand new services; therefore, consulting enterprises need to correspond to their expectations and satisfy their needs (Oliveira 2011; Patrício, 2011). At the present time, consulting has grown to be an essential and independent service in the business life of national and international enterprises (Fernandes, 2011; Teixeira, 2011). In our fast changing world, innovation is business, and consequently, suppliers of consulting need to be innovative.

1.2 Problem Statement

Open innovation has been studied by many researchers in the past (Leonard-Barton, 1995; Keil, 2002) nevertheless, some areas can still be quite interesting to conduct a research.

One the one hand, we have got the innovation development. At the present time, it is getting more and more difficult for enterprises to maintain a competitive advantage only through internal R&D, because of the fast pacing of technology development and the increase of knowledge and change of business environment. Given the dynamism and complexity of the environment, enterprises need to complement their internal resources and capabilities with ideas imported from outside, interacting with a wide range of actors inside the innovation system (von Hippel 1988; Lundvall 2010; Szulanski 1996; Laursen and Salter 2006). This complement to internal R&D (Cohen and Levinthal, 1990; Veugelers, 1997; Chesbrough et al., 2006) can give enterprises access to the

complementary assets needed to turn an innovation into a commercial success (Teece, 1986; Hagedoorn,1993).

On the other hand, we have got MC. The consulting industry supplies a constant stream of innovations to enterprises that seek external expert knowledge in order to compete in a dynamic and fast changing market and achieve business success (McKenna, 2006). MC is also considered as the "management fashion industry" (Kieser, 2002) and reshape the market to set up their own innovations as sources of market success (Abrahamson, 1996; Benders and van Veen, 2001; Kieser, 1997; Suddaby and Greenwood, 2001).

Following these two approaches, and this intriguing relationship, it is interesting to analyze if Portuguese MC enterprises, being the "management fashion industry" (Kieser, 2002) that redesign the market with their own innovation concepts (Abrahamson, 1996; Benders and van Veen, 2001; Kieser, 1997; Suddaby and Greenwood, 2001), complement their internal R&D[1] with external knowledge (Cohen and Levinthal, 1990; Veugelers, 1997; Chesbrough et al., 2006) in order to achieve innovation.

1.3 Study Justification

In studies about innovation a general concept of innovation is often used. This dissertation divides the concept of innovation, dividing it in four types: (1) product/service; (2) process; (3) organizational; and (4) marketing. The justification for this division lies in the need to address important issues regarding the effect of the external environment on each type of innovation, analyzing if a certain type of information source or cooperation agent, belonging to the external environment, stimulates the enterprise's innovation activities more than another. Many studies on innovation have been performed in the past, and other authors have already distinguished between types of innovations, for instance, Pavitt *et al.(*1987), Lundvall

[1] R&D departments can be generally defined as: specialists in different areas of MC expertise (Consulting, Development and Integration, Outsourcing, other MC services) following the latest trends (technological/scientific/concepts) and the market environment, in order to develop and adapt products to introduce to clients.

(1988), Cornish (1997), Kalantaridis and Pheby (1999), Lisa de Propris (2002), however the data analysis method used in this dissertation, *Chi-square Automatic Interaction Detector*, was less explored in previous studies on innovation.

1.4 Objectives

This study aims to investigate the impact of external environment over innovation on four different types: product, process, organizational and marketing innovation. Drawing on the existing literature, this dissertation aims to address the following aims:

- Appraise the propensity to use external sources of knowledge and cooperation agents in the type of innovation introduced in the market by Portuguese MC enterprises.

This objective will allow us to understand if Portuguese MC enterprises were either closed or open to be influenced by external sources and cooperation agents during their innovation process.

A second complementary and interrelated objective was formulated as follows:

- Identify which source(s) of knowledge and cooperation agents was (were) most used during the innovation process of each type of innovation introduced in the market by Portuguese MC enterprises.

This objective would allow us to assess which kind of external source or cooperation agent was the choice of Portuguese MC enterprises to better pursue the goal of a certain type (s) of innovation.

The third and last objective was formulated as the following:

- Segmentation of Portuguese MC enterprises on consideration to each type of innovation.

This objective would allow us to establish profiles of Portuguese MC enterprises concerning each innovation introduced in the market.

1.5 Research Questions

Having introduced the problem statement and established its objectives, it is now possible to formulate the research questions which this dissertation will attempt to analyze. They are four in total:

Research question 1

Were Portuguese MC enterprises influenced by the external environment while developing a new or significantly improved good or service in the market, during the period from 2008 to 2010?

Research question 2

Were Portuguese MC enterprises influenced by the external environment while developing a new or significantly improved production process, or new and significantly improved methods of supplying services, or supporting activity, during the period of 2008 to 2010?

Research question 3

Were Portuguese MC enterprises influenced by the external environment while developing a new organizational method in the enterprise's business practices, workplace organization or external relations, during the period from 2008 to 2010?

Research question 4

Were Portuguese MC enterprises influenced by the external environment while developing a new marketing method or strategy that involves significant changes in product design or packaging, product placement, product promotion or pricing, during the period from 2008 to 2010?

For this dissertation, a secondary dataset was used from the 2010 Community Innovation Survey. This study includes 374 enterprises as a sample of the innovative behavior of Portuguese MC enterprises, during the period from 2008 to 2010.

1.6 Dissertation Structure

The dissertation starts with the first Chapter - ”Introduction” aimed to familiarize the reader with the problem that is going to be approached along the dissertation, in addition to establish the objectives that this work attempts to accomplish.

The second Chapter “Literature Review” is aimed to explore on the one hand, the theoretical platform of management consulting, regarding its background since its first appearance up to the present day, with an approach to the Portuguese consultancy industry as well. On the other hand the literature review also explores innovation, with a close approach to cooperation and external sources of knowledge.

The third chapter is entitled methodology. Initially, an approach is given to the data set source which is the Community Innovation Survey, as well as an explanation of the data analysis method. The research question’s formulation and the selection of the variables to test with the CHAID method are also addressed in this chapter.

The fourth chapter is devoted to the results analysis. The results of the research questions analysis are presented at this point, combined with the discussion on the findings.

The fifth chapter, conclusion, is where the summary of key results is exposed, the limitations to the dissertation are disclosed and proposals for future research are suggested.

The complementary parts, References, Annexes, and Appendixes complete the dissertation structure.

CHAPTER 2

LITERATURE REVIEW

2.1 Management Consultancy Concept

In this point, fundamentals on definition of management consultancy, its segmentation and origins, in addition to an approach to the Portuguese MC market are given to allow a general understanding of the subject.

2.1.1 The Definition of Management Consultancy

Regarding MC definition, authors essentially choose one of two broad approaches. The first approach focuses on a wide functional interpretation of consultancy, while the second perceives consulting as a specific professional service.
An example for the first approach is Steele's definition:

> "...any form of providing help on the content, process or structure of a task or series of tasks, where the consultant is not actually responsible for doing the task itself, but is helping those who are" (Steele, 1975: 3).

Whilst the second approach is preferred by Greiner and Metzger:

> "Management consulting is an advisory service contracted for and provided to organizations by specially trained and qualified persons who assist, in an objective and independent manner, the client organization to identify management problems, analyze such problems, recommend solutions to these problems, and help, when requested, in the implementation of solutions"(Greiner and Metzger, 1983: 7).

A more recent definition focused on value to firms was introduced by FEACO[2]. This organization defined MC as:

> "…the creation of value for organizations through the application of knowledge, techniques and assets to improve performance. This is achieved through the rendering of objective advice and/or the implementation of business solutions"(FEACO, 2013).

2.1.2 Segmentation of MC Enterprises

The MC enterprises differ according to size, concentration and above all the area of expertise. Their focus varies from technology to pure strategy approach. However segmentation of consulting industry has not become an easy task for a few reasons. For instance portfolio naming, such as talent management and human resources management, despite using different names they both refer to the same service (Oliveira 2011; Teixeira 2011). Other reason is that the "key service lines" have become complexly structured.

In this work the segmentation introduced by FEACO in 2005 was preferred. Four main segments of consultancy business were identified by FEACO which reflect the complex nature of the consulting industry. These enterprises can be categorized as Consulting, Development and Integration, Outsourcing and Other services. The consulting segment is subsequently divided into two sub-segments: Business Consulting and Information Technology Consulting. The four main segments of consultancy business are further described in table 2.1.

[2] The European Federation of Management Consultancies Associations was formed in 1960 and gathers 14 national member associations. The Federation is a nonprofit organization, with the purpose of assisting in the promotion and development of Management Consultancy in Europe by providing support to national association members.

Table 2.1 - Types of management consultancy

Area of expertise	Service(s) Description
Consulting	Business Consulting which includes: Strategy Consulting, Organization/Operation Management, Change Management and Human Resources Consulting.
	Information Technology Consulting concerns evaluation of IT strategies with the objective of aligning technology with the business process.
Development and Integration	Consulting services that include development of applications (excluding software) and the creation of new functionalities through, often tailored, process developments.
Outsourcing	Outsourcing consists of three types of activities: management services, Applied Management Services and Business Process Outsourcing.
Other services	Management consulting Services that are generally complementary to Consulting, Development and Integration, and Outsourcing. Categories here include: Training, Engineering Consulting, Outplacement, Executive Selection and Recruitment and Audit and Accounting.

Source: FEACO 2005 Management consulting segmentation model (FEACO, 2005)

2.1.3 The Origins of Management Consultancy

Whilst some professions have their roots back centuries ago, MC is quite young, being less than 150 years old. Enterprises offering specialized advice emerged rather late in the industrial age (Kubr, 1986). Management problems such as little or no expertise on organizing processes, people or machinery resulting from demands for mass-produced goods drove specialists like Frederick Winslow Taylor3 and Charles Babbage4 to develop new methods for work organization, which resulted in significant improvements in factories (Ahmad, 2012).

In 1886, Arthur D. Little, Professor at the Massachusetts Institute of Technology founded the first recognized MC enterprise. In the beginning it was only focused on

[3] Frederick Winslow Taylor (1856 – 1915) is regarded as the father of scientific management as well as one of the first management consultants. Taylor sought to improve industrial efficiency and as a result he developed a system known as scientific management, which is a form of industrial engineering which established the organization of work as in Ford's assembly line.

[4] Charles Babbage (1791- 1871) pointed out that a careful division of labour and training or apprenticeship taken as fixed costs could bring extra commercial advantages. Babbage is also considered as "the father of the computer". He designed and invented the first mechanical computer whose basic architecture was similar to a modern computer.

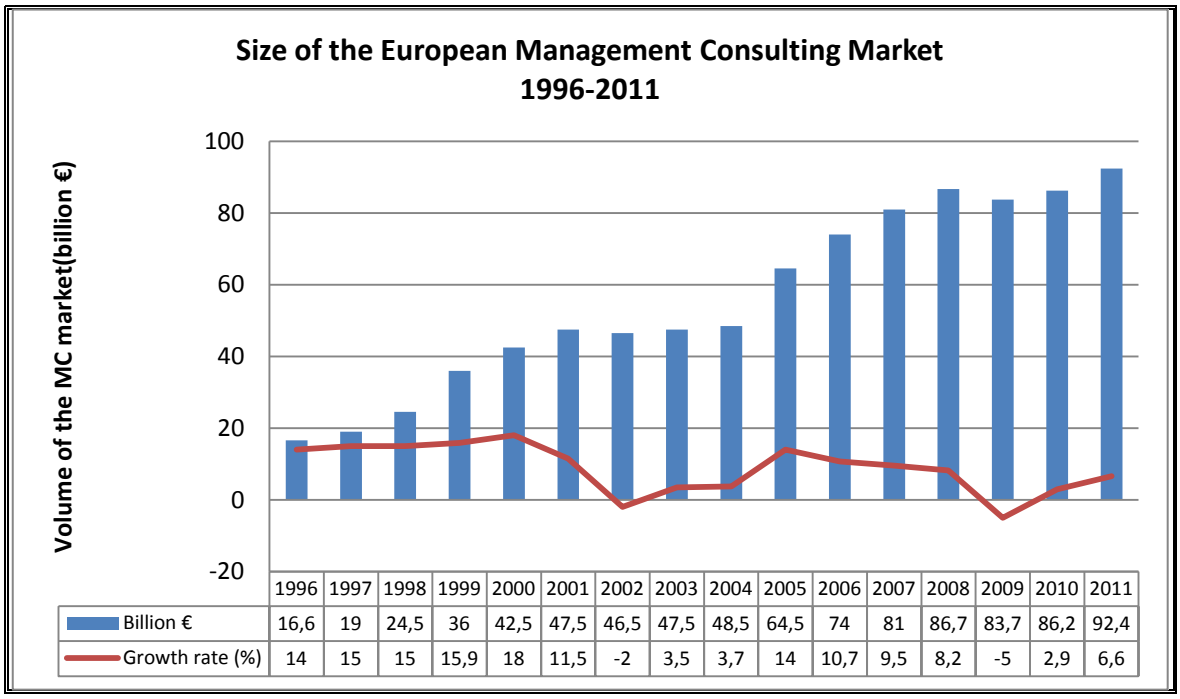
technical research; however it specialized later in "management engineering". In the 1890s, Arthur Young, William Deloitte, George Touche, started their business, which was initially centered in accounting practice and then shifted to auditing and advising after 1900. Therefore, we can assume the argument that true MC really made its debut in the twentieth century, and is traced to Edwin Booz, James McKinsey and Andrew Kearney. In 1914, Booz Allen Hamilton formed the first MC enterprise with the purpose of serving the industry as well as government clients. James O. McKinsey and Andrew Kearney founded McKinsey & Company in 1926, which became the first modern, pure management and strategy consulting company.

Robert David suggests that the growth experienced during the 1930 and 1980 period was induced by four external forces. First, the growing number and complexity of the enterprises, second, the ideology of corporate conversion to non corporate sectors, third, the Second World War organization effort, and last, the growing impact of business education and business press (David, 2001). Moreover, in his work, this author identifies four models of growth: administrative science, accounting, industrial research, and information technology (David, 2001). The increase in globalization promoted the boom in consulting, favoring a growth in the number of management consulting firms, and bringing a methodical approach to the study of strategy and management. It is important to mention that consultancy expanded due to the economic development, guided by a demand driven industry, which first began in the United States of America, later in Europe and finally in the rest of the world.

In the 90's there was another expansion of MC, first due to Central Europe opening its borders, and second, to the explosive growth of the World Wide Web. These events led management consultants to step up their effort to expand their business activity. In the last decades of the twentieth century the consultancy sector witnessed a rapid growth (McLarty and Robinson, 1998; Wright, 2000; Fincham and Clark, 2002; Kipping and Martin, 2005; Kipping and Armbrüster, 1998a; Ernst and Kieser, 2000) increasing between 10 and 15 percent per year, which is significantly higher than the world economy (Armbrüster and Kipping, 2003; Kipping et al., 2006).This industry suffered stagnation between 2001 and 2003 caused by the high-tech / e-business bubble - dot-

com crash[5] - that popped with severe consequences to clients and their consultants. The credit crunch[6] (2009-2011) was considered another setback to consultancy firms. The recession caused by the collapse of liquidity in the money markets originated a major crash in the stock markets and a decline in consumer confidence leading consultancy clients to reduce their discretionary spending.

Figure 2.1 - Size of the European Management Consulting Market



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Billion €	16,6	19	24,5	36	42,5	47,5	46,5	47,5	48,5	64,5	74	81	86,7	83,7	86,2	92,4
Growth rate (%)	14	15	15	15,9	18	11,5	-2	3,5	3,7	14	10,7	9,5	8,2	-5	2,9	6,6

Source: FEACO Surveys of the European Management Consultancy Market: 1996-2011 (FEACO)

Nowadays the consultancy sector is a multi-billion euro industry, which employs millions of people worldwide. As represented in figure 2.1, during the period of 1996-2011the European MC marketplace experienced stable growth, peaking at 92.4 billion Euros in 2011. Nevertheless, there were two periods in which consulting revenues declined, in 2002 and 2009. By 2002 the size of the MC market had decreased by 2 per cent to a total turnover of 46.5 billion Euros, caused by the high-tech / e-business economic crisis. The credit crunch[7] also strongly affected the global market and the

[5] The dot-com crash, which is also known as the dot-com boom, the Information Technology bubble and the Internet bubble, took place between 1997 and 2000. It was an historic speculative bubble caused by a group of Internet based companies, normally referred to as dot-coms which enormously increased their stock prices by simply adding an "e-" prefix in their name or a ".com" at the end, causing speculative stock prices which later collapsed.

[6] The 2009 -2011 credit crunch, also referred to as the credit crisis or credit squeeze, was a period in which banks suddenly tightened the conditions to get a loan.

consulting industry. This setback was experienced in 2009, especially in the size of the MC market which decreased by 5 per cent. Since 2010 the MC industry has been showing a moderate but steady recover both in size and growth. (FEACO, 2013)

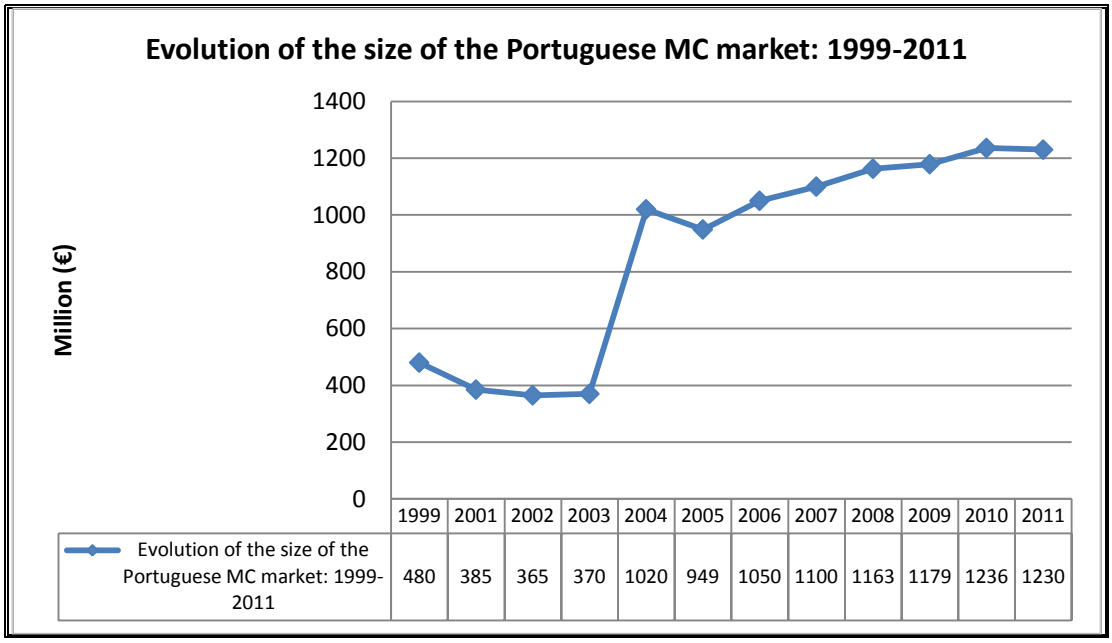
2.1.4 The Portuguese Background of Management Consultancy

Although the consultancy sector emerged in the early twentieth century (Kipping et al., 2006; Kipping, 2002; Canbäck, 1998), this industry only appeared in Portugal in the 40s. The first enterprises were consulting engineering driven, aimed at engineering consulting and large-scale infrastructure projects in the former Portuguese colonies, and some large diversified groups who sought advice in the area of large industrial projects (Sismet, 1993; Amorim, 1999a, b, c; Amorim and Kipping, 1999).

