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Determinants of Innovation in Portugal.

Designing, Implementing and Analyzing Evidence from the Third Community Innovation Survey

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Erratum

In page III (acknowledgments), the name of the Director at IN+ research center, Manuel Heitor, is not clearly stated.

In page 70, third paragraph, the correct (non average) values are respectively 6.2% of the personnel with Higher Education for the innovative companies in the manufacturing sector and 3.0% for the non-innovative companies. Fore the services sector the values (non referred explicitly in text) are respectively 19.7% and 11.5%. In national terms the values are, also respectively, 10.9% and 4.9%.

In page 75, the Table 21 – Innovation Intensity for Manufacturing and Services should be substituted by the following Table.

	Manufacturing				Services			
	All Firms			Innovators	All Firms			Innovators
	1995-1997	1998-2000			1995-1997	1998-2000		
		EVCISII	All	1998-2000		EVCISII	All	1998-2000
Small	1.8%	3,2%	3.4%	8.9%	2.1%	1.3%	1.2%	2.6%
Medium	1.9%	2.4%	2.4%	3.9%	1.6%	1.3%	1.3%	1.6%
Large	1.6%	2.9%	2.9%	3.4%	0.7%	2.8%	3.9%	4.7%
All	1.7%	2.7%	2.8%	4.1%	1.1%	2.1%	2.6%	3.5%

Table 21 – Innovation Intensity for Manufacturing and Services

In page 85, the legend of the Figure 47 – Innovation Barriers of Higher Importance for the Manufacturing Sector should be “Innovation Barriers of Higher Importance” because it presents results for both sectors Manufacturing and Services.

Título: *Determinantes de Inovação em Portugal.*
Concepção, Implementação e Análise de Dados do Terceiro Inquérito Comunitário à Inovação

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Provas Concluídas em:

Resumo

Este trabalho de investigação apresenta novos dados sobre os determinantes de inovação em Portugal, com base nos resultados do *Terceiro Inquérito Comunitário à Inovação* (CIS III). Esta investigação incluiu a concepção da versão portuguesa do questionário e a implementação do inquérito. Assim, questões relacionadas com a implementação foram também abordadas.

Os assuntos abordados podem ser relevantes em várias frentes. A descrição da metodologia e da implementação – incluindo o reportar da dificuldade e de algumas lacunas encontrados durante o processo – podem ser relevantes para países que queiram implementar processos semelhantes. Por outro lado, os resultados foram comparados com os resultados do *Segundo Inquérito Comunitário à Inovação* em Portugal, bem como com os de outros países.

Os resultados obtidos mostram uma mudança clara no desempenho em inovação das empresas portuguesas. Uma análise estatística e um teste de um modelo multi-variável estabelecido na literatura foram realizados para a identificação dos determinantes da inovação para Portugal.

Os resultados foram analisados no contexto do processo de mudança económica em Portugal e, especialmente, da evolução das políticas de desenvolvimento de ciência, tecnologia e inovação implementadas nos últimos anos no país.

Palavras-chave: Inovação, Inquérito Comunitário à Inovação, Sector Industrial, Sector de Serviços, Empresas, Políticas de Desenvolvimento

Title: *Determinants of Innovation in Portugal.*
Designing, Implementing and Analyzing Evidence from the Third Community Innovation Survey

Abstract

This research work brings new evidence on the determinants of innovation in Portugal, based on the results of the *Third Community Innovation Survey* (CIS III). The research included the design of the Portuguese version of the questionnaire and the implementation of the survey. Thus, issues of implementation were also addressed.

The insights reported may be of relevance in several fronts. The description of the methodology and of the implementation –including a reporting on difficulty and some of the shortcomings found along the way – may be relevant for countries embarking in similar exercises. The results, on the other hand, were compared with the results of the second community innovation for Portugal as well as with the results of other countries.

The new results show a dramatic change in the innovative performance of Portuguese firms. A statistical analysis and the test of a multivariate model established in the literature were performed for the identification of the determinants of innovation for Portugal.

The results were analyzed in the context of the process of economic change in Portugal and, especially, of the evolution of the science, technology and innovation policies implemented in the last few years in the country.

Keywords: Innovation, Community Innovation Survey, Manufacturing Sector, Service Sector, firms, policy

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Chapter I Introduction

This research work brings new evidence on the determinants of innovation in Portugal, based on the results of the *Third Community Innovation Survey* (CIS III). The CIS is a survey performed under the supervision of the European Community (EU) focusing on observation and collection of quantitative data regarding technological innovation. The survey was an application of the work developed within the Organization for Economic Co-operation and Development (OECD) concerning the measurement of innovation activity, that resulted in the so-called Oslo Manual (OECD, 1992, 1996). The CIS was launched under the European Monitoring System (EIMS) of DG XIII program SPRINT and in close collaboration with the Eurostat for periods of three years of data, collected every three years since 1992/9. It has been adopted as a framework of innovation analysis in a number of other countries, including candidate countries to EU and some others outside Europe. The research included the design of the Portuguese version of the questionnaire and the implementation of the survey[1]. Thus, issues of implementation will also be addressed due to their relevance and constraints in interpreting the results.

As a starting point, a brief review of the literature concerning innovation theory is presented, its evolution, the main contributions, as well as the problems associated with the methodologies of measurement and surveying of the main quantitative and qualitative variables involved in the innovation process. The review evolves from the development and construction of a support theory to the definition of taxonomies of the innovation phenomenon, the development of a model of the innovation process, its systemic nature, its economics consequences, its measurement, and a brief historical overview of the Community Innovation Survey and its roots.

Following this context, the design and implementation process of the Third Community Innovation Survey is presented. The insights reported may be of relevance in several fronts. The description of the methodology and of the implementation – including a reporting on difficulties and some of the shortcomings found along the way – may be relevant for countries embarking in similar exercises and also for the future Portuguese CIS exercises. The results, on the other hand, will be compared with the results of the second community innovation for Portugal as well as with the results of other countries whenever data are available. The presentation of the

[1] Performed under contract with the *Observatório das Ciências e Tecnologias* (OCT – Sciences and Technologies Observatory, and since early 2003, *Observatório das Ciências e do Ensino Superior*, Sciences and Higher Education Observatory - OCES) within the *Center for Innovation, Technology and Policy Research* at *Instituto Superior Técnico* (IN+/IST) and primary sources of the analyzed data.

results follows a model developed for the analysis of the Second Community Innovation Survey (Conceição and Ávila, 2001) in an effort to provide comparability between the results.

The CIS III results show a dramatic change in the innovative performance of Portuguese firms. A statistical analysis and testing of a multivariate model established in the literature will be performed for the identification of the determinants of innovation for Portugal and therefore secure the roots for the rationale of its study and derived policy development.

The results will be analyzed in the context of the process of economic change in Portugal and, especially, of the evolution of the science, technology and innovation policies implemented during the last few years in the country.

Chapter II Innovation Conceptual Framework

> *"To look for causes of a phenomenon before acquiring a fairly adequate knowledge of its external manifestations is an absurdity: how can we search for causes before one has a grasp of the subject itself?"*
>
> Wageman, E. F. (Wageman, 1930)

Knowledge evolution tends to move through recognizable major stages. At the earliest stage the work in a science is descriptive. In the next stage the work becomes taxonomic and then the work passes to the development of generalizing rules and hypothesis. Finally, in some sciences, the construction of predictive models stage is achieved. The latter science work is usable immediately by anyone skilled in the art for purposes of analytical design and invention while the first two are of lesser direct value for this purpose but could nevertheless pinpoint some directions.

In this chapter, a brief summary revision of innovation literature is performed to allow for a comprehensive understanding of the issues at stake in innovations surveys, providing the basis for understanding the implications for the economic development and policy design. In addition, it will provide some self containment to this research work. Therefore, it will address the major stages in the development of scholarly work on innovation: the establishment of a theory and its evolution; the structuring of taxonomies; the development of models and the complex and systemic nature of innovation; the national systemic framework for innovation analysis; the measurement of innovation; and finally the evaluation of systems of innovation through internationally comparable surveys.

II.1. The Quest for a Theory

In the search for the reasons of economic development, scholars have provided theories involving the innovation concept as early as the 19th century, either in Economics (Riedel, 1838, 1839), or in Sociology (Tarde's, 1890, 1993). In the former, Riedel was the precursor of entrepreneurial innovation focus, earlier and broader than Schumpeter with his theory of heroic entrepreneurship, in which he makes the innovation central to the analysis of the economic process (Schumpeter, 1912). Latter on, Schumpeter presented also the notions that innovation clusters on specific economic sectors and that innovation spurs as new combinations of existent knowledge and competencies, originating from different actors in the value chain (Schumpeter, 1939). This process, which he names creative destruction, was the fundamental impulse to the

capitalist engine emerging from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization being created as an industrial mutation – a biological metaphor within a crescent relevance of biological comparisons in further developments of these theories – that persistently transforms the economic structure from within, relentlessly destroying the old, incessantly creating the new, in a way that its performance, features and effects unfold over large periods of time (Schumpeter, 1943). Transient by nature, innovation in Schumpeterian terms emerges from the competition for the new commodity, the new technology, the new source of supply, the new type of organization.

Nelson and Winter presented an overview of the prevailing theoretical literature on innovation (Nelson and Winter, 1977), probing the adequacy of the existing theory at that time in order to guide innovation policy. A broader theoretical framework, beyond firms and entrepreneurs, was presented. Nelson and Winter argued that the most important policy issues involve finding ways to make lagging sectors more progressive - they focused their analysis on the vast inter-industry differences in rates of productivity growth, and other manifestations of differential rates of technological progress across industries.

Therefore, they presented a theoretical structure that bridged the existing separate subfields of innovation studies. In their view, a useful theory should encompass the uncertainty and institutional diversity surrounding the innovation process (apart from firms themselves, varying greatly from sector to sector), as well as the market and non-market milieu as a selective environment for innovation.

In the referred conditions, the economic causes and consequences of the innovation process are of fundamental importance. The success of technological innovation is a process of simultaneous pairing at the technological and economical levels – of drawing on the present state of economical knowledge and projecting it in a direction that brings about a combination with some substantial grouping of consumer needs and desires. In fact, important innovations have commonly been ahead of their times, and have created a non existent market which was not expected by the short sighted nor the fearful.

The economics of innovation reveal the occurrence of a rising of development costs especially in new products that push the technological frontier, all associated with the escalation of the financial risks and of markets with increasing requirement of critical mass to provide success (e.g., aircraft industry could go bankrupt trying to launch an innovation product). The need for venture capital therefore emerges, but also a set of barriers to entry of new firms, to protect the

investments and to prevent free riding effects. Schumpeterian innovators frequently collapse where imitators or fast seconds learning from the mistakes, may experience great commercial success. The degree of uncertainty in achieving success is associated with the life-cycle stage: in the early stage, major changes in product design are occurring rapidly, and a dominant successful design is searched for to organize a stable production and marketing around it; in the later stages, process changes to reduce production costs are dominant. Organizations appear to be effective in different kinds of innovation some in high risk, radical innovations, others in the small cumulative, evolutionary changes that reduce costs and bring better fit of a product to various market niches.

The elaboration of an endogenous technological change conceptualization by Romer – the New Growth Theory and subsequent analyses on the economics of knowledge and intellectual capital (Romer, 1986; Romer, 1990; Nelson and Romer, 1996) - provided additional support for the importance of technological progress (therefore innovation) as an internalized force in economic growth models. Providing a micro-level analysis framework, Porter also elaborated extensively on the networks of organizations, in which competitive advantage grows from dynamic interaction between actors, across sector boundaries, and spur innovation and upgrading through spillovers and knowledge transfer in the so-called clusters (Porter, 1990; Porter, 1996; Porter, 1998; Porter, 2000; Porter and Stern, 2001). The degree of innovative success was also found to be positively correlated to network cohesiveness (Ebadi and Utterback, 1984).

Innovation possesses therefore a relation of interdependency with economic performance (economic growth), where it is of central importance, as DeBresson claims, to identify national or regional loci that are the main springs of growth, increased welfare and well-being in economies (DeBresson, 1996a). Most economic phenomena – and innovation in particular – are polarized in space. Several contributions in this direction have been provided: Marshall and its industrial districts (Marshall, 1920; Marshall, 1927), Schumpeter and the clustering of innovation (Schumpeter, 1939), Dahmen and the development blocks (Dahmen, 1988; Dahmen, 1991), Perroux with the development and growth poles (Perroux, 1950; Perroux, 1988), economic geographers with industrial and high tech agglomerations (Dorfman, 1985; Saxenian, 1985; Saxenian, 1988; Saxenian, 1989; Krugman, 1991b; Krugman, 1991a; Krugman, 1995; Saxenian, 1995; Krugman, 1999).

A largely empirically based research agenda has certainly benefited from advances in the evolutionary theory of economic change. However, its effects on developments in the evolutionary theory itself have been diminishing over time, probably because practical problem-solving has been displaced by formal theory and model building as the mains drivers in its

development: hence the ever-present danger of the continuing co-existence of ‘numbers without theory’ with ‘theory without numbers’.

II.2. Taxonomies

In pursuing improvement of the understanding of the nature and sources of the technological knowledge that underlies the continuously technical change in contemporary society, and of the implications for public policy and corporate management, Keith Pavitt proposed a taxonomy of technological change (Pavitt, 1984). For Pavitt, technological knowledge is much more than codified information, suggesting the following dimensions for analysis of technological activities:

- Cognitive (dominance in corporate technological activities of expensive experiments and prototyping in comparison with less costly experiments to develop scientific understanding; central importance of tacit knowledge in interpreting the performance of complex artifacts and knowing how and where to search for improved performance; the incremental step-by-step nature of corporate search for improved technical performance);
- Organizational (within business firms, ensuring the assimilation of the relevant fields of technological knowledge, through linkages to the wider knowledge communities, and the capacity within the firm to experiment and learn across cognitive and functional boundaries; in the regional, national and international environments, establishing competencies, institutions and incentive structures that ensure the development and diffusion of technological knowledge, involving market institutions and transactions but also public funding and professional networks of development and exchange)
- Combination of Cognitive and Organizational (specialized and differentiated nature of corporate technological and related organizational knowledge, determined by the principal products markets – path dependence – what businesses have been able to do in the past defines and constrains what they can hope to do in the future; the advantages of physical proximity in innovative activities that involve tacit knowledge, uncertainty, and coordinated experimentation across functional and disciplinary boundaries)

In the elaboration of his taxonomy (Pavitt, 1999), Pavitt departed from a comparison of sectors in terms of:

- the sector sources of technologies used in a sector (generated within the sector or outside through the purchase of production equipment and materials);

- the institutional sources and nature of the technology produced in a sector (the relative importance of intramural and extramural knowledge sources, and of product and process innovations);
- the characteristics of innovating firms (their size and main activity).

Subsequently, he structured his proposal while recognizing two central characteristics of innovation:

- knowledge applied by firms in innovations is not general purpose and easily transmitted and reproduced, but appropriated for specific applications and appropriated by specific firms (technological change is largely a cumulative process specific to firms);
- variety (sectors vary in their relative importance of product and process innovations, in sources of process technology, and in the size and patterns of technological diversification of innovating firms).

Finally, based in this structure of sector technology trajectories Pavitt proposed the following taxonomy for innovation: Supplier Dominated; Production Intensive (Scale-intensive; Specialized equipment suppliers); Science Based, later expanded by introducing enterprise size and sector specificities as fundamental dimensions of the innovation process (Evangelista et al., 1997).

Nonetheless, other routes were exploited by looking at the interactions in the innovation process, which often go beyond short-term market transactions and include more durable trust-based relations: networks. The network concept has been used in engineering for a long time to manage complex systems (Transport and Telecommunications especially). The network approach enables the incorporation of several strands of analysis and aspects of innovation: Schumpeterian dynamics, transaction cost analysis, supplier-user linkages, interactive learning, or more generally the overlapping area between economics and sociology (creating and shaping markets and organization). The Schumpeterian legacy is obvious. If innovation consists of new technology combinations, networks provide the flexibility with which to exploit opportunities for the recombination of the various components. Networks can be a privileged way of innovating. And, additionally, it permits to supersede the methodological individualism of the "heroic" Schumpeter's entrepreneur.

Following these lines of thought, DeBresson presented a taxonomy of innovative agents considering firms or networks as unit of analysis (DeBresson, 1996a). In what concerns firms, the proposed classification was:

- Innovators – introduce products and processes, which are new to the industry, some are exporters, others invest heavily in equipment, and some do both;

- Adopters only through fixed investments – adopt innovations almost exclusively through acquisition of machinery; Adopters, exporters and investors – adopt innovations for the export market and make fixed investments;
- Exporting adopters – adopt and export, but make few fixed investments;
- Marginal Adopters – even adopted innovations are only a fraction of their sales, few fixed investments, no costs.

In what concerns networks, he proposed the following classification:

- Weaker or no external networks;
- Equipment Supplier Dominated Network;
- Integrating Networks – Marketing Oriented Network (customers and competitors; with Suppliers and Users Only; with suppliers, users and competitors) and Complete Information Networks (suppliers, customers, competitors, government laboratory and university).

II.3. Innovation Model Development

After the development of taxonomies, the innovation scholar work was focused on a more complex stage, the development of a model of the innovation process. Since World War II, the linear model prevailed, i.e. research lead to development, which enables production and finally marketing. Nonetheless, and quoting Thomas Kuhn, one should not abandon a model for thinking about a complex situation until a better model could be put in its place (Kuhn, 1967).

The complexity and interactions – where actors almost never innovate in isolation (Silverberg et al., 1988) - were addressed by Kline and Rosenberg, considering technological innovation as absolutely central to economic growth and to improvements in efficiency, and proposing another innovation framework (Kline and Rosenberg, 1986). In their view, innovation is controlled by two distinct sets of forces that interact with one another in subtle and unpredictable ways. On the one hand are the market forces, that is, such factors as changes in incomes, relative prices, and underlying demographics that combine to produce continual changes in commercial opportunities for specific categories of innovation. On the other hand, the forces of progress at the technological and scientific frontiers often suggest possibilities for fashioning new products, or improving the performance of old ones, or producing those products at lower cost. Successful outcomes in innovation thus require the running of two challenges: the commercial and the technological.

Kline and Rosenberg portray innovation as involving the creation and marketing of the new (Kline and Rosenberg, 1986). These disputes, singly and in combination, make the outcome of innovation a highly uncertain process. They focus the fact that systems used in innovation processes are among the most complex known (both technically and socially), and that the requirements for successful innovation vary greatly from case to case. Thus, a general discussion of innovation should require the exploration of a number of dimensions and the use of caution in deciding what can be generalized. Such a discussion must also make sure that the implicit models of the innovation process are adequate, since the use of simplistic models can seriously distort thinking. Innovation in this line of thought occurs more from market needs than technical opportunities and, consequently, is market driven.

In the search for a model framework of innovation, Kline and Rosenberg started from the conception of socio-technical systems or strong intertwined combinations of the social and the technical. They leave behind the so called black box model (system containing unknown components and processes) analysis, identification and measure of the inputs and outputs (the latter more difficult to measure and identify).

In the characterization of innovation it is important to remember that, the effects are hard to measure due to innovation multiple dimensions. The transformation process shows the intertwinement of economic and technological considerations, processes and systems used are complex and variable, a complex of different ideas are needed for effective innovation and innovation effects could appear far from were they were originated.

The common sense tendency to identify technological innovation with major innovations of a highly visible sort (e.g., electric power, antibiotics, radio, automobiles, airplanes, plastics, televisions, computers, mobile phones) is cumbersome of the importance played by less visible small changes in technical innovation as a large and important part of the process.

One could not regard an innovation as a well-defined and homogeneous thing, entering the economy in precise point in time. Most innovations go trough rather drastic changes over their lifetimes that can even transform their economic significance. Therefore, novelty by itself is not an economic advantage.

The process of innovation has all to do with the changes in a complete system of, not only hardware, but also market environment, production facilities and knowledge, and the social contexts of the innovating organizations. However, considerable as an improvement, the chain

link model is a top-level model that still omits a great deal of the diversity of the innovation process.

Rosenbloom and Spencer proposed a "Total Process" view of innovation: an extension of the Chain-Linked model involving the recognition of organizational capabilities and the special characteristics of innovation built on discontinuities in technologies or markets (Rosenbloom and Spencer, 1996a; Rosenbloom and Spencer, 1996b). The former are presented as the foundations of competitive advantage in innovation: firm-specific knowledge from accumulated learning in the organization; communities of practice, of skilled technical people with common and complementary expertise working across the organization in specific tasks; technology platforms, a common framework on which families of specific products and processes can be created over time.

II.4. The National Innovation Systems Approach

In the path of the complex modeling of the innovation process, a systemic approach considering the nation as the unit of analysis, the national innovation system framework[2] emerged (Lundvall, 1988). The work of Lundvall depicts a framework in which the Industry, the Academic Community, "final users" of innovations (workers, consumers and the public sector), which are principal components in the National production system, are equally the basis for a national innovation system. By explaining this user-producer perspective he claims that production and innovation are mutually interdependent, where Learning-by-doing, Learning-by-using (Production) and Learning-by-Interacting (between parties) result in important inputs to innovation.

Nelson and Rosenberg also provided an insightful rationale of National Innovation Systems (Nelson, 1993; Nelson and Rosenberg, 1993). Beyond the increasing transnational attribute of technology and business, it makes sense to use these three aggregated terms in a broader sense to *"encompass the processes by which firms master and get into practice product designs and manufacturing processes that are new to them, if not to the universe or even to the nation"* - National Innovation System Concept (Nelson and Rosenberg, 1993). Becoming the leader in the introduction of a new product or process by performing a set of specific activities and investments, cover up the importance to the development of innovation of those linked with staying near the leader, or catching up, much less harshly evident than its commonly presumed.

[2] Freeman presented a comprehensive analysis of the concept evolution of National Innovation Systems (Freeman, 1995).

Moreover, the strictly Schumpeterian innovator, the first firm to bring a new product to market, is commonly not the firm that in the end captures most of the economic rents related with the innovation. Additionally, much of the interest in innovative capability is attached to the concern about economic performance, and here it is surely the broader concept rather than the narrower one (the determinants of being first) that matters. Therefore, leadership (firms at the forefront of world's technology or institutions doing the most advanced scientific research) is not the only factor that countries pursue and instead they sometimes focus on broader factors influencing national technological capabilities. In their view, there is no presumption that the system was knowingly designed, even the set of institutions whose interactions determine the innovative performance of national systems. Rather their systems concept is that of a set of institutional actors that, together, plays the foremost part in influencing innovative performance.

II.5. Innovation Measurement: an Open Question

One knows from the writings of Rosenberg and Derek de Solla Price that improvements in techniques of measurement have often been the source of major theoretical and practical progresses in sciences, by answering questions that could not be previously answered, and of equally importance, by raising relevant new questions outside the established theory that needed answering (Rosenberg, 1974; Price, 1984). One knows that measurement attributes should be analytically useful, comparable over space and time, coherent and feasible to gather systematically over time. Furthermore, theories should be confronted with observations and be able to predict phenomena. Schumpeter's theory of innovation remains a necessary starting point for any analysis and observation of innovative outputs, regardless of its limitations (DeBresson, 1996b). Fundamentally, one should have the objective to strive toward observations that are as precise as possible, while requiring for the construction of concepts in order to observe the phenomena of interest that will be measured qualitative and quantitatively and therefore find out how many there are and under what condition they occur (Bunge, 1994).

In a linear approach, two goals coexist while analyzing a phenomenon: understanding a phenomenon (positive aspect, examining the past after the fact – *ex post factum*) and mastering the phenomenon (normative or prescriptive aspect, examining facts as they happen – *ex ante*). A theory in the more traditional and linear terms could be operational when this last point is achieved. Nonetheless, theories could eventually not fulfill these requirements. The complex systems, while not providing clear and predictable answers, provide nevertheless the opportunity to be explained.

Consequently, Schumpeter's concept of innovation cannot give rise in the present stage of our knowledge to an operational *ex ante* measurement. Therefore, the *ex post* measured observation of innovation should be replaced by the quantification of an explanatory proxy indicator: innovative activities (DeBresson, 1996b).

The analysis could be performed in the usual way from case studies to surveys. In the former, it must account for the multi-dimensionality of a phenomenon such as innovative activity and is a privileged way to construct qualitative concepts that are prerequisites for quantitative concepts. In the latter, the focus is breadth rather than depth and can be designed to be representative of a reference population. In order to be representative of the economy, interviews or mail questionnaires must necessarily be short, therefore examining only a few dimensions of innovative activity. Their limitations emerge as a consequence of their strength. (Bunge, 1994)

In a survey, a clear and measurable definition of innovative activity should thus be used, e.g. the introduction of a new or improved product or process. Nonetheless, one should consider and account for the existence of bias due to the value load of what we want to know and the limited spatial and temporal horizons of the respondents (who should reasonably be expected to supply objective information about what is new to the business, e.g. when asking about something that is viewed as very positive, respondents are likely to make their business look good, and therefore incur in a pro-innovation bias in the responses).

The OECD, main spring of Science and Technology surveys namely with the "Frascati Manual" (OECD, 1980, 1993), provided as result of a process described in II.6 and in the so-called "Oslo Manual" (OECD, 1992, 1996) a commonly accepted definition of measuring innovation (Innovation Activities) from a company viewpoint:

> "*Market introduction of a product (Good or Service) new or significantly improved, or the introduction of new or significantly improved processes, based in new technological developments, new combinations of existing technologies or use of other type of knowledge acquired.*

In the company viewpoint, the product or process should be new (or significantly improved) to the firm (it does not necessarily have to be new to the relevant market).