The origins of the management consulting sector in Portugal are related to scientific management and production efficiency improvement, the consulting market developed later when compared with other European countries (Amorim, 1999a, c; Amorim and Kipping, 1999). This late evolution was mainly due to the specific economic, political and social development, which was defined as an underdeveloped economy. The situation only progressed to a better framework when Portugal joined the EU in 1986. This event changed the national economy with an increase in its level of globalization. The entry of Portugal to the EU caused a positive stimulus in the Portuguese economy which generated increased inflows of foreign direct investment and a rearrangement of the economical and social framework of the country. The EU financial support, brought business opportunities and the rise of several management consulting national enterprises which offered their services, to SMEs and to the public sector as well (Amorim, 1999b).

Over the 90s the MC market in Portugal experienced a growth with various multinational players entering it in order to explore new business opportunities, offering mainly organizational consulting, strategy and IT (Amorim 1999a, b, c).

Figure 2.2 - Evolution of the size of the Portuguese MC market: 1999-2011



Source: FEACO Surveys of the Portugal Management Consultancy Market: 1999-2011(FEACO, 2013)

Despite the raise of the level of competitiveness, remaining the market attractive until the beginning of 2000, the Portuguese consultancy industry was then negatively affected. During the period from 2000 to 2003, the country was severely hit by the general economic recession. As a consequence the market hit its lowest point in 2002 to a total turnover of 365 million Euros, better described in figure 2.2. The 2009 global crisis had a significant impact over the country's economy. Nonetheless the MC market recovered very rapidly as in 2010 reached a 4.8% growth rate with a total turnover of 1236 million euros, which decreased to 1230 millions in 2011. In fact, this Portuguese sector still remains a very small market when compared with other Western European countries, notably Germany and the UK.

Amorim (1999b) analyzed the Portuguese consultancy market and noticed that it is defined by two distinct segments. The first consists of large corporations, essentially multinationals, with large national and international companies as major customers, whose market consulting focuses at the level of IT services, strategy and corporate finance. On the other hand, there are the small and medium-sized consultancy enterprises whose main clients are national SME and whose main services consist of training, quality systems improvement, economic studies, as well as advice on financial support from the EU.

The Portuguese economy faces now a significant recession, being under agreement for economic and financial assistance with the European Central Bank, European Commission and International Monetary Fund. The consulting industry is being strongly affected by crisis and recession. This pessimistic economic situation has caused deterioration of the demand for services as well as reduction, if not even an elimination of client's budget for consulting services (Jerónimo, 2011). The situation has imposed rigorous adjustments to consulting enterprises due to the market restrictions and the negative global environment, both in the private and public sector.

2.2 Innovation

Innovation and its external environment are the main factors for this research. In order to draw up a frame of reference, some of the studies that provided basis for this research are summarized in Appendix 1.

2.2.1 The Concept of Innovation

Innovation is a theme of interest for researchers of different business and management disciplines such as strategy, research and development, information technology, marketing, operations management, entrepreneurship or even engineering and product design. A definition of innovation common to all of these disciplines is hard, because as authors Damanpour and Schneider state "Innovation is studied in many disciplines and has been defined from different perspectives" (Damanpour and Schneider, 2006: 216). Baregheh, Rowley and Sambrook collected 60 definitions of innovation from the various disciplinary literatures in their study "Towards a multidisciplinary definition of innovation" (Baregheh et al., 2009), as described below:

- Business and management - 18 definitions from 1966 to 2007;
- Technology, science and engineering - 13 definitions from 1969 to 2005;
- Economics- 9 definitions from 1934 to 2004;
- Innovation and entrepreneurship - 9 definitions from 1953 to 2007;
- Organization studies - 6 definitions from 1953 to 2008;
- Knowledge management - 3 definitions from 1999 to 2007;

- Marketing - 2 definitions from 1994 to 2004.

Addressing this problem of ambiguity and confusion due to the high number and diversity of innovation definitions, authors Baregheh, Rowley and Sambrook propose both a diagrammatic model and a simple textual definition which mutually act as a foundation for summarizing the meaning of "innovation":

> "Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, services or processes, in order to advance, compete and differentiate themselves successfully in their marketplace"(Baregheh et al., 2009: 1334).

Baregheh, Rowley and Sambrook assume the above definition, having its limitations because first, it was based on the existing theoretical work from a range of business disciplines and second, a chronological perspective of the nature and focus of innovation was not taken into consideration (Baregheh et al., 2009). It is important to mention that it can only be considered an innovation when an enterprise develops an invention in order to introduce it in the market (Kuznets, 1962).

2.2.2 Disclosing the Concept of Innovation

Innovation can be achieved in a variety of elements depending on the enterprise's resources, capabilities, requirements and strategies. The most common types of innovation refer to products, materials, services or organizational structures (Ettlie and Reza, 1992).

The dataset used in this dissertation is provided by the CIS, which collects information on four major concepts: product/service innovation, process innovation, organizational and marketing innovation. Accordingly, in order to address the research questions of this dissertation, it was necessary to divides the concept of innovation, distinguishing it in four types: (1) product/service; (2) process; (3) organizational; and (4) marketing. Following this line, an appropriate or at least almost accurate definition to innovation was necessary. Thus the following definition was adopted:

> "Innovation concerns the search for, and the discovery, experimentation, development, imitation, and adoption of new products, new production processes and new organizational set-ups"(Dosi's, 1988: 222).

Other authors have already focused on different types of innovation: Pavitt et al. (1987), Lundvall (1988), Cornish (1997), Kalantaridis and Pheby (1999). For instance, Lisa de Propris concentrated her investigation on the impact of inter-firm co-operation over innovation on four different types of innovation: product, process, incremental and radical innovation (Lisa de Propris, 2002). An analysis CHAID to assess the influence of the external environment (information sources and cooperation agents) on the four different types of innovation (product/service, process, organizational and marketing), can help disclosing distinctive aspects among them. That is the purpose of the present work.

2.2.3 The Theoretical Background of Innovation

Since the 1980s, firms were forced to reassess their innovation strategies due to the increasing volatility of the competitive environment with shorter product and technological life cycles (Nijssen et al., 2001), meaning that new products and services had to be faster developed (Chatterji, 1996). Organizations strive to gain competitive advantage in a competitive environment, consequently they adopt innovations supposedly better to enhance their organizational performance (Hernandez et al., 2008; Herring and Roy, 2007). Already in 1925 Alfred Marshall recognized that the firms' internal knowledge base should be conveniently complemented with external sources. Marshall emphasizes in his work, the importance of the development of firms' positive externalities through a market-based organization (Marshall, 1925: 335). Since the mid-1990s, in order to exploit new opportunities, achieve economies of scale, or market strength, multinational firms as well as small and medium-sized firms have been establishing more relationships with other companies (Rosenfeld, 1996; Hagedoorn et al., 2000). Nowadays, given the dynamism and complexity of the actual environment it is essential to complement the enterprises internal knowledge with external sources of knowledge. Even major organizations, dynamic in terms of innovation, cannot depend exclusively on internal sourcing, requiring knowledge beyond their boundaries in order

to develop their innovations (Rigby and Zook, 2002). Freeman states that firms with R&D departments have a propensity to employ external knowledge sources intensively (Freeman, 1991). Several theorists point out that the introduction of new products and processes into the market rely on the firm's skills to build strong relations with external agents meaning that firms seldom innovate on their own (Håkannson, 1987; Baptista and Swann, 1998; Cooke and Morgan, 1998).

It is now widely acknowledged that firms' innovation patterns depend on the sources employed and that they are specific to each industry (Pavitt, 1984; von Hippel, 1988; Archibugi et al., 1991; Evangelista, 1996). These external sources are of extreme significance to small and medium-sized firms particularly those belonging to the knowledge-intensive sector (Lawton Smith, 1993; Malecki and Tootle, 1996; Rothwell, 1992; Shapira et al., 1995).

2.2.4 Open Innovation

In the process of developing new products/services it becomes essential to perceive the significance wielded by external agents as a source for innovation projects.

Nowadays, firms cannot rely solely on their R&D departments as they need to balance internal resources and capabilities with ideas from beyond their boundaries, and interact with a large choice of players within the innovation system (von Hippel, 1988; Lundvall, 2010; Szulanski, 1996; Laursen and Salter, 2006). This concept is the main support of the "open innovation" model (Chesbrough, 2003a, b). Open innovation is defined as:

> "…the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the market for external use of innovation, respectively"(Chesbrough et al., 2006: 2).

In the open innovation model, the firm business model is tailored in privilege of R&D activities, and the technological change takes place outside the firm. As a consequence, innovation becomes progressively more spread among various partners (von Hippel,

1988). Therefore new ideas and knowledge for product innovations can result from collaboration with external partners (Lambe and Spekman, 1997; Ahuja, 2000).

On the one hand, external knowledge connections are a vital factor in the open innovation model, and on the other, a complement to internal research (Cohen and Levinthal, 1990; Veugelers, 1997; Chesbrough et al., 2006). Following this approach, firms that are internally centered need to open their boundaries to external partners otherwise, numerous opportunities may be missed (Chesbrough, 2003a; Laursen and Salter, 2006). Several studies support that firm's boundary requires porosity in order to absorb knowledge and capabilities from the external environment (Chesbrough, 2003b; Shan et al., 1994; Leonard-barton, 1995; Powell et al., 1996), which provide an extensive variety of novel ideas and innovation opportunities (Laursen and Salter, 2006; Powell et al., 1996) and access to complementary resources to turn an innovation into a market success (Teece, 1986; Hagedoorn, 1993). The use of external knowledge is a vital element of innovative performance (Cohen and Levinthal, 1990).

2.2.5 Cooperation with External Agents for Innovation Development

In most countries the economic environment where business takes place is defined by complexity and dynamism. Fast changing factors such as technology, customers or competitors force enterprises to renew their strategy in order to survive, reshaping their activities, in particular innovation development. The process of developing an innovation normally implies two types of strategy: generate knowledge in-house (make) or purchase it (buy) (Veugelers and Cassiman, 1999; Santamaría, 2001), nevertheless, in recent times theorists have detected a third strategy for acquiring knowledge – Cooperation in innovation with other agents (Navarro, 2002).

Strategy authors have demonstrated that agents from outside the enterprise constitute a significant resource in actual competitive framework, especially in the development of new products and processes (Penrose, 1959; Rumelt, 1984; Teece, 1984; Wernerfelt, 1984; Barney, 1991; Peteraf, 1993). The enterprise's intention to cooperate with other agents in innovation activities is impelled by the fact that it is an efficient way to improve the chances of success on the development of differential products or services (Belderbos et al., 2003; Becker and Dietz, 2004; Abramovsky et al., 2005, Sampson,

2007). Besides, enterprises that are highly internally focused, not opening themselves up to external networks and relationships may miss a lot of opportunities (Chesbrough, 2003a; Laursen and Salter, 2006). Hence, in the development of innovations the decision to cooperate with other agents is important (Mowery and Rosenberg, 1989; Arora and Gambardella, 1990) since it will enhance the enterprise's learning capabilities. However, literature states that the enterprises performance depends on their ability to locate, absorb and exploit these sources in a productive way (Cohen and Levinthal, 1990). Several factors support the firm's decision to cooperate considering that it allows to share expenses and uncertainty, exploit synergies, scope or recognize economies of scale, as well as to benefit from government support (Shing, 1997; Croisier, 1998; Veugelers and Cassiman, 1999; Becker and Dietz, 2004). Given these advantages of cooperation, if the concept of innovation among firms has been introduced in an industry, non participation will be acknowledged as a competitive disadvantage (Enkel et al., 2009).

The innovation process may involve external sources from different origins, ranging from clients, suppliers, universities, to competitors as well as other agents (von Hippel, 1988, 2005; Arora and Gambardella, 1990; Gemünde et al., 1992; Powell et al., 1996). Essentially, innovation sources are divided in two types: internal and external. Table 2.2 shows a more detailed picture of these sources. The internal type comprises the innovation activities carried out within the enterprise: R&D, marketing and production departments. The external are related to: (1) market sources such as customers and users, suppliers (materials, equipment, software, etc) competitors, consultants and experts, other sources such as commercial laboratories or technological parks, (2) educational and research sources (universities and research institutes) and (3) public available information (conferences, fairs/exhibitions, journal and magazines and patents).

Table 2.2 - Sources of Innovation

Sources of Innovation	
Internal	**External**
R&D Department	(1)Market ➢ Customers and users ➢ Suppliers ➢ Competitors ➢ Consultants and experts ➢ Others
Marketing Department	(2) Educational/Research ➢ Universities ➢ Research institutes
Production Department	(3) Public available information ➢ Conferences ➢ Fairs /Exhibitions ➢ Journals, Magazines ➢ Patents

Source: Own elaboration

It is clear that enterprises have at their disposal a wide range of agents to cooperate in their innovatory effort, yet, decide which one(s) to cooperate with, depend on the ability to identify the type of agent that can better satisfy their internal needs and improve their competitive advantage.

2.2.5.1 Customers

Customers can be the cooperation agent with greatest impact on the intensity of innovation activities, somewhat because, just like the suppliers, it is vertical or non-competitive cooperation. Their involvement in the manufacturing and service sectors in Spain is a good example of their contribution in new product development (Sánchez-González and Herrera, 2010).

The success of product innovations in public sector institutions is also highly related to cooperation with customers (Freel and Harrison, 2006). This external partner is an important source of knowledge because its inputs help firms to identify new ideas about products and solutions (Urban and von Hippel, 1988), comprehend customer's needs, and identify new market trends in advance (Li and Calantone, 1998). For example high-tech industries benefit from customers contribution particularly to learn about technological trends and develop superior products. (Atuahene-Gima and Ko, 2001; Brettel and Cleven, 2011). Some firms invite customers to participate in the innovation

process, most frequently in the design of the next new product, for example, the online Lego DesignbyMe tool (von Hippel, 2005). Regarding complex technologies and / or products this external source provides particularly valuable information (Tether, 2002). The similar principle applies when the product presents a high level of novelty (Amara and Landry, 2005). This can be explained by the fact that the user's experience can be of great help either to reshape or improve the existing design or even give ideas for new models and applications. Apart from improving the product design, collaboration with customers provide a more controlled development of the innovation process with less time and lower costs (Jeppesen, 2002).

2.2.5.2 Suppliers

The relationship between suppliers is normally considered as vertical or non-competitive cooperation. It is a fact that enterprises have increased their relationships with their suppliers from the eighties onwards mainly because of Japanese car and electronics success relationship in the innovation development (Bidault et al., 1998). According to Håkansson and Eriksson (1993), suppliers are base factors of business. These players can be a source of innovative ideas and critical technologies considering that suppliers have specific knowledge and competencies not to mention that they are always interested in improving relationships with their clients.

In countries like the United Kingdom and the United States, large enterprises that choose to downsize and concentrate on core competences, have increased their collaboration with these agents to guarantee a supply of quality inputs (Belderbos et al., 2004). The high degree of efficiency attained is one of the main reasons for cooperating with suppliers in terms of innovation in new products or processes (Tether 2002; Bayona et al., 2003; Santamaría and Rialp, 2007). Suppliers are also the partners of choice when the enterprise's objectives have a commercial nature, such as entering new markets or internationalization (Bayona et al., 2001, Santamaría and Rialp, 2007). These agents, just like customers, assist not only the development of products and processes, quality improvement and market adaptation, but also productivity and flexibility (Chung and Kim, 2003). Reduction of production cost is another reason to cooperate with suppliers (Atallah, 2002), likewise costs and risks involved in new product development (Chung and Kim, 2003).

2.2.5.3 Competitors

Establishing a relationship with competitors is normally referred horizontal cooperation which is not an unusual type of cooperation. Competitors are an external source that can be involved in the innovation process (von Hippel, 1988, 2005). The knowledge generated by these agents can easily be accessed and exploited by firms that do not hold a high level of internal technological competence (Cohen and Levinthal, 1990).

This type of relationship is quite appealing, considering that it contributes to intensify international competitiveness in enterprises, industries and countries and to solve issues associated to market failures and its technological deficiencies (Harabi, 2002). Relationships with competitors involve, on the one hand a reduction in investment risk and market uncertainty, and on the other, sharing of costs when enterprises initiate their R&D activities (Harabi, 2002). According to von Hippel, enterprises copy and improve products and processes by learning from their competitors, and through know-how exchange as well (von Hippel, 1988).

Nevertheless, besides advantages there are also risks associated with the possibility of anti-competitive behavior (Tether 2002) and involuntary spillover of key knowledge to competitors (Casiman and Veugelers, 2002; Miotti and Sachwald, 2003). Therefore, cooperation is more likely to occur either in protected areas or sharing knowledge that is not vital. Enterprises avoid areas that may raise competition and favor cooperation on solving common issues (Tether, 2002; Cassiman and Veugelers, 2002) such as collaboration on basic research/projects or establishing standards in the sector (Gemünden et al., 1992; Tether, 2002).

2.2.5.4 Consultants and Experts

Enterprises tend to seek alternative sources of knowledge and information when the development of innovations is affected, in particular when it is not going as fast as needed or does not correspond to the enterprise expectations. In this context, consultants and experts are a suitable solution (Tether, 2002). These agents are a source of

specialized knowledge and skills that provide a wide range of valuable inputs for innovation development.

Consultants and experts render possible experience sharing, concerning the definition and articulation of specific innovation needs, offer ideas on new needs and solutions, or even idea transfer among enterprises (Bessant and Rush, 1995). Besides, these agents can bring to the enterprise different points of view, as they are not familiar to the enterprises products and processes, since the enterprise staff can sometimes be an obstacle to new ideas. Thus, the contributions brought by these types of agents encourage a growth in the number of effective innovative ideas (Bruce and Morris, 1998).

2.2.5.5 Universities and Research Institutes

The most common form of partnership is cooperation with scientific agents particularly in science-based firms (Castro and Fernández, 2006). Universities and research institutes have a main role in the development of technological innovations contributing to new scientific and technological knowledge (Drejer and Jørgensen, 2005). This type of collaboration does not bring any type of commercial risk, unlike cooperation with competitors, inasmuch as these agents are focused in generating R&D knowledge of a basic or generic nature, and not introducing it in the market (Miotti and Sachwald, 2003). Cooperation with Universities is a way of sharing costs and exploit knowledge which is available to public (Veugelers and Cassiman, 2005).

Universities as well as their research institutes are constantly creating and developing scientific knowledge, thus, as research in firms intensifies and becomes very expensive, specialized academic knowledge is brought to balance and complement the firm's R&D in order to gain access to rising technologies (Tidd and Trewhella, 2002) and achieve technological discovers that lead to viable commercial products (Spencer, 2003).

Probably, one of the reasons why enterprises chose this source may be to benefit from public funds destined to research (Davenport et al., 1999; Bayona et al., 2001; Cassiman and Veugelers, 2002; Miotti and Sachwald, 2003; Fontana et al., 2006). It is quite usual

for policy-makers the encouragement of the relationship between enterprises and research institutes as a mandatory requisite to subsidize projects with public funds.

Although cooperation with these agents is very important, enterprises must have an important in-house R&D capability in order to absorb scientific knowledge generated (Cohen and Levinthal, 1990). Although universities and their research institutes are acknowledged as key players in new product development their roles in the innovation process is not yet totally clear (MacPherson, 1997; Reichstein and Salter, 2006).

2.3 Management Consultancy – "An Innovative fashion"

Nowadays, the fast changing environment causes uncertainty on enterprise managers which is considered the main factor for demanding consulting services (Kakabadse et al., 2006). In the current dynamic and knowledge-intensive economies, the management consultancy enterprises have achieved a strong economic and social influence as the new "market protagonist" (Faust, 2002) and are often classified as the "management fashion industry" (Kieser, 2002). Considered knowledge-intensive enterprises (Armbrüster, 2006; Empson, 2001; Morris, 2001) consultancies provide a constant stream of innovations to clients in need of external expert knowledge in order to compete with current trends and achieve business success (McKenna, 2006). This behavior develops the reputation of management consultancies as thought leaders, due to a continued demand for their knowledge (Ernst and Kieser, 2002; Fincham and Clark, 2002).

The constant need for innovation is reflected in the diversity of concepts created by consultants. Exploiting desire for security and control of management (Huczynski, 1993; Sturdy, 1997), consultancy enterprises have been able to create a steady demand for their services, through constantly introducing new management tools, known as "fashions". These management techniques and practices are defined by consultants as "fashionable" at any point in time (Abrahamson, 1991, 1996). This author describes "management fashion" as:

> "…a relatively transitory collective belief, disseminated by management fashion setters, that a management technique leads rational management progress"(Abrahamson, 1996: 257).

Rational and progressive means, first that it is an efficient way to important goals, and second, the improvement over time of techniques. In this line, "fashions" represent solutions for problems faced frequently by managers, creating a legitimized market for consulting. For instance, customer service excellence, ethical trade, services portfolio, methods and techniques of quality management, business diagnostic tools, balanced scorecard (BSC), can be considered "fashions".

This "fashion phenomenon", has been criticized by several authors, such as Abrahamson (1991, 1996), Collins (2001), Blunsdon (2002) and Kieser (2002). They argue that managers are driven by these "fashions", which are nothing else but new ways to sell the same product/service (Abrahamson, 1991; Collins, 2001; Blunsdon, 2002; Kieser, 2002). Yet, it is this kind of innovation that brings competitive advantages to enterprises. As soon as the innovation becomes a "fashion", because it has been standardized among different companies, consultants start seeking new approaches and solutions to introduce in the market. And as it becomes a "fashion" again the recurring cycle begins once more. Researchers of management "fashions" suggest that management consultancy enterprises reshape the market by means of criticizing concepts in order to set up their own innovations as sources of market success (Abrahamson, 1996; Benders and van Veen, 2001; Kieser, 1997; Suddaby and Greenwood, 2001).

CHAPTER 3

METHODOLOGY

3. Methodology

The objective of the previous chapter was to reveal the theoretical background involving essentially MC and innovation. The external environment and cooperation partners were explored in order to provide a general picture on prior studies concerning the subject. Literature has proven the influence of these information sources and agents on the development of innovations.

Table 3.1 - Studies using CIS Data and their Methodology

Author (s)	Title of the Study	Country(ies)	Methodology
Autant-Bernard et al. (2010)	Measuring the adoption of innovation. A typology of EU countries based on the Innovation Survey.	Twenty-two EU countries	Correlation
Cassiman, and Veugelers (2006)	In search of complementary in innovation strategy: internal R&D and external knowledge acquisition.	Belgium	Logistic Regression Probit Regression Bivariate probit
Evangelista et al. (1997)	Nature and impact of innovation in manufacturing industry: some evidence from the Italian innovation survey.	Italia	Logistic Regression
Faria et al. (2010)	Cooperation in innovation activities: The importance of partners.	Portugal	Probit Regression
Frenz and Ietto-Gillies (2009)	The impact on innovation performance of different sources of knowledge: Evidence from the UK Community Innovation Survey.	United-Kingdom	OLS Regression Probit Regression
Mention (2011)	Co-operation and co-opetition as open innovation practices in the service sector: Which influence on innovation novelty?	Luxembourg	Logistic Regression
Negassi (2004)	R&D co-operation and innovation a micro econometric study on French firms.	France	Regression Tobit Regression
Simonen and McCann (2008)	Firm innovation: The influence of R&D cooperation and the geography of human capital inputs.	Finland	Probit Regression
Teirlinck and Spithoven (2008)	The Spatial Organization of Innovation: Open Innovation, External Knowledge Relations and Urban Structure.	Belgium	Log-linear model
Veja-Jurado et al. (2009)	Does external knowledge sourcing matter for innovation? Evidence from the Spanish manufacturing industry.	Spain	Logistic Regression

Source: Own elaboration

Various empirical studies on innovation have been based on CIS dataset. The above table represents some studies that used data from CIS and their methodology. These

authors applied the most suitable methodology depending on the research objectives and questions (Peskova, 2006). Concerning this dissertation, it intends to explore the impact of external environment over four different types of innovation: product, process, organizational and marketing. The CHAID is the chosen method that will attempt to provide answers to established study's objectives: (1) verify if Portuguese MC enterprises were either closed or open to being influenced by external sources and cooperation agents during their innovation process; (2) assess which kind of external source or cooperation agent was the choice of Portuguese MC enterprises to better pursue the goal of a certain type (s) of innovation, and (3) establish profiles of Portuguese MC enterprises concerning each type of innovation introduced in the market.

3.1. The Community Innovation Survey

This study uses the dataset from the CIS 2010. The European Union employs this main statistical instrument to monitor Europe's progress in the area of innovation, and it is conducted by national statistical offices throughout the EU. A total of 31 countries participated in the CIS 2010, including Turkey, Iceland, Serbia, Norway, Croatia and all European Union Member states, except Greece. The survey was based on a harmonized questionnaire (Annex 1) directly addressed to enterprises in order to collect primary data on their innovation performance, as well as on a variety of factors that may influence the innovation activities. According to the CIS, the survey sample was selected randomly, being each firm representative of firms with the same economic activity, size, and region (DGEEC, 2013).

CIS was initially aimed at the manufacturing sector inasmuch as its definition was technology focused, however it has been recognized that, it is also able to efficiently identify features related to innovation in services (Tether, 2005).

The target population includes only firms with more than 10 employees and active in a wide range of sectors. The survey was conducted as an online survey and organized through a stratified method involving the geographical location (NUTS II), firm size (number of employees) and economic activity (International Standard for Industrial Classification) (DGEEC, 2010).

3.2 Sample

The CIS 2010 dataset included 374 enterprises belonging to MC sector. This group of firms will be the study sample for innovative behavior of Portuguese MC firms, during the period from 2008 to 2010. 53 enterprises of CAE-Rev.3[8] code 62020 – Information Technology Consulting Business, 264 enterprises of CAE-Rev.3 code 70220 - Organization/Operation Management Consulting Business and 57 enterprises of CAE-Rev.3 code 74900 – Other scientific, technical and similar activities on consulting business. A clear picture of the enterprise size is given by the table below.

Table 3.2 - Enterprise size

Enterprise Size	CAE-Rev.3		
	62020	70220	74900
Small	17	168	47
Medium-sized	22	75	8
Large	14	21	2

Source: Own elaboration based on SPSS 16.0 descriptive statistics output.

In order to have a clear picture of the sample, descriptive tests were performed using the SPSS 16.0 software. Table 3.3 represents the percentages concerning four main variables: (1) Enterprises belonging to an enterprise group; (2) Head office location; (3) Geographic market; and (4) Enterprise's employees in 2010 with a university degree. In the sample, only 28.3% of MC enterprises were part of an enterprise group in 2010, while the largest percentage 71.7% were firms functioning by themselves. In terms of the group's head office, 71.7% are located in Portugal, 19.8% are situated in other European countries, and about 8.6% are sited in a country or countries outside Europe. Referring to the geographic market in which MC enterprises sold products (goods or services) from 2008 to 2010, 86.1% were locally/regionally focused, and 78.9% were selling nationally. As for the European Union (EU), EFTA, or EU candidate countries and remaining countries worldwide the results were 36.4% and 33.7% respectively.

[8] Portuguese classification of economic activities, revision 3.

Table 3.3 -Sample descriptives

Variable	%
(1) Belong to Group Enterprise	
Yes	28.3
No	71.7
(2) Head Office location	
Portugal	71.7
European Country	19.8
Country outside Europe	8.6
(3) Geographic Market	
Local /Regional	86.1
National	78.9
Other European Union, EFTA or EU candidate countries	36.4
All other Countries	33.7
(4) Employees with a university degree	
0%	3.5
1% to 4%	7.2
5% to 9%	3.7
10% to 24%	11.5
25% to 49%	16.8
50% to 74%	17.4
75% to 100%	39.8

Source: Own elaboration based on SPSS 16.0 descriptive statistics output.

The last variable (4) presented the following results: A low percentage (14.4 %) of enterprises ranged from 0% to 9% of employees with a university degree. From 10% to 74% displayed the highest number of enterprises (45.7%), followed by 39.8% of firms ranging from 75% to 100% of employees with a university degree.

3.3 Data Analysis Method

The Chi-square Automatic Interaction Detection (CHAID) technique was applied to the sample in order to create a tree-based classification model. Based on the values of the independent variables this dependency technique classifies cases into groups of predictor values of a dependent variable. The CHAID method selects, at each step, the

independent variable that has the strongest interaction with the dependent variable, producing segments commonly exclusive as well as exhaustive through chi-square tests with significant value adjustment using the Bonferroni method.

3.3.1 The Chi-square Automatic Interaction Detection Method

The CHAID method proceeds with three major steps: (1) prepare the predictors; (2) merge categories; and (3) select the split variable.

3.3.1.1 Prepare the Predictors

Categories or classes are naturally defined for categorical predictors. In this study only categorical predictors were used.

3.3.1.2 Merge Categories

Merging categories involve determining the least significantly different pair of predictors for each predictor with regard to the dependent variable. If there are regression problems, *F* tests will be computed, and for classification problems, Pearson *Chi*-square tests. If the respective test for a given pair of predictor categories is statistically significant, a Bonferroni adjusted p –value test will be computed for the set of categories for the respective predictor. In case there is not statistical significance as defined by an alpha-to-merge value for the particular pair of predictors, categories merging for respective predictor categories occur and this step is repeated (Kass, 1980).

3.3.1.3 Select the Split Variable

In the selection of the split predictor, the variable with the smallest adjusted p-value is chosen to perform the split node. A terminal node occurs when the smallest adjusted p-value for any predictor is superior to the alpha-to-split value. The process will be repeated until no further splits can be performed.

3.3.2 The Classification Tree and its Validation

In terms of validation and considering a sample less than 1000 cases, the choice was cross validation with 10 sample folds. This process involved dividing the initial data into 10 different sub-samples, validating it, and estimating the error of incorrect classifications (Hill and Lewicki, 2006; Pestana and Gageiro, 2009). This number originated balanced cross-validated risk estimation for the final tree, allowing it to generalize the results to a larger population.

3.3.3 The Classification Tree and its Criteria

Setting up the criteria involved establishing the growth limits of levels in the tree and adjusting the minimum number of cases for parent and child nodes in a balanced method. Given the size of the sample and numerous tests, an unbiased selection was important because if the minimum values to split the nodes were too high it could produce fewer nodes in the tree and consequently less useful results. The choice was a growth limit of three levels with a minimum number of 20 cases in parent node and 10 in child node which produced acceptable results.

3.4 Selection of the Dependent Variables

The CIS 2010 collected information on mainly four concepts: product/service innovation, process innovation, organizational and marketing innovation. This statistical instrument allows the achievement of a wide range of indicators on innovation activities, innovation objectives, innovation expenditures, public funding, knowledge sources for innovation and cooperation on innovation. The main concepts from the CIS data collection are described below as well as research questions formulation.

3.4.1 Product (Good or Service) Innovation

It is considered product innovation when an enterprise introduces to the market a new or significantly improved good or service with respect to its capabilities, technical specifications user friendliness, components or sub-systems. Improved good or service does not need to be new to the market; however it must be new to the enterprise and it

should not matter if it was originally developed by the enterprise or by other external partners.

3.4.1.1 Research Question 1 Formulation

Following the concept of product/ service innovation, research question 1 is formulated as follows:

Q1: Consultancy enterprises were influenced by the external environment while developing a new or significantly improved good or service in the market, during the period from 2008 to 2010?

3.4.1.2 Product/Service Innovation as Dependent Variable

The survey questions concerning product (good or service) innovation were:

- "During the three years 2008 to 2010, did your enterprise introduce":
  - "New or significantly improved goods (exclude the simple resale of new goods and changes of a solely aesthetic nature)";
  - "New or significantly improved services"?

These questions are represented as variables in table 3.4.

Table 3.4 - Variables for Product/ Service Innovation Survey

Product/ Service Innovation Survey Questions		
Variable	**Description**	**Codification**
INPDGD	During the three years 2008 to 2010, did your enterprise introduce new or significantly improved goods?	0 = "No";1 = "Yes";
INPDSV	During the three years 2008 to 2010, did your enterprise introduce new or significantly improved services?	0 = "No";1 = "Yes";

Source: Own elaboration based on CIS 2010 data

This study considered that the enterprise really introduced a product/service innovation to the market if it answered positively to one of those two questions. In consequence these two variables were transformed into a variable named product/service innovation (INOV_PRD_SRV).

3.4.2 Process Innovation

Process innovation occurs when an enterprise implements a new or significantly improved production process, or new and significantly improved methods of supplying services, or supporting activity. Purely organizational or managerial changes are excluded. This innovation does not need to be new to market; however, it must be new to the enterprise not mattering if it was originally developed by the enterprise or by other external partners.

3.4.2.1 Research Question 2 Formulation

After presenting the concept of process innovation, research question 2 is formulated:

Q2: Consultancy enterprises were influenced by the external environment while developing a new or significantly improved production process, or new and significantly improved methods of supplying services, or supporting activity, during the period from 2008 to 2010?

3.4.2.2 Process Innovation as Dependent Variable

The survey questions concerning process innovation were:

- "During the three years 2008 to 2010, did your enterprise introduce":
  - "New or significantly improved methods of manufacturing or producing goods or services";
  - "New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services";

- "New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing"?

These questions are represented as variables in table 3.5.

Table 3.5 - Variables for Process Innovation

Process Innovation Survey Questions		
Variable	**Description**	**Codification**
INPSPD	Did the enterprise introduce new or significantly improve methods of manufacturing or producing goods or services?	0 = "No";1 = "Yes";
INPSLG	Did the enterprise introduce new or significantly improve logistics, delivery or distribution methods for your inputs, goods or services?	0 = "No";1 = "Yes";
INPSSU	Did the enterprise introduce new or significantly improve supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing?	0 = "No";1 = "Yes";

Source: Own elaboration based on CIS 2010 data

It was considered that the enterprise really implemented a process innovation if it answered positively to one of those three questions. Therefore, these three variables were transformed into a variable named process innovation (INOV_PROC).

3.4.3 Organizational Innovation

An organizational innovation is a new organizational method in the enterprise's business practices (including knowledge management), workplace organization or external relations that has not been previously used by the enterprise. This type of innovation needs to result from management strategic decisions, excluding mergers or acquisitions.

3.4.3.1 Research Question 3 Formulation

After presenting the concept of organizational innovation, research question 3 is formulated:

Q3: Consultancy enterprises were influenced by the external environment while developing a new organizational method in the enterprise's business practices, workplace organization or external relations, during the period from 2008 to 2010?

3.4.3.2 Organizational Innovation as Dependent Variable

The survey questions regarding organizational innovation were:

- "During the three years 2008 to 2010, did your enterprise introduce":
  - "New business practices for organizing procedures (i.e. supply chain management, business re-engineering, knowledge management, lean production, quality management, etc)";
  - "New methods of organizing work responsibilities and decision making (i.e. first use of a new system of employee responsibilities, team work, decentralization, integration or de-integration of departments, education/training systems, etc)";
  - "New methods of organizing external relations with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc) "?