II.6. A Brief Historical Overview of the CIS Experience

The introduction of the rationale presented in the previous chapter allowed the possibility of quantification of innovation in large scale surveys. The possibility was opened for large scale innovation surveys based on the firm[3] as the unit for analysis. Conceição and Ávila provide a description and review of this evolution (Conceição and Ávila, 2001). A set of pioneering experiences occurred in Italy in the mid 1980's by the Consiglio Nazionale delle Ricerche (CNR) and the Instituto Nazionale di Statistica (ISTAT) with an especial relevance and in Germany in the early 1990's conducted by the Institut für Wirtschaftsforschung (IFO). (Scholz, 1992)

It was Italy with their first survey that influenced more the advances in innovation surveys, mainly due to the large success of the broad scale inquiry to more than 35.000 firms in Manufacturing with more than 20 employees. This first inquiry was designed to be performed in two stages. In the first one, the questionnaire was relatively short and the focus was the identification of the firms that introduced innovation. In a second stage, the set of firms introducing innovations was surveyed using a broader questionnaire focusing with more detail the innovation process characteristics. The reported results of this exercise (Archibugi et al., 1991), influenced in a decisive way the future of innovation surveys in showing that national large scale innovations surveys were possible. Furthermore and of crucial relevance, these results provide strong indications that innovation and research were distinct activities: more than two thirds of the Italian enterprises were innovators, even the smallest ones with none or insignificant research activities. The innovation process could then be empirically recognized as vaster than the development of research activities. Therefore, the existing surveys of national resources in science and technology were not capturing much of relevant information of the innovation process. The OECD, main spring of these surveys namely with the Frascati Manual (OECD, 1980, 1993) and the work of the National Experts on Science and Technology Indicators (NESTI), soon recognized its limitations in capturing innovation characteristics. Therefore, it promoted a series of workgroups discussions and meetings focusing the innovations issues during the 1980's that culminated with the constitution of a NESTI committee that contributed greatly to the discussion and evolution of innovation surveys, and with the elaboration of the Oslo Manual (OECD, 1992, 1996). The first version of the Oslo Manual, only proposed a conceptual methodology for the framework of innovation surveys, defining a set of rules and norms for the collection of quantitative data on innovation through questionnaires to firms.

[3] The terms "firm", "enterprise" and "company" will be used throughout this research as equivalent units.

The focus of OECD on innovation surveys provided a common platform for different countries, i.e. a guarantee of international comparability. All this occurred under the influence of a transnational experience of implementation of an innovation survey to four Scandinavian countries (Denmark, Finland, Norway and Sweden), stimulated by the Nordic Industrial Fund (Smith, 1991).

The European Community was also focusing on observation and collection of quantitative data regarding technological innovation. Under the European Monitoring System (EIMS) of DG XIII program SPRINT and in close collaboration with the Eurostat, a survey was launched in 1992/93 in 11 of the European Community member countries (all but Norway and Spain) to 40.000 firms. This exercise, the largest performed until then, become known as the first Community innovation Survey (CIS 1).

The Community Innovation Survey (CIS) emerged based on the "Oslo Manual" (OECD, 1992, 1996) as an alternative survey methodology in which the focus of the survey is the analysis of the innovation activity within the enterprise boundaries as opposed to innovation itself. This has resulted in the acceptance of a loss of information on innovation and the establishment of shorter time lags for the analysis. Therefore, the indicators should identify the enterprises introducing innovations. From this, data should be assembled in order to characterize the organization of the activities oriented towards innovation, the motivations underlying the introduction of innovations, the difficulties hampering the innovation process, and the network of liaisons and cooperation's with other entities as other enterprises (parent, suppliers, clients, competitors), Universities and R & D Laboratories.

The results of the survey were presented and discussed in the International Conference on Innovation Measurement and Policies that took place in May of 1996 in Luxemburg under the EIMS (Arundel and Garrelfs, 1997). A more detailed analysis of the exercise (Arundel et al., 1998), showed the deficiencies of the CIS I and described its influence in the process of revision of the Oslo Manual with the consequent replacement of the used questionnaire. Nevertheless, the results emerging from the CIS I provided opportunities for analysis beyond the usual R&D indicators and several research works were performed (Archibugi et al., 2000).

The CIS I difficulties occurred both on its design and its implementation. Concerning design, although product and process innovations were already differentiated, one could not identify product innovation according to its impact and novelty in the firm. Therefore, in the revision process of the Oslo Manual a correction is considered by differentiating new products from

improved ones and their contribution to the firm turnover. Additionally, innovations new to market (radical innovations) were also distinguished from the ones new to the firm. From the implementation point of view, a multitude of problems occurred. Sampling was not homogeneous across countries, the statistical treatment procedures and criteria varied greatly, and even the questionnaires were different from country to country.

The Second Community Innovation Survey (CIS II) emerged in 1997/1998 for the reference period of 1995-1997 and addressed the referred problems and suggestions of the revision of the Oslo Manual. Furthermore, following the lead of the Italian survey (Evangelista and Sirilli, 1998) services were contemplated in the CIS II as well. Eurostat, in an international coordinator capacity, suggested strong limitations to the questionnaire by national authorities and also clear common guidelines for the conducting and statistical treatment of the results in order to provide data comparability.

The CIS II results have been discussed thoroughly in the last few years either in the framework of European Union (EIMS, 1993 to 2001; Eurostat, 2000; Eurostat, 2001b) or at the Portuguese level (Conceição and Ávila, 2001; Heitor and Conceição, 2003), as a crescent tool for policy design. Outside this environment, a crescent number of exercises in diversified countries using the CIS methodology are becoming a standard for the development of their own survey, namely in Central and Eastern Europe (Radosevic, 1999), Latin America, Canada and the United States of America (Hansen, 1999; Hamdani, 2000), and Australia, North Korea, Mexico, Switzerland and Turkey (Muzart, 1999).

Chapter III The Community Innovation Survey Exercise: The Third Edition in a comparative perspective

The CIS III was put into place, again after a long discussion on the limitations of the CIS methodology and, under the EIMS, a number of empirical studies have been performed to evaluate the CIS II methodology (Richiardi, 2000; STEP-S.A.S., 2000; Wengel et al., 2000)[4]. An important set for this discussion was the conference *"Innovation and Enterprise Creation: statistics and indicators*", at Sophia Antipolis, France, in 2000, promoted by the Innovation program of DG Enterprise and Eurostat, contributing in the following topics: advances in innovation indicators, the impact of innovation on firm performance, results of national and regional Innovation studies, and Policy-oriented innovation indicators[5].

The limitations discussed included not accounting for the interactions between firms - network effects - (Tomlinson, 2000), the influence of the Information and Communications Technologies (ICT) in the firms organization (Bresnaham, 1999), and more importantly (Arundel et al., 1998): the absence of quantitative measures of knowledge flows, source differentiation between in house innovation and out of the firm adoption of innovation, bias towards highly innovative firms and lack on data of non-innovators, broader questions not useful for the specific requirements of public policies, the lack of evaluation of the importance of highly diversified and large dimension companies.

Another open question is the impact of organizational innovations on the performance and competitiveness of firms, as recognized in recent literature (Sirilli, 2003). Either because the new organizational forms or management methods are superior to the old ones and increase productivity, improve competitiveness and enhance profits, or because there are complementarities between organizational innovation and technological innovations, where an organization could have to adjust its structure to new technologies in a supporting role. The CIS contribution, by providing a specific question and consequent comprehensive coverage with a set of questions, could not meet all of the information challenges that only an independent survey could achieve through balanced and improved perspectives on organizational innovations, with least cost and burden to the already long CIS questionnaire. Nonetheless,

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[4] A more comprehensive list can be found at CORDIS http://www.cordis.lu/eims/src/stud.htm

[5] For a summary of the Conference proceedings see the Newsletter *Innovation & Technology Transfer*, March 2001 edited by the European Commission's Innovation Directorate at CORDIS http://www.cordis.lu/itt/itt-en/01-2/innov01.htm

small inclusions of organizational innovations questions in CIS will complement this analysis (Wengel et al., 2000).

Richiardi identifies a set of problems concerning the structure of the CIS II questionnaire (Richiardi, 2000), (a) the lack of references to the other strategies of the firm and to its competitive environment; (b) the definition of an innovative firm; (c) the measurement of innovation; (d) the limited ability to identify the actors in the innovation process, and to differentiate diffusers from creative innovators, and (e) the lack of a true regional dimension in the questionnaire. In his view, innovation is not yet thought as a systemic process, involving all the strategy from the firm, together with the economic, scientific, institutional and cultural context where the firm operates.

The limitations discussed in the process of analysis of the CIS II where partially included in the course of the Eurostat *Working Party Group on Innovation and R&D Statistics* decisions regarding the implementation of the CIS III exercise. Nevertheless, some are still open for discussion for future CIS's while others were discarded in favor of the required balance of the questionnaire. Still, while the proposal of CIS III methodology enables a broader comparability between countries, it needs more coherence regarding the set up of more specified national sample dimensioning, and to achieve a statistical desirable rate of response of at least 50%, while reducing the exercise completing time. Even so, due to national and local specificities and their importance to economic development (Oxley and Yeung, 1998), further insightful studies are more adequate at those levels and should be performed to complement for the innovation knowledge, e.g. (Gambardella and Malerba, 1999) and (Conceição et al., 2000; Conceição et al., 2002).

III.1. The Design and Implementation of CIS III in Portugal

III.1.a. Methodology

As a follow up of the process described before, Eurostat proposed a common methodology for CIS III (Eurostat, 2001a) that it is next summarized.

The target population of the CIS III was the total population of enterprises of a certain size and industrial sector. Whereas the minimum size considered was of 10 employees and industrial sectors are those presented in Table 1. Additionally, countries might survey smaller enterprises or additional industries, but with data treated separately.

Sub-sector	NACE Code[6]
Mining and Quarrying	10 to 14
Manufacturing	15 to 37
Electricity, Gas and Water Supply	40 to 41
Wholesale Trade	51
Transport, Storage and Communication	60 to 64
Financial Intermediation	65 to 67
Computer and Related Activities	72
Research and Development	73
Architectural and Engineering Activities	74.2
Technical Testing and Analysis	74.3

Table 1 – Surveyed Sub-sectors

The statistical unit considered for CIS III was the enterprise, as defined in the European Council Regulation on statistical units[7] or as defined in the statistical business register. If the enterprise for some specific reasons is not feasible as statistical unit, other units like divisions of enterprise groups, kind of activity units or even enterprise group could be used. Therefore, it is important that the data collectors know which unit each report to Eurostat relates to and make the necessary adjustments to avoid double-counting or missing reporting. Thus, other units used than the enterprise should be included in the database.

As to the survey methodology, the sampling frame should be a business register with as good quality as possible, containing basic information such as names, addresses, NACE-sector, size and region of all enterprises in the target population. The ideal frame would be an up-to-date official business register established for statistical purposes. If possible, the official statistical business register of the country should be used. Otherwise other registers would have to be used. If the quality was too poor, e.g. not covering all sampling units of interest, important variables were missing or not up-to date, it would be necessary to improve the register, otherwise the survey might fail.

Innovation data may be collected both through census or sample surveys. Resource limitations and response burden will in most cases rule out a survey of the entire population (census). It was assumed that the Third Community Innovation Survey, like the second, should be based on mail surveys.

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[6] Statistical Classification of Economic Activities (NACE, Rev. 1) for the European Community.
[7] Council Regulation (EEC) N° 696/93 of 15 March 1993, OJ N° L76 of the 3 March.

A census might however be unavoidable in some cases. It might be a legal requirement that all business surveys have to be censuses. In addition, when the frame population is fairly small (e.g. in small countries), proper sampling technique might produce a sample relatively close in size to the frame population. In such cases, censuses might be worth considering.

In what concerns stratification, when one has to deal with a heterogeneous population, a sound technique is to break the target population into similar structured subgroups or strata. Appropriate stratification gives results with smaller sampling errors that a non-stratified sample of the same size and also makes sure that there are enough units in the respective strata to perform disaggregated comparison.

The stratification variables for CIS III, i.e. the characteristics used to breakdown the sample into similarly structured groups, were the industry classification (NACE) and size according to number of employees. These two variables are highly correlated with innovation activity, as econometric studies of innovation have shown. The size-classes should at least be the following three classes: 10-49 employees (small), 50-249 employees (medium-sized) and 250+ employees (large). A more detailed size-band within these three classes may also be used, but whenever these are grouped, they should fit in the size bands mentioned above. Stratification by NACE should be done at the 2-digit level (division) or groups of division, with 74.2 and 74.3 as exceptions. The regional dimension should be taken into account by checking that the regional allocation of sample units seemed reasonable compared to the regional distribution of the population before the sample was finally decided.

It was recommended to select samples for the innovation survey according to a randomizing procedure. Only random samples offer the major advantage that the order of magnitude of sampling errors can be controlled at the design state and are determined after the survey solely from the data obtained with the sample.

In general, there are two main ways of calculating the sample size in each stratum, either proportional or optimum allocation. In the pure proportional allocation method, the same sampling fraction is applied to all strata, thus yielding a self-weighting sample. If numerous estimates have to be made, a self-weighting sample is time-saving. However, it is recommended to fix different sampling fractions, at least according to size. A full census, or high fraction rate, is recommended for large enterprises, and lower fraction rate for medium-sized enterprises and even lower for small enterprises. The allocation principle can be further fine-tuned by NACE; normally the larger the number of enterprises in the strata, the smaller should be the sampling fraction.

The aim of optimum allocation is either to minimize the variance of an estimator for a specified cost or to minimize the cost for a specific variance. The allocation is based on the following rules of conduct: a larger sample is selected for a stratum if it has a higher weight in the population, if it has a higher variance and if the survey cost per unit is lower in this stratum. The variance in each stratum could be based on previous CIS.

If new sectors of the economy were added in CIS III, data from CIS II would obviously not be available. However the optimal allocation could be carried out by the use of assumptions. Either the new sectors were considered as the average national firm (based on the national mean of the share of innovators by size class) or one could assume the new sector will be close to a sector that had already been sampled previously.

The sample should be carried out in order to achieve a certain level of precision with regard to the following indicators: the percentage of innovators, the share of new or improved products in total turnover, and total turnover per employee. It was recommended that the 95% confidence interval for the first two indicators should be within ± 5% of the estimated indicator. For the last indicator the confidence interval should be within ± 10% of the estimated indicator.

The response rates in CIS II varied between countries from 24% to 90%, with 57% as the average. The expected response rate has to be taken into account when determining the sample size. The optimal number of enterprises in each stratum should be the expected number in the realized sample.

In what concerns the collecting and processing of data, all efforts should be made to minimize unit non response. To secure an acceptable response rate, at least two reminders would have to be made. If the non response exceeded 30% based on the ratio between non-responding and operating enterprises in the sample population as a whole (by exclusion of no longer operating enterprises or not found enterprises), a non-response analysis was mandatory. The experience from CIS I and CIS II showed that non-respondents might be biased towards certain types of enterprises.

Therefore, a non-response analysis would have to be undertaken including the main questions of the ordinary questionnaires in order to make it possible to distinguish innovators from non innovators. At least a 10% sample of the non-respondents should be drawn (where no longer operating enterprises have been excluded). Given that the sample size of the non-response

analysis would have to be relatively small and given the large number of strata, stratification by NACE and size classes might not be used. However information on the NACE and size class must be available. The non-response analysis should be made on the basis of a simple random sample of the non-respondent population. In order for the non-response analysis to be useful, it should have a very high response rate (preferably 100%).

Item non-response and partial item non-response should be kept at a minimum by asking the enterprises for additional information. Item non-response for variables on general and basic information about the enterprises should not exist. This information should be available in the business registers or from other sources. As far as possible, it should be required to impute item non response and use auxiliary information whenever possible. The data should also be checked and corrected for logical inconsistencies.

To extrapolate results to the whole target population weighting factors would have to be calculated. The weighting factors should be based on shares between the numbers of enterprises or number of employees in the realized sample and total number of enterprises/employees in each stratum of the frame population, correction made for no longer existing enterprises and changes in size or NACE classes (and adjusted for non response). In case a non-response analysis was carried out then the results of the non response analysis should be used in the calculation of weighting factors.

It is important that quality controls have been done on the data at micro and macro level. There should be a set of controls agreed upon as common rules. Eurostat proposed a set of rules based on those used in CIS II (Eurostat, 2001c).

The Portuguese Third Community Innovation Survey followed closely these methodological guidelines and the description of its specificities is provided ahead in the chapter.

III.1.b. National Questionnaire

Eurostat provided a harmonized questionnaire common for Services and Manufacturing and other industries with some optional questions and a set of innovations examples. It is composed of eleven questions sets:

- General Information;
- Basic Economic Information;
- Product and Process Innovation;

- Innovation Activities and Expenditure;
- Intramural R & D;
- Effects of Innovation;
- Public Funding;
- Innovation Co-operation;
- Sources of Information for Innovation;
- Hampered Innovation Activity;
- Patents and Other Protection Methods;

The characteristics of the Portuguese Questionnaire are summarized below.

III.1.b.i) General Characteristics of the national questionnaire

The Portuguese questionnaire (Annex VI.1) is mainly a translation of the given questionnaire by Eurostat, but includes some national questions in addition to the proposed harmonized questionnaire described later on. Nevertheless, and due to the experience with CIS II, a more comprehensive design of the questionnaire was developed with several notes and examples portrayed along the questionnaire to facilitate the perception of the questions by the respondent.

A cover was added to the questionnaire introducing the objectives of the survey. This included emphasizing the survey framework for European comparisons, reassuring the confidentiality of the data provided and conveying to the receivers that they could rely on all the support needed. For solving any doubts in the interpretation and in answering the questionnaire, they could use the mail, telephone, fax and e-mail contacts provided. For this purpose a support team to the survey has been trained by experts in innovation with experience in the CIS II, to provide support by fax, e-mail, or in real-time over a dedicated phone-line.

III.1.b.ii) National Questions added to the Common Questionnaire

The following questions were also included in the Portuguese questionnaire:

- "Monetary Unit of the response" (Euros or Thousands *Escudos*)
- "Firm Fiscal Identification Number" – most commonly used as identification variable in national business databases; served as a check for correct company identification
- Year of establishment of the company in Portugal
- "Gross Value Added in 1998" (from the company accounting annual statements)
- "Gross Value Added in 2000" (from the company accounting annual statements)

- "Labor Costs in 1998" (all the expenditures that revert for the personnel)
- "Labor Costs in 2000" (all the expenditures that revert for the personnel)
- "Employees with Tertiary Education in 1998"
- "Employees with Secondary Education in 1998 and above"
- "Employees with Secondary Education in 2000 and above"
- "Qualified Employees in 1998" (qualified and highly qualified professionals, Technical and Non-Technical)
- "Qualified Employees in 2000" (qualified and highly qualified professionals, Technical and Non-Technical)
- Expenditure in internal or external training of personnel directly aimed at the development and/or introduction of innovations
- Expenditure in internal or external marketing activities directly aimed at the market introduction of the enterprise new or significantly improved goods or services
- Expenditure in procedures and technical preparations to realize the actual implementation of products (goods/services) and process innovations not covered elsewhere
- Persons involved in intramural R&D activities in 2000 in Full-Time Equivalent
- Consultancy Companies in "Other Sources of Information" for the Innovation between 1998 and 2000
- Reduced market size in "Other Factors Hampering Innovation Activity"

III.1.b.iii) Pre-testing of the Questionnaire

No pre-test of the questionnaire was performed. However, the support team of the survey and the experts involved in CIS II and CIS III performed a check of the questionnaire in a set of round table discussions that led to its adoption and tuning.

III.1.b.iv) Difficulties in understanding the questionnaire

Some questions raised difficulties in the interpretation to the Portuguese, although most of them were solved due to the previous CIS II experience. Nevertheless, some still cause non responses or incorrect responses that the support team could not clarify. The most worrying situations are presented next:

- The perception that the inquired company does not comply with the innovation definition led them not to read or respond to the entire questionnaire;

- The NACE code is usually misinterpreted as the Company Fiscal Identification Number;
- The NACE code changes (in significant numbers) from the original sample database from Manufacturing to more or less equivalent Services NACE codes, corresponding to an observable change towards an economy more focused on services; In these cases, the general rule was followed, answers were considered if the new NACE code was also surveyed;
- Companies providing only services may not understand well their inclusion in the survey due to the language and concepts adopted (the concept of product is directly linked to goods in Portuguese language and it is somewhat difficult to understand it linked to services; Thus, further examples related with the providing of service innovations more commonly used should be in the future provided);
- The question regarding the average life of products (goods or services) before being replaced is often misinterpreted as the life span of the product (e.g., bread - 3 days; copper ore - timeless);
- Employees questions are often answered without including middle-management, management or Board of Directors;
- Since most of the surveyed companies (mainly of small or medium size) do not perform detailed analytical accounting, most of the expenditures regarding innovation activities are left unanswered;
- Question 5 regarding internal R&D was misunderstood, as perceived in the manual correction and validation of the questionnaires, when the enterprises where confronted with the correct concepts and therefore should in the future be further clarified with examples.

The questionnaire for the CIS III, much improved from CIS II, still originates doubts regarding the innovation concepts, although a considerable number of examples were provided. Based on experience from the inquiry and support provided, this happens because the concept of incremental innovations in products (goods or services) or processes within the company boundaries fails to be understood and identified, and is often disregarded by companies especially those of small dimension. This misperception occurs also when the addressed market is considered as a wider boundary, although in this case because of insufficient knowledge of all of competing products features in the market. Furthermore, the concepts of products as goods

and/or services, and processes are very different from the still commonly perceived ones by companies.

Additional difficulties were also encountered because of the solicitation of both financial and more technical and management information. These sometimes caused the questionnaire to be sent to accounting departments or external accountants with less sensitivity to innovation and development, therefore leaving much of the required fields blank.

III.1.c. Sampling Frame

III.1.c.i) Origin of the Frame and Coverage of the Target Population

The sample was extracted by the National Statistical Office (INE)[8] from the General File on Statistical Units (FGUE)[9] record of business companies in September of 2001. The sample contained companies selected from a population of 24,467 companies.

III.1.c.ii) Stratification Variables Used

The variables used for the stratification of the sample followed the Eurostat methodological recommendations (Eurostat, 2001a) and were:

- NACE code (by individual two digit classes, ranging from 10 to 37; 40 and 41; 52; 60 to 67; 72 and 73; and the independent three digit classes, 74.2 and 74.3)
- Size (companies equal or with more than 10 employees, divided in three classes: small, 10 to 49; Medium, 50 to 249; Large, equal or more than 250 employees)

III.1.c.iii) Sample Unit used

The sample unit used was the company. The additional rule proposed by Eurostat for mergers and acquisitions (Annex VI.4) was also followed for a few situations when several companies in a group where surveyed and did not reply separately because of internal corporate regulations, of inexistent disaggregated data availability in the requested time frame or of requirements of the Portuguese Law. In order to achieve a response, the above rule was applied in a minority of cases, mostly banking and insurance companies. As an example, one may cite the insurance companies which are obliged by Law to split the *Life* and *Non-Life* business units into two

[8] *Instituto Nacional de Estatística* (INE)
[9] *Ficheiro Geral de Unidades Estatísticas* (FGUE)

companies with different legal and fiscal personality, and different account statements, although they share the same offices, the same personnel and the same Board of Directors. Therefore, they aggregate all the other information and accounting that is not required to be separated by Law.

III.1.c.iv) Sampling method used

The sample was created through a mixed method, combining a census approach and a stratified random sample. The sample covered by census all the companies of the above mentioned NACE codes with at least 200 employees. Bellow this threshold, the sample was obtained through a stratified random sample. Even so, it was assured that each stratum contained at least 5 companies. When the population stratum had less than 5 companies, all were included in the sample.

III.1.c.v) Nature of the survey

According to the Portuguese Law, the survey is mandatory. However, there is a problem with the enforcement system, which was rarely implemented, as commonly known by companies. Therefore, one may consider that the survey is in fact more of a voluntary nature, as reflected in the achieved response rate: higher than in voluntary surveys, but lower than in mandatory surveys.

III.1.c.vi) Data Gathering

Information was gathered by post mail. An accompanying letter to all companies, explaining the reasons for the survey, their importance, and urging them to answer it, with mail, telephone, fax and e-mail contacts for answering questions on comprehension or questionnaire filling, was sent with the questionnaire by registered mail with free postage envelopes for reply inside. Additionally, all companies were reached by phone before and after the questionnaire had been sent by the Support Team.

III.1.c.vii) Information Contained in the frame

The information given by the INE on the selected companies is as follows:

- Sample ID Number
- Fiscal Identification Number
- NACE/Rev. 1 (Full digits)

- Company Size (reported number of Employees)
- Company Name
- Company Address
- Full Postal Code
- Location (Town/Village Name)

Additional information was gathered by the Support Team while checking for the database validity:

- Full Telephone Number(s)
- Full Fax Number(s)
- A Contact Person Name (for a more direct mailing)

III.1.c.viii) Population Breakdown and Sampling fraction by Sector and by Size Class

Sector	NACE	Small (10 to 49)	Medium (50 to 249)	Large (> 249)	Sub-Total
Mining and Quarring	**10-14**	**308**	**44**	**2**	**354**
Manufacturing	**15-37**	**13,215**	**2,968**	**384**	**16,567**
Food Products, Beverage and Tobacco	15-16	1,574	296	47	1,917
Textiles and Leather	17-19	4,508	1,276	137	5,921
Wood, Pulp and Publishing	20-22	1,744	264	30	2,038
Coke and Chemicals	23-24	249	76	18	343
Rubber and other Non-metallic	25-26	1,336	325	42	1,703
Basic Metals and Fabricated Metal Products	27-28	1,343	259	22	1,624
Machinery and Equipment NEC	29	715	154	15	884
Electric and Optical Equipment	30-33	246	73	37	356
Transport Equipment	34-35	217	70	25	312
Manufacturing NEC and Recycling	36-37	1,283	175	11	1,469
Electricity, Gas and Water Supply	**40-41**	**40**	**44**	**16**	**100**
Services	**51, 60-67,72-73, 74.2, 74.3**	**6,564**	**763**	**119**	**7,446**
Wholesale Trade	51	4,571	425	30	5,026
Transport and Storage	60-63	1,187	182	40	1,409
Post and Telecommunications	64	41	13	10	64
Financial Intermediation	65-67	302	78	33	413
Computer and Related activities	72	164	33	5	202
Research and Development	73	7	0	0	7
Engineering Services	74.2	258	29	1	288
Testing and Analysis	74.3	34	3	0	37
Total		**20,127**	**3,819**	**521**	**24,467**

Table 2 - Breakdown of the number of companies in the population by Sector and by size class

Sector	Small (10 to 49)		Medium (50 to 249)		Large (> 249)		Sub-Total	
	Quantity	Pop. Cov.	Quantity	Pop. Cov.	Quantity	Pop. Cov.	Quantity	Pop. Cov.
Mining and Quarring	**62**	**20%**	**44**	**100%**	**2**	**100%**	**108**	**31%**
Manufacturing	**1694**	**13%**	**1065**	**36%**	**384**	**100%**	**3143**	**19%**
Food Products, Beverage and Tobacco	345	22%	68	23%	47	100%	460	24%
Textiles and Leather	334	7%	251	20%	137	100%	722	12%
Wood, Pulp and Publishing	204	12%	161	61%	30	100%	395	19%
Coke and Chemicals	61	24%	61	80%	18	100%	140	41%
Rubber and other Non-metallic	144	11%	132	41%	42	100%	318	19%
Basic Metals and Fabricated Metal Products	120	9%	119	46%	22	100%	261	16%
Machinery and Equipment NEC	60	8%	63	41%	15	100%	138	16%
Electric and Optical Equipment	161	65%	73	100%	37	100%	271	76%
Transport Equipment	142	65%	70	100%	25	100%	237	76%
Manufacturing NEC and Recycling	123	10%	67	38%	11	100%	201	14%
Electricity, Gas and Water Supply	**40**	**100%**	**44**	**100%**	**16**	**100%**	**100**	**100%**
Services	**897**	**14%**	**363**	**48%**	**119**	**100%**	**1379**	**19%**
Wholesale Trade	327	7%	86	20%	30	100%	443	9%
Transport and Storage	174	15%	121	66%	40	100%	335	24%
Post and Telecommunications	41	100%	13	100%	10	100%	64	100%
Financial Intermediation	158	52%	78	100%	33	100%	269	65%
Computer and Related activities	60	37%	33	100%	5	100%	98	49%
Research and Development	7	100%	-	-	-	-	7	100%
Engineering Services	96	37%	29	100%	1	100%	126	44%
Testing and Analysis	34	100%	3	100%	-	-	37	100%
Total	**2693**	**13%**	**1516**	**40%**	**521**	**100%**	**4730**	**19%**

Table 3 – Sampling Fraction by Sector and Size

Table 2 provides the breakdown of companies in the population and it is a good picture of the Portuguese economy. Small firms represent 82% of the population which has a distribution of firms of 70% of Manufacturing firms and 30% of Services firms. Nonetheless, some sub-sectors at a more disaggregated level could present some validity problems to the data due to their low number of enterprises especially if the number of responses obtained were not significant. After checking, the regional allocation of sample units was considered reasonable compared to the regional distribution of the population. However, this should be also maintained within reasonable boundaries in the realized sample in order to provide regionally valid final data.