These questions are represented as variables in table 3.6.

Table 3.6 - Variables for Organizational Innovation

Organizational Innovation Survey Questions		
Variable	**Description**	**Codification**
ORGBUP	Did the enterprise introduce new business practices?	0 = "No";1 = "Yes";
ORGWKP	Did the enterprise introduce new methods of organizing work responsibilities and decision making?	0 = "No";1 = "Yes";
ORGEXR	Did the enterprise introduce new methods of organizing external relations with other firms or public institutions?	0 = "No";1 = "Yes";

Source: Own elaboration based on CIS 2010 data

It was considered that the enterprise really implemented an organizational innovation if it answered positively to one of those three questions. Thus these three variables were transformed into a variable named organizational innovation (INOV_ORG).

3.4.4 Marketing Innovation

It is considered marketing innovation when an enterprise implements a new marketing method or strategy that involves significant changes in product design or packaging, product placement, product promotion or pricing. It is only considered marketing innovation if the strategy adopted has not been used before differing considerably from the marketing strategy followed by the enterprise.

3.4.4.1 Research Question 4 Formulation

Following the concept of marketing innovation, research question 4 is formulated as follows:

Q4: Consultancy enterprises were influenced by the external environment while developing new marketing method or strategy that involves significant changes in product design or packaging, product placement, product promotion or pricing, during the period from 2008 to 2010?

3.4.4.2 Marketing Innovation as Dependent Variable

The survey questions regarding marketing innovation were:

- "During the three years 2008 to 2010, did your enterprise introduce":
  - "Significant changes to the aesthetic design or packaging of a good or service (exclude changes that alter the product's functional or use characteristics – these are product innovations)";
  - "New media or techniques for product promotion (i.e. the first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc)";

- “New methods for product placement or sales channels (i.e. first time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc)”;
- “New methods of pricing goods or services (i.e. first time use of variable pricing by demand, discount systems, etc)”?

These questions are represented as variables in table 3.7.

Table 3.7 - Variables for Marketing Innovation

Marketing Innovation Survey Questions		
Variable	**Description**	**Codification**
MKTDGP	The enterprise introduced significant changes to the aesthetic design or packaging of a good or service?	0 = "No";1 = "Yes";
MKTPDP	The enterprise introduced new media or techniques for product or service promotion?	0 = "No";1 = "Yes";
MKTPDL	The enterprise introduced new methods for product placement or sales channels?	0 = "No";1 = "Yes";
MKTPRI	The enterprise introduced new methods of pricing goods or services?	0 = "No";1 = "Yes";

Source: Own elaboration based on CIS 2010 data

It was considered that the enterprise achieved a marketing innovation if it responded positively to one of those four questions. As a result, these four variables were transformed into a variable named marketing innovation (INOV_MKT).

Table 3.8 - Dependent variables derived

	Dependent Variables		
Reseach Questions	**Variable**	**Description**	**Codification**
Research question 1	INOV_PRD_SRV	Product/Service Innovation	0 = "No";1 = "Yes";
Research question 2	INOV_PROC	Process Innovation	0 = "No";1 = "Yes";
Research question 3	INOV_ORG	Organizational Innovation	0 = "No";1 = "Yes";
Research question 4	INOV_MKT	Marketing Innovation	0 = "No";1 = "Yes";

Source: Own elaboration

An overview of the all dependent variables, which were created for analyzing the research questions, is described above in Table 3.8.

3.5 Selection of the Independent Variables

In the line of open innovation, some of the questions present in the survey were selected. The information sources, both internal and external, as well as the cooperation with the different sources of information were taken into consideration regarding the choice of independent variables to perform the analysis of the research questions. A total of 46 Independent Variables were selected for this analysis. Its description as well as its codification can be verified on Table 3.9.

3.5.1 The Internal Environment

Considering that the enterprises R&D departments must be complemented with knowledge and players beyond their boundaries (von Hippel, 1988; Lundvall, 2010; Szulanski, 1996; Laursen and Salter, 2006), it is essential to evaluate the importance of the internal source on the innovation development, when combined with external agents or information sources. The relevance intensity attributed to an internal variable combined with an external one may produce different results on innovation activities. A certain type of innovation may be developed with a higher success rate when the enterprise considers of high importance the internal environment, and low importance an external player. Given the significance of this problem, as well as the need to generate the most accurate results possible, two internal variables were considered in the analysis: (1) internal information source "within the enterprise or enterprise group"; and (2) cooperation agent "other enterprises within the enterprise group".

3.5.2 Internal and External Information Sources

The survey questions regarding the importance given by the MC enterprises to information sources were evaluated through a four-point Likert scale ranging from 0 (Not important) to 3 (high, as highly important). The chosen information sources were: Internal source - enterprise or enterprise group; Market source - suppliers of equipment, materials, components, or software; Market source - clients or customers; Market source - competitors or other enterprises in the sector; Market source - consultants, commercial labs, or private R&D institutes; Institutional sources - universities or other higher education institutions; Institutional sources - government or public research institutes;

Other sources - conferences, trade fairs, exhibitions; Other sources - scientific journals and trade/technical publications; Other sources - professional and industry associations.

3.5.3 Cooperation with the Different Sources of Information

Regarding cooperation with other agents for innovation activities during the period from 2008 to 2010, the MC enterprises were asked a straight "yes or no" answer. A complementary question concerning the type of cooperation partner was included - Other enterprises within the enterprise group; Suppliers of equipment, materials, components, or software; Clients or customers; Competitors or other enterprises in the sector; Consultants, commercial labs, or private R&D institutes; Universities or other higher education institutions; Government or public research institutes - with a multiple selection availability on its location – Portugal; Other European countries; United States; China or India; All other countries. The enterprises were free to choose more than one co-operation partner.

Table 3.9 - Independent Variables Selection

Independent Variables		
Variable	**Description**	**Codification**
SENTG	How important to the enterprise's innovation activities is the information source (Internal source) within the enterprise or enterprise group?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
SSUP	How important to the enterprise's innovation activities is the information source (Market sources) suppliers of equipment, materials, components, or software?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
SCLI	How important to the enterprise's innovation activities is the information source (Market sources) clients or customers?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
SCOM	How important to the enterprise's innovation activities is the information source (Market sources) competitors or other enterprises in the sector?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
SINS	How important to the enterprise's innovation activities is the information source (Market sources) consultants, commercial labs, or private R&D institutes?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
SUNI	How important to the enterprise's innovation activities is the information source (Institutional sources) universities or other higher education institutions?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
SGMT	How important to the enterprise's innovation activities is the information source (Institutional sources) government or public research institutes?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
SCON	How important to the enterprise's innovation activities is the information source (Other sources) conferences, trade fairs, exhibitions?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"

SJOU	How important to the enterprise's innovation activities is the information source (Other sources) scientific journals and trade/technical publications?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
SPRO	How important to the enterprise's innovation activities is the information source (Other sources) professional and industry associations?	0 = "Not important"; 1 = "Low"; 2 = "Medium"; 3 = "High"
CO	Did the enterprise co-operate on any of the innovation activities with other enterprises or institutions?	0 = "No";1 = "Yes";
CO11	Type of innovation co-operation partner - Other enterprises within the enterprise group - Portugal	0 = "No";1 = "Yes";
CO12	Type of innovation co-operation partner - Other enterprises within the enterprise group - Other Europe's countries	0 = "No";1 = "Yes";
CO13	Type of innovation co-operation partner - Other enterprises within the enterprise group - United States	0 = "No";1 = "Yes";
CO14	Type of innovation co-operation partner - Other enterprises within the enterprise group - China or India	0 = "No";1 = "Yes";
CO15	Type of innovation co-operation partner - Other enterprises within the enterprise group - All other countries	0 = "No";1 = "Yes";
CO21	Type of innovation co-operation partner - Suppliers of equipment, materials, components, or software - Portugal	0 = "No";1 = "Yes";
CO22	Type of innovation co-operation partner - Suppliers of equipment, materials, components, or software - Other Europe's countries	0 = "No";1 = "Yes";
CO23	Type of innovation co-operation partner - Suppliers of equipment, materials, components, or software - United States	0 = "No";1 = "Yes";
CO24	Type of innovation co-operation partner - Suppliers of equipment, materials, components, or software - China or India	0 = "No";1 = "Yes";
CO25	Type of innovation co-operation partner - Suppliers of equipment, materials, components, or software - All other countries	0 = "No";1 = "Yes";
CO31	Type of innovation co-operation partner - Clients or customers - Portugal	0 = "No";1 = "Yes";
CO32	Type of innovation co-operation partner - Clients or customers - Other Europe's countries	0 = "No";1 = "Yes";
CO33	Type of innovation co-operation partner - Clients or customers - United States	0 = "No";1 = "Yes";
CO34	Type of innovation co-operation partner - Clients or customers - China or India	0 = "No";1 = "Yes";
CO35	Type of innovation co-operation partner - Clients or customers - All other countries	0 = "No";1 = "Yes";
CO41	Type of innovation co-operation partner - Competitors or other enterprises in the sector - Portugal	0 = "No";1 = "Yes";
CO42	Type of innovation co-operation partner - Competitors or other enterprises in the sector - Other Europe's countries	0 = "No";1 = "Yes";
CO43	Type of innovation co-operation partner - Competitors or other enterprises in the sector - United States	0 = "No";1 = "Yes";
CO44	Type of innovation co-operation partner - Competitors or other enterprises in the sector - China or India	0 = "No";1 = "Yes";
CO45	Type of innovation co-operation partner - Competitors or other enterprises in the sector - All other countries	0 = "No";1 = "Yes";
CO51	Type of innovation co-operation partner - Consultants, commercial labs, or private R&D institutes - Portugal	0 = "No";1 = "Yes";
CO52	Type of innovation co-operation partner - Consultants, commercial labs, or private R&D institutes - Other Europe's countries	0 = "No";1 = "Yes";

CO53	Type of innovation co-operation partner - Consultants, commercial labs, or private R&D institutes - United States	0 = "No";1 = "Yes";
CO54	Type of innovation co-operation partner - Consultants, commercial labs, or private R&D institutes - China or India	0 = "No";1 = "Yes";
CO55	Type of innovation co-operation partner - Consultants, commercial labs, or private R&D institutes - All other countries	0 = "No";1 = "Yes";
CO61	Type of innovation co-operation partner - Universities or other higher education institutions - Portugal	0 = "No";1 = "Yes";
CO62	Type of innovation co-operation partner - Universities or other higher education institutions - Other Europe's countries	0 = "No";1 = "Yes";
CO63	Type of innovation co-operation partner - Universities or other higher education institutions - United States	0 = "No";1 = "Yes";
CO64	Type of innovation co-operation partner - Universities or other higher education institutions - China or India	0 = "No";1 = "Yes";
CO65	Type of innovation co-operation partner - Universities or other higher education institutions - All other countries	0 = "No";1 = "Yes";
CO71	Type of innovation co-operation partner - Government or public research institutes - Portugal	0 = "No";1 = "Yes";
CO72	Type of innovation co-operation partner - Government or public research institutes - Other Europe's countries	0 = "No";1 = "Yes";
CO73	Type of innovation co-operation partner - Government or public research institutes - United States	0 = "No";1 = "Yes";
CO74	Type of innovation co-operation partner - Government or public research institutes - China or India	0 = "No";1 = "Yes";
CO75	Type of innovation co-operation partner - Government or public research institutes - All other countries	0 = "No";1 = "Yes";

Source: Own elaboration based on CIS 2010 data

CHAPTER 4

RESULTS ANALYSIS

4.1 Product/Service Innovation

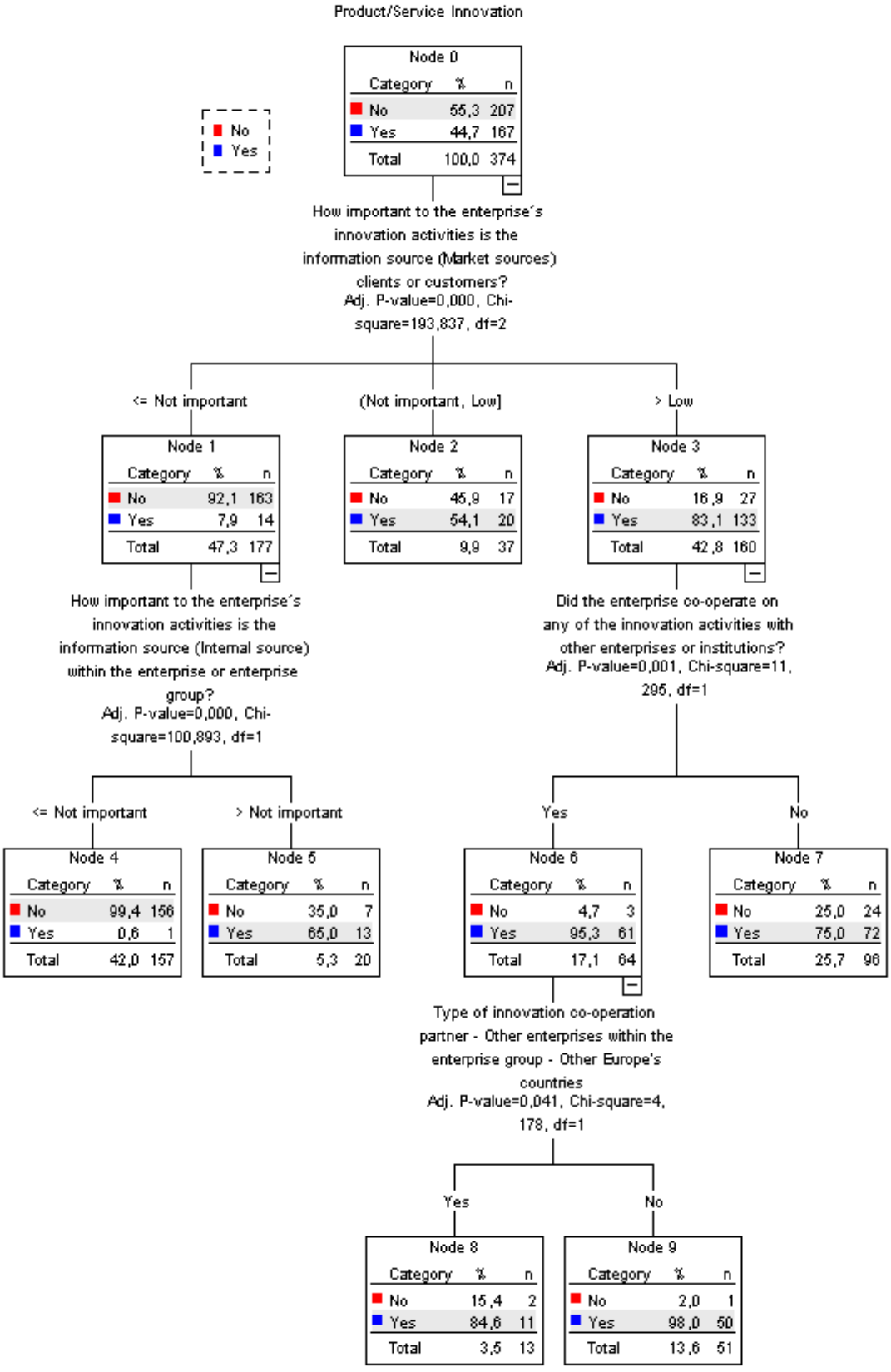
Figure 4.1 represents the CHAID Tree for product/service innovation. Regarding the dependent variable product/service innovation, the results indicate that 44.7% of the sample firms introduced in the market a new or significantly improved good or service during 2008-2010, and 55.3% did not achieve a product or service innovation during the same period. The tree displays three hierarchical levels, six terminal nodes (node 2, 4, 5, 7, 8 and 9) suggesting six segments of enterprises. A total of four predictors out of the original 46 present a significant explanation of the dependent variable, which led to a three level tree: "How important to the enterprise's innovation activities is the information source (Market sources) clients or customers?" (chi-square 193.897; p-value = 0.000);" How important to the enterprise's innovation activities is the information source (Internal source) within the enterprise or enterprise group?" (chi-square 100.893; p-value = 0.000); "Did the enterprise co-operate on any of the innovation activities with other enterprises or institutions?" (chi-square 11.295; p-value = 0.001); "Type of innovation co-operation partner - Other enterprises within the enterprise group - Other Europe's countries" (chi-square 4.178; p-value = 0.041).

The tree has an estimated risk[9] of 0.139 with a standard error of 0.018, meaning that the overall percentage of correct classification is 86.1%. The cross-validation method presented a risk[10] ratio of 0.152 with a standard error of 0.019.

[9] The risk estimate is a SPSS measure which helps to identify the tree's predictive accuracy, by estimating the proportion of cases which are incorrectly classified. In this case there is an estimation of 13.9% cases that are inexactly classified.

[10] The cross validation risk is the average of the risks of all trees defined for this validation method. The value for the product/service innovation tree is 15.2%.

Figure 4.1 - Product/Service Innovation CHAID tree



Source: SPSS 16.0

Six segments of enterprises resulted from the CHAID analysis for product/service innovation and are represented in Table 4.1 below:

Table 4.1 - Tree segments - Product/Service Innovation

Segment	Size n (%)	Dependent Variable		Independent Variables			
		Product /Service Innovation		Information source (Market sources) clients or customers	Information source (Internal source) within the enterprise or enterprise group	Co-operation on any of the innovation activities with other enterprises or institutions	Co-operation partner - Other enterprises within the enterprise group - Other Europe's countries
		Yes (%)	No (%)				
I (node 2)	37 (9.9)	54.1	45.9	0 / -			
II (node 4)	157 (42)	0.6	99.4	0	0		
III (node 5)	20 (5.3)	65	35	0	- / -+ / +		
IV (node 7)	96 (25.7)	75	25	-+ / +		No	
V (node 8)	13 (3.5)	84.6	15.4	-+ / +		Yes	Yes
VI (node 9)	51 (13.6)	98	2	-+ / +		Yes	No

0, Not Important; -, Low Importance; -+, Medium Importance; +, High Importance

Source: Own elaboration

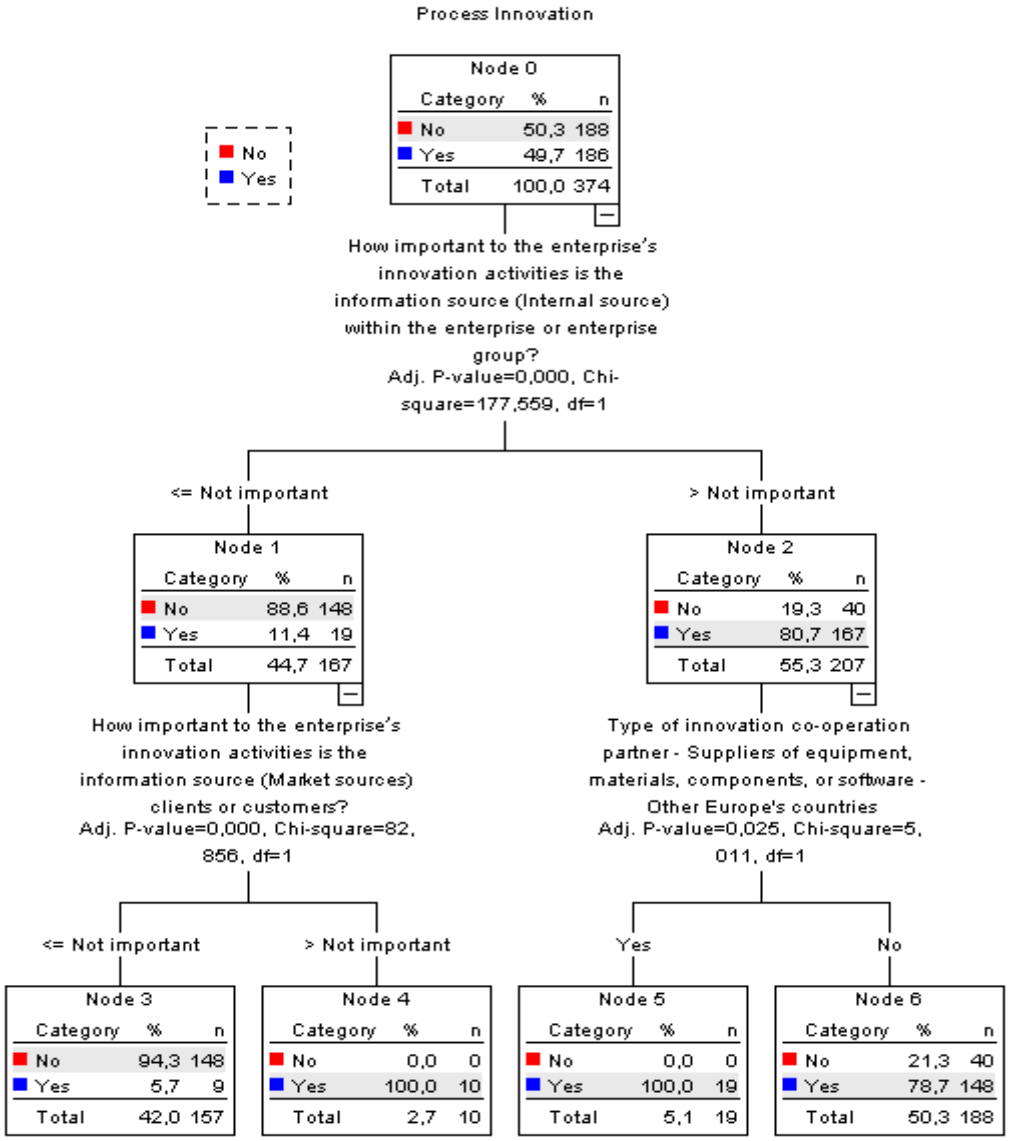
Segment I (n=37) is not a well-defined group, as it is composed both by firms that innovate (20) and firms that did **not innovate** (17). The ones that did innovate considered the market sources of information (clients or customers) of some importance. Segment II (n=157) is largely composed by non-innovators (156). These firms give no importance to either the internal sources of information or to the Market sources. Segment III (n=20) differs from segment II because it comprises innovative firms (13) that exclusively rely on internal information sources. Segment IV (n=96) refers to innovative enterprises (72) that count on a market source of information (clients or customers), but did not register any cooperation activity. Segment V (n=13) is composed by firms that innovate (11) depending not only on clients or customers, but also on cooperation with other European enterprises within the group. Segment VI (n=51) is composed by innovators (50) that differ from the ones in segment V as they are willing to cooperate but not with an internal partner.

4.2 Process Innovation

The CHAID tree for process innovation is illustrated in figure 4.2. According to the dependent variable process innovation, 49.7% of enterprises implemented a new or significantly improved production process, or new and significantly improved methods of supplying services, or supporting activity. A total of 50.3% did not implement a process innovation during the period of 2008 to 2010. The tree displays four terminal nodes (node 3-6) suggesting four segments of enterprises. A total of three predictors out of the original 46 present a significant explanation of the dependent variable, which led to a two level tree: "How important to the enterprise's innovation activities is the information source (Internal source) within the enterprise or enterprise group?" (chi-square 177.559; p-value = 0.000); "How important to the enterprise's innovation activities is the information source (Market sources) clients or customers" (chi-square 82.856; p-value = 0.000); "Type of innovation co-operation partner - Suppliers of equipment, materials, components, or software - Other European countries." (chi-square 5.011; p-value = 0.025).

The tree has an estimated risk of 0.131 with a standard error of 0.017, meaning that the overall percentage of correct classification is 86.9%. The cross-validation method presented a risk ratio of 0.160 with a standard error of 0.019.

Figure 4.2 - Process Innovation CHAID tree



Source: SPSS 16.0

Regarding the CHAID analysis for process innovation, four segments of enterprises were identified. Segment I (n=157) is mainly composed by the **non-innovators** (148). These firms give no importance to both internal sources of information and to market sources, such as clients or customers. Segment II (n=10) comprises only innovative firms that rely on market sources to collect information for their innovation activities. Segment III (n=19) represents a group of innovators that depend on internal sources of information and are able to develop cooperation with European suppliers for innovation purposes. Segment IV (n=188) is mostly composed by innovators (148) that use internal

sources. It differs from segment III given the absence of European suppliers as cooperation agents.

Table 4.2 - Tree segments - Process Innovation

Segment	Size n (%)	Dependent Variable		Independent Variables		
		Process Innovation		Information source (Internal source) within the enterprise or enterprise group	Information source (Market sources) clients or customers	Co-operation partner - Suppliers of equipment, materials, components, or software - Other Europe's countries
		Yes (%)	No (%)			
I (node 3)	157 (42)	5.7	94.3	0	0	
II (node 4)	10 (2.7)	100	0	0	- / -+ / +	
III (node 5)	19 (5.1)	100	0	- / -+ / +		Yes
IV (node 6)	188 (50.3)	78.7	21.3	- / -+ / +		No

0, Not Important; -, Low Importance; -+, Medium Importance; +, High Importance

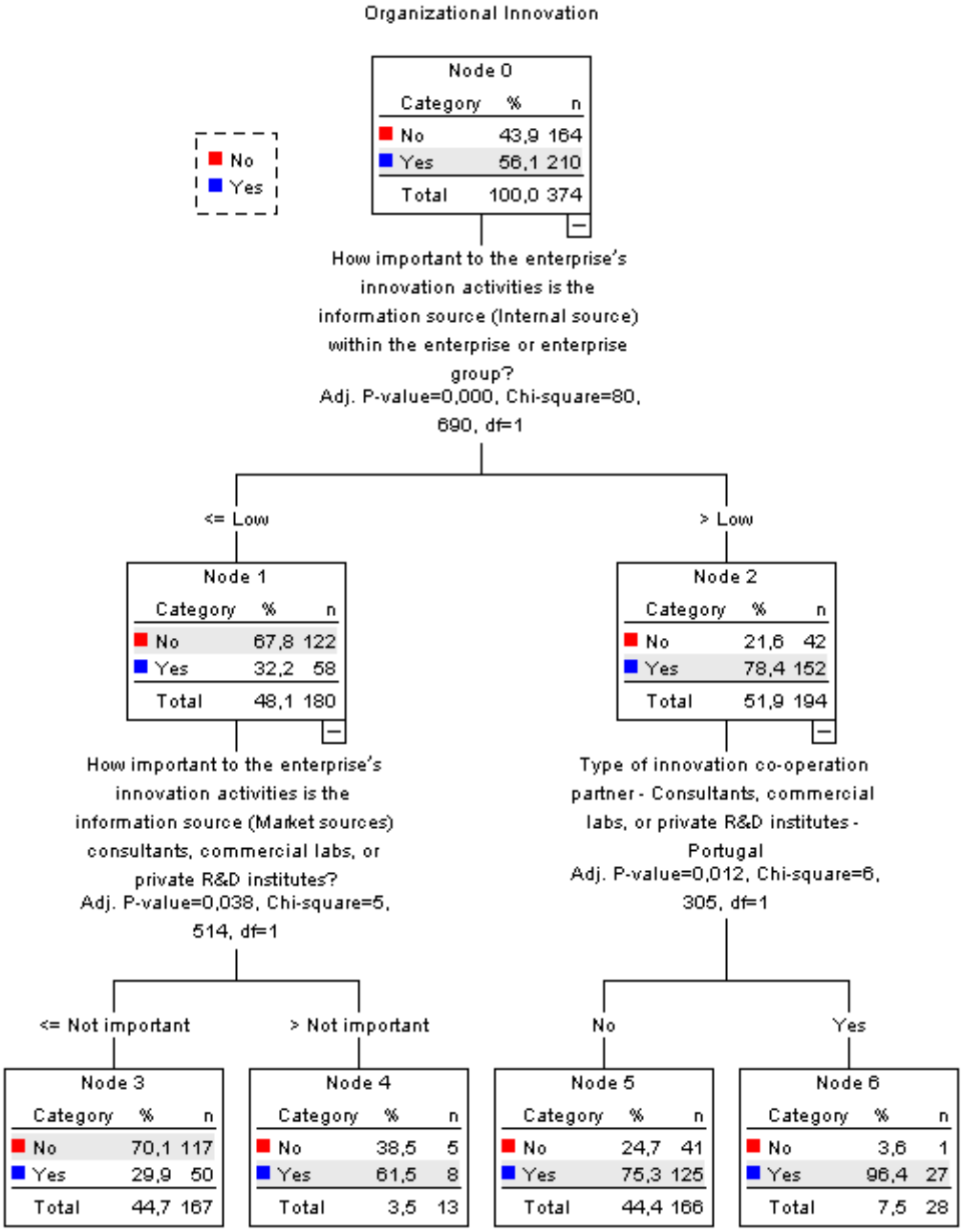
Source: Own elaboration

4.3 Organizational Innovation

Analyzing figure 4.3, which illustrates the CHAID tree for organizational innovation, it is possible to conclude that 56.1% of the sampled firms implemented a new organizational method in the enterprise's business practices, workplace organization or external relations. However 43.9% of the firms did not accomplish this innovation novelty during the period from 2008 to 2010.

The tree displays four terminal nodes (node 3-6) suggesting four segments of enterprises. A total of three predictors out of the original 46 present a significant explanation of the dependent variable, which led to a two level tree: "How important to the enterprise's innovation activities is the information source (Internal source) within the enterprise or enterprise group?" (chi-square 80.690; p-value = 0.000);"How important to the enterprise's innovation activities is the information source (Market sources) consultants, commercial labs, or private R&D institutes?" (chi-square 5.514; p-value = 0.038); "Type of innovation co-operation partner - Consultants, commercial labs, or private R&D institutes - Portugal" (chi-square 6.305; p-value = 0.012).

Figure 4.3 - Organizational Innovation CHAID tree



Source: SPSS 16.0

The tree has an estimated risk of 0.259 with a standard error of 0.023, meaning that the overall percentage of correct classification is 74.1%. The cross-validation method presented a risk ratio of 0.278 with a standard error of 0.023.

The tree displays four segments of enterprises with different profiles regarding organizational innovation, which can be seen on the table below. Segment I (n=167) represents the **non-innovative** firms (117). These enterprises give no importance to

either internal or external sources of innovation. Segment II (n=13) is a poorly defined group considering that it is composed by firms that did innovate (n=8) as well as by firms that did not (n=5). This group gives no importance to internal sources of information, but recognizes the importance of market sources, such as consultants, commercial labs, or private R&D institutes, in their innovation activities. Segment III (n=166) is mostly comprised of innovators enterprises (125) that rely on internal sources of information, although it did not choose consultants, commercial labs, or private R&D institutes in Portugal as cooperation partners. Segment IV represents a group of innovative firms that besides using internal sources of information also preferred a Portuguese entity such as consultants, commercial labs, or private R&D institutes as their cooperation agents.

Table 4.3 - Tree segments - Organizational Innovation

Segment	Size n (%)	Dependent Variable		Independent Variables		
		Organizational Innovation		Information source (Internal source) within the enterprise or enterprise group	Information source (Market sources) consultants, commercial labs, or private R&D institutes	Co-operation partner - Consultants, commercial labs, or private R&D institutes - Portugal
		Yes (%)	No (%)			
I (node 3)	167 (44.7)	29.9	70.1	0 / -	0	
II (node 4)	13 (3.5)	61.5	38.5	0 / -	- / -+ / +	
III (node 5)	166 (44.4)	75.3	24.7	-+ / +		No
IV (node 6)	28 (7.5)	96.4	3.6	-+ / +		Yes

0, Not Important; -, Low Importance; -+, Medium Importance; +, High Importance

Source: Own elaboration

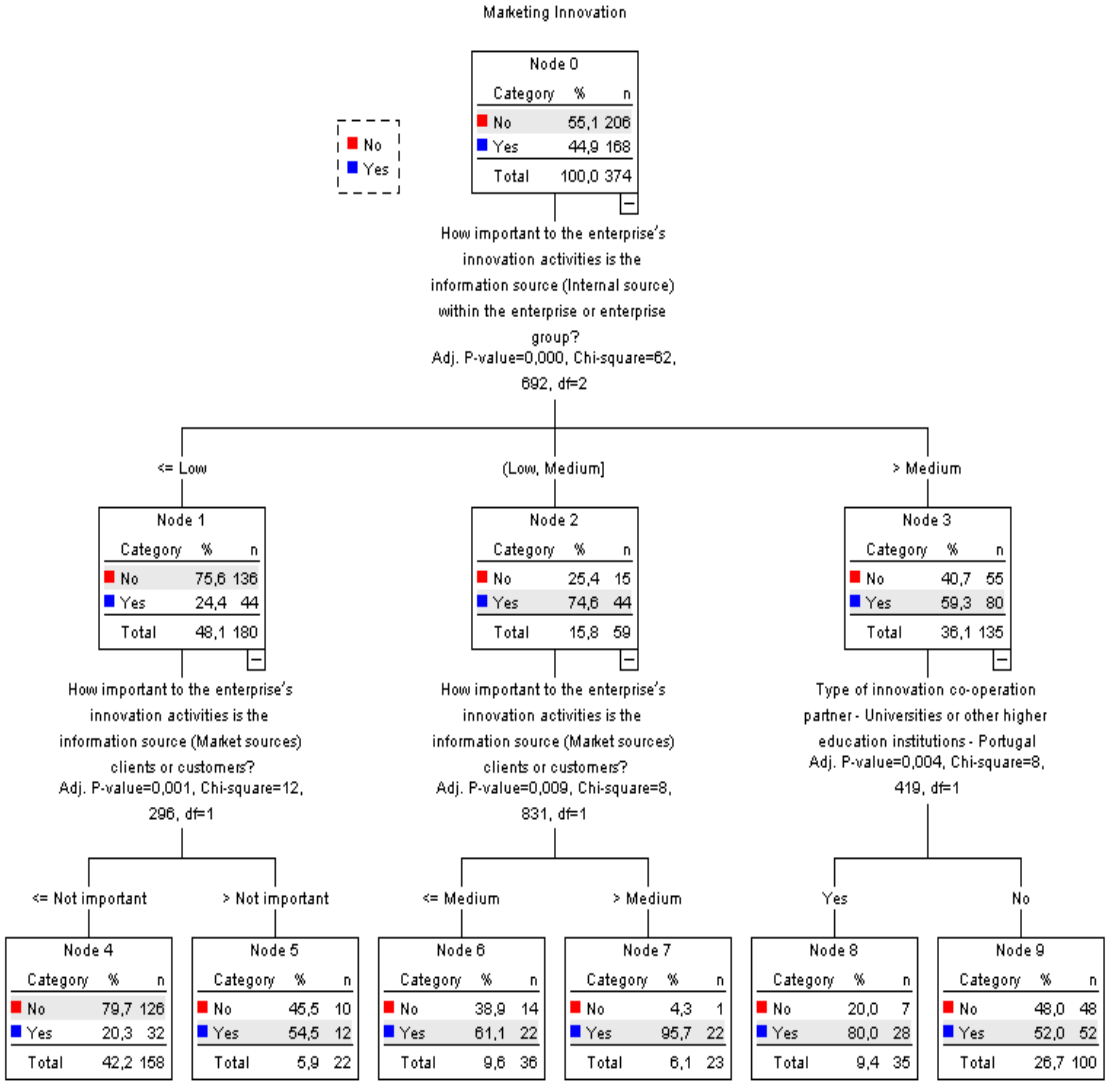
4.4. Marketing Innovation

With regard to marketing innovation, 44.9% of enterprises implemented a new marketing method or strategy which involved significant changes in product design or packaging, product placement, product promotion or pricing, as 55.1% did not implement a marketing innovation during the period from 2008 to 2010.

The tree displays six terminal nodes (node 4-9) suggesting six segments of enterprises. A total of four predictors out of the original forty-six present a significant explanation of the dependent variable, which led to a two level tree: “How important to the enterprise’s innovation activities is the information source (Internal source) within the enterprise or enterprise group” (chi-square 62.92.865; p-value = 0.000);”How important to the enterprise’s innovation activities is the information source (Market sources) clients or customers?” (chi-square 12.296; p-value = 0.001); “How important to the enterprise’s innovation activities is the information source (Market sources) clients or customers?” (chi-square 8.831; p-value = 0.009); “Type of innovation co-operation partner - Universities or other higher education institutions - Portugal” (chi-square 8.419; p-value = 0.004).