III.1.d. Field Work and Feature of the Redefined Sample

Due to business and institutional culture, Portuguese managers show a severe reluctance in answering surveys. These difficulties occurring in the field work were undoubtedly compounded by the fact that the Survey was performed in the closing of the fiscal year due to the delay caused by Eurostat in the signature between OCT/OCES at the national level and Eurostat in its coordinating capacity.

III.1.d.i) Methods Used to overcome Unit Non-Response

The fieldwork started in October 2001 with the validation of the sample database provided by INE, as the experience with CIS II showed that the database provided might not be accurate in some variables (mainly regarding address and name). Along with the gathering of phone, fax, e-mail, and a contact person to whom the questionnaire would be formally addressed, an effort

was made to track the largest number as possible of bankrupt and deactivated companies. This approach on the other hand, was extremely time and resources consuming, and resulted in the extension until late November 2001, giving little time to responses due to the proximity of the Christmas and New Year season, along with the closing of the fiscal year accounts and reports. Nevertheless, the questionnaire mailing started alongside this task by late October 2001.

Each postal dispatch was registered and tracked for reception using the National Post Office Carrier Track and Trace Internet System (CTT)[10]. Each was comprised of a letter in the terms earlier referred presenting the survey and signed by the Presidency of the Sciences and Technologies Observatory, the questionnaire with an examples appendix and a free postage reply envelope.

In face of the described delay, the deadline of 31st December 2001 was extended to 31st March 2002. Following this, a persistent round of phone calls was placed to all companies that failed to answer, with an additional dispatch of the questionnaire bundle. Furthermore, a fax reminder with a more stringent text focusing the mandatory nature of the survey and its deadline proximity, was sent to the still failing companies. This last measure resulted in a substantial attention from companies, which started sending their replies at a higher rate than in the previous phase.

III.1.d.ii) Redefining the initial sampling

As referred before, a pre-survey validation of the database sample provided by the INE was performed. This validation tried to clarify minor errors of the database (wrong spellings, switched locations, etc.), to recognize bankrupt or closed down companies and not identifiable companies, i.e. companies not contactable by post, phone or any other means (including companies relocated to undisclosed locations) that would result in postal returns. The means used to perform this task were more recent phone and fax operator directories and internet search for additional directories databases.

The cases where the company situation was clearly established as discontinued (284 cases), were removed from the initial sample. Additionally, companies that had changed their NACE code and current activity to one outside the surveyed sectors or companies which had changed size bellow the 10 employees' minimum, were also excluded from the sample. That resulted in a

[10] http://www.ctt.pt

realized sample that will be the base for the survey response rates. The number of exclusions and its relative distribution are presented in Table 4.

	No. of Companies	%
Bankruptcies and Closed Down Companies	284	44.3%
Non-Identifiable Companies	228	35.6%
Changed NACE and Size Class less than 10	129	20.1%
Total	641	100%

Table 4 – Exclusions from Sample and its Distribution

This total of 641 exclusions represents 13.6% of the initial sample, a little less than the 14.6% that occurred in CIS II. However, Bankruptcies, Closed Down Companies and Non-Identifiable companies have increased, both in their contribution to exclusions from 56.2% in the CIS II to 79.9%, and in their number from 328 in the CIS II to 512. To better clarify these exclusions, Table 5 will present their breakdown by Sector and Size Class. A total of 7 responses were also included in the sample in addition to the initial sample due to reclassification by NACE and Size Class, therefore compounding a total of 634 exclusions.

Sector	Small (10 to 49)		Medium (50 to 249)		Large (> 249)		Sub-Total	
	Excluded	% Initial Sample	Excluded	% Initial Sample	Excluded	% Initial Sample	Excluded	% Initial Sample
Mining and Quarring	**12**	**19.4%**	**2**	**4.5%**	**0**	**0.0%**	**14**	**13.0%**
Manufacturing	**313**	**18.5%**	**59**	**5.5%**	**7**	**1.8%**	**379**	**12.1%**
Food Products, Beverage and Tobacco	75	21.7%	2	2.9%	2	4.3%	79	17.2%
Textiles and Leather	107	32.0%	23	9.2%	3	2.2%	133	18.4%
Wood, Pulp and Publishing	28	13.7%	16	9.9%	1	3.3%	45	11.4%
Coke and Chemicals	6	9.8%	2	3.3%	0	0.0%	8	5.7%
Rubber and other Non-metallic	16	11.1%	3	2.3%	0	0.0%	19	6.0%
Basic Metals and Fabricated Metal Products	9	7.5%	4	3.4%	0	0.0%	13	5.0%
Machinery and Equipment NEC	9	15.0%	1	1.6%	0	0.0%	10	7.2%
Electric and Optical Equipment	26	16.1%	3	4.1%	0	0.0%	29	10.7%
Transport Equipment	23	16.2%	6	8.6%	1	4.0%	30	12.7%
Manufacturing NEC and Recycling	14	11.4%	-1	-1.5%	0	0.0%	13	6.5%
Electricity, Gas and Water Supply	**9**	**22.5%**	**30**	**68.2%**	**10**	**62.5%**	**49**	**49.0%**
Services	**148**	**16.5%**	**40**	**11.0%**	**4**	**3.4%**	**192**	**13.9%**
Wholesale Trade	49	15.0%	11	12.8%	1	3.3%	61	13.8%
Transport and Storage	37	21.3%	6	5.0%	1	2.5%	44	13.1%
Post and Telecommunications	10	24.4%	2	15.4%	0	0.0%	12	18.8%
Financial Intermediation	19	12.0%	11	14.1%	3	9.1%	33	12.3%
Computer and Related activities	12	20.0%	5	15.2%	0	0.0%	17	17.3%
Research and Development	1	14.3%	-	-	-	-	1	14.3%
Engineering Services	16	16.7%	5	17.2%	0	0.0%	21	16.7%
Testing and Analysis	4	11.8%	0	0.0%	-1	-	3	8.1%
Total	**482**	**17.9%**	**131**	**8.6%**	**21**	**4.0%**	**634**	**13.4%**

Note: Negative numbers indicate inclusions above the initial sample resulting from the difference between exclusions and inclusions by aggregated strata.

Table 5 – Exclusions from Sample by Sector and Size

The information on the preceding table showed that these 634 companies are evenly distributed and there are no excessive concentrations in some classes. As a rule, the exclusions only amount

to high proportions in those cases where the number of sampled companies in the class was very small.

III.1.d.iii) Changes in the size of the initial sampling

From the exclusion of the above situations, the realized sample obtained a total value of 4096 companies. The breakdown of these companies by Sector and Size Class is presented in Table 6. Companies that changed their classification and that were still in the surveyed NACE and Size Class were reclassified and counted in their new stratum as pertaining to the corrected sample.

Sector	Small (10 to 49)	Medium (50 to 249)	Large (> 249)	Sub-Total
Mining and Quarring	**50**	**42**	**2**	**94**
Manufacturing	**1381**	**1006**	**377**	**2764**
Food Products, Beverage and Tobacco	270	66	45	381
Textiles and Leather	227	228	134	589
Wood, Pulp and Publishing	176	145	29	350
Coke and Chemicals	55	59	18	132
Rubber and other Non-metallic	128	129	42	299
Basic Metals and Fabricated Metal Products	111	115	22	248
Machinery and Equipment NEC	51	62	15	128
Electric and Optical Equipment	135	70	37	242
Transport Equipment	119	64	24	207
Manufacturing NEC and Recycling	109	68	11	188
Electricity, Gas and Water Supply	**31**	**14**	**6**	**51**
Services	**749**	**323**	**115**	**1187**
Wholesale Trade	278	75	29	382
Transport and Storage	137	115	39	291
Post and Telecommunications	31	11	10	52
Financial Intermediation	139	67	30	236
Computer and Related activities	48	28	5	81
Research and Development	6	-	-	6
Engineering Services	80	24	1	105
Testing and Analysis	30	3	1	34
Total	**2211**	**1385**	**500**	**4096**

Table 6 – Corrected Sample by Sector and Size

All the received questionnaires were the subject of a *Data Plausibility Check* during the fieldwork. The ones that didn't correspond to the plausibility norms provided by (Eurostat, 2001c) were subject of a check by phone. This was performed in approximately 50% of the received questionnaires. Whenever possible, additional information was asked to fill blank questions.

III.1.d.iv) The realized Sample: Response Rate by Sector and Size Class

The realized sample concerns the number of valid answers obtained by applying the exclusion rules referred for Valid Unit Response by Eurostat, i.e. a total of 1875 from 2041 answers received. The breakdown of these valid answers and their corresponding Response Rates by Sector and Size Class are presented in the following table.

Sector	Small (10 to 49)		Medium (50 to 249)		Large (> 249)		Sub-Total	
	Valid	Resp. Rate	Valid	Resp. Rate	Valid	Resp. Rate	Valid	Resp. Rate
Mining and Quarring	**23**	**46.0%**	**22**	**52.4%**	**0**	**0.0%**	**45**	**47.87%**
Manufacturing	**623**	**45.1%**	**455**	**45.2%**	**198**	**52.5%**	**1276**	**46.16%**
Food Products, Beverage and Tobacco	96	35.6%	34	51.5%	25	55.6%	155	40.68%
Textiles and Leather	97	42.7%	100	43.9%	66	49.3%	263	44.65%
Wood, Pulp and Publishing	88	50.0%	72	49.7%	15	51.7%	175	50.00%
Coke and Chemicals	24	43.6%	24	40.7%	12	66.7%	60	45.45%
Rubber and other Non-metallic	63	49.2%	58	45.0%	21	50.0%	142	47.49%
Basic Metals and Fabricated Metal Products	59	53.2%	45	39.1%	16	72.7%	120	48.39%
Machinery and Equipment NEC	25	49.0%	29	46.8%	8	53.3%	62	48.44%
Electric and Optical Equipment	63	46.7%	28	40.0%	18	48.6%	109	45.04%
Transport Equipment	64	53.8%	32	50.0%	13	54.2%	109	52.66%
Manufacturing NEC and Recycling	44	40.4%	33	48.5%	4	36.4%	81	43.09%
Electricity, Gas and Water Supply	**9**	**29.0%**	**8**	**57.1%**	**4**	**66.7%**	**21**	**41.18%**
Services	**313**	**41.8%**	**158**	**48.9%**	**62**	**53.9%**	**533**	**44.90%**
Wholesale Trade	126	45.3%	28	37.3%	12	41.4%	166	43.46%
Transport and Storage	66	48.2%	56	48.7%	24	61.5%	146	50.17%
Post and Telecommunications	6	19.4%	6	54.5%	5	50.0%	17	32.69%
Financial Intermediation	56	40.3%	34	50.7%	14	46.7%	104	44.07%
Computer and Related activities	17	35.4%	14	50.0%	5	100.0%	36	44.44%
Research and Development	2	33.3%	-	-	-	-	2	33.33%
Engineering Services	31	38.8%	17	70.8%	1	100.0%	49	46.67%
Testing and Analysis	9	30.0%	3	100.0%	1	100.0%	13	38.24%
Total	**968**	**43.8%**	**643**	**46.4%**	**264**	**52.8%**	**1875**	**45.8%**

Note: The Response Rates were calculated on the basis of the corrected sample.

Table 7 - Realized Sample: Response Rate by Sector and Size Class

As we can see, response rates were fairly homogeneous. In one class only, with few companies, the 100% response rate was achieved, and in a few others the 70% response rate was almost reached. Nevertheless, the majority of the classes presented a response rate between 40 and 50%. It was lower than 40% only in Post and Telecommunications, and R&D. The 0% response rates observed correspond to classes of 1-2 companies. Generally, the lower response rates were not concentrated in any particular sector. However, a little lower response rates were obtained in smaller size classes.

III.1.e. Non-Response Analysis

The objective of a non-response analysis is to compare both sets of respondents and non-respondents in what concerns one or more variables in order to compensate for any non-response bias due to the lower response rates than the ones usually defined by theory and

practice. As explained in Eurostat guidelines, because a response rate superior to 70% was not achieved, a non-response analysis had to be implemented.

The analysis included the design of a Survey to the Non-respondents by (i) establishing a random sample of Non-Respondents; (ii) Designing the Questionnaire to Non-Respondents and Implementing the Survey; (iii) Analyzing the Results; (iv) Comparing the Distributions of the two Surveys and (v) Calibrating the Sampling Weights (If necessary, i.e. if significant non-response bias was detected on any of the analyzed variables).

III.1.e.i) Non-Respondents Population and Sample

Sector	Small (10 to 49)	Medium (50 to 249)	Large (> 249)	Sub-Total
Mining and Quarring	**28**	**19**	**2**	**49**
Manufacturing	**756**	**536**	**193**	**1,485**
Food Products, Beverage and Tobacco	169	33	24	226
Textiles and Leather	132	129	66	327
Wood, Pulp and Publishing	88	72	13	173
Coke and Chemicals	33	34	8	75
Rubber and other Non-metallic	64	65	25	154
Basic Metals and Fabricated Metal Products	54	64	14	132
Machinery and Equipment NEC	29	30	8	67
Electric and Optical Equipment	67	38	18	123
Transport Equipment	51	33	11	95
Manufacturing NEC and Recycling	69	38	6	113
Electricity, Gas and Water Supply	**20**	**6**	**2**	**28**
Services	**418**	**164**	**56**	**638**
Wholesale Trade	148	42	17	207
Transport and Storage	75	53	17	145
Post and Telecommunications	23	6	4	33
Financial Intermediation	78	38	16	132
Computer and Related activities	27	14	2	43
Research and Development	4	0	0	4
Engineering Services	46	10	0	56
Testing and Analysis	17	1	0	18
Total	**1,222**	**725**	**253**	**2,200**

Table 8 - Non-Respondents Population Breakdown by Sector and Size

A random sample of 300 enterprises was extracted according to the procedure recommended by Eurostat, representing 13.6% of the referred Non-Respondents population.

III.1.e.ii) Questionnaire and Survey to Non-Respondents

The Portuguese questionnaire to Non-Respondents (Annex VI.2) follows the Eurostat guidelines as presented in the *"User Guide for SAS programs for CIS 3 data processing"*(Eurostat, 2001c).

However, it was decided to merge the two questions regarding "Abandoned and Ongoing Innovating Activities" into one, in order to facilitate the response by providing the possibility of a one page reply and therefore hoping to gather more answers.

The survey to Non-Respondents was performed preferentially by fax. When a fax number was not available it was done by phone. Two phone reminders were used when necessary, with replies being accepted by phone during this type of contact.

A cover was added to the questionnaire introducing the objectives of the survey, emphasizing the importance of the survey framework for European comparisons, assuring the confidentiality of the data provided and promising all the support needed in solving all doubts in the interpretation and in answering the questionnaire (mail, telephone and fax contacts were provided). A clear statement invoking the addressee condition of Non-Respondent to the CIS III Inquired was also included. Additionally, a one page condensed version of the innovations examples provided with the CIS III Questionnaire was also provided.

III.1.e.iii) Non-Respondents Results

Sector	Size Class					Total
	Small (10 to 49)	Medium (50 to 249)	Large (> 249)	Sub-Total	Outside Sample Frame	
Mining and Quarring	**2**	**4**	**0**	**6**	**1**	**7**
Manufacturing	**70**	**60**	**20**	**150**	**11**	**161**
Food Products, Beverage and Tobacco	12	7	3	22	2	24
Textiles and Leather	13	13	6	32	3	35
Wood, Pulp and Publishing	6	3	2	11	1	12
Coke and Chemicals	2	2	1	5	0	5
Rubber and other Non-metallic	5	13	3	21	2	23
Basic Metals and Fabricated Metal Products	11	8	0	19	1	20
Machinery and Equipment NEC	0	4	2	6	0	6
Electric and Optical Equipment	7	5	2	14	1	15
Transport Equipment	6	3	1	10	1	11
Manufacturing NEC and Recycling	8	2	0	10	0	10
Electricity, Gas and Water Supply	**2**	**1**	**0**	**3**	**1**	**3**
Services	**31**	**18**	**7**	**56**	**13**	**56**
Wholesale Trade	9	4	0	13	3	13
Transport and Storage	6	6	4	16	2	16
Post and Telecommunications	0	0	0	0	0	0
Financial Intermediation	7	7	3	17	2	17
Computer and Related activities	5	1	0	6	1	6
Research and Development	1	0	0	1	0	1
Engineering Services	2	0	0	2	4	2
Testing and Analysis	1	0	0	1	1	1
Sub-Total	**105**	**83**	**27**	**215**	**26**	**-**
Outside Sample Frame	**7**	**0**	**1**	**8**	**34**	**-**
Total	**112**	**83**	**28**	**-**	**-**	**249**

Table 9 - Non-Respondents Replies

From the total of 300 enterprises in the sample, 23 could not be identified and 34 proved to be outside the sample frame, either because of size or because of previously undetected NACE changes or misclassification in the population files. The number of 215 valid answers was obtained, corresponding to a response rate of 88.5% for the corrected sample of 249 enterprises (11% of the total population of the survey).

Sector	Product Innovation				Process Innovation				Ongoing or Abandoned Innovation			
	Size Class			Sub-Total	Size Class			Sub-Total	Size Class			Sub-Total
	Small	Medium	Large		Small	Medium	Large		Small	Medium	Large	
Mining and Quarring	0	0	0	**0**	1	1	0	**2**	0	0	0	**0**
Manufacturing	16	26	14	**56**	29	33	16	**78**	7	9	6	**22**
Electricity, Gas and Water Supply	0	0	0	**0**	1	0	0	**1**	0	0	0	**0**
Services	13	10	3	**26**	12	6	3	**21**	4	4	2	**10**
Total	**29**	**36**	**17**	**82**	**43**	**40**	**19**	**102**	**11**	**13**	**8**	**32**

Table 10 – Non-Respondents Answers by Sector and Class Size

The answers obtained to the three innovation questions to Non-Respondent enterprises are presented in Table 10 in detail aggregated by sector and size class. A proportion of 38.1% Product Innovators, 47.4% Process Innovators and 14.9% with Ongoing or Abandoned Innovation Activity were achieved. Considering the aggregated variable Innovation Activity defined in the Eurostat Guidelines (if at least one answer is positive there is Innovation Activity) one obtains the results in the table with a proportion of Innovation Activity of 57.7%.

Sector	Innovation Activity			
	Class Size			Sub-Total
	Large	Medium	Small	
Mining and Quarring		1	1	**2**
Manufacturing	17	38	36	**91**
Electricity, Gas and Water Supply			1	**1**
Services	3	11	16	**30**
Total	**20**	**50**	**54**	**124**

Table 11 – Answers of Innovation Activity by Sector and Size

III.1.e.iv) Respondents and Non-respondents Distributions Analysis

Complying with the methodology established for the calibration procedure, a test to compare the distributions of the answers of the Respondents and the answers obtained in the Non-Respondents Survey was performed following a well established statistical procedure (Freund and Simon, 1997). This occurred in steps by (1) Estimating the p statistic; (2) Calculating the Standard Deviation; (3) Testing the Difference of Proportions; and (4) Evaluating the null Hypothesis that the two distributions were identical.

First Step: Estimation of the p statistic

$$\hat{p} = \frac{n_{NR} f_{NR} + n_R f_R}{n_{NR} + n_R} = \frac{71{,}5163 + 399{,}9765}{124 + 866} = 0{,}4763$$

n_{NR} – Non - Respondents with Innovative Activity

n_R – Respondents with Innovating Activity

f_{NR} – Frequency of Non - Respondents

f_R – Frequency of Respondents

Second Step: Calculus of σ (Standard Deviation)

$$\sigma = \sqrt{\hat{p}(1-\hat{p})}\sqrt{\frac{1}{n_{NR}} + \frac{1}{n_R}} = \sqrt{0{,}4763\,(1-0{,}4763)}\sqrt{\frac{1}{124} + \frac{1}{866}} = 0{,}0480$$

Third Step: Test to the Difference of Proportions

$$z = \frac{\hat{p}_{NR} - \hat{p}_R}{\sigma} = \frac{f_{NR} - f_R}{\sigma} = \frac{0{,}5767 - 0{,}4619}{0{,}0480} = 2{,}3917$$

For a large sample, the random variable tested will assume a standard normal distribution for z. Therefore, one could substitute the $\hat{p}_i$ by the frequencies of Respondents and Non-Respondents.

Fourth Step: Evaluation of the hypothesis

The hypothesis H0 and H1 could be assumed,

1. H0: $p_R = p_{NR}$

   H1: $p_R \neq p_{NR}$
2. $\sigma \approx 0.05$
3. One rejects the null hypothesis for the equality of distributions if $z \leq -1.96$ or if $z \geq 1.96$
4. z=2.3917 and therefore, one rejects the equality of the distributions of Respondents and Non-Respondents.

III.1.e.v) Calibration Procedure

A calibration procedure for the sampling weights should therefore be performed due to the differences between the two distributions. In compliance with the established procedures (Eurostat, 2001c), the CALMAR routine (Sautory, 1993) provided by the French *Institut National de la Statistique et des Études Économiques* (INSEE) was used for calibration.

The *Innovation Activity* variable as previously assumed was used for this purpose. In order to estimate its value for the population, the value for Respondents and Non-Respondents was calculated by using the CIS III Survey response rate as portrayed in Table 12.

	Innovative Activity			
	No		**Yes**	
Respondents	15968	67.03%	7854	32.97%
Non-respondents	10086	42.33%	13743	57.67%

Estimation of Innovating Activity for the Population

	No		**Yes**		**Total**
Respondents (with 45.776% of the Population)	7310	67.02%	3595	32.97%	**10905**
Non-Respondents (with 1-45.776%= 54.224% of the Population)	5469	42.33%	7452	57.67%	**12921**
Respondents and Non-Respondents Population	12779	53.63%	11047	46.37%	**23826**

Table 12 – Estimation of Innovative Activity for the Population

These values were used in the CALMAR calibration procedure resulting in a successful and robust calibration process from the statistical point of view, which can be assessed in the CALMAR output in Annex VI.3. Consequently, all the sampling weights were adjusted to the ones calculated in the procedure.

III.2. CIS III Data Processing

Following the validation process, all received valid questionnaires were codified in digital format in a Statistical Software package (SPSS). Eurostat provided a complete set of software programs for the CIS III data processing to the Member States. The use of these set of software routines, although not mandatory, enforced the international comparability of the CIS III results. For this reason, Portugal opted to use the so-called *"SAS programs for CIS III data processing"* (Eurostat, 2001c). Nonetheless, some of the variables collected in the Portuguese CIS III were not subject to the process of imputation of missing values. The complete list of variables included in the CIS III Data Processing is presented in Annex VI.5.

The referred processing is developed in the SAS Statistical package environment and covers the domains of micro-level consistency checks, imputation of missing data, comparison of raw and processed data, meta-data reporting on selected variables and macro-level checks. Additionally, routines for the import and export of files in the format required by Eurostat were provided and also instructions on how to implement the process of non-response analysis.

III.2.a. Micro-Level Consistency Checks

The micro-level consistency checks were developed in two stages. First, the check of edit fails was processed. It performed the detection and adjustment of individual errors in the data records due to wrong insertions into file, inconsistencies, discrepancies and missing answers. Therefore, the routine produces a list of almost blank forms (non-valid, completeness errors), out of scope units (i.e. out of the survey target population by NACE x Size), coding errors (values outside the set of possible answers for each variable) and consistency of answers between two or more variables (consistency errors and route errors). In the second stage after correcting manually all the coding errors and a set of small consistency errors, an automatic process of correction by logical consistency check and the preparation for logical or deductive imputation correction was performed. In the process, the variables modified were flagged with an *Original Data Modified* or *Missing Data Estimated* status.

III.2.b. Missing Variables Imputation Process

The missing values imputation process is a common data processing technique which enables that missing data could be estimated without affecting the final results. This was undertaken by using well establish statistical methods and also in two stages.

In the first stage the estimation of metric variables was performed. The procedure of estimation was based in the method of ratio means by strata with two constraints. The first one is that the response rate should be above 50% for better results. If not, aggregation of neighboring size classes within the same NACE class was performed until the 50% value was achieved and if the value was still below this a neighboring NACE grouping was also tested until a 50% rate was achieved. The second constraint is that outliers are discarded from the calculation of the ratio mean. After verifying and testing the results of this procedure only the metric imputation associated with financial variables was performed, due to poorer outcomes related with some low response rates in some strata.

In the second stage of the imputation process, the ordinal and nominal missing variables are processed by entropy. The technique used was nearest-neighbor imputation by hot deck. It uses data free from logical inconsistencies to impute recipient records. The donors are chosen in such a way that a multivariate measure of distance between them and the recipient is minimized in order to detect a close similar case, as described in depth in the routines guide.

III.3. Imputation Process Outcome Analysis

In the comparison of raw and processed data modules, the progression of the processing is evaluated in its different stages regarding the evolution of the modifications brought to the variables.

Variables	Original Input data	Data Cleaned from Coding Errors and Logical Inconsistencies	Final Estimated Data (Metric and Ordinal Imputation)
Innovators	100.1	100.0	100
Innovating activities	101.0	100.0	100
Products new to market	90.4	93.6	100
Turnover due to product new to enterprise	63.7	63.7	100
Turnover due to product new to the market	64.7	64.7	100
Total innovation expenditure	86.1	86.1	100
Expenditure in intramural RD	71.5	71.5	100
Enterprises with in intra-mural RD expenditure	94.6	94.6	100
Number of persons involved in intra RD	100.0	100.0	100
Improve quality in goods as a relevant effect of innovation	95.3	95.3	100
Innovation cooperation	100.0	100.0	100
National partners for innovation cooperation	99.0	99.0	100
Suppliers of equipment as partners for innovation cooperation	98.7	98.7	100
Clients and customers as a source of info for innovation	94.1	93.6	100
Burdened/cumbered innovation activity	69.9	68.7	100
Not innovating due to factors impeding innovation	58.0	100.3	100
Excessive perceived economic risks, total	97.2	97.2	100
Excessive perceived economic risks, innovators	96.0	96.0	100
Excessive perceived economic risks, non-innovators	98.3	98.3	100
With patent applications	96.9	100.0	100
Registration of design patterns	87.1	87.1	100
Organizational changes	96.7	96.7	100

Note: The final estimated data is the reference (100) for each variable in terms of number of responses.

Table 13 - Global overview of the Data Processing

Table 13 summarizes the evolution of the transformations to the data. A more detailed table with the results of the response rates is presented in Annex VI.6.

Some difficulties and challenges were also encountered while processing the data. The output obtained from the processing of the data revealed that some non-existing errors were generated by the SAS processing routines. This occurred due to some initial high values of Item Non-response in some strata regarding the variables dealing with *Exports Sales*, *Innovation Expenditure*, *Level of Importance in Cooperation*, *Innovation Hampering Factors Status*

(Delayed, Not Started and Canceled) and *Patents*. After consultations with other Member States, the following methodology was applied according to the Eurostat standards to conclude the CIS III exercise, guaranteeing international comparability:

1 – Modification of the SAS imputation routines so that the imputation is performed only on those variables that exhibited low error levels with the non-modified routines;

2 – Use of a modified version of the "edit fails" and of the "correction of consistency errors" routines, after the imputation procedure described in 1. The objective of these modifications was to correct the errors emerging from the imputation process described in 1. Values were reverted to missing when the imputation resulted in error.

Most of these challenges were surpassed during the fine tuning of the imputation procedure. The ones that remained problematic were related to the *Level of importance in Cooperation*, *Innovation Hampering Factors Status* and *Patents* with still high rates of non-response, with the exception of *R&D Full Time Equivalent Personnel* and *Investment in Tangible Assets* with 11 to 12%, nevertheless fairly acceptable. The other ones have relatively low rates of item non-response in the range from zero to 5 %, which are normally acceptable statistical values.

III.4. Lessons Learned

A summary of the lessons learned during the design and implementation of the survey in complement to the ones already presented is a point in case. The most important of them should surely be the ones related to the extension of the survey. This had to do mainly due to two reasons: the efforts for the correction of the database along with the first phone contact and the time extension required to fill all the information in the questionnaire. In the first case, for future surveys an alternative approach should be pursued that rationalizes resources and therefore financial costs while reducing its extension.

However, taking into account the high unit non-response rate it would be advisable to revise the questionnaire with the aim of reducing the burden on respondents. The questionnaire might perhaps be made shorter and more focused on fundamental indicators, for example by using a smaller version at shorter time intervals and an expanded version at larger intervals between surveys.

A lot of item non-response, and probably also of unit non response, is caused by the fact that financial variables asked related to innovation expenditure do not correspond directly to any accounting category, placing on the respondents the burden of making estimates that are not readily available and producing results that can be highly uncertain. To reduce item non-response on these variables (not to mention the issue of estimate reliability), it might be useful to reduce their number and to match them, as much as possible, with standard accounting categories. Off course, if some of the accounting practices, namely analytical accounting, were partially included into law requirements for Portuguese firms perhaps related to innovation fiscal incentives, this would solve the problem for the large majority of firms.

As a concluding note, the notion of innovation in CIS III may be difficult to understand in the Portuguese cultural context as stated before. A significant number of people associate innovation only with the "radical" or novel innovation concept, diminishing the importance of the incremental concept notion. Furthermore, from the doubts reported and answered by the Support Team, a significant number of service firms found it hard to identify the boundaries of the surveyed concept of innovation, especially product innovation, and how it is applicable to them. This will probably lead to non-response and to some degree of underestimation in the sector. More conceptual work and elaboration on examples would be useful. Nevertheless, from the experience of CIS III, it should be advisable to study the possibility and the validity to overcome this reality for example trough the use of a persistent mass media communication strategy exemplifying and detailing the differences while reinforcing the importance of both concepts for the Portuguese economy.

Chapter IV CIS III Results

The presentation of the CIS III results will follow the framework used for CIS II (Conceição and Ávila, 2001) for better comparison. This framework is structured in six sets of subjects (1) *Extension of Innovation*; (2) *Characteristics of Innovative Companies*; (3) *Innovation Resources*; (4) *Innovation Objectives*; (5) *Sources of Information and Cooperation* and (6) *Barriers to Innovation*. It must be said that due to the reformulation of the CIS III, the comparison with CIS II is not direct: the sample frame changed (inclusion of companies with 10 to 19 employees in the Manufacturing sector, inclusion of additional Sub-sectors NACE 63, 73, 74.3 and all the 64 in the Service sector); a common questionnaire for both Manufacturing and Services was adopted; some questions were added and admissible answers were removed, expanded or aggregated; *Innovation Objectives* were changed for *Innovation Effects* (only innovators were considered as opposed to the broader definition of involved in innovation activity); and a completely new set of questions regarding *Other Strategic and Organizational Important Changes* was included (added to the framework of analysis). Nonetheless, the comparison is possible in most of them by analyzing the CIS III results trough the use of an equivalent value for comparison with CIS II (EVCISII).[11]

The results will be presented next in the referred conditions, although differently aggregated. *Extension of Innovation* and *Characteristics of Innovative Companies*, will be analyzed first however, both *Resources Allocated to Innovation* and *Other Strategic and Organizational Important Changes* will be analyzed in sequence under the topic of *Enterprises Options*. The remaining will be analyzed under the topic *Some Systemic Characteristics*. For a more detailed analysis see the tabulations with the CIS III results provided in the Annex VI.4.

IV.1. Extension of Innovation

The extension of innovation is measured mainly through the determination of the proportion of firms that introduced into the market products (goods or services) or processes which are new or significantly improved in the context of the enterprise in a reference period of time. The CIS III results show a significant increase in this variable, either at national or at sector level. At the national level, a result of 44.3% innovating enterprises was achieved in the period, with an EVCISII of 48.4%, showing an increase of 22.2 percentage points (see Table 14). At the sector level, Manufacturing and Services reached similar growths, respectively 42.4% and 48.7%, with

[11] The CIS III equivalent value for comparison with CIS II (EVCISII) is obtained by removing from the analysis the data not surveyed in CIS II.

EVCISII of 48.4% and 48.9%. The CIS II European average was of 49% for the Manufacturing Sector with Portugal being one of the less innovative countries. In the Services sector, Portugal was above Finland, Norway and Belgium and closest to the EU average of 36%. The observed difference related to EVCISII in Manufacturing is due to the inclusion of enterprises with a number of employees between 10 and 19 in CIS III with only 31.7% of innovative enterprises. In the Services sector, the inclusion of additional sub-sectors with 45.6% innovating companies had a low impact on the results. This Manufacturing-Services sector analysis is a fundamental dimension to assess, although innovation varies along multiple dimensions. They traditionally present clearly different structures in their production development. While manufacturing companies rely mainly on manufacturing processes to obtain tangible assets, Services companies have an intangible character. Therefore, both from theory and CIS II results it is expected they vary accordingly. That is not the case if we compare the results of CIS II and their CIS III equivalents. Nonetheless, it is noted in the evolution of enterprises that more and more provide both goods and services in complement due to a product-service market strategy. This important innovation setting is not currently evaluated in CIS although fostered by EU policies[12].

Innovation Extension	Manufacturing			Services			National (3)		
	1995-1997	1998-2000 (1)	1998-2000 (2)	1995-1997	1998-2000 (1)	1998-2000 (2)	1995-1997	1998-2000 (1)	1998-2000 (2)
Proportion of the total of firms that:									
Introduced Innovation	25.8	48.4	42.4	28	48.9	48.7	26.7	48.4	44.3
Product Innovation	15.1	31.1	26.8	-	31.9	31.6	-	30.9	27.9
Process Innovation	22.9	37.5	31.1	-	30.3	30.6	-	34.8	31.1
were involved in Inovating Activities	28.5	50.7	44.8	35.6	50.1	50.1	31.4	50.3	46.4
Ongoing or Abandoned Innovating Activities	8.3	21.3	17.8	11.1	17.2	17.6	9.4	19.5	17.7
Proportion of the total of firms that were involved in Innovating Activities that:									
Introduced Innovation	90.4	95.5	94.6	78.7	97.5	95.7	85	96.3	95.5
Product Innovation	52.9	61.4	59.8	-	63.6	63.1	-	61.4	60.2
Process Innovation	80.3	73.9	69.4	-	60.5	61.2	-	69.1	67.1
Ongoing or Abandoned Innovating Activities	29.2	42	40.4	31.1	34.3	35.2	30.1	38.7	38.1

Note: in CIS 2 (1995-1997), by opposition to CIS 3 (1998-2000), two separate questionnaires were used for Manufacturing and Services. In the latter, a distinction between process and product was not asked, therefore these values are not available.
(1) For comparison with the data of 1995-1998 some Service sub-sectors (NACE 63, 73, 74.3 and 64 except 64.2) and the Manufacturing firms in between 10 and 19 employees that were surveyed in 1998-2000 are not included.
(2) Includes the results not considered in (1).
(3) Includes also the results of Minning and Quarring (NACE 10 to 14) in (2) and Electricity, Gas and Water Distribution (NACE 40 and 41) in (1) and (2).

Table 14 – Innovation Extension in CIS 3 and CIS 2

It is also of great importance to evaluate the innovating activity of the companies in the period, even if they did not succeed in introducing innovation. The innovating activity could be measured in addition to the introduction of innovation by the involvement in innovation projects in the period that are still ongoing without results or were abandoned. The proportion of enterprises engaged in innovating activities increased in CIS III to 46.6%, with an EVCISII of 50.3% compared with 31.4% in CIS II.

[12] The EU enforced a policy through its Growth Program- Key action 1 – TRA 1.5 to foster the "Product-Services of the Future"; available at ftp://ftp.cordis.lu/pub/growth/docs/c_ka1_tra15_info_en_200004.pdf

IV.1.a. Type of Innovation

The performance of the Portuguese enterprises regarding the distribution of product and/or process innovation is presented in Figure 1. From Table 14 the proportion of enterprises that introduced product innovation is 27.9% and 13.2% introduced "Only Product Innovation". As to the Process Innovation, 31.1% of the enterprises introduced it and 16.4% introduced "Only Process Innovations". From a sector point of view, the distribution of companies introducing Only Product and Only Process Innovations are of similar magnitude for Services and higher for Only Product Innovations in Manufacturing. In the latter, firms innovating both in Products and Process are approximately also the same as Only in Products. This distribution of innovation is a characteristic similar to the one found in the CIS II.

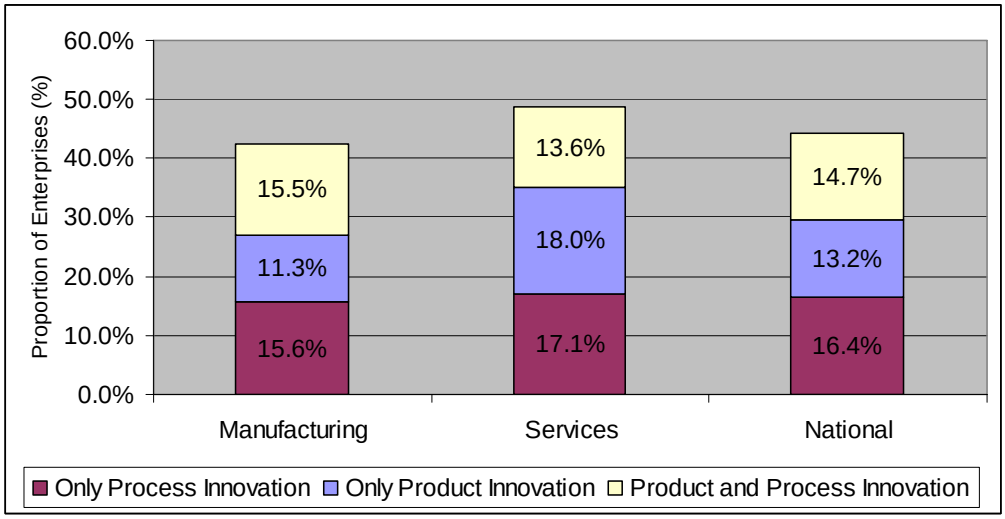


Figure 1 – Product and Process Innovation

It is important to evaluate the level of enterprises that introduced product innovations which were novel to their market due to the logical output benefices that could occur for them (see Figure 2). Considering all sectors, 71.3% of the enterprises introducing product innovations declared to have introduced novel innovative products, whereas in the manufacturing sector, the same proportion was of 70.1% (an increase of 23.1 percentage points from the CIS II). For the Service sector the proportion was slightly higher 72.8% (no collected data for CIS II). This is a sustained increase from the CIS II as this indicator increased approximately the same as the proportion of innovating enterprises or of product innovators. Nonetheless, an assessment of their importance on the firm turnover should be also of great assistance to portray the impact in the output. This is what is detailed in Figure 3.

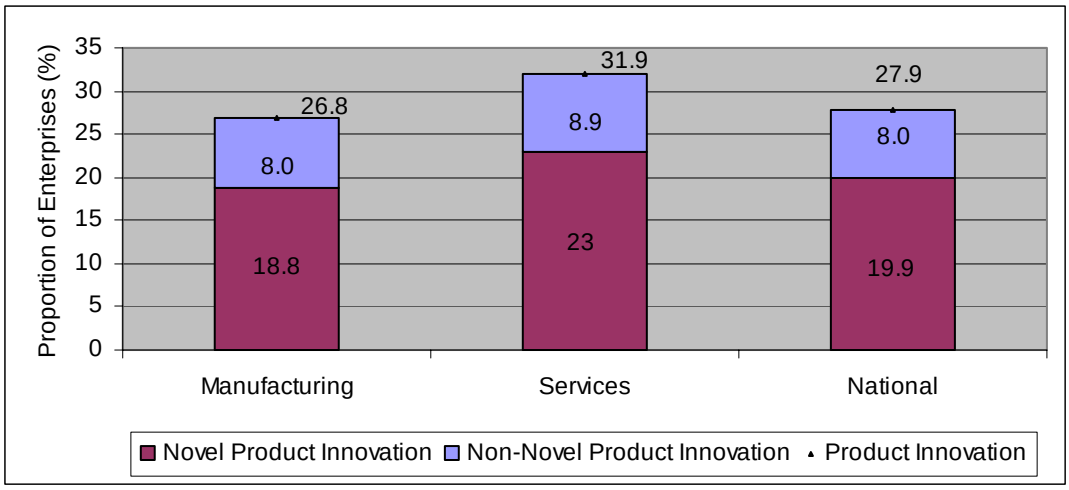


Figure 2 – Novel Product Innovation

IV.1.b. Share of Turnover

The results obtained for the share of turnover of innovating enterprises due to Product Innovation are lower than the ones obtained in CIS II: share of turnover of about 38% in CIS II and of 31% for CIS III for all enterprises introducing innovation in the Manufacturing sector; and approximately 40% in CIS II and 29.5% in CIS III for those that introduced Novel Innovations. The relative difference remains similar. However, the importance of introducing innovations new in the context of the market is clear from the difference of results for all sectors in terms of share of Turnover between innovating enterprises introducing Novel and Non-Novel Innovations. Novel Products are responsible nationally for 76.3% of the Share of Turnover in Enterprises that introduced novel products (a total of 25.5%), significantly above the 7% of other firms introducing only Non-Novel Product Innovations.

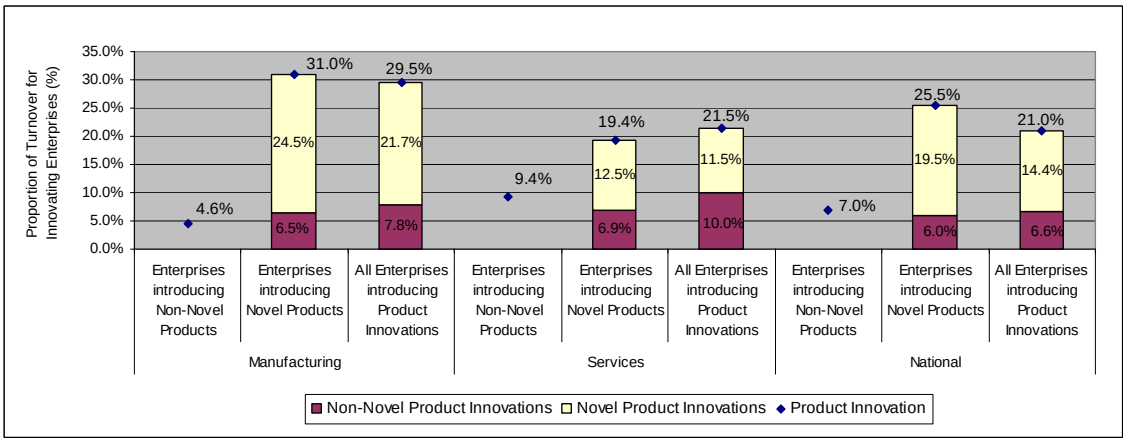


Figure 3 – Share of Turnover of Innovating Enterprises due to Product Innovation

A difference could be observed also between Manufacturing and Services, with a much cleaner distinction in Manufacturing than in Services regarding the contrast between the shares of Turnover due to the introduction of Novel and Non-Novel product innovations. Nonetheless, the Share of Turnover is higher in Manufacturing than in Services for the enterprises introducing Novel Innovations.

Some possibilities could be explored regarding the observed differences in Share of Turnover due to innovations between the CIS II and CIS III. Among them, the significant increase in innovative enterprises may have brought into play a set of more inefficient enterprises in capturing financial outcomes of innovation, or innovations may not be in a high growing or mature phase in the marketing cycle. In Services, although more innovative and 52% higher in terms of Total Turnover of innovative firms, the financial outcome obtained from innovation in terms of share of Turnover is lower than in Manufacturing. More insightful studies on these or other possibilities are of great importance, due to their impact in the economic development, and could have crucial consequences at the policy level.

IV.1.c. Patenting and Other Protection Methods

Another valuable analysis is the influence of patenting and other protection methods in the innovation development. An extension of the questions asked in CIS II was introduced in CIS III. In addition to performing a patent application, it was asked for: the number of applications and of valid patent of Goods, Services and Processes; and of only Goods and Services; the Share of Revenues due to valid patents and patent applications; and the engagement in a set of formal or strategic methods for the protection of inventions or innovations.

Patents are commonly known instruments of stimulus to innovators due to the grant of exclusive rights to economically explore or licentiate to others their new processes or products. Nevertheless, due to the restrictions (new on the market, and using state of the art technology) and characteristics (a patent could be submitted and become valid before its introduction in the market or even never be introduced in the market) of the patenting process, the relation between innovation and patenting is not direct. Additionally, other protection methods of formal (Registration of Design Patterns, Trademarks and Copyrights) and informal nature (Secrecy, Complexity of Design and Lead-time advantage over competitors), could complement or even be an alternative to the protection provided by a patent. The option for these other methods is usually dependent from sector specificities and also to the need for shorter protection time due to product life cycles. Therefore, the subsequent analysis on patenting activities should be read in liaison with the analysis of other protection methods.

It is important to examine patent applications evolution from the CIS II. However; one should remember the methodological problems reported earlier on the patenting variables in the CIS III missing variables imputation process. These will hinder the process of analysis and the possibility of inference based on this data. Nonetheless, a descriptive analysis of the results obtained along with the interpretation possible will be presented, although not across all the sectors within Manufacturing and Services. It should also be noted that the patenting activity is asked in the context of the enterprise or enterprise group, therefore non-innovating companies integrated into a group are also evaluated.

Patents applications in CIS II were only of 10.9% and 2.9% in Manufacturing and Services respectively. An inverse trend was verified in CIS III, where only 5.3% and 7.5% of the Manufacturing and Services enterprises submitted patent applications. The new information regarding active patents provides a relation where 9.9% and 5.7% of respectively, Manufacturing and Services innovating enterprises hold active patents. This is consistent with CIS II patent application data, revealing that its distribution is consistent with the distribution of valid patents in CIS III, probably due to a change in the status of the applications into valid patents during the CIS time frame.

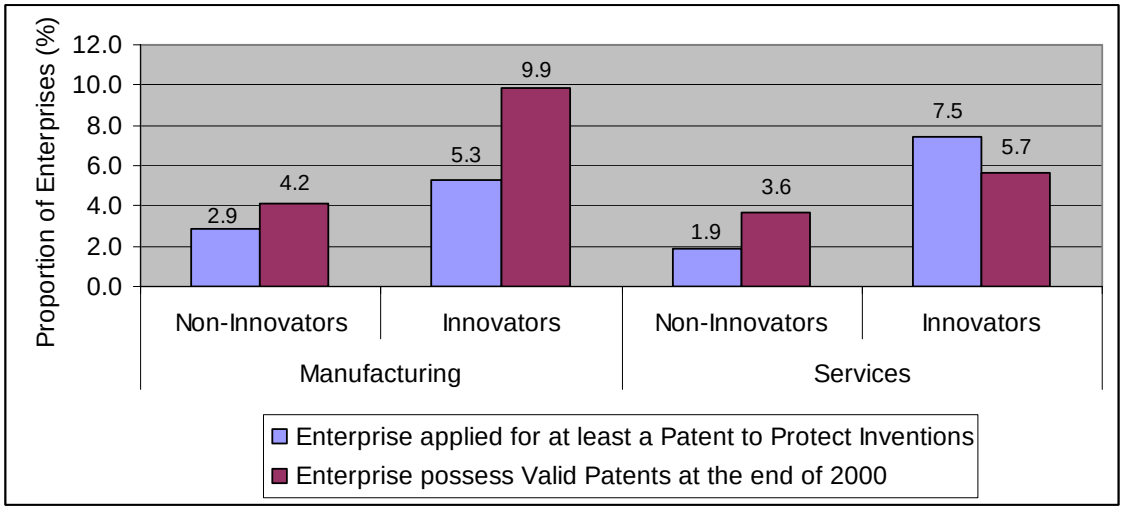
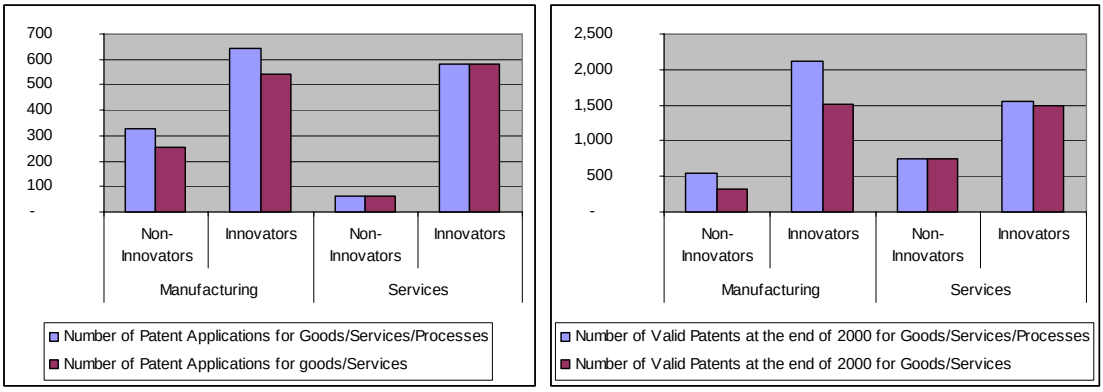


Figure 4 – Patent Applications and Valid Patents

A new situation occurs in CIS III that had not occurred in CIS II, the existence of both patent applications and valid patents in non-innovating enterprises due to the enlargement to patenting within an enterprise group. The proportion of Non-Innovators that submitted patent applications was of 2.9% and 1.9% of respectively in Manufacturing and Services. This is counterintuitive, even more so because a similar relation was found in enterprises stating their non-involvement in innovative activities ongoing or abandoned (3% Manufacturing and 2% Services). Therefore, they were not considering the development (or acquisition) of the good, service or process to be

patented as innovative, or that the innovation was not to be introduced in the market (good/service) or used (process) - remind that he innovation frontier is the company. Nonetheless, it should be noted that patenting activity is higher in integrated and non-integrated innovating enterprises than in the non-innovating belonging to a group.

As to the number of patent applications and valid patents, it should be noted that enterprises were asked to answer without duplicates (one per good, service or process, independently of the country of submission) and that all patents for enterprises belonging to the enterprises in the group counted. A methodological limitation referred before regarding the imputation of missing values on patents does not enable the comparison between the distribution of numbers of patents of Goods/Services and Processes - see note on Table 14. Therefore, the numbers presented there should be read in the light of these constraints. Nevertheless, they show a proxy for the potential of the pool for valid patents and applications available in the Portuguese economy. The relations portrayed before for the engagement in the patenting process remain similar for the number of valid patents and patent applications and the clear relation of higher number of patenting activity for the innovating enterprises as opposed to non-innovators integrated into a group is reinforced.



Note: These values were not subjected to a missing value imputation process. Therefore, some situations could occur where the values were answered only for Goods/Services or Goods/Services/Processes, leading respectively to an equal value for Goods/Services/Processes or to consider zero the value for Goods/Services underestimating their importance (see number of patent applications of innovators in services for an example).