The tree has an estimated risk of 0.299 with a standard error of 0.024, meaning that the overall percentage of correct classification is 70.01%. The cross-validation method presented a risk ratio of 0.329 with a standard error of 0.024. The CHAID tree for marketing innovation is illustrated in the figure below.

Figure 4.4 - Marketing Innovation CHAID tree



Source: SPSS 16.0

Six segments of enterprises resulted from the CHAID analysis for marketing innovation which can be verified on table 15. Segment I (n=158) is mainly composed by the **non-innovators**. These firms confer no importance to both internal and external information sources. Segment II (n=22) and Segment III (n=36) are poorly defined groups. Firms from segment II do not accredit importance to internal sources but recognize the importance of market sources. Regarding segment III, these enterprises rely more on internal sources but give medium, low or no importance to clients or customers as information source, in their innovation activities. Segment IV (n=23) is largely comprised by innovators. It contrasts with segment III because this group of firms confers medium or high importance to the market information source.

Segment V (n=35) refers to innovative enterprises that cooperated with national universities or other higher education institutions, and gives high importance to the internal source within the enterprise or enterprise group. Segment VI (n=100) is again a mixed group with both innovators (48) and non-innovators (52).It diverges from the previous segment since enterprises did not have universities or other higher education institutions in Portugal, as their cooperation partner.

Table 4.4 – Tree segments - Marketing Innovation

Segment	Size n (%)	Dependent Variable		Independent Variables		
		Marketing Innovation		Information source (Internal source) within the enterprise or enterprise group	Information source (Market sources) clients or customers	Co-operation partner - Universities or other higher education institutions - Portugal
		Yes (%)	No (%)			
I (node 4)	158 (42.2)	20.3	79.7	0 / -	0	
II (node 5)	22 (5.9)	54.5	45.5	0 / -	- / -+ / +	
III (node 6)	36 (9.6)	61.1	38.9	- / -+	0 / - / -+	
IV (node 7)	23 (6.1)	95.7	4.3	- / -+	+	
V (node 8)	35 (9.4)	80	20	+		Yes
IV (node 9)	100 (26.7)	52	48	+		No

0, Not Important; -, Low Importance; -+, Medium Importance; +, High Importance

Source: Own elaboration

4.5 Profile the Segments

Following the description of the CHAID tree segments, an analysis to identify the segments profile was performed. A crosstabs report was executed on the previously identified segments using the variables, "Enterprise size", "Largest market in terms of turnover from 2008 to 2010", "Head office of the group location", "Percentage of enterprise's employees in 2010 who had a university degree". In the following four tables only the largest percentages are represented.

4.5.1 Product/Service Innovation – Profile the Segments

The six segments uncovered in the product/service innovation CHAID tree are represented in the table below.

Table 4.5 - Product/ Service Innovation - Profile the segments

Variables	Segment I (node 2)	Segment II (node 4)	Segment III (node 5)	Segment IV (node 7)	Segment V (node 8)	Segment VI (node 9)
Enterprise Size (chi square = 99.346; P value = 0.000)	**Small enterprise** (67.6 %)	**Small enterprise** (77.7 %)	**Small enterprise** (85 %)	**Small enterprise** (52.1 %)	**Large enterprise** (69.2 %)	**Medium-sized enterprise** (51 %)
Largest market in terms of turnover from 2008 to 2010 (chi square = 67.096; P value = 0.000)	**National (other regions of Portugal)** (59,5 %)	**Local / regional within Portugal** (63.7 %)	**Local / regional within Portugal** (50 %)	**National (other regions of Portugal)** (59.4 %)	**National (other regions of Portugal)** (53.8 %)	**National (other regions of Portugal)** (62.7 %)
Head office of the group location (chi square = 82.171; P value = 0.000)	**Portugal** (86.5 %)	**Portugal** (84.1 %)	**Portugal** (70 %)	**Portugal** (63.5 %)	**European country** (53.8 %)	**Portugal** (56.9 %)
Percentage of enterprise's employees in 2010 had a university degree (chi square = 82.171; P value = 0.000)	**75% to 100%** (37.8 %)	**75% to 100%** (24.2 %)	**75% to 100%** (55 %)	**75% to 100%** (39.6 %)	**75% to 100%** (69.2 %)	**75% to 100%** (76.5 %)

Source: Own elaboration

A similar profile pattern was found in two pairs of segments. The first occurrence regards to segment I and IV. These small MC firms, with their head office located in the country were focused in Portugal's national market. About 40% of these enterprises ranged from 75% to 100% employees with a university degree. The second case (segment II and III) includes, in general, small national firms aimed at a local or regional market. In terms of employees with university studies, enterprises in segment III have twice as many in segment II. Segment V, is composed of large MC enterprises which have their head office located in a country outside Europe. This group is focused on the national market and has a high percentage of employees with a university degree. The last segment contrasts with the previous one (V) due to the head office location and enterprise size, Portugal and medium-sized.

4.5.2 Process Innovation – Profile the Segments

The results obtained in table 4.6 refer to the process innovation's tree. The small MC enterprises of segment I chose to sell their services at a local/regional level. Moreover,

this group has its head office based in Portugal and only a small number of firms have a high percentage of employees with a university degree.

Table 4.6 - Process Innovation - Profile the segments

Variables	Segment I (node 3)	Segment II (node 4)	Segment III (node 5)	Segment IV (node 6)
Enterprise Size (chi square = 47.764; P value = 0.000)	**Small enterprise** (77.7 %)	**Small enterprise** (90 %)	**Medium-sized enterprise** (57.9%)	**Small enterprise** (52.1%)
Largest market in terms of turnover from 2008 to 2010 (chi square = 43.434; P value = 0.000)	**Local / regional within Portugal** (63.7 %)	**National (other regions of Portugal)** (70 %)	**National (other regions of Portugal)** (63.2 %)	**National (other regions of Portugal)** (56.4 %)
Head office of the group location (chi square = 32.105; P value = 0.000)	**Portugal** (84.1 %)	**Portugal** (90 %)	**European country** (42.1 %)	**Portugal** (63.8 %)
Percentage of enterprise's employees in 2010 had a university degree (chi square = 63.891; P value = 0.000)	**75% to 100%** (24.2 %)	**10% to 24%** (30 %)	**75% to 100%** (68.4 %)	**75% to 100%** (51.1 %)

Source: Own elaboration

A quite identical profile emerged from segments II and IV. This group comprises principally small enterprises with headquarters in Portugal and it is focused on the national market. The difference between these segments arose in the variable employees with a university degree, which turned to be considerably higher in node 6. With reference segment III, it was noted that the profile was composed of medium-sized MC firms, whose head office was based abroad (Europe) and analogous with node 4 and 6, is aimed at the national market. In addition the employees of these enterprises are well qualified with regard to higher education.

4.5.3 Organizational Innovation – Profile the Segments

The crosstabs analysis on the organizational innovation tree formed the profiles presented in table 4.7.

Table 4.7 - Organizational Innovation - Profile the segments

Variables	Segment I (node 3)	Segment II (node 4)	Segment III (node 5)	Segment IV (node 6)
Enterprise Size (chi square = 47.764; P value = 0.000)	**Small enterprise** (78.4 %)	**Small enterprise** (69.2 %)	**Small enterprise** (50 %)	**Medium-sized enterprise** (42.9 %)
Largest market in terms of turnover from 2008 to 2010 (chi square = 42.359; P value = 0.000)	**Local / regional within Portugal** (61.7 %)	**Local / regional within Portugal** (53.8 %)	**National (other regions of Portugal)** (55.4 %)	**National (other regions of Portugal)** (71.4 %)
Head office of the group location (chi square = 46.583; P value = 0.000)	**Portugal** (84.4 %)	**Portugal** (76.9 %)	**Portugal** (50 %) **European country** (50 %)	**Portugal** (63.8 %)
Percentage of enterprise's employees in 2010 had a university degree (chi square = 67.992; P value = 0.000)	**75% to 100%** (25.1 %)	**10% to 24%** (38.5 %)	**75% to 100%** (50.6 %)	**75% to 100%** (71.4 %)

Source: Own elaboration

Segment I and II are both composed of small MC firms with their head office in the country and selling their services locally/regionally. Nevertheless, in terms of employees' higher education the results appeared different. While node 3 presents 25.1% of enterprises ranging from 75% to 100% employees with a university degree, node 4 shows 38.5% in the range 10% to 24%. Segment III and IV display a profile of firms focused on the national market and employing a considerable number of highly qualified staff. Yet, a significant result concerning the firm headquarters arose in node 5. Half of the sample had its head office located in Portugal and the other half was sited abroad, in Europe. Lastly, segment III and IV comprise mainly small and medium-size firms respectively.

4.5.4 Marketing Innovation – Profile the Segments

Table 4.8 shows the six segments of the marketing innovation tree. The profile that emerged from segment I consists largely of small MC firms, which have their headquarters in Portugal and chose to sell their services locally or regionally. Only a small percentage of these enterprises have a substantial number of employees with higher studies.

A comparable profile pattern was found in three segments (II, III and VI). It consists of small firms focused on the national market and head office location in the country. With reference to personnel with a university degree, although the results appear in the range 75% - 100%, only a minimal percentage of enterprises have a high number of knowledgeable employees. Segment IV, is composed of medium-sized MC enterprises whose headquarters is situated in Portugal. This group is focused on the national market and has a medium percentage of employees with a university degree. Segment V differs from the previous one (IV) due to the enterprise size and the head office location. Node 8 is composed of 40% large firms, whose headquarters are sited outside Portugal in a European country.

Table 4.8 - Marketing Innovation - Profile the segments

Variables	Segment I (node 4)	Segment II (node 5)	Segment III (node 6)	Segment IV (node 7)	Segment V (node 8)	Segment VI (node 9)
Enterprise Size (chi square = 81.200; P value = 0.000)	**Small enterprise** (77.8 %)	**Small enterprise** (77.3 %)	**Small enterprise** (72.2 %)	**Medium-sized enterprise** (56.5 %)	**Large enterprise** (40 %)	**Small enterprise** (47 %)
Largest market in terms of turnover from 2008 to 2010 (chi square = 51.666; P value = 0.000)	**Local / regional within Portugal** (63.3 %)	**National (other regions of Portugal)** (54.5 %)	**National (other regions of Portugal)** (47.2 %)	**National (other regions of Portugal)** (73.9 %)	**National (other regions of Portugal)** (65.7 %)	**National (other regions of Portugal)** (55 %)
Head office of the group location (chi square = 53.169; P value = 0.000)	**Portugal** (84.2 %)	**Portugal** (81.8 %)	**Portugal** (77.8 %)	**Portugal** (52.2 %)	**European country** (45.7 %)	**Portugal** (62 %)
Percentage of enterprise's employees in 2010 had a university degree (chi square = 78.920; P value = 0.000)	**75% to 100%** (24.7 %)	**10% to 24%** (27.3 %) **75% to 100%** (27.3 %)	**75% to 100%** (38.9 %)	**75% to 100%** (56.5 %)	**75% to 100%** (77.1 %)	**75% to 100%** (50 %)

Source: Own elaboration

4.6 Discussion

The four models (product/service innovation, process innovation, organizational innovation and marketing innovation) produced considerable evidence to divide the sample into two groups - Innovative and non-innovative enterprises. Interestingly, significant segment profiles emerged from the crosstabs analysis, which emphasized the

differences regarding the employment of cooperation partners and external sources importance in the innovation activities.

Around 50% of the sampled enterprises recognize themselves as non-innovators. In relation to the results obtained through the CHAID trees and when compared with the group of innovators, these enterprises generally do not assign importance to the information sources, being these either internal or external (market). Specifically, 99.4% of enterprises in segment II of product/service innovation tree, do not recognize, either clients/customers or in-house information sources in innovation activities. Similarly, these two information sources were also considered not important by non-innovative enterprises in both segment I of the process (99.4%) and marketing (75.6%) innovation trees. With regard to organizational innovation, 70.1% (segment I) of non-innovative enterprises give no importance to consultants, commercial labs, or private R&D institutes, as well as to the internal source, in-house or enterprise group. It should be noted that cooperation with other agents is also disregarded by these enterprises. In terms of profile characteristics, this group is principally composed of small firms with their head office located in Portugal. Furthermore these enterprises are noticeably more oriented towards a local/regional market and employ a small percentage of workers with higher studies.

On the other hand, the enterprises that declared being innovators have a propensity to cooperate with other agents in their innovation activities. Four forms of co-operation over innovation are distinguished, one internal and three external: (1) other enterprises within the enterprise group in other European countries; (2) suppliers of equipment, materials, components, or software in other European countries; (3) consultants, commercial labs, or private R&D institutes in Portugal; and (4) universities or other educational institutions in Portugal. In terms of information sources appraisal, this group favors three forms: (1) within the enterprise or enterprise group; (2) clients or customers; and (3) consultants, commercial labs, or private R&D institutes.

The first form of cooperation, “with other enterprises within the enterprise group in other Europe’s countries”, is found in segment V of the product/service innovation CHAID tree and accounts for only 3.5% of the sampled enterprises. Despite being a small percentage of the sample, 84.6% of this group affirm being innovators. In this

segment, clients or customers are considered of medium and high importance for innovative activities. This group comprises mainly large enterprises whose headquarters are situated in a European country, and promotes their sales at a national level. Moreover about 69.2% of the enterprises have a percentage ranging from 75% to 100% of employees with a university degree.

The second form of cooperation, relates to suppliers of equipment, materials, components, or software in other European countries. Concerning process innovation tree, this partner is the choice of 5.1% sampled enterprises in segment III. For this group, the information source within the enterprise or enterprise group is situated between low and high importance. Remarkably 100% of this group claimed being innovators. The enterprise's profile comprises: medium-sized firms, head office out of Portugal, in a European country; aimed at the national market; and have a high percentage (75%-100%) of employees with a degree.

Consultants, commercial labs, or private R&D institutes in Portugal was the third agent of cooperation chosen by enterprises, when pursuing to improve or introduce a new organizational method in their business practices, workplace organization or external relations. Obviously, consultants should be disregarded from this set, because it concerns the enterprises addressed in this study. For that reason consultants should be envisaged as a different cooperation agent, specifically competitors. Around 96.4% of firms in segment IV acknowledge being innovators when cooperating with this agent. This group that accounts for 7.5% of the sampled enterprises also affirms that the internal information source is of medium/high importance in the development of innovations. This set of medium-sized firms exhibits a focus on the national market and employs a considerable number of highly qualified staff. Lastly, their head office is located in Portugal.

Finally, universities or other higher educational institutions in Portugal were the cooperation agent of choice in marketing innovation. In segment V, which totals 9.4% of the sampled enterprises, about 80% of firms have declared themselves as being innovators. This group that engages in co-operation over innovation with this player also perceives its enterprise or enterprise group as an information source of high importance in R&D activities. This segment mainly features are: large size enterprises,

head office in a European country; national market focused; and significant number of workers with high studies.

Besides these four forms of cooperation exposed above, the product/service innovation CHAID tree presented another segment of innovators which accounted for 13.6% of the sample. This group engages in co-operation over innovation with other external partners; nevertheless, this segment did not originate a child node to confirm which one(s). Significantly, over 98% of this particular cluster of enterprises acknowledges being innovators. With reference to profile features, segment VI relates to medium-size firms selling their services at a national level and whose headquarters are located in the country. Around 76% of the enterprises in this segment have a high percentage of employees with a university degree.

The findings associated with external information sources also corroborate with the innovative accomplishment of enterprises. The information source clients or customers were rated between medium and high importance in three CHAID trees: product/service innovation (segment IV); process innovation (segment II); and marketing innovation (segments II, III and IV). The results confirm that firms which envisage clients or customers as of high importance in innovation development, normally have a high success rate, in particular those accrediting importance to the internal source as well. With regard to profile characteristics, a similar pattern was found in the referenced segments. This group mainly features are: head office in Portugal, national market focused, and not many employees with university degrees. With regard to enterprise size, all segments are essentially composed of small firms with the exception of segment IV (marketing innovation) which is principally formed by medium-sized enterprises.

Commercial labs, or private R&D institutes were another information source emerging in the organizational innovation tree. Enterprises rated some importance to the above mentioned external source; nevertheless, after assessing the results in this terminal node, it was considered a poorly defined group, due to a mix of innovators and non-innovators. The cause may lie in the importance given to the internal source, which was considered by these firms of low or no importance in their innovation activities. Two other similar cases arose in the CHAID trees, particularly product/service (segment I)

and marketing (segment IV). These undefined groups only rely on internal sources in the development of innovation. These results are in line with the need to complement internal R&D with external information sources or cooperation partners (von Hippel, 1988; Lundvall, 2010; Szulanski, 1996; Laursen and Salter, 2006). The use of only one of these internal or external sources does not guarantee the success of the innovatory process, meaning innovation has an imprecise probability of success.

The below table summarizes the main findings of the study.

Table 4.9 - Main findings summary

Innovators	**Product/Service Innovation**	Cooperation partner – "within the enterprise or enterprise group –other Europe's countries" + Information source – "clients or customers"	Large firm Head-office in a country outside Europe National Market High percentage of employees with university degree	(N) 13 Firms
		Undefined cooperation partner + Information source – "clients or customers"	Medium-sized firm Head-office in Portugal National Market High percentage of employees with university degree	(N) 51 Firms
	Process Innovation	Information source "within the enterprise or enterprise group" + Cooperation partner – "Suppliers of equipment, materials, components, or software – other Europe's countries"	Medium-sized firm Head-office in European country National Market High percentage of employees with university degree	(N) 19 Firms
	Organizational Innovation	Information source "within the enterprise or enterprise group" + Cooperation partner – "Commercial labs, or private R&D institutes – Portugal"	Medium-sized firm Head-office in Portugal National Market High percentage of employees with university degree	(N) 28 Firms
	Marketing Innovation	Information source "within the enterprise or enterprise group" + Information source – "clients or customers"	Medium-sized firms Head-office in Portugal National Market Medium percentage of employees with university degree	(N) 23 Firms
		Information source "within the enterprise or enterprise group" + Cooperation partner – "Universities or other higher education institutions - Portugal	Large firm Head-office in European country National Market High percentage of employees with university degree	(N) 35 Firms

Innovation - Imprecise probability of success	Firms rely on/use: Internal R&D or External information sources and cooperation agents	Small or medium-sized firm Head-office in Portugal National Market Low/medium percentage of employees with university degree
Non-Innovators	Firms do not rely on/use both: Internal R&D and External information sources and cooperation agents	Small firm Head-office in Portugal Local/regional market Low percentage of employees with university degree

Source: Own elaboration

CHAPTER 5

CONCLUSION

5.1 Main Findings

The aim of this dissertation was to address important questions regarding the effect of the external environment on each type of innovation, analyzing if a certain type of information source or cooperation agent, belonging to the external environment stimulates the enterprise's innovation activities more than another. Accordingly, this study focuses on the open innovation paradigm (Chesbrough, 2003a, b).