Figure 5 – Number of Patent Applications and Valid Patents

Summarizing the results in terms of patents, the only clear characteristic is that the Portuguese companies ignore or do not choose to use patenting as a protection tool. Complementing the analysis however, the other protecting methods surveyed (also asked in the context of the enterprise or enterprise group) are used in relatively low proportions even in the innovating companies, although higher than patenting (see Figure 6). The three main other protection methods used are “lead-time advantage over competitors”, “secrecy” and “trademarks”, both in

Manufacturing and Services, although with differences in the order of their importance. On the other hand, "complexity of design" appears as a solid fourth in their preference in both Manufacturing and Services; "registration of design patterns" appears to be used consistently more in Services than in Manufacturing; protection by "copyright" is almost ignored. Again it is clear that innovating companies are considerably more engaged in protection methods than non-innovating.

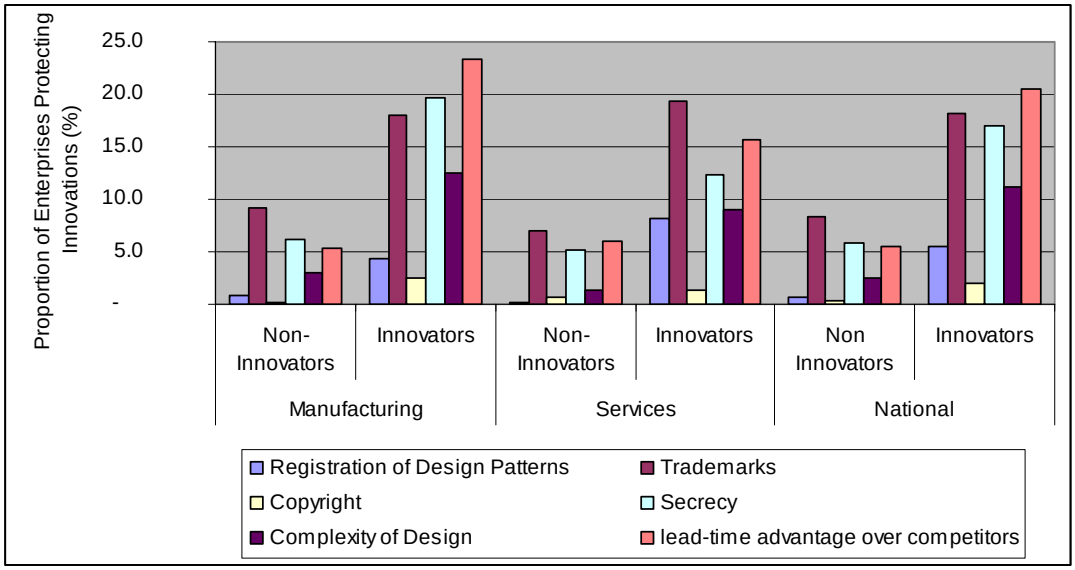


Figure 6 – Engagement in Protection Methods

IV.1.d. Innovation Development Origin's

The origins of the development of innovations provide another complementary knowledge on innovation characteristics. The following figure provides comparable results with CIS II. In CIS III, innovations were also developed mainly in house (including enterprise group), roughly 50% more than those developed in cooperation and by other enterprises or institutions, with process innovators relying significantly more on cooperation than simply on outsourcing.

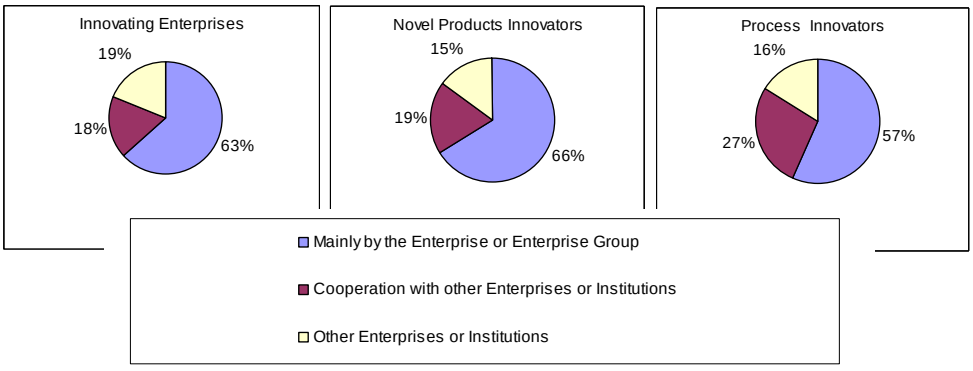


Figure 7 – Development of Innovations

IV.2. Innovation and Company Characteristics

Scholarly work has showed that the ability to innovate varies greatly from firm to firm and it is determined by a large number of factors of a complex and interdependent nature, internal and external to the enterprise. The identification of these factors and their relationship is also a complex procedure that rarely provided a positive and clearer result. Therefore, the recognition of the characteristics which render an enterprise more able than other to innovate is also less possible. Nonetheless, a possibility of analysis could be pursued by using some of the frequent firm characteristics and classifications, and verify whether they are systematically related to differences in their innovation ability. However, due to the restrictions referred, this could still not be enough to explain it, as similar firms could present different innovating capacities.

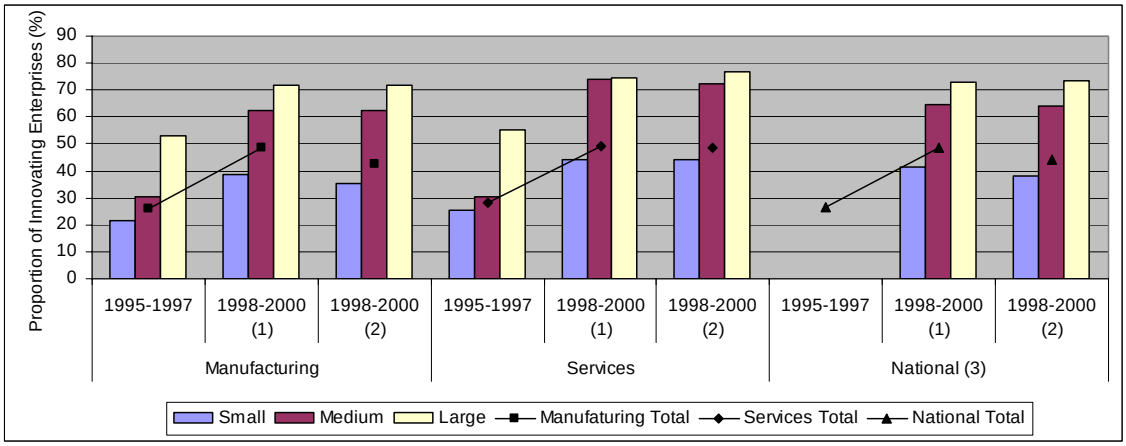
Despite this, the presentation of innovation alongside company characteristics is an important proxy measure in the process of recognizing the determinants of innovation. This measurement could be performed by considering two principal axes: dimension and sector affiliation. Even so, additional enterprise characteristics are also important and will also be analyzed: if it is part of a group, if it is a startup, location, preferential market, the average value of product life cycle of most important good or service, the occurrence of a merger or sale of the enterprise or partial closure with significant impact in the company turnover, and education status of the personnel. The analysis will be developed by applying whenever possible some of the analysis framework and structure used in the previous chapter.

IV.2.a. Firm Dimension

The dimension of a firm could be quantified by using the number of employees. Three categories were used in CIS III (five in CIS II) to classify dimension: Small (10 to 49 employees), Medium (50 to 249) and Large (more than 250). From the analysis of the population of the survey presented in the previous chapter, 82.3% of the firms are considered of small dimension, 15.6% medium and 2.1% are large. Looking only at the Manufacturing sector, the proportion is 79.8%, 17.9% and 2.3%, and in services, 88.0%, 10.2% and 1.6% respectively.

In general it is expected that innovation extension varies with firm dimension. Results show again a significant improvement from CIS II, although national results were not available (see Figure 8). The CIS II EU averages were for the Small, Medium and Large size classes respectively 40.3%, 54.6% and 76.4% for the Manufacturing sector and 34%, 41% and 64% for the Services sector. The analysis of the dimension variable again presents an expectable result:

larger firms innovate more than smaller ones. However, the medium size companies now appear almost as innovative as larger ones, when in CIS II their proportion was similar to the smaller companies. Moreover, in the Services sector the difference in innovating enterprises of Medium and Large dimension is approximately the same. It appears that the cutoff point for analyzing innovation regarding dimension is moving, and that another refinement of the classification is needed, mainly in Small and Medium Size classes.



Note: in CIS II (1995-1997), by opposition to CIS III (1998-2000), two separate questionnaires were used for Manufacturing and Services.

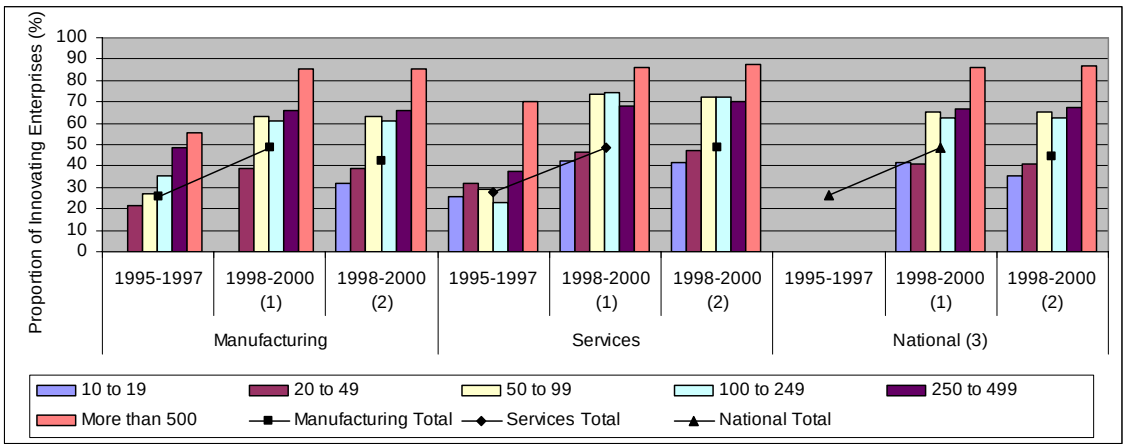
(1) For comparison with the data of 1995-1998 some Service sub-sectors (NACE 63, 73, 74.3 and 64 except 64.2) and the Manufacturing firms in between 10 and 19 employees that were surveyed in 1998-2000 are not included.

(2) Includes the results not considered in (1).

(3) Includes also the results of Mining and Quarrying (NACE 10 to 14) in (2) and Electricity, Gas and Water Distribution (NACE 40 and 41) in (1) and (2).

Figure 8 – Innovating Enterprises by Size

The classification used in CIS II comprehended six classes: 10-19 (services only), 20 to 49, 50 to 99, 100 to 249, 250 to 499 and more than 500 employees. This classification could be used to clarify the referred situation. However methodological constraints could hinder the accuracy of the results due to the sampling process use of the small, medium and large division as representative variable. Nevertheless, in Figure 9 the results show that classes ranging from 50 to 499 employees show similar results, nearer those of larger firms with more than 500 employees, and smaller enterprises of 10 to 49 employees have significantly lower innovating enterprises as expected.



Note: see note in **Figure 8**.

Figure 9 - Innovating Enterprises by Size (6 Classes)

The results from this reclassification support the hypothesis that the similar classes in terms of innovation achievement could be changing in Portugal to Small (10 to 49), Medium (50 to 499) and Large (over 500 employees). However, the validity of this hypothesis remains unverified.

Considering the broader definition of innovative activity, one can measure the effort rate in innovation by looking at the share of enterprises involved in innovative activities that introduced innovation. This provides a tool for detailing the effort rate in terms of the dimension of the enterprise. For CIS II, the inverse of the effort rate, the non-innovating enterprises involved in innovation activities, presented a rate for all size classes in manufacturing between 20 and 36% and between 5 and 31% in services. Although in services, the distribution does not follow the linear trend presented in the analysis of the dimension, i.e. more success in innovation in larger enterprises to less successful in smaller ones. This confirms that there is more to explain innovation than a single even if compounded characteristic.

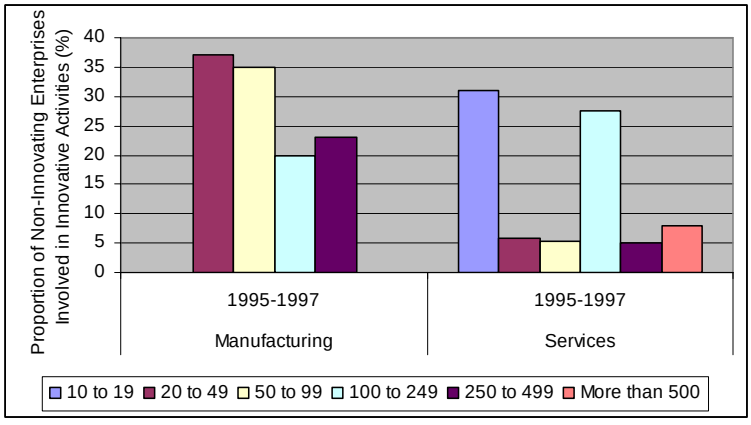


Figure 10 – CIS II Non-Innovating Enterprises engaged in Innovation Activities by Size

In national terms, and manufacturing and services sectors also, the effort rate of firms engaged in innovative activity increased for numbers above 95% (Table 1 - page 42). Therefore, the number of non-innovating enterprises involved in innovation activities decreased consistently below 5%. On the other hand, in some class dimensions in manufacturing this value is surpassed, but in services there is a clear improvement, whereas in larger firms there is not a single enterprise involved in innovation activities that fail to innovate.

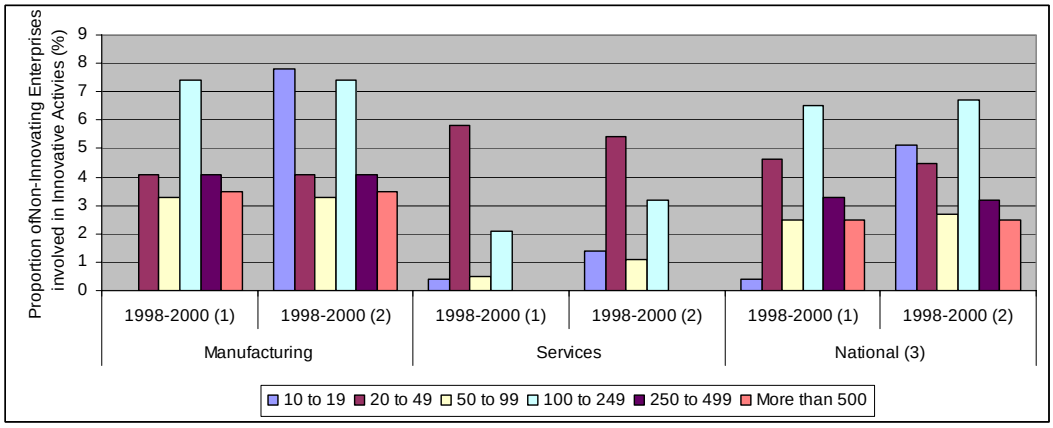


Figure 11 – CIS III Non-Innovating Firms engaged in Innovative Activities by Size

A clearer view of this improvement can be seen next in Table 15 where the number of non-innovators engaged in innovative activities, over the number of firms with ongoing or abandoned innovative activities is presented. The proportion of unsuccessful companies in the universe of all those that had ongoing or abandoned innovative activities has significantly decreased in manufacturing and services in all size classes. A clear effectiveness was achieved in larger companies in services. In national terms, this performance follows the rule of thumb regarding the analysis of innovation by dimension: smaller firms are less effective than larger ones.

Size Class	Manufacturing			Services			National (3)	
	1995-1997	1998-2000 (1)	1998-2000 (2)	1995-1997	1998-2000 (1)	1998-2000 (2)	1998-2000 (1)	1998-2000 (2)
10 to 19			22.7	80.9	1.3	5.0	1.3	16.1
20 to 49	37.2	12.3	12.3	27.3	17.6	15.8	13.9	13.4
50 to 99	35.0	7.5	7.5	61.1	1.0	2.4	5.7	6.1
100 to 249	19.8	14.5	14.5	80.4	5.6	8.0	13.4	13.7
250 to 499	24.2	6.1	6.1	62.8	-	-	4.7	4.5
More than 500	-	5.7	5.7	25.4	-	-	3.8	3.6

Note: see note in Table 14. National results for CIS II not available.

Table 15 – Proportion of Non-Innovators engaged in Innovation Activities over Enterprises with Ongoing or Abandoned Innovative Activities by Size Class (%)

In what concerns the origin of the development of innovations in firms (see Figure 12), the great majority of companies prefers to innovate internally to the firm or group (no size class or innovation type below 50%). In terms of product innovations or novel product innovations this

occurs more in larger companies than in smaller ones and in processes there is a relative equilibrium across all size classes. In opposition, as expected, smaller companies search for more external help than larger ones, probably due to the lack of critical mass. As to the cooperation with other enterprises and institutions, they usually are the firms' second choice across product and process innovators, increasing its importance with the size of the enterprise.

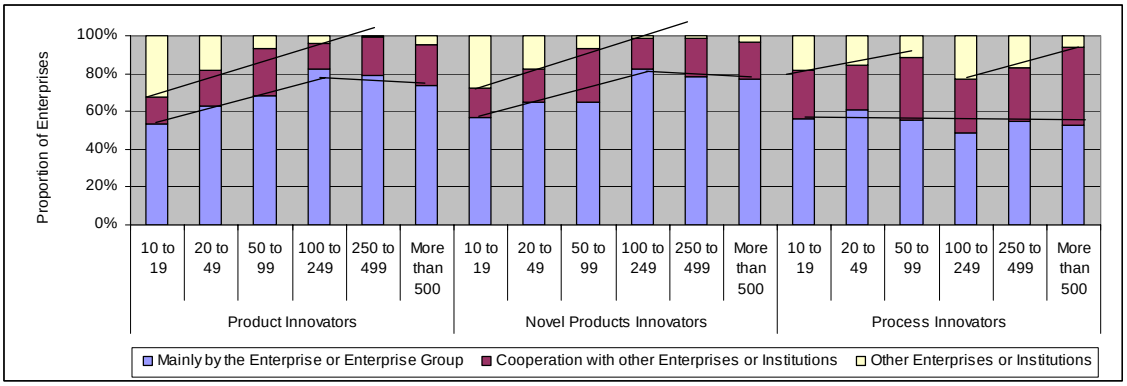


Figure 12 – Innovation Development by Size

In manufacturing however, the external origin for innovation almost disappears in large companies and the internal origin of innovation is even higher from smaller to larger companies for product and novel product innovators (see Figure 13). Conversely, the process innovators distribution of "origins of innovations development" remains similar to the referred before in national terms.

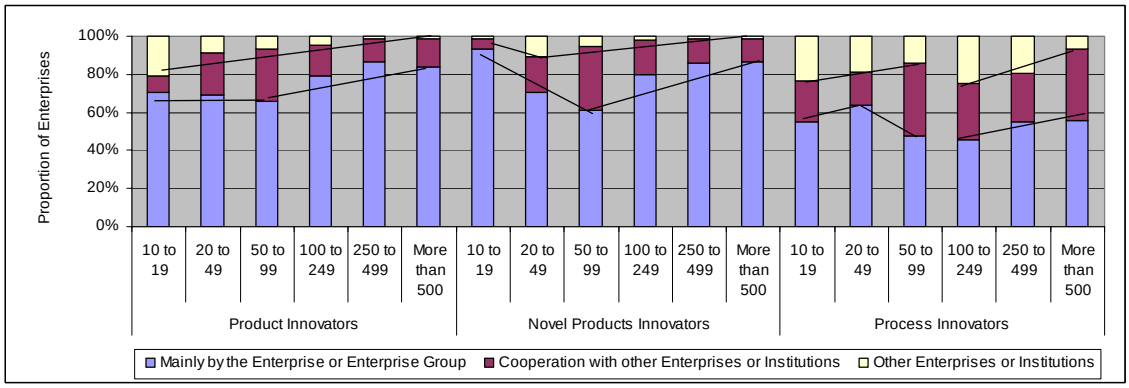


Figure 13 – Innovation Development by Size in Manufacturing

The contrast concerning the dimension effect is even clearer in the Services sector, on the topic of product and novel product innovators. Some large companies disregard external innovation, although in these cases "cooperation with other institutions" shares the firms' preference equally (50%) with "internal origins".

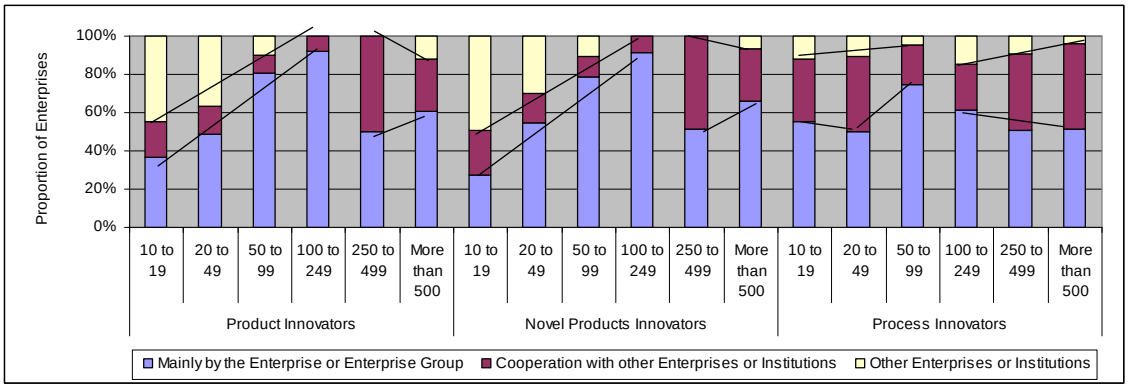


Figure 14 - Innovation Development by Size in Services

Patent data as referred, has less quality than desirable and hinders the possibility of rigorous analysis. Therefore, it is left open for further studies concerning dimensions characteristics and others after improvements in data quality.

Lately, the analysis of the real economic objective of firms, i.e. the output of innovation in terms of share of turnover for innovative firms due to innovations is presented by size classes.

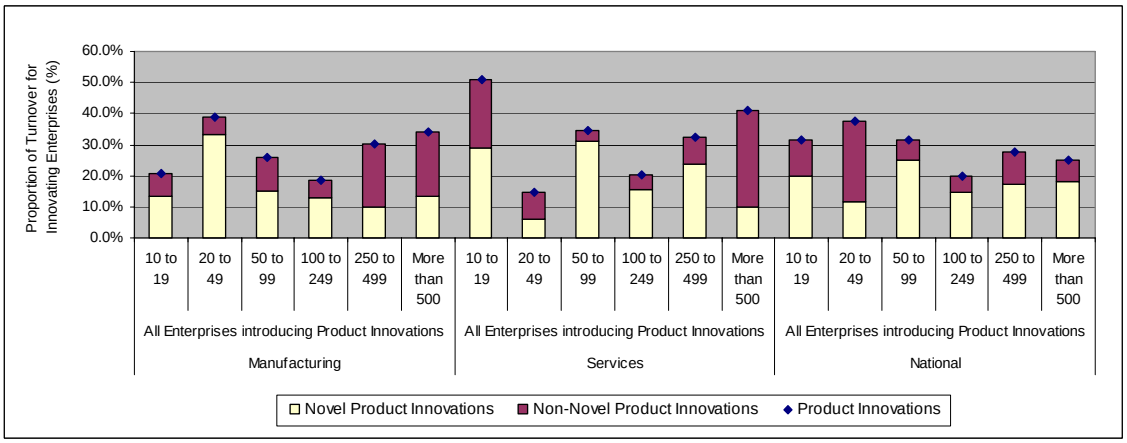


Figure 15 – Share of Turnover of Innovating Enterprises due to Product Innovation by Size

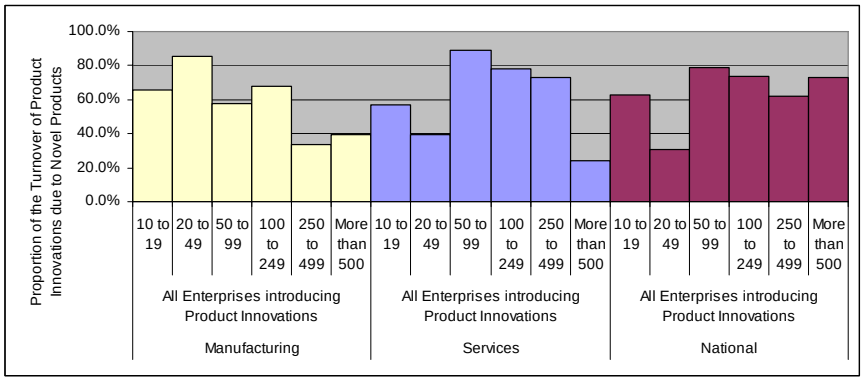


Figure 16 - Proportion of Turnover of Product Innovations due to Novel Innovation by Size

In the Manufacturing sector, the smaller companies capture more share of the turnover due to product innovations from novel products than larger ones, ranging from 85.7% to 33.3%, where as in the Services Sector it appears to be a focus in the mid classes with approximately 70 to 80% (see Figure 15 and Figure 16). Nonetheless, in the Services sector the smallest companies obtain a significant amount of revenues from product innovations, almost 50%, which is the largest share in services, whereas in the Manufacturing sector smaller companies have the lowest share in turnover due to innovations. Both in the Services and the Manufacturing sector (see Figure 15), this share almost resemble a U-shape, a significant difference from the CIS II where medium size companies were very close to the average that ranged from 30 to 40% for the entire manufacturing sector with lower values for larger companies.

IV.2.b. Economic Sector Activity

The innovative activity is known to be differentiated by sectors of activity as reviewed in Chapter II. Increasing the depth of analysis beyond the dichotomy Services-Manufacturing already showed, the innovation characteristics will be presented using a more common feature of an aggregation of NACE-2 digits classification for sectors in manufacturing and services.

IV.2.b.i) Manufacturing

A set of ten industrial sectors are commonly used for the analysis in the manufacturing sector (see Table 2 in page 27). In CIS II the EU average was above the Portuguese for all sectors, but with smaller deviations on those that innovated more ranging from -0.2 to -1.5 times the EU average. The most innovative sector in CIS III was Chemicals (Coke and Petroleum do not exist in the population) with 66% of its enterprises being innovative. However, it was a drop from the CIS II of 11% although it was then the second more innovative sector. The CIS III second best, Basic Metals and Fabricated Metal Products had an increase from 18.8% in CIS II to 53.3%. There was also a significant pattern change from CIS II, where the innovative enterprises by sectors ranged from 16.8% to 80.4%, compared with 31.1% to 66% in CIS III. All sectors displayed lesser dispersion around the average, certainly a result of the increase in innovative activity, compounded by the fact that the inclusion of firms with 10 to 19 employees decreased the sector total. The Rubber and Other Non-Metallic and the Electric and Optical Equipment sectors were the only to diminish their share of innovative activities, caused by a strong decrease in innovative activity in smaller companies from 66.7-100% range and around 81% respectively in CIS II to 40.6-80.5% and 30-62.5% ranges in CIS III.

Sector of Activity	Number of Employees						Sector Total	
	10 to 19	19 to 49	50 to 99	100 to 249	250 to 500	Over 500	(1)	(2)
Coke and Chemicals	22.2	98.3	73.7	83.0	100.0	100.0	66.0	90.3
Basic Metals and Fabricated Metal Products	40.1	60.9	49.3	59.0	69.5	60.9	53.3	59.9
Manufacturing NEC and Recycling	45.3	42.0	79.1	87.5	35.7	100.0	51.0	55.4
Machinery and Equipment NEC	36.9	53.0	57.9	80.4	57.9	-	50.4	57.1
Transport Equipment	32.4	36.6	77.6	75.3	76.3	82.1	50.3	59.0
Electrical and Optical Equipment	45.7	30.5	62.5	72.6	90.6	100.0	49.2	51.3
Rubber and Other Non-Metallic	35.6	40.6	80.5	63.8	74.9	89.6	47.9	55.1
Food products; Beverages and Tobacco	31.1	49.9	72.4	71.3	48.7	78.4	47.8	57.0
Wood, Pulp and Publishing	28.5	31.4	58.2	81.2	70.5	82.5	36.1	43.2
Textiles and Leather	23.2	21.6	51.7	49.5	61.6	80.0	31.1	34.7

Note: (1) CIS 3 results (2) Results for comparison with CIS II.

Table 16 – Proportion of Innovating Enterprises in Manufacturing (%)

The clear identification of four groups of different innovating performances in CIS II (Conceição and Ávila, 2001) is now reduced to a larger one where one in each two companies is an innovator (the majority of the sectors) and the two outliers situations are respectively one in each three firms is an innovator (Wood, Pulp and Leather) and two in each three firms are innovators (Coke and Chemicals). Even so, a more deep analysis could be pursued, e.g. by analyzing the relation between innovation and the level of technological sophistication, although technological innovation is not exclusive of the sectors that use and develop more advanced or the state of the art technologies. Therefore, the sector classification for technological intensity provided by OECD (OECD, 1987) will be used as in Conceição and Ávila.

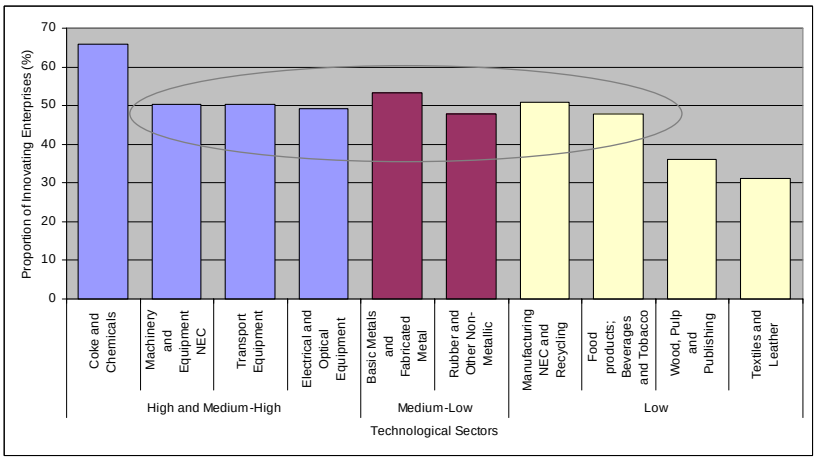


Figure 17 - Innovating Enterprises in Manufacturing by Technological Sector

From the result of this classification one could see as expected that there is a similar level of innovation in most of the sectors. However, the situation referred earlier concerning the outliers, is now confirmed as pertaining to the High and Medium-High Technological Sector (Coke and Chemicals) and to the Low Technological Sector (Wood, Pulp and Publishing; Textiles and Leather). This is completely different from what was observed in CIS II where half of the High and Medium High Technological Sectors had significantly higher shares than the other sectors.

This confirms again the pervasiveness in the increase of the share of innovating companies in the Portuguese economy. Nonetheless, it makes it harder for the comprehension of a hypothetical relation with the level of technological intensity of sectors.

The behavior of innovation in the analyzed sectors regarding the dimension effect is presented in the following figures. In either classification, the proportion of innovating enterprises is higher in larger companies than in smaller ones, as traditionally expected. There were only some variations regarding "Machinery and Equipment" above 500 employees because there was no reply in this class to the survey and "Coke and Chemicals" (Chemicals only) where there was a 100% share of innovative enterprises.

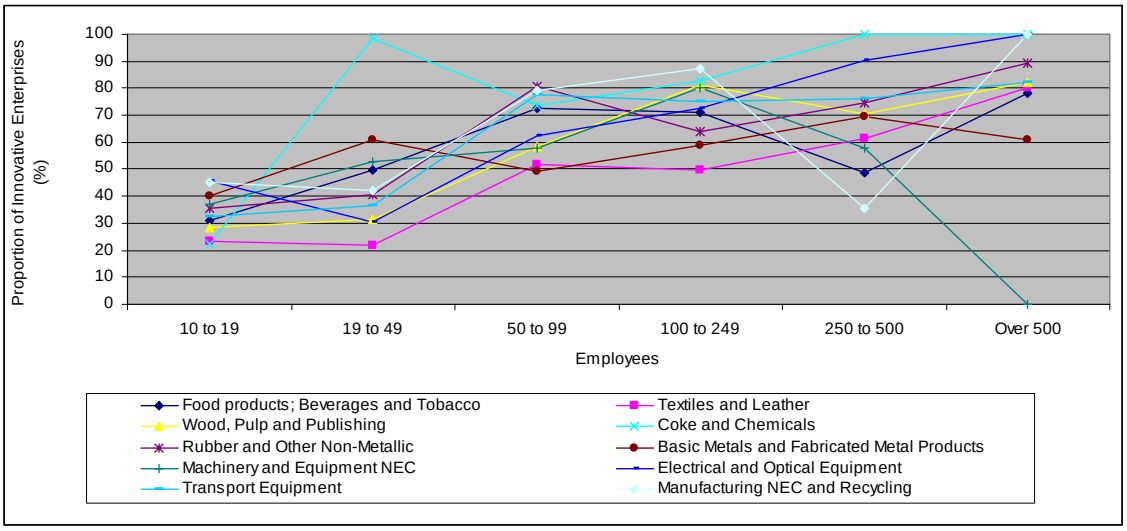


Figure 18 –Innovating Enterprises in Manufacturing by Sectors and Size

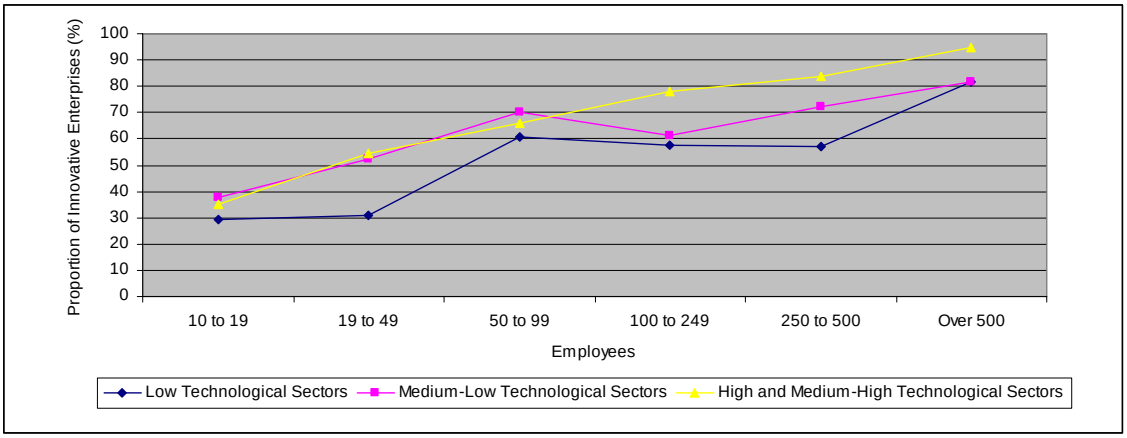


Figure 19 - Innovating Enterprises in Manufacturing by Size and Technological Sector

The identification of product and process innovation within sector and size boundaries is presented in the following tables. The same effects concerning the contraction of the range of

observed shares of innovative enterprises by sector (see Table 16) could be similarly observed in product innovators (see Table 17). In what concerns process innovators (see Table 18), similar effects were verified, nonetheless more dispersed than in product innovators.

Sector of Activity	Product Innovators						
	10 to 19	19 to 49	50 to 99	100 to 249	250 to 500	Over 500	Sub-Total
Food products; Beverages and Tobacco	36.9	39.8	46.3	80.4	20.9	-	**42.3**
Basic Metals and Fabricated Metal Products	30.3	48.1	41.2	44.1	54.2	60.9	**41.6**
Textiles and Leather	24.3	29.7	48.4	75.3	76.3	48.1	**39.4**
Machinery and Equipment NEC	40.5	19.3	45.4	69.1	72.2	66.9	**38.7**
Coke and Chemicals	24.9	36.0	61.1	43.0	36.6	78.4	**35.9**
Electrical and Optical Equipment	24.2	31.4	54.2	81.2	26.1	70.6	**33.1**
Transport Equipment	2.7	43.7	48.4	49.5	74.3	100.0	**33.0**
Rubber and Other Non-Metallic	14.9	34.0	67.6	26.9	63.0	89.6	**32.7**
Wood, Pulp and Publishing	13.7	17.3	62.5	65.7	35.7	100.0	**25.0**
Manufacturing NEC and Recycling	12.4	16.5	47.0	39.0	54.4	71.0	**23.4**

Table 17 – Proportion of Product Innovators in Manufacturing by Sector and Size (%)

Sector of Activity	Process Innovators						
	10 to 19	19 to 49	50 to 99	100 to 249	250 to 500	Over 500	Sub-Total
Coke and Chemicals	22.2	87.4	61.6	76.9	100.0	100.0	**60.0**
Manufacturing NEC and Recycling	45.3	38.9	75.0	65.7	35.7	50.0	**48.3**
Electrical and Optical Equipment	41.7	20.4	43.4	64.2	77.5	88.7	**40.6**
Transport Equipment	24.2	32.2	58.7	54.5	57.2	82.1	**40.0**
Rubber and Other Non-Metallic	23.5	25.4	67.0	57.1	62.3	52.9	**34.6**
Basic Metals and Fabricated Metal Products	29.0	34.5	35.4	36.1	69.5	60.9	**34.2**
Food products; Beverages and Tobacco	9.3	33.3	42.9	53.6	40.6	78.4	**28.2**
Machinery and Equipment NEC	-	26.5	40.5	57.4	57.9	-	**22.5**
Textiles and Leather	13.8	12.7	28.9	19.6	40.0	55.0	**17.1**
Wood, Pulp and Publishing	9.7	6.7	19.0	42.1	44.4	70.6	**12.1**

Table 18 – Proportion of Process Innovators in Manufacturing by Sector and Size (%)

From CIS II, there was a clear difference between two groups that innovated clearly more, either in product or process, than the other sectors (Chemical, Electric and Optic Equipment, and Rubber), although preferentially in processes. These groups are not present in the CIS III data. From Figure 20, one could see that all sectors are more concentrated, however, some innovate more in process than in product and vice-versa. Moreover, for the Coke and Chemical sector the relation product versus process was clearly inverted from 70-80 in CIS II to 60-33. These changes should be analyzed further in the future to clarify the reasons for such drastic modification and test for its consistence over time.

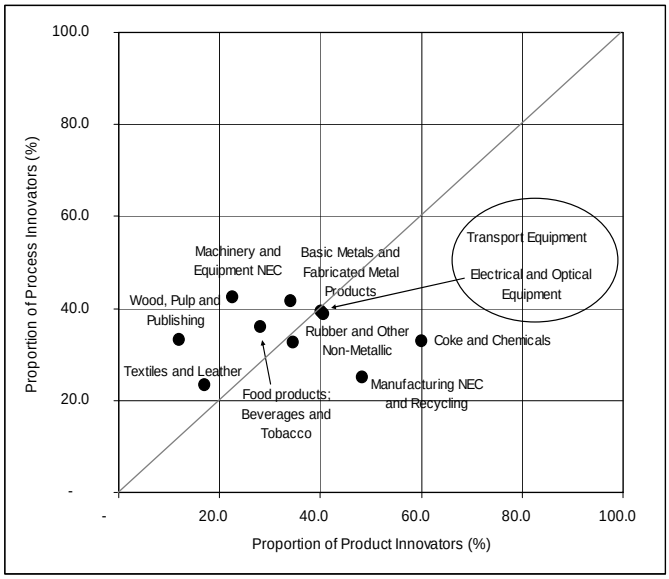


Figure 20 – Product versus Process Innovators in Manufacturing (%)

After displaying strong differences with CIS II in what concerns sector analysis in manufacturing, it is time to evaluate the output of these evolutions by analyzing its impact in the obtained turnover. In the following figure it could be observed that the Transport Equipment Sector obtains the highest shares of turnover from product innovations, a similar proportion than in CIS II and well as two other High and Medium-High Technology Sectors out of four. The Textile and Leather sector is the only one to decrease significantly from the CIS II, from one of the highest values in terms of share of turnover (more than 55%) to only 26.6% in CIS III. The remaining sectors present small changes in terms of share of turnover due to product innovations.

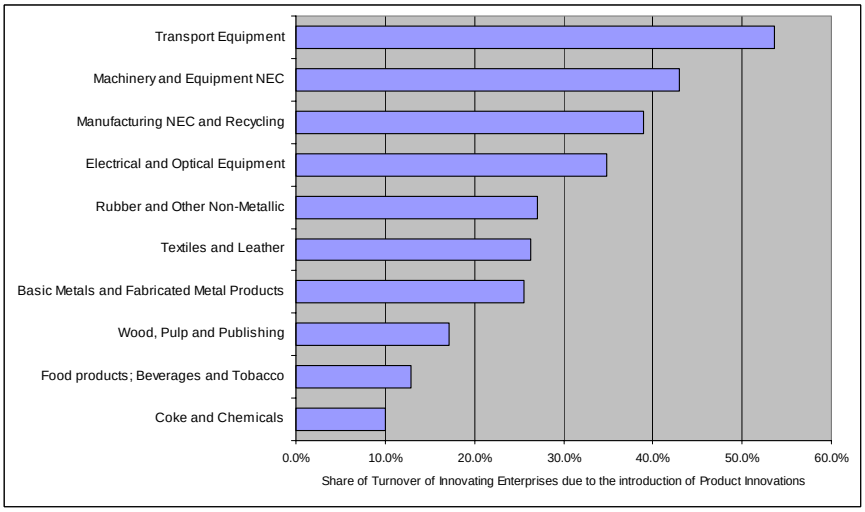


Figure 21 – Share of Turnover of Product Innovative Enterprises due to the introduction of Product Innovations in Manufacturing by Sector (%)

IV.2.b.ii) Services

The population in the Services sector (see Table 2) is concentrated almost 70% in the Wholesale Trade sector. Transport and Storage has 19% of the population, Financial Intermediation, 5.5% and Engineering Services 4%, the remaining sectors are less than 1%. Moreover, in Research and Development there are no Medium or Large companies, and in Technical Testing and Analysis there are no Large companies.

Sector of Activity	Number of Employees						Sector Total	
	10 to 19	19 to 49	50 to 99	100 to 249	250 to 500	Over 500	(1)	(2)
Research and Development	100.0	-	-	-	-	-	100.0	-
Post and Telecommunications	77.9	100.0	100.0	100.0	63.7	100.0	92.7	96.8
Computer and Related Activities	74.6	56.0	100.0	74.8	94.4	100.0	74.1	74.1
Financial Intermediation	55.4	69.3	69.1	94.1	76.5	100.0	70.5	70.5
Architectural and Engineering Activities	82.4	39.6	71.5	77.9	100.0	-	61.1	61.1
Wholesale Trade and Commission Trade	38.4	48.5	70.7	76.8	52.7	77.9	46.1	46.1
Technical Testing and Analysis	25.6	63.7	63.7	-	100.0	-	42.9	-
Transport and Storage	39.4	30.3	69.8	44.0	63.8	68.6	41.1	40.2

Note: (1) CIS 3 results (2) Results for comparison with CIS II.

Figure 22 – Proportion of Innovating Enterprises in the Services Sector by Size and Sector (%)

The results in the services sector show a significant increase in the proportion of innovative enterprises for all sectors, even when considering the results for comparison with CIS II (the deviation from the CIS II EU average for the sectors in Services ranged from +0.1 to -1 times the EU average). Three sets of sectors could be observed, the "highly innovative" R & D (with few companies) and Post and Telecommunications; the "Higher than average innovators" Computer and Related Activities, Financial Intermediation, and Architectural and Engineering Activities; the "average innovators" Wholesale Trade (the dominant sector in terms of number of enterprises), Technical Testing and Analysis, and Transport and Storage (the second larger). The natural effect on the Services sector average is due to the weight these last referred two sectors in compounding the average. However, it should be noted that the increase in the proportion innovating enterprises for these sectors was significant from CIS II (25.9% in Trade and 27.9% in Transports. Also, the growing effect of dimension in the proportion of innovating enterprises is only clearly observed in all but the "highly innovative" sectors.

One should remember that in CIS II the Services sector was only asked about "service" innovations". Therefore, it should also be analyzed the new division between Services and Processes.

Sector of Activity	Product Innovators						
	10 to 19	19 to 49	50 to 99	100 to 249	250 to 500	Over 500	Sub-Total
Post and Telecommunications	77.9	100.0	73.4	100.0	63.7	100.0	**87.8**
Computer and Related Activities	59.6	56.0	64.2	22.9	84.5	100.0	**56.4**
Financial Intermediation	40.0	37.0	46.6	77.3	50.8	100.0	**48.2**
Technical Testing and Analysis	25.6	31.9	63.7	-	100.0	-	**35.7**
Architectural and Engineering Activities	51.5	7.9	66.3	58.4	100.0	-	**34.1**
Wholesale Trade and Commission Trade	32.1	29.5	23.6	51.2	52.7	77.9	**31.3**
Transport and Storage	22.1	11.6	25.6	16.6	25.5	54.8	**19.3**
Research and Development	-	-	-	-	-	-	**-**

Table 19 – Proportion of Product Innovators in the Services Sector by Size and Sector (%)

The proportions of product innovators in the Service sectors are lower than the innovating enterprises. In R&D there were even no product innovators. Still, similar sets could be constructed now focused on product innovation where it could be recognized the "Highly Innovative" Post and Telecommunications; the "higher than average innovators" Computer and Related Activities, and Financial Intermediation; the "average innovators" Technical Testing and Analysis, Architectural and Engineering Activities, and Whole Sale and Commission Trade; and the "lower than average innovators" Transport and Storage.

Sector of Activity	Process Innovators						
	10 to 19	19 to 49	50 to 99	100 to 249	250 to 500	Over 500	Sub-Total
Research and Development	100.0	-	-	-	-	-	**100.0**
Financial Intermediation	51.3	63.4	57.2	61.8	76.5	90.5	**60.9**
Computer and Related Activities	44.7	28.0	100.0	67.2	94.4	100.0	**55.2**
Architectural and Engineering Activities	61.8	39.6	71.5	77.9	100.0	-	**53.8**
Post and Telecommunications	38.9	-	53.2	66.7	63.7	100.0	**45.3**
Transport and Storage	19.6	26.7	63.4	33.7	38.4	55.0	**28.6**
Technical Testing and Analysis	12.8	31.9	63.7	-	100.0	-	**28.6**
Wholesale Trade and Commission Trade	17.5	27.0	56.9	51.2	52.7	58.4	**25.5**

Table 20 - Proportion of Process Innovators in the Services Sector by Size and Sector (%)

In what concerns process innovators, the again similar sets are recognizable, the "Highly Innovative" R&D; the "higher than average innovators" Financial Intermediation, Computer and Related Activities, Architectural and Engineering Activities, and Post and Telecommunications; "near the average innovators" Transport and Storage, Technical Testing and Analysis, and Whole Sale and Commission Trade. The expected dimension effect in innovating performance is clearly observed either in product or process innovation across all sectors (except R&D for obvious reasons).

The same groups devised before could be more clearly recognized in a Product vs. Process Innovation chart as used in Manufacturing. Apart from the situation of the R&D sector that is representative of only three enterprises out of seven possible, conversely all the other sectors present statistically admissible results.

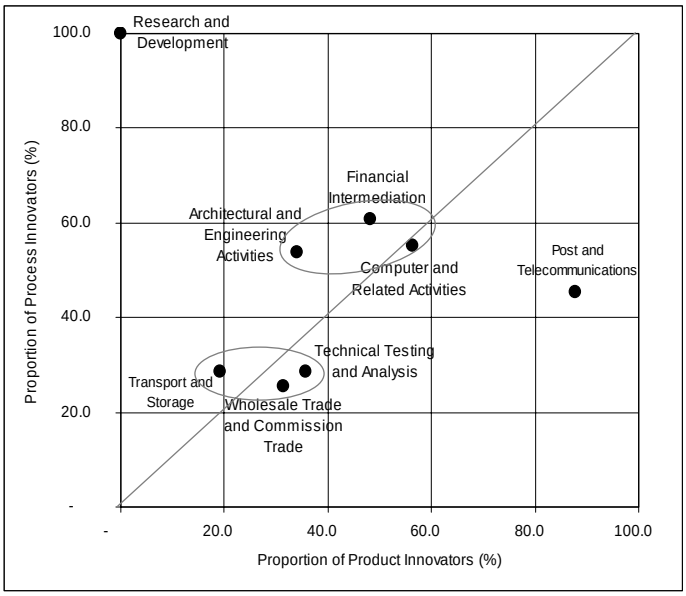


Figure 23 – Product versus Process Innovators in the Services Sector (%)

In the Figure 23 the "Highly Innovative" sector comprehends the R&D and Post and Telecommunications; the "higher than average innovators" Financial Intermediation, Computer and Related Activities, and Architectural and Engineering Activities; "average innovators" Transport and Storage, Technical Testing and Analysis, and Whole Sale and Commission Trade. Nonetheless, no immediate intrinsic distinction other than this could be devised as a cause for this aggregation behavior. Neither, dimension, or exposure to a competitive environment, or intensive technological exposure, for example, appear as clear direct responsible for it, although a compound effect of all or some of them in a systemic framework could be accountable. Again, further research on this subject regarding its persistence or not over time or a more in dept analysis could provide insightful information's valorous for policy design.

The output of innovations in the Services Sector is presented in Figure 24. In contrast with what was observed before has to the type of innovating activity, the Post and Telecommunications sector is the one with lower share of turnover due to the introduction of product innovations slightly above 10%. The Financial Intermediation sector follows somewhat above this performance with 16%. The Transport and Storage, and Wholesale Trade and Commissioning have a share of 32 and 34% respectively, the Architectural and Engineering Activities presents a 50% mark and Computer and Related Activities present the highest value with almost 81% of share of Turnover due to their product innovations.

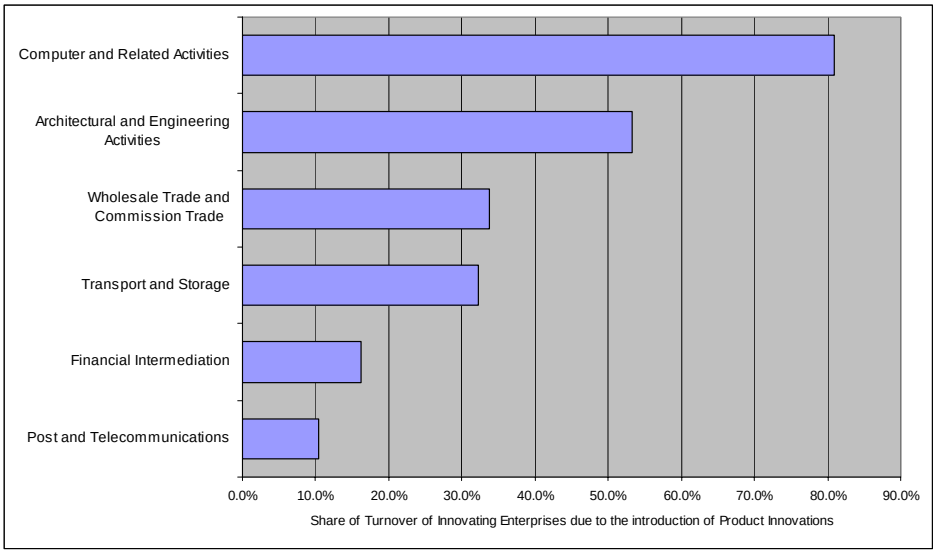


Figure 24 – Share of Turnover of Product Innovating Enterprises due to the introduction of Product Innovations in Services by Sector (%)

IV.2.c. Innovation and Other Characteristics

A set of additional firm's characteristics has been collected in the CIS III. In this chapter, firm's innovation performance will be analyzed through them: if it is part of a group, if it is a startup, location, preferential market, the average value of product life cycle of most important good or service, the occurrence of a merger or sale of the enterprise or partial closure with significant impact in the company turnover, and education and qualification status of the personnel.

The independence level of an enterprise could be assessed by their integration in a group or by being autonomous. In CIS III, it was again verified that enterprises integrated in a group innovate more than those who are not (see Figure 25), although all them increased their share of innovating companies either in the Manufacturing sector or in the Services Sector. The proportion between innovators that are part of a group and those that are not is higher in the Manufacturing sector than in the Services sector, a characteristic also verified in CIS II.