Distinctively from many studies that make use of the general concept of innovation, this dissertation divided this concept, distinguishing four types: (1) product/service; (2) process; (3) organizational; and (4) marketing. With regard to the external environment it became essential to perceive the significance wielded by external information and agents in enterprise's innovation projects. Thus to assess the importance of the external environment a total of ten information sources and cooperation with seven different types of agents, have been considered.

The Chi-square Automatic Interaction Detection (CHAID) technique used on the sample created four tree-based classification models: (1) product/service innovation; (2) process innovation; (3) organizational innovation; and (4) marketing innovation. These models presented significant profile of segments, which emphasized the differences on the external sources importance in the enterprise's innovation activities. The results produced considerable evidence to divide the sample into two groups - Innovative and non-innovative enterprises.

The MC enterprises that declared being innovators have a propensity to cooperate with other agents in their innovation activities. A significant positive association was identified between certain cooperation agents and the type of innovation introduced in the market. Our results indicate that the MC enterprises orientation towards process innovation has a positive connection in the enterprise's relations with suppliers of equipment, materials, components, or software in other European countries. The profile that emerged relates this group to medium-sized enterprises that have their head office in a European country, are aimed at the national market, and have a high percentage of employees with a degree. Remarkably, this group that gives importance to the

information source within the enterprise or enterprise group, claimed to be 100% process innovators. These results demonstrate that a close cooperation with the supply chain plays an important role in the success of innovation activities, particularly in the high degree of efficiency attained (Tether, 2002; Bayona et al., 2003; Santamaría & Rialp, 2007).

It has also been noticed that cooperation with commercial labs, or private R&D institutes in Portugal, is positively associated with organizational innovation, considering that nearly 96% of the firms acknowledge being innovators when cooperating with this agent. This segment also considers within the enterprise or enterprise group, an information source of medium or high importance in the development of the related innovation. Concerning the profile it was observed that these medium-sized firms are focused on national market level, have a high percentage of employees with a university degree, and their head office is located in Portugal. Furthermore, the findings have indicated that cooperation with universities or other higher educational institutions in Portugal produces significant positive results in marketing innovation activities. Surprisingly, this group also perceives their enterprise or enterprise group as an information source (internal) of high importance in innovation activities. The profile characteristics for this segment are consistent with large firms with a high percentage of employees with a degree, head office in a European country and oriented towards a national market.

The results also point to a significantly positive association between external information sources and the innovation introduced in the market. Clients or customers contributed to the innovative accomplishment of MC enterprises in three models: (1) product/service innovation; (2) process innovation; and (3) marketing innovation. Commercial labs, or private R&D institutes were another information external source which was considered important to organizational innovation.

The MC firms that had no innovation introduced in the market during the reference period represented approximately 50% of the sample in each of the four models. In the referenced segments, this group did not assign importance to the information sources, being these either internal or external (market), and disregarded any type of cooperation with other agents. Another important finding is that these MC enterprises frequently

tend to emerge on a certain type of profile: small enterprise, head office location in Portugal, oriented toward a local/regional market, and having a small percentage of employees with a university degree. These findings suggest that Portuguese MC firms may be highly internally focused and not opening themselves up to external partners, which means that they are missing a lot of opportunities (Chesbrough, 2003a; Laursen and Salter, 2006). The implications are consistent with the idea that, the introduction of new products and processes on to the market rely on the enterprise's skills to build up strong relations with external agents, meaning that enterprises seldom innovate on their own (Håkannson, 1987; Baptista and Swann, 1998; Cooke and Morgan, 1998).

To summarize, the results of this study show that innovative accomplishment is higher in firms using internal and external environments jointly, in their innovation activities (Cohen and Levinthal, 1990; Veugelers, 1997; Chesbrough et al., 2006). Large and medium-size enterprises with their head office abroad have a propensity to use both internal and external environment (Rigby and Zook, 2002), through cooperation (Navarro, 2002) or information sources, achieving usually a high success rate in innovation development (Cohen and Levinthal, 1990). A large percentage of employees with a university degree is very common in these firms, which may be a plausible explanation for a favorable outcome in innovation achievement. Commercial labs and private R&D institutes played an important role in organizational innovation accomplishment. Firms relied on both of them as cooperation agents or information sources. The results also suggest that cooperation with suppliers is a highly effective way to improve the production process, methods of supplying services and the supporting activity (Tether, 2002; Bayona et al., 2003; Santamaría and Rialp, 2007). Universities or other higher educational institutions were also a cooperation agent of relevance when pursuing a marketing innovation. Another important finding was that clients or customers were a significant information source in the development of both products/services and marketing method or strategy. A large percentage of firms using this information source were able to accomplish their innovation goals.

This combination of findings provides some support for the premise that the external environment is important in innovative accomplishment (Cohen and Levinthal, 1990). It is consistent with the idea that the enterprise's ability to innovate is positively influenced by outsiders who can provide a diversity of potential solutions to complex

problems, and foster the sort of combinatorial innovation so as to generate new ideas and concepts.

5.2 Limitations

It is important to mention that in the referenced period of the study, 2008-2010, the global crisis had a significant impact on the country's economy, affecting the Portuguese consultancy sector. The dataset may be slightly distorted given the negative circumstances which the MC enterprises faced under this period of severe crisis.

The absence of response from enterprise's managers, on variables of the CIS dataset such as number of employees of the MC enterprise, limited the analysis of the profile.

5.3 Suggestions for Future Research

Future research can overcome at least one of the limitations. Other CIS dataset should be studied in order to verify whether the findings disclosed in this study are exceptional, given the negative circumstances of the period in study or a tendency on the choice of information sources and cooperation agents in fact exists.

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Annex 1 – CIS 2010 Questionnaire

The Community Innovation Survey 2010
(CIS 2010)

THE HARMONISED SURVEY QUESTIONNAIRE

The Community Innovation Survey 2010 **FINAL VERSION July 9, 2010**

This survey collects information on your enterprise's innovations and innovation activities during the three years 2008 to 2010 inclusive.

An innovation is the introduction of a new or significantly improved product, process, organisational method, or marketing method by your enterprise. The innovation must be new to your enterprise, although it could have been originally developed by other enterprises.

Sections 5 to 8 only refer to product and process innovations.

Please complete **all** questions, unless otherwise instructed.

Person we should contact if there are any queries regarding the form:

Name: _____
Job title: _____
Organisation: _____
Phone: _____
Fax: _____
E-mail: _____

1. General information about the enterprise

Name of enterprise _____
Address[1] _____
Postal code _____ **Main activity**[2] _____

1.1 In 2010, was your enterprise part of an enterprise group? (A group consists of two or more legally defined enterprises under common ownership. Each enterprise in the group can serve different markets, as with national or regional subsidiaries, or serve different product markets. The head office is also part of an enterprise group.)

Yes ☐ In which country is the head office of your group located? [3] _____

No ☐

If your enterprise is part of an enterprise group: Please answer all further questions about your enterprise only for the enterprise for which you are responsible in [your country]. Exclude all subsidiaries or parent enterprises.

1.2 In which geographic markets did your enterprise sell goods and/or services during the three years 2008 to 2010?

	Yes	No
A. Local / regional within [your country]	☐	☐
B. National (other regions of [your country])	☐	☐
C. Other European Union (EU), EFTA, or EU candidate countries*	☐	☐
D. All other countries	☐	☐

Which of these geographic areas was your largest market in terms of turnover during the three years 2008 to 2010? (Give corresponding letter) _____

*: Include the following countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Turkey, Spain, Sweden and the United Kingdom.

[1] NUTS 2 code
[2] NACE 4 digit code
[3] Country code according to ISO standard

2. Product (good or service) innovation

A product innovation is the market introduction of a **new** or **significantly** improved **good or service** with respect to its capabilities, user friendliness, components or sub-systems.

- Product innovations (new or improved) must be new to your enterprise, but they do not need to be new to your market.
- Product innovations could have been originally developed by your enterprise or by other enterprises.

A **good** is usually a tangible object such as a smart phone, furniture, or packaged software, but downloadable software, music and film are also goods. A **service** is usually intangible, such as retailing, insurance, educational courses, air travel, consulting, etc.

2.1 During the three years 2008 to 2010, did your enterprise introduce:

	Yes	No
New or significantly improved goods (*exclude the simple resale of new goods and changes of a solely aesthetic nature*)	☐	☐
New or significantly improved services	☐	☐

If no to all options, go to section 3, otherwise:

2.2 Who developed these product innovations?

Tick all that apply

	Goods innovations	Service innovations
Your enterprise by itself	☐	☐
Your enterprise together with other enterprises or institutions*	☐	☐
Your enterprise by adapting or modifying goods or services originally developed by other enterprises or institutions*	☐	☐
Other enterprises or institutions*	☐	☐

*: *Include independent enterprises plus other parts of your enterprise group (subsidiaries, sister enterprises, head office, etc). Institutions include universities, research institutes, non-profits, etc.*

2.3 Were any of your product innovations (goods or services) during the three years 2008 to 2010:

		Yes	No
New to your market?	Your enterprise introduced a new or significantly improved product onto your market before your competitors (it may have already been available in other markets)	☐	☐
Only new to your firm?	Your enterprise introduced a new or significantly improved product that was already available from your competitors in your market	☐	☐

Using the definitions above, please give the percentage of your total turnover[4] in 2010 from:

New or significantly improved products introduced during the three years 2008 to 2010 that were **new to your market**	☐☐☐ %
New or significantly improved products introduced during the three years 2008 to 2010 that were **only new to your firm**	☐☐☐ %
Products that were **unchanged or only marginally modified** during the three years 2008 to 2010 (include the resale of new products purchased from other enterprises)	☐☐☐ %
Total turnover in 2010	1 0 0 %

2.4 Were <u>any</u> of your product innovations during the three years 2008 to 2010:

	Yes	No	Don't know
A first in [your country]	☐	☐	☐
A first in Europe	☐	☐	☐
A world first	☐	☐	☐

[4] For Credit institutions: Interests receivable and similar income, for insurance services: Gross premiums written

3. Process innovation

A process innovation is the implementation of a **new** or **significantly** improved production process, distribution method, or supporting activity.

- Process innovations must be new to your enterprise, but they do not need to be new to your market.
- The innovation could have been originally developed by your enterprise or by other enterprises.
- Exclude purely organisational innovations – these are covered in section 9.

3.1 During the three years 2008 to 2010, did your enterprise introduce:

	Yes	No
New or significantly improved methods of manufacturing or producing goods or services	☐	☐
New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services	☐	☐
New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing	☐	☐

If no to all options, go to section 4, otherwise:

3.2 Who developed these process innovations?

	Tick all that apply
Your enterprise by itself	☐
Your enterprise together with other enterprises or institutions*	☐
Your enterprise by adapting or modifying processes originally developed by other enterprises or institutions*	☐
Other enterprises or institutions*	☐

**: Include independent enterprises plus other parts of your enterprise group (subsidiaries, sister enterprises, head office, etc). Institutions include universities, research institutes, non-profits, etc.*

3.3 Were any of your process innovations introduced during the three years 2008 to 2010 new to your market?

Yes	☐
No	☐
Do not know	☐

4. Ongoing or abandoned innovation activities for process and product innovations

Innovation activities include the acquisition of machinery, equipment, software, and licenses; engineering and development work, design, training, marketing and R&D when they are *specifically* undertaken to develop and/or implement a product or process innovation. Also include basic R&D as an innovation activity even when not related to a product and/or process innovation.

4.1 During the three years 2008 to 2010, did your enterprise have any innovation activities that did not result in a product or process innovation because the activities were:

	Yes	No
Abandoned or suspended before completion	☐	☐
Still ongoing at the end of the 2010	☐	☐

If your enterprise had no product or process innovations or innovation activity during the three years 2008 to 2010 (no to all options in questions 2.1, 3.1, and 4.1), go to section 8.

Otherwise, go to section 5

5. Innovation activities and expenditures for process and product innovations

5.1 During the three years 2008 to 2010, did your enterprise engage in the following innovation activities:

		Yes	No
In-house R&D	Creative work undertaken within your enterprise to increase the stock of knowledge for developing new and improved products and processes (include software development in-house that meets this requirement) If yes, did your enterprise perform R&D during the three years 2008 to 2010: Continuously (your enterprise has permanent R&D staff in-house) ☐ Occasionally (as needed only) ☐	☐	☐
External R&D	Same activities as above, but performed by other enterprises (including other enterprises or subsidiaries within your group) or by public or private research organisations and purchased by your enterprise	☐	☐
Acquisition of machinery, equipment and software	Acquisition of advanced machinery, equipment (including computer hardware) or software to produce new or significantly improved products and processes	☐	☐
Acquisition of external knowledge	Purchase or licensing of patents and non-patented inventions, know-how, and other types of knowledge from other enterprises or organisations for the development of new or significantly improved products and processes	☐	☐
Training for innovative activities	Internal or external training for your personnel specifically for the development and/or introduction of new or significantly improved products and processes	☐	☐
Market introduction of innovations	Activities for the market introduction of your new or significantly improved goods or services, including market research and launch advertising	☐	☐
Design	Activities to design, improve or change the shape or appearance of new or significantly improved goods or services	☐	☐
Other	Other activities to implement new or significantly improved products and processes such as feasibility studies, testing, routine software development, tooling up, industrial engineering, etc.	☐	☐

5.2 Please estimate the amount of expenditure for each of the following four innovation activities in 2010 only. (Include personnel and related costs)[5]

If your enterprise had no expenditures in 2010, please fill in '0'

In-house R&D (Include capital expenditures on buildings and equipment specifically for R&D)	
Purchase of external R&D	
Acquisition of machinery, equipment, and software (Exclude expenditures on equipment for R&D)	
Acquisition of external knowledge	
Total of these four innovation expenditure categories	

[5] Give expenditure data in 000's of national currency units to eight digits.

5.3 During the three years 2008 to 2010, did your enterprise receive any public financial support for innovation activities from the following levels of government? Include financial support via tax credits or deductions, grants, subsidised loans, and loan guarantees. Exclude research and other innovation activities conducted entirely for the public sector under contract.

	Yes	No
Local or regional authorities	☐	☐
Central government (including central government agencies or ministries)	☐	☐
The European Union (EU)	☐	☐
If yes, did your enterprise participate in the EU 7th Framework Programme for Research and Technical Development?	☐	☐

6. Sources of information and co-operation for product and process innovation

6.1 During the three years 2008 to 2010, how important to your enterprise's innovation activities were each of the following information sources? Please identify information sources that provided information for new innovation projects or contributed to the completion of existing innovation projects.

		Degree of importance			
		Tick 'not used' if no information was obtained from a source.			
	Information source	**High**	**Medium**	**Low**	**Not used**
Internal	Within your enterprise or enterprise group	☐	☐	☐	☐
Market sources	Suppliers of equipment, materials, components, or software	☐	☐	☐	☐
	Clients or customers	☐	☐	☐	☐
	Competitors or other enterprises in your sector	☐	☐	☐	☐
	Consultants, commercial labs, or private R&D institutes	☐	☐	☐	☐
Institutional sources	Universities or other higher education institutions	☐	☐	☐	☐
	Government or public research institutes	☐	☐	☐	☐
Other sources	Conferences, trade fairs, exhibitions	☐	☐	☐	☐
	Scientific journals and trade/technical publications	☐	☐	☐	☐
	Professional and industry associations	☐	☐	☐	☐

6.2 During the three years 2008 to 2010, did your enterprise co-operate on any of your innovation activities with other enterprises or institutions? Innovation co-operation is active participation with other enterprises or non-commercial institutions on innovation activities. Both partners do not need to commercially benefit. Exclude pure contracting out of work with no active co-operation.

Yes ☐
No ☐ (**Please go to question 7.1)**

6.3 Please indicate the type of innovation co-operation partner by location

(Tick all that apply)

Type of co-operation partner	[Your country]	Other Europe*	United States	China or India	All other countries
A. Other enterprises within your enterprise group	☐	☐	☐	☐	☐
B. Suppliers of equipment, materials, components, or software	☐	☐	☐	☐	☐
C. Clients or customers	☐	☐	☐	☐	☐
D. Competitors or other enterprises in your sector	☐	☐	☐	☐	☐
E. Consultants, commercial labs, or private R&D institutes	☐	☐	☐	☐	☐
F. Universities or other higher education institutions	☐	☐	☐	☐	☐
G. Government or public research institutes	☐	☐	☐	☐	☐

*: Include the following European Union (EU) countries, EFTA, or EU candidate countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Turkey, Spain, Sweden and the United Kingdom.

6.4 Which type of co-operation partner did you find the most valuable for your enterprise's innovation activities? (Give corresponding letter) _____

7. Objectives for your product and process innovations during 2008 to 2010

7.1 How important were each of the following objectives for your activities to develop product or process innovations during the three years 2008 to 2010?

If your enterprise had several projects for product and process innovations, make an overall evaluation

	High	Medium	Low	Not relevant
Increase range of goods or services	☐	☐	☐	☐
Replace outdated products or processes	☐	☐	☐	☐
Enter new markets or increase market share	☐	☐	☐	☐
Improve quality of goods or services	☐	☐	☐	☐
Improve *flexibility* for producing goods or services	☐	☐	☐	☐
Increase *capacity* for producing goods or services	☐	☐	☐	☐
Reduce labour costs per unit output	☐	☐	☐	☐
Reduce material and energy costs per unit output	☐	☐	☐	☐
Reduce environmental impacts	☐	☐	☐	☐
Improve health or safety of your employees	☐	☐	☐	☐

8. Factors hampering product and process innovation activities

8.1 During the three years 2008 to 2010, how important were the following factors in preventing your enterprise from innovating or in hampering your innovation activities?