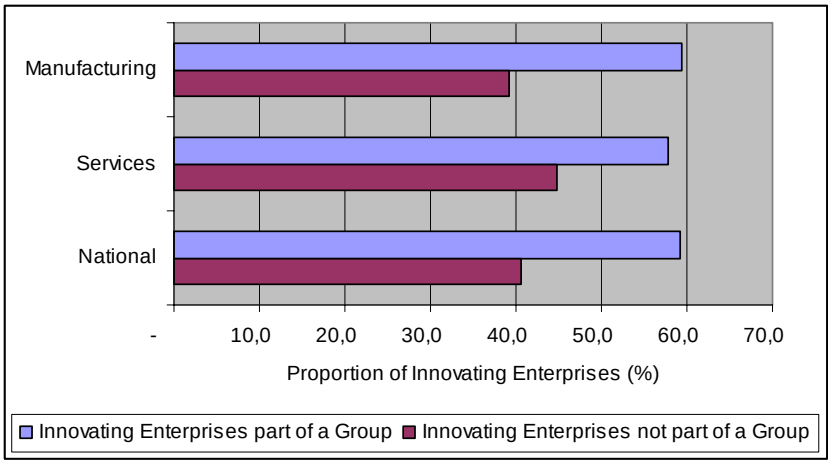


Figure 25 – Innovating Enterprises and their integration in Groups

The international origin or country of head office of enterprises integrated in groups is presented in Figure 26 for the Manufacturing sector and in Figure 27 for the Services sector. In the Manufacturing sector, all but France provide a proportion of innovating enterprises with a value superior the Manufacturing sector average of 42.4% for all enterprises. It is important to note that in the Manufacturing sector, some usually considered more competitive economies like the United States, Germany, France, Japan and Italy have the lowest values for the proportion of innovating enterprises integrated in a group, even lower than the ones integrated in a Portuguese group.

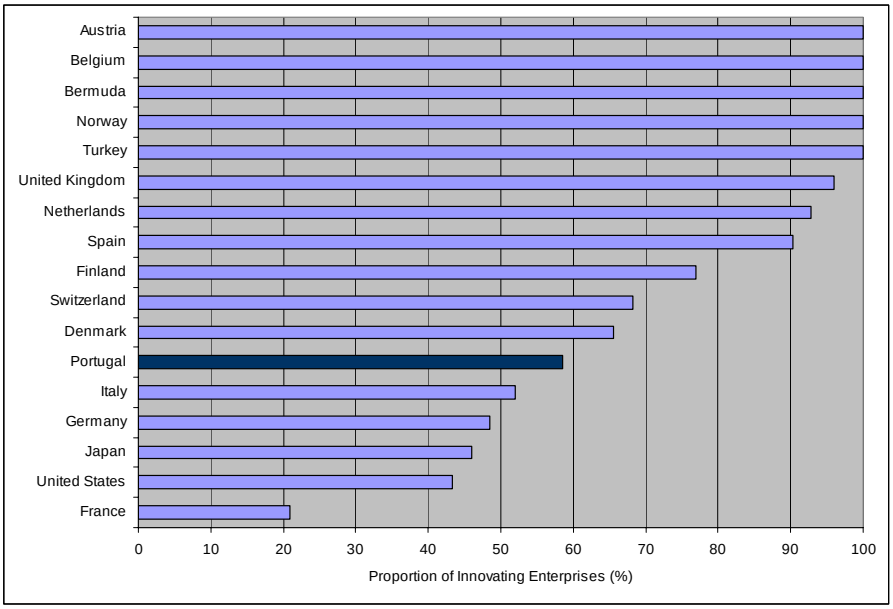


Figure 26 – Innovating Enterprises integrated in a Group in the Manufacturing sector by Country of Head Office

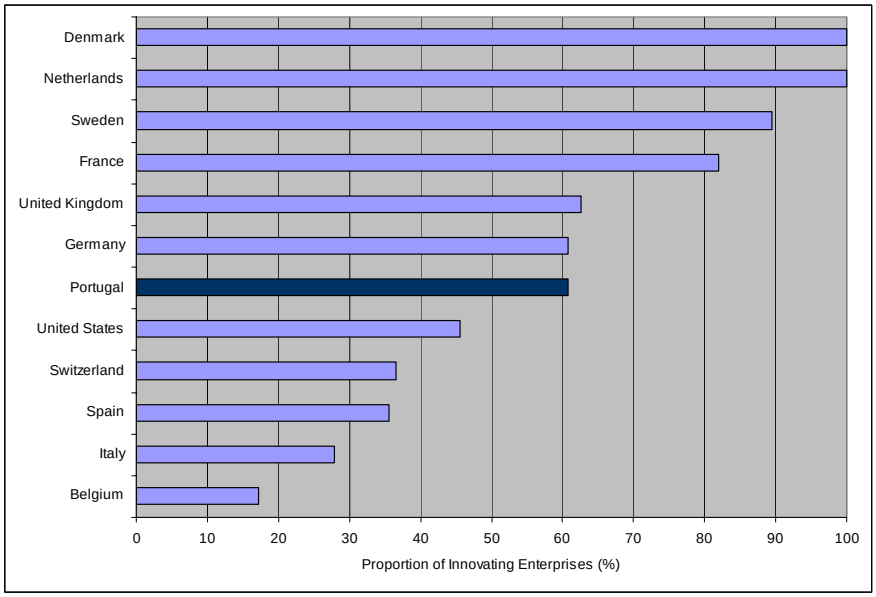


Figure 27 - Innovating Enterprises integrated in a Group in the Services sector by Country of Head Office

In the Services Sector, Switzerland, Spain, Italy and Belgium appear in the group of countries that provide a proportion of innovating enterprises with a value inferior to the Services sector average of 48.7% for all enterprises (United States have a close value). In the Services sector, the referred countries also have a lower proportion of innovating enterprises integrated in a group than the ones integrated in a Portuguese group. Spain, Switzerland and France have inverted positions considering the sector of activity. Spain and Switzerland provide lower proportions of innovating enterprises integrated into a group in the Services sector and a higher proportion in the Manufacturing sector. France on the other hand, provides a lower proportion of innovating enterprises integrated into a group in the Manufacturing Sector and a higher proportion in the Services sector.

The setup year of the company is also a valuable indicator in what concerns innovation performance. Startup companies[13] provide more innovative companies in the Services sector than non-startup companies and the inverse is observed in the Manufacturing sector (see Figure 28). This behavior could be related to the tangible and non-tangible characteristics of the sectors and their relation with the setup time for both types of enterprises and also to the time needed to market the products (usually it takes longer to setup a manufacturing activity than a Services activity). Therefore, in the Manufacturing sector, innovation outcomes could in average take longer to occur than in the Services Sector and occur or not outside the time frame of the survey. However, this hypothesis remains to be verified. It is also to note that only 2.8% of the

[13] Startup companies are considered here as all the companies that were established in the reference period of 1998-2000.

innovators are startup companies in the Manufacturing sector and 2.7% in the Services Sector, and for that reason the results for non-startups is so close to the respective average values.

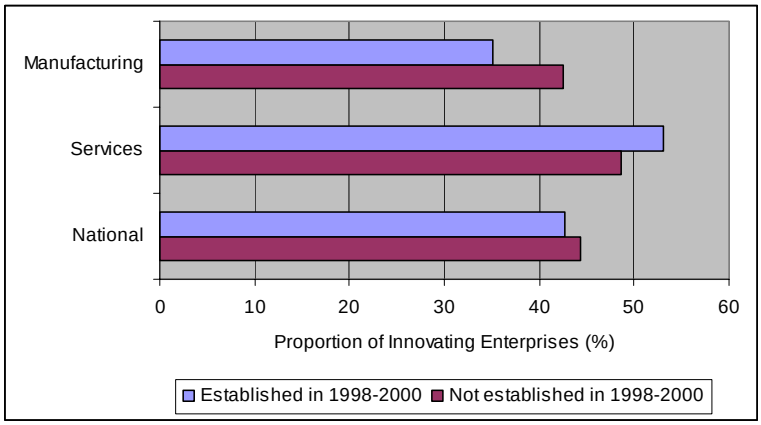


Figure 28 – Startup Innovating Enterprises

In what concerns location, the following figure details the proportion of innovating enterprises and of enterprises engaged in innovative activities by region[14]. The most innovative regions are "Lisboa e Vale do Tejo" and "Centro" with approximately 50% of innovating enterprises. The "Norte" region has a share of approximately 41%, the "Alentejo" region 31% and the "Algarve" region has almost 16% of innovating enterprises. In what concerns innovating activity, the distribution is similar, however the more innovative regions have small difference between the proportions of innovating enterprises and of innovative activity corresponding to "Ongoing or Abandoned Innovating Activity". Moreover, the proportion of effectiveness of innovation (innovating enterprises over those with innovating activity) is of 98% and 96% in "Lisboa e Vale do Tejo" and "Centro" respectively, 93% in the "Norte" and "Algarve" regions, and 92% in the "Alentejo" region. Although not presented in the figure, a similar distribution is obtained either in the Manufacturing or in the Services sector.

[14] The regions comply with the Nomenclature of Statistical Units (NUTS) level 3 regions as defined by the European Union; the conversion table used was dated December 2000.

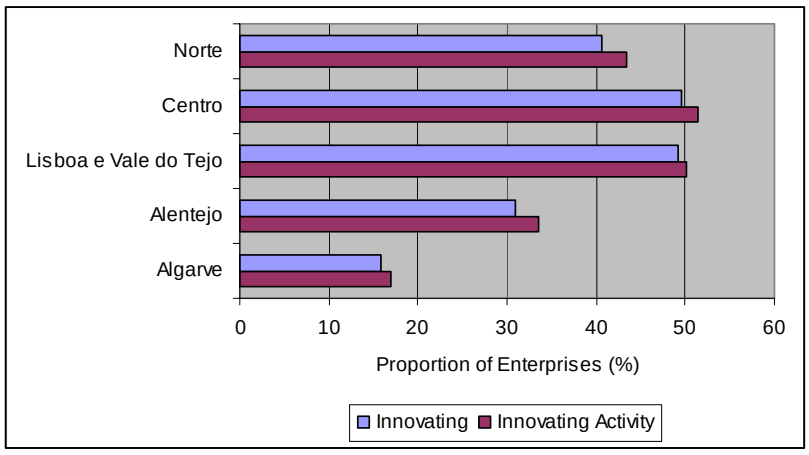


Figure 29 – Innovating Activity by Region

The distribution in terms of preferential market for innovating enterprises is presented in Figure 30. The national market obtains the preference of almost 50% of the Innovating enterprises and, with less importance, the International market 28% and the local[15] market with 20%. The Local market including Neighboring Country obtains the preference of only 3% of the innovating enterprises, even in the Manufacturing and in the Services sectors.

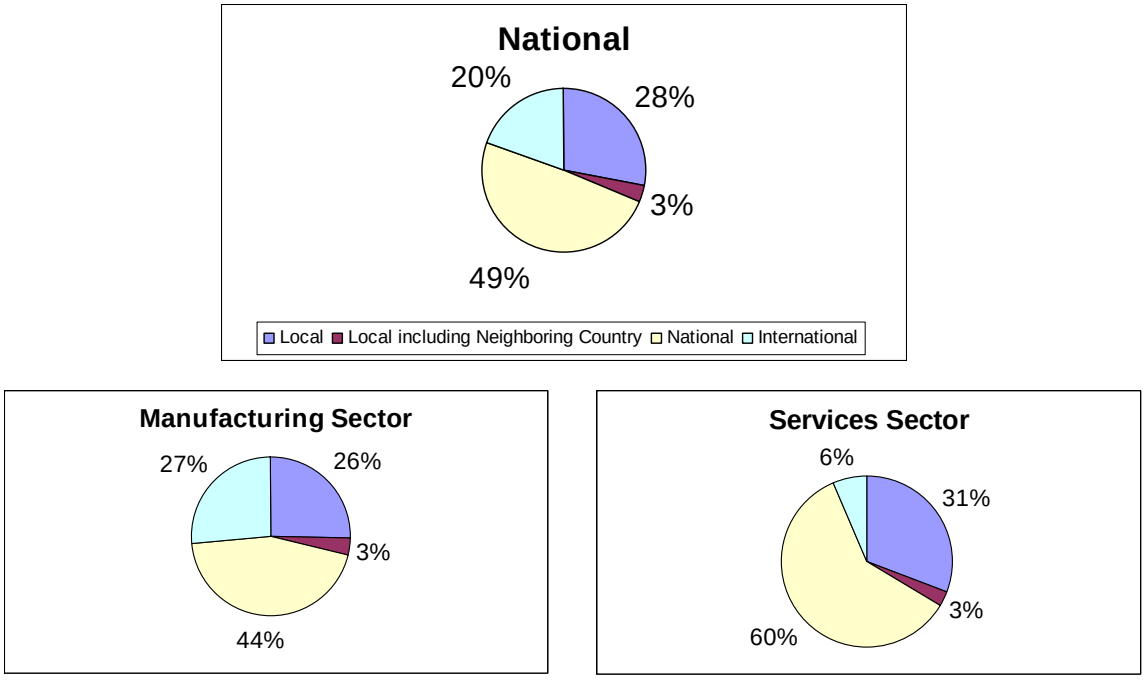


Figure 30 – Innovating Enterprises preferential Market

The great difference in terms of innovators preferential Market between the Manufacturing and the Services sector is the tradeoff between National and International Market. In the manufacturing sector, 27% of the innovating enterprises consider the international market as

[15] "Local" is considered to be the market in approximately a 50 Km radius.

their preferred market, a little more than the 26% that prefer the local market. Conversely, in the Services sector the international market has only 6% of preferences of innovating enterprises and the national market is preferred by 60%. If one considers the distribution of preferred market for non-innovators one obtains similar distributions for Local including Neighboring Country and for the International market. Nonetheless, in the Manufacturing sector for Non-innovating firms the local market increases for 35% of preferences and the international market decreases for 20%. In the Services sector, the local market is also preferred by 40% of the non-innovators and the national market 51%.

The average lifetime of the most important product was asked in CIS III for the first time. The largest obtained response was that it was "Impossible to Answer", from 30 to 50% of either innovating or non-innovating enterprises. Nonetheless, it could be stressed that for the innovating enterprises in the Manufacturing sector the periods "Between 1 and 3 Years" leads the preferences with 22% of the innovating enterprises selecting this period as the average lifetime of their most important product, followed by "Less than a Year", "Between 4 and 6 Years" and "More than 9 Years" with 14 to 15% has the most common periods. In the Services sector, the choice relies mainly in the period "Between 1 and 3 Years" with 19% of the innovating enterprises selecting this period as the average lifetime of their most important product and the period "Less than a Year" with 12%. But more important to notice is that a consistent proportion of innovating and non-innovating enterprises of approximately half of the positive replies expects to change its product in the three years period that CIS uses for reference.

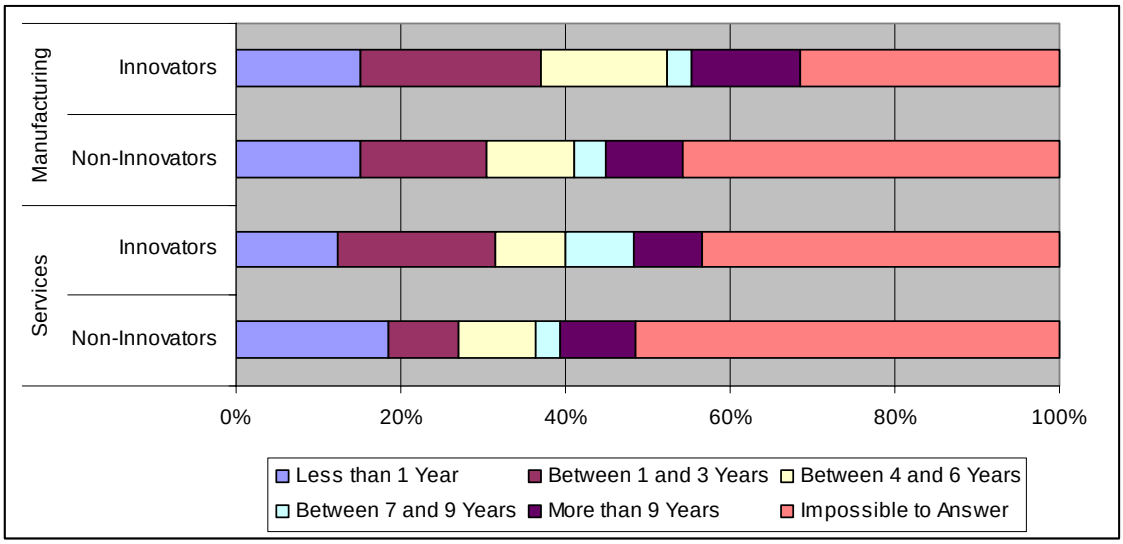


Figure 31 – Average Lifetime of Most Important Product

The number of enterprises that reported turnover changes due to mergers or acquisitions is relatively small. Nonetheless, for innovating enterprises there are more enterprises increasing turnover than decreasing either in the Manufacturing or in the Services Sector. For the non-innovating enterprises, in the Manufacturing sector there are more companies decreasing than increasing the Turnover due to mergers or partial or full enterprises sales; in the Services sector the results are the inverse, the double of the enterprises reported increases in their turnover (see Figure 32).

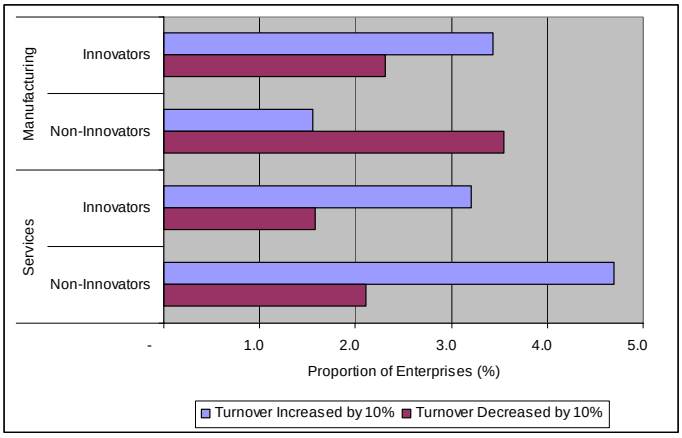


Figure 32 – Turnover changes due to Mergers or Sales of Enterprises in full or in part

Finally, in what concerns higher education, in the Manufacturing sector the innovating companies present an average of 5% of the personnel with Higher Education, a proportion of 2.5 more than the non-innovating companies with only 2%. In the services sector, the average values are two to three times higher and the difference between innovators and non-innovators is smaller. The innovating companies have an average of 14% and the non-innovators an average of 11% of personnel with higher education.

IV.3. Enterprise Options

From the innovation theories presented in the first chapter, it is clear that enterprises own the possibility to choose from a set of options in order to achieve innovation. These inputs, considered in the systemic framework presented earlier, provide additional information to the analysis presented until now. Two sets of possible firms' options were covered in CIS III and will be analyzed next: the resources allocated to innovation; and other strategic and organizational changes within the firms (the so-called non-technical innovations).

IV.3.a. Resources Allocated to Innovation

The resources allocated by firms to innovation covered by CIS III are either of financial nature or human resources. In the former, one has the information regarding the engagement of firms in a set of activities related to innovation and the associated expenditures. These activities are "Intramural R&D", "Extramural R&D", "Acquisition of Machinery and Equipment", "Acquisition of other external Knowledge" and "Design, Training and Marketing". In what concerns human resources, it was only measured the R&D personnel involved in "Intramural R&D" in "full-time equivalent" (FTE)[16] terms.

Innovation Expenditure - Manufacturing

The engagement in innovation activities is presented in Figure 33 for all sectors in Manufacturing. From the analysis of the data, one could see that a larger proportion of enterprises were engaged in the "Acquisition of Machinery and Equipment" for all sectors. The second preference for engagement is "Internal R&D", followed by "Training Activities". The remaining activities have usually low values of engagement for most of the sectors. However, for the more innovative Chemicals sector, and where the proportion of engaged enterprises across all activities is usually higher than in other sectors, the preferred engagement is "Internal R&D" with a significant difference from other proportions of engagement. This preference also occurs with the Transport Equipment sector, but with smaller significance.

[16] The full-time equivalent (FTE) is a simple and common used measure for calculating the engagement of personnel into an activity, either partially or at full-time; it consists in adding to a total only the proportion of engagement in the evaluated activity of a person total time spent in the all the activities it performs (on average).

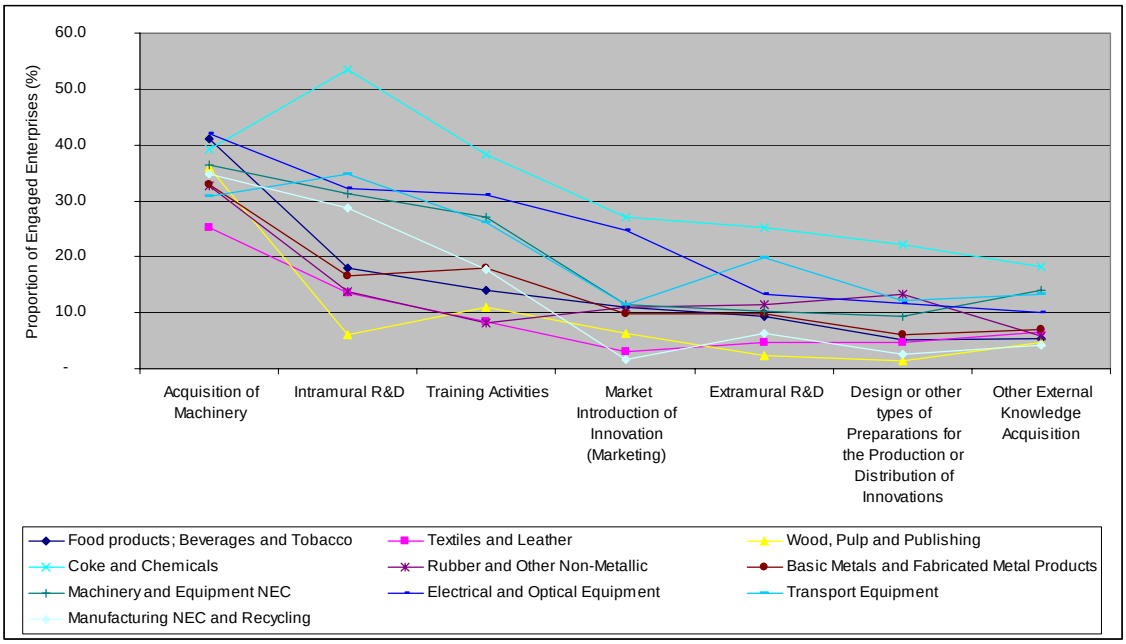


Figure 33 – Engagement in Innovation Activities in sectors in Manufacturing

If we compare this information with the level of expenditure allocated to innovating activities in the Manufacturing sector results presented in Figure 34 it could be also verified that the expenditure in "Acquisition of Machinery and Equipment" still is by far the most important expenditure, with almost 70% of the total available innovation expenditure (almost the same than in CIS II). This activity is closely linked to the innovation diffusion mechanism. The remaining activities, although quite far in terms of relative expenditure, traduced a shift in terms of the options produced by the enterprises. It is significant to say that the relative importance of "Internal R&D" is now above the level of the "Expenditure on Design, Training and Marketing" passing from a proportion of 6% in CIS II to 11% in CIS III. It is also important to note that the proportion of expenditure on "External R&D" also rise from 4% to 7%. On the other hand, the proportion of expenditure in the "Acquisition of Other External Knowledge" decreases its importance from 8% to 2%. These results are consistent with the high rate of innovating activities developed within the enterprise or enterprise group.

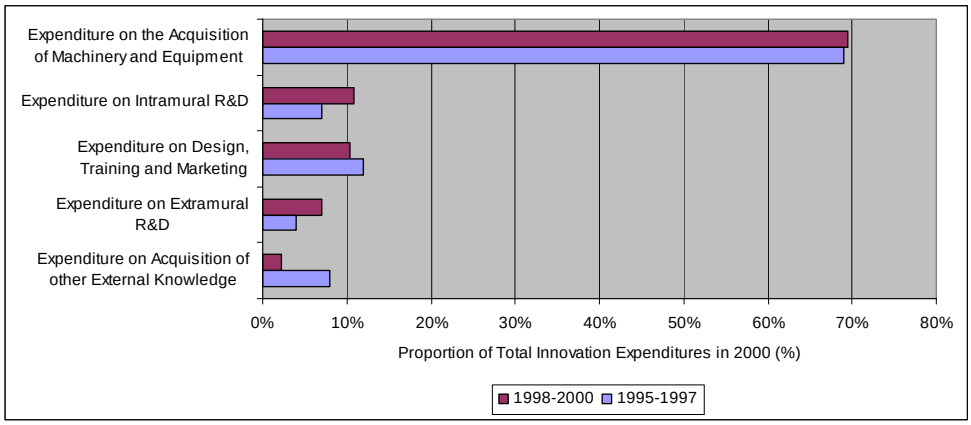


Figure 34 – Distribution of Expenditures in Innovation for Manufacturing Firms

Innovation Expenditure - Services

The profile of innovation engagement in the Services sector provides diversified patterns of choices (see Figure 35). For example, the "Computer and Related Activity" sector presents a high level of engagement in innovating activities as "Intramural R&D", "Training Activities", "Acquisition of Machinery" and "Market Introduction of Innovation", in that order of preference. The "Research and Development" sector is a particular case where all the enterprises are engaged in "Internal R&D" and half are engaged also in "External R&D". As to the "Architectural and Engineering Activities", they present the same level of engagement preference for the "Acquisition of Machinery", "Intramural R&D", "Other External Knowledge Acquisition" and "Training Activities". The "Technical Testing and Analysis" sector however, is only engaging the "Training Activities" and "Internal R&D" in significant numbers. Therefore, sector specificities in what concerns the engagement in innovating activities is verified.