		Degree of importance			
		High	Medium	Low	Factor not experienced
Cost factors	Lack of funds within your enterprise or group	☐	☐	☐	☐
	Lack of finance from sources outside your enterprise	☐	☐	☐	☐
	Innovation costs too high	☐	☐	☐	☐
Knowledge factors	Lack of qualified personnel	☐	☐	☐	☐
	Lack of information on technology	☐	☐	☐	☐
	Lack of information on markets	☐	☐	☐	☐
	Difficulty in finding cooperation partners for innovation	☐	☐	☐	☐
Market factors	Market dominated by established enterprises	☐	☐	☐	☐
	Uncertain demand for innovative goods or services	☐	☐	☐	☐
Reasons not to innovate	No need due to prior innovations by your enterprise	☐	☐	☐	☐
	No need because of no demand for innovations	☐	☐	☐	☐

9. Organisational innovation

An organisational innovation is a new organisational method in your enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by your enterprise.

- It must be the result of strategic decisions taken by management.
- Exclude mergers or acquisitions, even if for the first time.

9.1 During the three years 2008 to 2010, did your enterprise introduce:

	Yes	No
New **business practices** for organising procedures (i.e. supply chain management, business re-engineering, knowledge management, lean production, quality management, etc)	☐	☐
New methods of **organising work responsibilities and decision making** (i.e. first use of a new system of employee responsibilities, team work, decentralisation, integration or de-integration of departments, education/training systems, etc)	☐	☐
New methods of **organising external relations** with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc)	☐	☐

If no to all options, go to section 10.

Otherwise, go to question 9.2

9.2 How important were each of the following objectives for your enterprise's organisational innovations introduced during the three years 2008 to 2010 inclusive?

If your enterprise introduced several organisational innovations, make an overall evaluation

	High	Medium	Low	Not relevant
Reduce time to respond to customer or supplier needs	☐	☐	☐	☐
Improve ability to develop new products or processes	☐	☐	☐	☐
Improve quality of your goods or services	☐	☐	☐	☐
Reduce costs per unit output	☐	☐	☐	☐
Improve communication or information sharing within your enterprise or with other enterprises or institutions	☐	☐	☐	☐

10. Marketing innovation

A marketing innovation is the implementation of a new marketing concept or strategy that differs significantly from your enterprise's existing marketing methods and which has not been used before.

- It requires significant changes in product design or packaging, product placement, product promotion or pricing.
- Exclude seasonal, regular and other routine changes in marketing methods.

10.1 During the three years 2008 to 2010, did your enterprise introduce:

	Yes	No
Significant changes to the aesthetic **design** or **packaging** of a good or service (*exclude changes that alter the product's functional or user characteristics – these are product innovations*)	☐	☐
New media or techniques for **product promotion** *(i.e. the first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc*)	☐	☐
New methods for **product placement** or sales channels *(i.e. first time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc)*	☐	☐
New methods of **pricing** goods or services *(i.e. first time use of variable pricing by demand, discount systems, etc)*	☐	☐

If no to all options, go to section 11.

Otherwise, go to question 10.2

10.2 How important were each of the following objectives for your enterprise's marketing innovations introduced during the three years 2008 to 2010 inclusive?

If your enterprise introduced several marketing innovations, make an overall evaluation

	High	Medium	Low	Not relevant
Increase or maintain market share	☐	☐	☐	☐
Introduce products to new customer groups	☐	☐	☐	☐
Introduce products to new geographic markets	☐	☐	☐	☐

11. Creativity and skills

11.1 During the three years 2008 to 2010, did your enterprise employ individuals in-house with the following skills, or obtain these skills from external sources?

Tick both 'Employed in-house' and 'Obtained from external sources' if relevant.

	Employed in-house	Obtained from external sources*	Skills not used / not relevant
Graphic arts / layout / advertising	☐	☐	☐
Design of objects or services	☐	☐	☐
Multimedia (combining audio, graphics, text, still pictures, animation, video etc)	☐	☐	☐
Web design	☐	☐	☐
Software development	☐	☐	☐
Market research	☐	☐	☐
Engineering / applied sciences	☐	☐	☐
Mathematics / statistics / database management	☐	☐	☐

**: Include freelancers, consultants, other independent enterprises, other parts of your enterprise group, etc.*

11.2 During the three years 2008 to 2010, did your enterprise use any of the following methods to stimulate new ideas or creativity among your staff? If yes, was the method successful in producing new ideas or increasing creativity?

	Method used and:			
	Successful	Not Successful	Don't know if successful	Method not used
Brainstorming sessions	☐	☐	☐	☐
Multidisciplinary or cross-functional work teams	☐	☐	☐	☐
Job rotation of staff to different departments or other parts of your enterprise group	☐	☐	☐	☐
Financial incentives for employees to develop new ideas	☐	☐	☐	☐
Non-financial incentives for employees to develop new ideas, such as free time, public recognition, more interesting work, etc	☐	☐	☐	☐
Training employees on how to develop new ideas or creativity	☐	☐	☐	☐

12. Basic economic information on your enterprise

12.1 What was your enterprise's total turnover for 2008 and 2010?[6] Turnover is defined as the market sales of goods and services (Include all taxes except VAT[7]).

2008	2010

12.2 What was your enterprise's average number of employees in 2008 and 2010?[8]

2008	2010

12.3 Approximately what percent of your enterprise's employees in 2010 had a university degree?[9]

- 0% ☐
- 1% to 4% ☐
- 5% to 9% ☐
- 10% to 24% ☐
- 25% to 49% ☐
- 50% to 74% ☐
- 75% to 100% ☐

[6] Give turnover in '000 of national currency units. *Leave space for up to nine digits.*
[7] For Credit institutions: Interests receivable and similar income; for Insurance services give gross premiums written
[8] If administrative data are used and the annual average is not available, give results for the end of each year. Leave space for up to six digits for question 12.2.
[9] National translation: This includes ISCED 5a and 6. If administrative data are used, use the same time period as for question 12.2.

Appendix I - Frame of Reference from Studies on Innovation

Author (s)	Title of the Study	Objective(s) of the Study
Arora and Gambardella (1990)	Complementarity and external linkages: The strategies of the large firms in biotechnology.	Test the hypothesis that the strategies of external linkage of the large firms with other parties are complementary to one another.
Abramovsky, L., Kremp, E., López, A., Schmidt, T., Simpson, H. (2005)	Understanding co-operative R&D activity: evidence from four European countries.	Investigate the co-operative research activity by firms in four countries, France, Germany, Spain and the UK.
Bao Y. X. Chen and K. Z. Zhou (2012)	Zhou. External learning, market dynamics, and radical innovation: Evidence from China's high-tech firms.	Analyze how two types of external learning, technical and administrative learning, affect radical innovation, and assess how such effects are conditional on two types of market dynamics , technological turbulence and competitive intensity.
Barge-Gil, A. (2010)	Cooperation-based innovators and peripheral cooperators: an empirical analysis of their characteristics and behavior.	Investigate the characteristics and cooperative behavior of firms that use cooperation as the main way to achieve innovation (cooperation-based innovators).
Bayona, C., T. García and E. Huerta (2002)	Collaboration in R&D with universities and research centres: An empirical study of Spanish firms.	Understand the reasons that lead companies to cooperate with universities and research centers and the characteristics of the relationship that this involves.
Belderbos, R., Carree, M. and Lokshin, B. (2004)	Cooperative R&D and Firm Performance.	Analyze the impact of R&D cooperation on firm performance differentiating between four types of R&D partners (competitors, suppliers, customers, and universities and research institutes), and considering two performance measures: labour productivity and productivity in innovative (new to the market) sales.
Bercovitz, J., Feldman, M., (2007)	Fishing upstream: firm innovation strategy and university research alliances.	Examine how innovation strategy influences firms' level of involvement with university-based research.
Brettel M. and N. J. Cleven (2011)	Innovation Culture, Collaboration with External Partners and NPD Performance.	Observe the impact of the firm's innovation culture on its openness to external knowledge and how it influences the firm's NPD performance.
Caloghirou, Y., I. Kastelli and A. Tsakanikas (2004)	Internal capabilities and external knowledge sources: Complements or substitutes for innovative performance?	Investigate the extent to which the existing internal capabilities of firms and their interaction with external sources of knowledge affect their level of innovativeness.
Cassiman, B. and R. Veugelers (2006)	In search of complementary in innovation strategy: internal R&D and external knowledge acquisition.	Explore the complementarity between organizational design decisions combining a "productivity" and an "adoption" approach. Search for contextual variables in the firm's strategy that affects complementarity.
Chesbrough H. (2003)	Open innovation.	Describe an innovation paradigm shift from a closed to an open model based on close observation of a small number of companies.
Chesbrough, H. (2003)	The era of open innovation.	Explore the concept open innovation : The use of external ideas and knowledge in conjunction with internal R&D.
Chesbrough, H. (2003)	Open Innovation: The New Imperative for Creating and Profiting from Technology.	Explain how companies can use their business models to identify a more enlightened role for R&D in a world of abundant information,

		better manage and access intellectual property, advance their current business, and grow their future business.
Chesbrough, H., W. Vanhaverbeke and J. West (2006)	Open Innovation: Researching a New Paradigm.	Specify the new contributions and emphases that Open Innovation can bring to earlier academic work. Identify the various areas where further research on Open Innovation is needed. Determine limits to Open Innovation.
Cohen, W. M. and D. A. Levinthal (1990)	Absorptive capacity: A new perspective on learning and innovation.	Study how important is the firms' ability to recognize the value of new, external information, assimilate it, and apply it to commercial ends in terms of innovative capabilities. Characterize the factors that influence absorptive capacity at the organizational level, learn how an organization's absorptive capacity differs from that of its individual members, and discover the role of diversity of expertise within an organization.
Dogson, M., Gann, D. and Salter, A. (2006)	The role of technology in the shift towards open innovation: The case of Procter & Gamble.	Analyze Procter and Gamble's 'Connect and Develop' strategy as a case study of the major organizational and technological changes associated with open innovation.
Ebersberger, B., Pyka, A. (2008)	Why do firms cooperate for innovation?—a comparison of Austrian and Finnish CIS 3 results.	Investigate co-operative behavior of innovative firms in Finland and Austria.
Enkel E., O. Gassmann and H. Chesbrough (2009)	"Open R&D and open innovation: exploring the phenomenon".	Study how and where open innovation can add value in knowledge-intensive processes. Advance the R&D, innovation, and technology management perspective by building on past and present studies in the field and providing future directions.
Faria P.,Lima F. and Santos R. (2010)	Cooperation in innovation activities: The importance of partners.	Investigate the importance of cooperation partners for the development of innovation activities.
Freel, M., Harrison, R. (2006)	Innovation and cooperation in the small firm sector: evidence from 'Northern Britain'.	Map the extent of small firm innovation-related networking. Understand the unique contribution of small firm innovation-related networks make to the successful introduction of new products and processes. Investigated the impact of networking on innovation in both manufacturing and services.
Gomes, C.M., I. Kruglianskas and F.L. Scherer (2011)	Analysis of the relationship between practices of managing external sources of technology information and indicators of innovative performance.	Understand the different processes for managing outside sources of technology information, with a major focus on practices that companies actually adopt. Construct a theoretical and practical frame of reference for developing processes of sustainable technological innovation.
Hagedoorn, J. (2000)	Research partnerships.	Synthesize the academic, professional, and policy literature on research partnerships with an eye toward technology policy.
Håkansson, H. and Eriksson, A. (1993)	Getting Innovations Out of Supplier Networks.	Analyze the key issues concerning the handling of cooperative development processes: the problem of choosing partners as well as of trying to interest and engage those chosen; the

		problem of synchronization, in technical and other dimensions, of the actors involved in the development process; the problem of timing within and between various relationships; the resistance to technical change within an industrial network structure.
Kang K. and J. Kang (2009)	How do firms source external knowledge for innovation? Analysing effects of different knowledge sourcing methods.	Investigate the relationship between external knowledge and performance of technology innovation. Identify external knowledge sourcing based on information transfer from informal network, R&D collaboration and technology acquisition.
Kesidou Effie and C. Snijders (2012)	External Knowledge and Innovation Performance in Clusters: Empirical Evidence from the Uruguay Software Cluster.	Assess the importance of local and non-local knowledge networks for the innovation performance of firms in clusters.
Lambe, C.J. and Spekman, R.E. (1997)	Alliances, External Technology Acquisition, and Discontinuous Technological Change.	Explore two issues related to alliances and Discontinuous Technological Change (DTC). Why does DTC motivate companies to use alliances as a means for acquiring technology? How do these motivations change during the various stages of the DTC life-cycle?
Laursen, K. and A. Salter (2006)	Open for Innovation: the role of openness in explaining innovation performance among UK manufacturing firms.	Investigate the links of search strategy to innovative performance.
Linus D. and M. G. David (2010)	How open is innovation?	Clarify the definition of 'openness' as currently used in the literature on open innovation, and to re-conceptualize the idea for future research on the topic.
Lisa De Propris (2000)	Innovation And Inter-Firm Co-Operation: The Case Of The West Midlands.	Test the hypothesis that firms have a greater chance of being innovative if they co-operate with other firms over innovation, although undertaking no investment in R&D.
Macpherson, A. (1997)	A comparison of within-firm and external sources of product innovation.	Study the role of internal and external research, design and development (RD&D) activity in the innovation performance of New York State manufacturing firms in the scientific instruments sector.
Mention, A.L. (2011)	Co-operation and co-opetition as open innovation practices in the service sector: Which influence on innovation novelty?	This study aims to identify the influence of co-operation practices and the use of internal and external information sources on the propensity of firms to introduce new to the market innovations in the service sector.
Miotti L. and F. Sachwald (2003)	Co-operative R&D,why and with whom?An integrated framework of analysis.	Develop an integrated framework to examine the determinants of the choice of partners with which firms co-operate on R&D.
Oerlemans, L., M. Meeus and F. Boekema (1998)	Do networks matter for innovation? The usefulness of the economic network approach in analysing innovation.	Empirically Explore the relations between the mobilization and use of internal and external resources in innovation processes, and the innovative performance of firms, using an adapted version of Håkansson's (1987) economic network model.
Rosenfeld, S. (1996)	Does cooperation enhance competitiveness? Assessing the impacts of inter-firm collaboration.	Assess on two evaluations of network initiatives, one sponsored by a state and one by a private foundation, to discuss issues, methodologies, evidence of impacts, and challenges.
Rothwell, R.	Successful industrial innovation:	Sketch the developments in the dominant

(1991)	critical factors for the 1990s.	perceived model of industrial innovation from the simple linear 'technology push' and 'need pull' models of the 1960s and early 1970s, through the 'coupling model' of the late 1970s to early 1980s, to the 'integrated' model of today.
Rothwell, R. and M. Dogson (1991)	External linkages and innovation in small and medium-sized enterprises.	Address the issue of SMEs' external linkages and present data from a number of studies showing the importance of in-house technical skills to linkage activity. The importance of complementary between in-house and external know-how accumulation; and the importance of technology strategy in guiding the accumulation process.
Sánchez-González G. and Herrera L. (2010)	The influence of R&D cooperation on innovatory effort.	Analyze the influence of 9 types of cooperation with external agents on three indicators of innovatory effort in 20 industrial and service sectors in Spain.
Teirlinck P. and Spithoven A. (2008)	The Spatial Organization of Innovation: Open Innovation, External Knowledge Relations and Urban Structure.	Study the dependence that both, the organization of innovation as well as the use of external knowledge, have on the physical, socio-economic and cultural environment.
Tether, B.S. (2002)	Who co-operate for innovation, and why. An empirical analysis.	Investigate the patterns of co-operation between innovating firms and external partners.
Tether, B.S. and A. Tajar (2008)	The organisational-cooperation mode for innovation and its prominence amongst European service firms.	Analyze the innovation orientations of 2500 European firms. Identify distinct modes of innovation.
Tian D. and Y. Feng (2010)	The Categories of External Technology Sources in Open Innovation.	Explore the categories of external technology sources in open innovation. Study the external technology sources in open innovation for equipment industry, (suppliers, users, competitors, universities and research institutes, R&D service companies).
Tomohiro M., S. Miyahara, M. Tsuji and Y. Ueki (2010)	The effect of internal and external sources of knowledge on product innovation in Southeast Asia.	Examine the effect of internal and external sources of knowledge on the introduction of new products based on new technologies or information to the firms responded to the questionnaire survey conducted in four Southeast Asian countries.
Veja-Jurado, J., A. Gutiérrez-Gracia and I. Fernández-de-Lucio (2009)	Does external knowledge sourcing matter for innovation? Evidence from the Spanish manufacturing industry.	Study the effects of external knowledge-sourcing strategies on the development of both product and process innovations. Assess the degree to which effects of external knowledge-sourcing strategies are influenced by the firm's internal technological capacities.
Veugelers R. (1997)	Internal R&D expenditures and external technology sourcing.	Explore the two-way relationship between external R&D activities and internal R & D expenditures on a cross-section of Flemish R&D active companies.
Veugelers, R. (1998)	Collaboration in R&D: An Assessment of Theoretical and Empirical Findings.	Review the Industrial Organization mainstream input output models on R&D cooperation and results, with a focus on the management of voluntary and involuntary transfers of know-how in imperfect competition.
Veugelers, R., Cassiman, B. (1999)	Make and buy in innovation strategies: Evidence from Belgian manufacturing firms.	Characterize the innovation strategy of manufacturing firms. Examine the relation between the innovation strategy and industry-, firm- and innovation-

		specific characteristics using Belgian company data.
Veugelers, R., Cassiman, B. (2005)	R&D cooperation between firms and universities. Some empirical evidence from Belgian manufacturing.	Analyze which firm and industry characteristics are conducive to cooperation with universities.

Source: Own elaboration