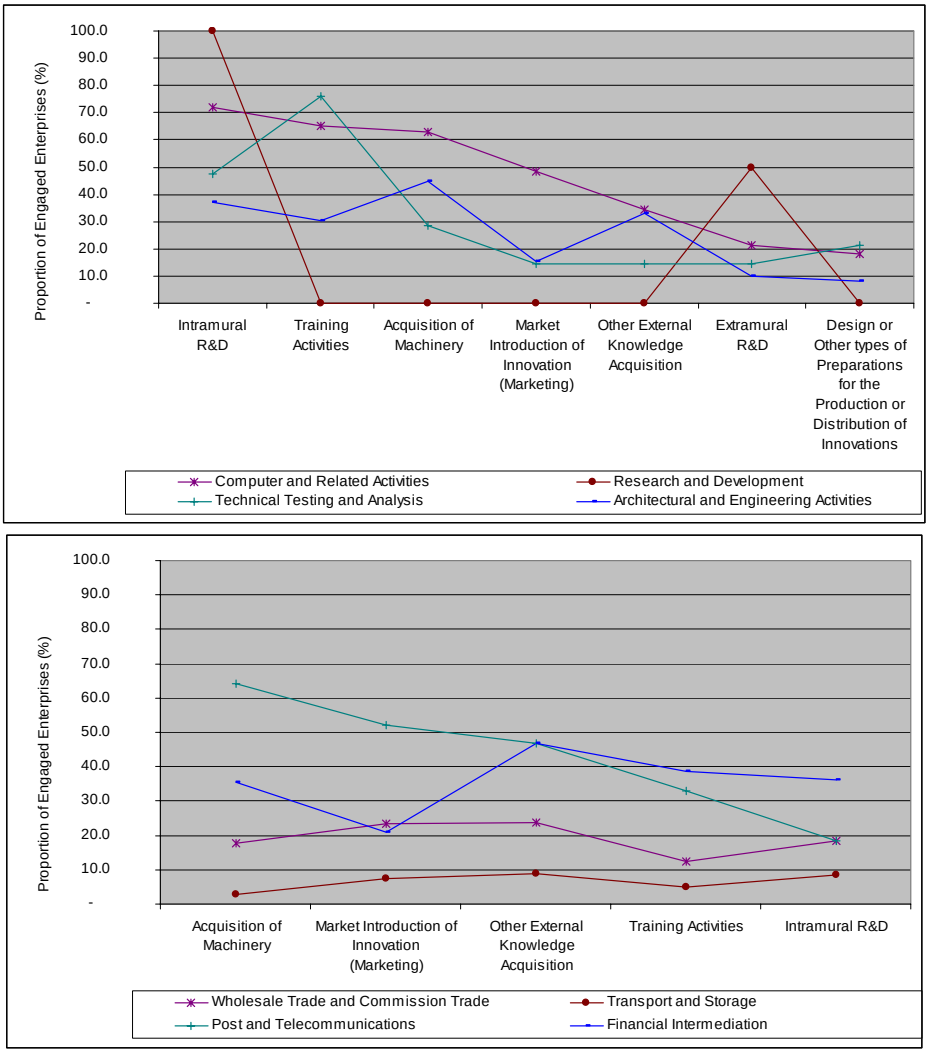


Figure 35 – Engagement in Innovating Activities for the sectors within Services

Considering the proportion of the total innovation expenditure in the services sector, it could be seen that the profile of expenditure changed significantly from CIS II to CIS III. The expenditure in the "Acquisition of Machinery" activity decreases from 35% to 17% in its importance and therefore looses its place as the more important activity. This place has been occupied by the expenditure on "Design, Training and Marketing" passing from 17% in CIS II to 37% in CIS III.

Still, the more radical change was the trade-off between the expenditure on the "Acquisition of Other External Knowledge" (from 45% to 5%) for the expenditure on "External R&D" (from 3% to 29%). This portrays a complete change in attitude towards the innovative activity, probably by searching for the increase in missing internal competencies or even the end of a cycle of setup of new businesses in the services sector that required a huge investment in machinery and "ready made" external solutions.

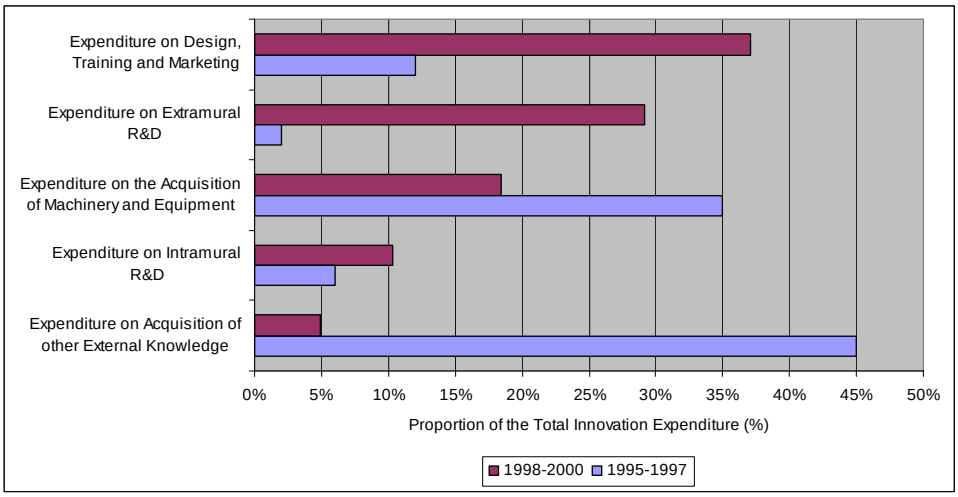


Figure 36 - Distribution of Expenditures in Innovation for Services Firms

Innovation Intensity

The measurement of a firm's innovation efforts in financial terms is provided by Innovation intensity. It is the ratio between the total of Innovation Expenditure and the Turnover of the firm (see Table 21).

	Manufacturing			Services		
	All Firms		Innovators	All Firms		Innovators
	1995-1997	1998-2000	1998-2000	1995-1997	1998-2000	1998-2000
Small	2.0%	3.4%	8.9%	0.4%	1.2%	2.6%
Medium	1.9%	2.4%	3.9%	1.0%	1.3%	1.6%
Large	1.6%	2.9%	3.4%	1.8%	3.9%	4.7%
All	1.8%	2.8%	4.1%	1.6%	2.6%	3.5%

Table 21 – Innovation Intensity for Manufacturing and Services

The observed decrease in this indicator from small to large firms in Manufacturing portrays well the difference in efforts, which is even greater if one had considered only the innovating enterprises. Conversely, in the Services sector the effort observed decreases from the larger to the smaller firms, although the smaller firms present values almost identical to the medium size firms but with significantly lower values than larger ones. When comparing these situations with the variation of the extension of innovation with firm size (larger companies innovate more in proportion), it is clear that the Manufacturing sector small size companies allocate significantly more financial efforts to obtain innovation and achieve poorer results. In the Services Sector this relation is not observed. However, medium size innovating services showed smaller efforts than small and large size innovating enterprises. As expected from the CIS II data, innovating enterprises devote more funds proportionally to their turnovers and therefore more efforts in innovating endeavors.

Overall, the results of innovation intensity increased substantially from the CIS II Nonetheless, it should be noted that in CIS II the EU countries provided diversified intensity vs. extension of innovation results. The results were concentrated in the range from 2% to 4% of innovation intensity for a proportion of 27% to 73% innovating enterprises in Manufacturing (similar in services) with no apparent liaison. This suggests that there is an efficiency discrepancy in obtaining innovations that is not well understood.

Public Funding

An important component of the available innovation resources is public funding. The firms answering to the CIS III reported the public funding engagement present in the table below. The results show a higher level in Manufacturing than in Services in all available funding. Local and regional authorities show a lower value probably due to the usually centralized functioning of public funding in Portugal. The EU was contributing in the reference period of CIS III with public funding for one in each four enterprise in Manufacturing. If one considers the desegregation by innovative and non-innovative firms, the result do not differs significantly from this analysis.

	Local or Regional Authorities	Central Government	EU	EU's Framework Programs
Manufacturing	3.1	15.2	25.0	18.8
Services	0.1	7.8	11.3	7.0

Table 22 – Proportion of Enterprises receiving Public Funding

R&D Personnel

The involvement of R&D personnel in the innovation process obtained from the CIS III is shown in Table 23. Non innovating enterprises show a very small proportion of enterprises with R&D personnel engaged in innovating activities; nonetheless, there are more enterprises with R&D personnel in Manufacturing than in Services, where it is even inexistent in larger companies. The same effect is present in innovators also: there are more enterprises with R&D personnel engaged in innovating activities in Manufacturing than in Services. Again, the proportion of enterprises with R&D personnel is higher in larger than in smaller enterprises (with the referred exception).

		Size Class					
		10 to 19	19 to 49	50 to 99	100 to 249	250 to 500	Over 500
Manufacturing	**Non-Innovators**	1.2	1.7	0.4	3.4	2.8	-
	Innovators	10.3	9.0	27.8	33.3	44.8	61.7
Services	**Non-Innovators**	0.4	0.6	0.5	-	-	-
	Innovators	12.9	15.1	30.7	38.1	56.4	53.2

Table 23 – Proportion of Enterprises with R&D Personnel engaged in Innovating Activities

		Size Class						
		10 to 19	19 to 49	50 to 99	100 to 249	250 to 500	Over 500	Sub-Total
Manufacturing	Non-Innovators	115	78	18	54	26	-	**292**
	Innovators	597	1,153	1,716	2,388	1,311	849	**8,014**
Services	Non-Innovators	35	192	25	-	-	-	**253**
	Innovators	910	753	330	470	414	834	**3,710**

Table 24 – Number of R&D Personnel in FTE engaged in Innovating Activities

In what the concerns the FTE numbers of R&D personnel engaged in R&D, there was a total of 12.268 FTE involved in innovating activities in the Manufacturing and Services sectors (see Table 24). In what concerns the non-innovators, the same situation as reported before occurs. However, in what concerns the innovators, medium size companies provide the gross of the innovators in Manufacturing and the situation is inverted in Services where smaller and larger companies provide higher FTE. In average terms, the non-innovators have an average below 0.5 FTE per enterprise for both sectors (therefore, zero FTE). The innovators in Manufacturing are respectively, from smaller size class to larger {0, 1, 2, 3, 5, 7} FTE R&D personnel. In the Services sector this average is higher in larger enterprises, respectively of {1, 1, 1, 2, 6, 17} FTE R&D personnel.

IV.3.b. Other Strategic and Organizational Important Changes

In the CIS III it was a novelty to ask for some activities implemented in the domain of the so-called non-technological innovations. However, it was not asked if they contributed for the innovating activity. The five activities surveyed were the implementation of new or significantly modified corporate strategies, the implementation of advanced management techniques by the enterprise, the implementation of new or significantly altered organizational structures, significant changes in the marketing strategies or marketing concepts, and aesthetic changes by design or other type of subjective changes in products.

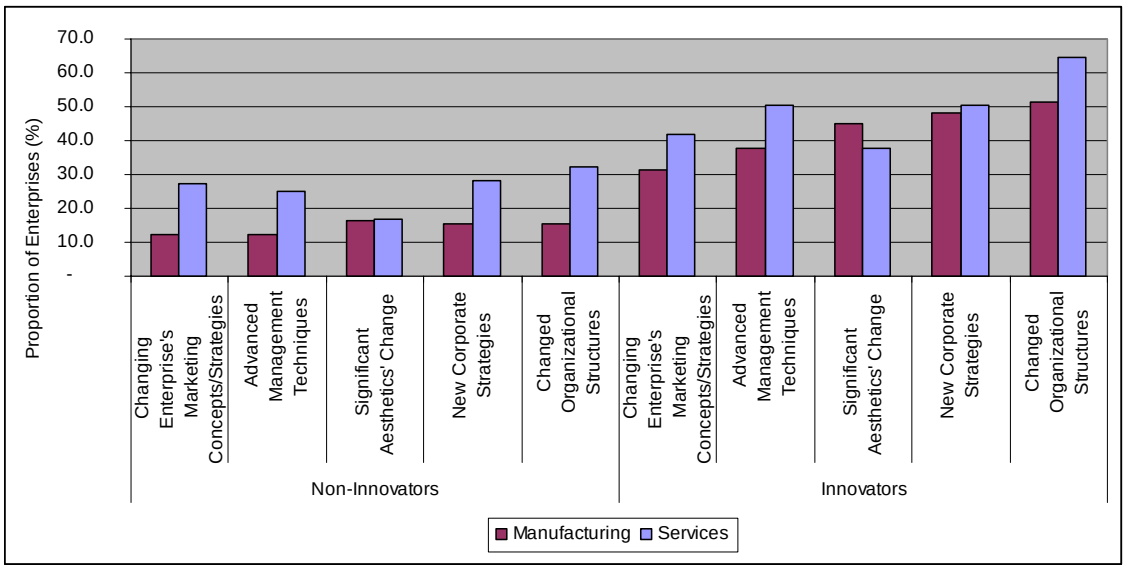


Figure 37 – Other Strategic and Organizational Changes

It is clear from the data presented in Figure 37 that a larger proportion of innovating enterprises implement strategic and organizational changes than non-innovating enterprises. It is also valid to say that a larger proportion of enterprises in the Services sector introduce more strategic and organizational changes than the enterprises in the Manufacturing Sector. An exploratory hypothesis of this phenomenon could be the more intangible character of Services that provide a more fruitful environment to deal with changes. The exception to this rule is the changing of the aesthetics' of a product, usually more valued in goods than in services. It is interesting to note that the most implemented option by innovating companies in both sectors was to change organizational structures (65% and 50% of the innovating enterprises in Services and Manufacturing), followed by the implementation of new corporate strategies (50% and 49%, respectively). It should also be pointed out that a proportion of also 50% of the innovating companies in the Services sector implemented advanced management techniques.

If one unfolds the analysis of these non-technical innovations through enterprises size class it is verified that 60% of the larger innovating companies in the Manufacturing sector implement consistently almost all of the activities, with the exception of changing marketing concepts/strategies (see Figure 38). Small enterprises however, appear to be engaged at a lower proportion but consistently in all activities, although in a proportion around 30%. Therefore, the effect of the size of the enterprise is also a factor that conditions the option to implement other strategic and organizational changes. This occurs similarly in the Services sector although with some self-evident specificities (see Figure 39).

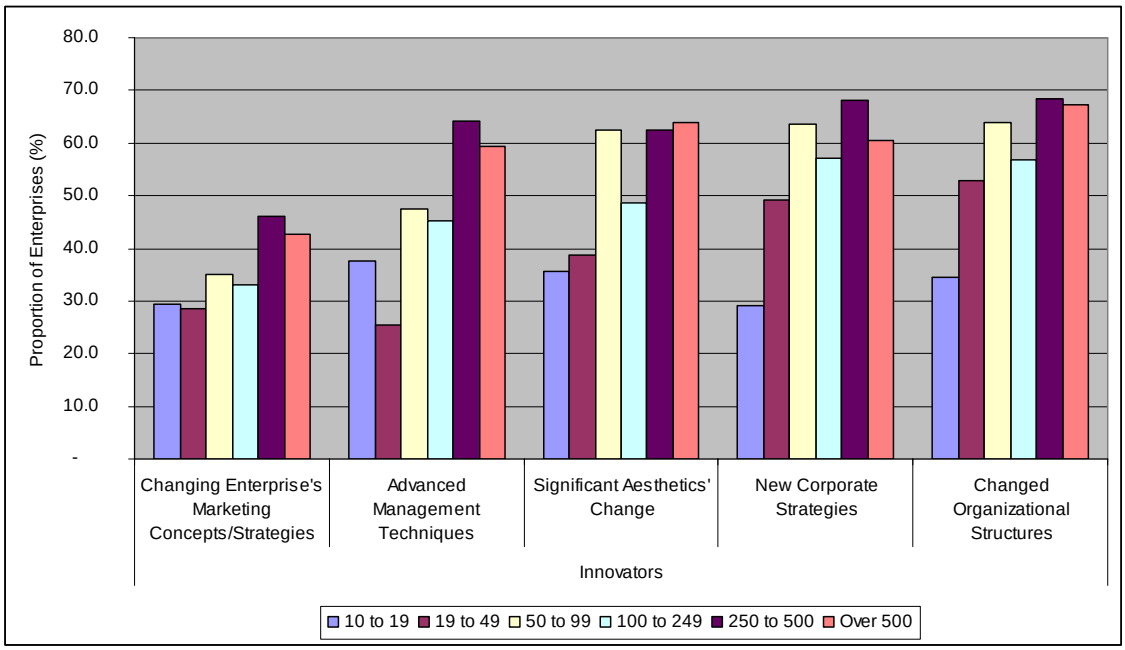


Figure 38 – Other Strategic and Organizational Changes in Innovating Enterprises - Manufacturing

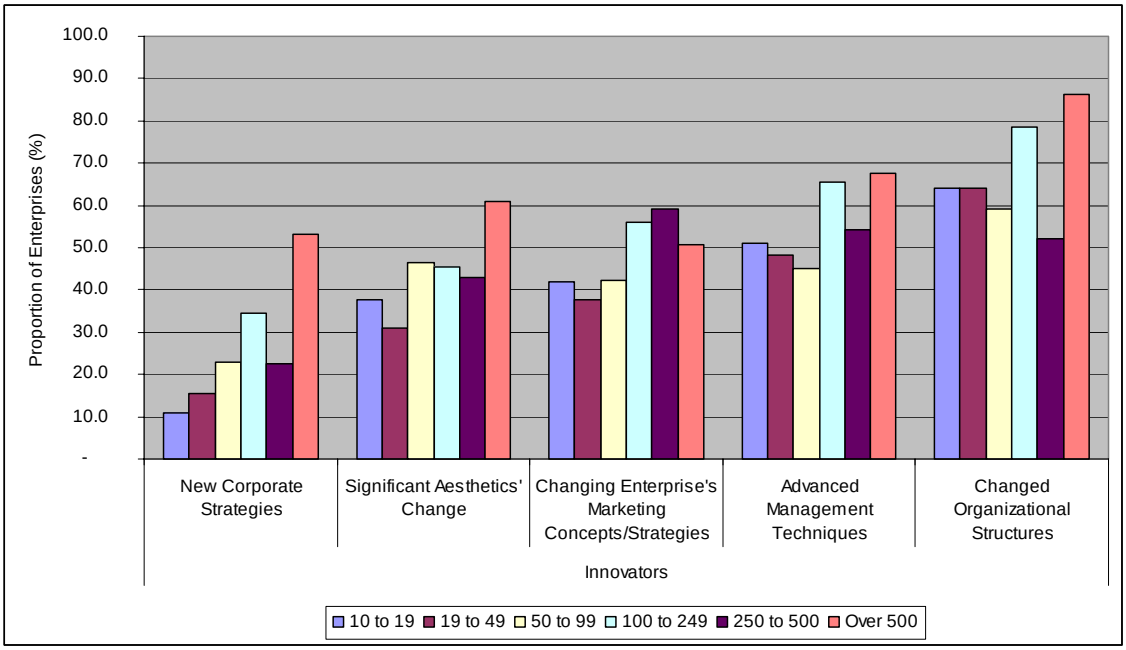


Figure 39 - Other Strategic and Organizational Changes in Innovating Enterprises - Services

IV.4. Some Systemic Characteristics

The CIS is an instrument that lays on the work developed in the Oslo Manual which provoked a rupture with the old linear model tradition of measuring only visible inputs to innovation (R&D; patents; publications), by providing the tools for measuring the innovations output in firms (products; processes). Additionally, it opened the way for measuring some of the interactions

within the innovation system. In this chapter, some of these interactions surveyed in the CIS III that follow in the realm of systemic characteristics of innovation will be analyzed: *Sources of Information and Cooperation*, *Innovations Barriers* and *Innovation Effects*.

IV.4.a. Sources of Information and Cooperation

An innovation project is not generated spontaneously. Although some of the initial ideas that could be traced *ex post* appear as "solitary thoughts", the final innovation output is a product of a long way with many twists and turns, setbacks, feedbacks and interactions. Moreover, some usual sources referred in innovation scholarly work already reviewed in chapter II, appear clearly as inputs to the innovation process and, more important, open diverse two way interactive links between the players in the system. These usual sources of information and cooperation were listed in CIS III where it was asked to the firms to evaluate the importance given to them, ranging from highly important to not relevant. The distribution of the replies is presented in the figure below for the innovating companies in the Manufacturing sector.

Sources of Information

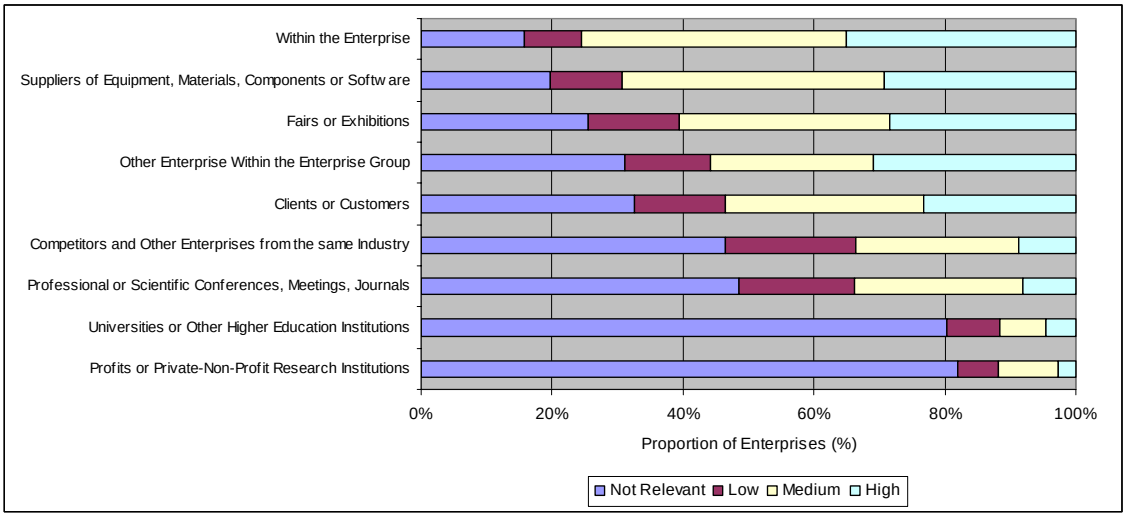


Figure 40 – Sources of Information for Innovative Enterprises in the Manufacturing Sector

The sources of information more relevant (High and Medium) for the innovating companies in the Manufacturing sector were clearly within the enterprise, suppliers, fairs, within the group, and clients or customers, all equal or above a threshold of 50%. Other sources presented values of preferences below 5% for highly relevant.

Following the sector analysis performed earlier, Figure 41 presents the proportion of innovating enterprises in each technological intensity sector considered as highly relevant sources of information.

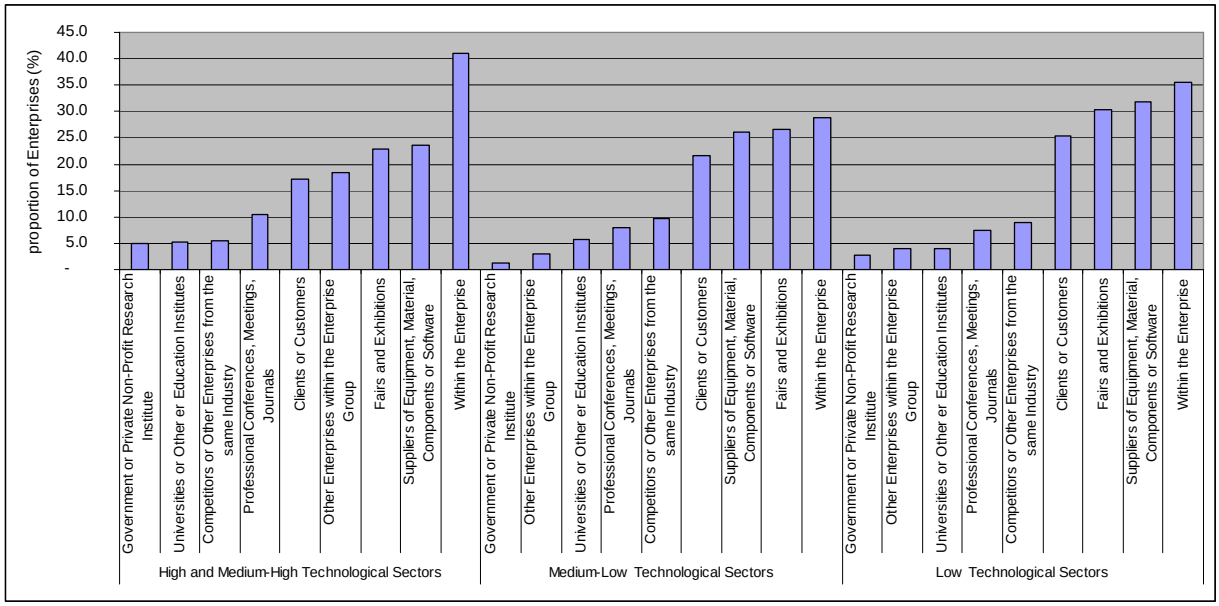


Figure 41 – Highly Relevant Sources of Information by Technological Intensity sectors in Manufacturing

The within the enterprise sources are still the more relevant when detailing the analysis by technology intensity sectors. Especially in the High and Medium-High Technological sector where it almost doubles the other significant preferences. All three classifications have more or less the same preferences with only some changes in the order of preference of the activities. Therefore, there are not significant sector characteristics at this level. Even the Services sector presents the same distribution of highly relevant sources (see Figure 42).

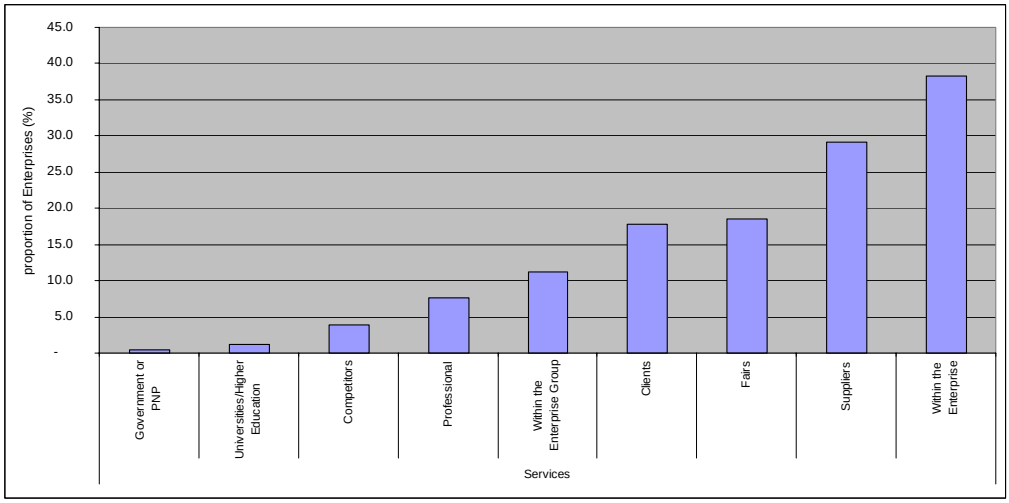


Figure 42 - Highly Relevant Sources of Information in Services

Cooperation

The sources of information provide a common ground for the development of privileged linkages on the innovation process. These cooperation linkages with preferred partners are analyzed next. The number of innovating enterprises reporting to have established cooperation agreements with other enterprises or institutions was 17.6% for the services sector, 13.1% for the Low technological sector, 14% for the Medium-Low technological sector and 29.8% for the High and Medium-High technological sector.

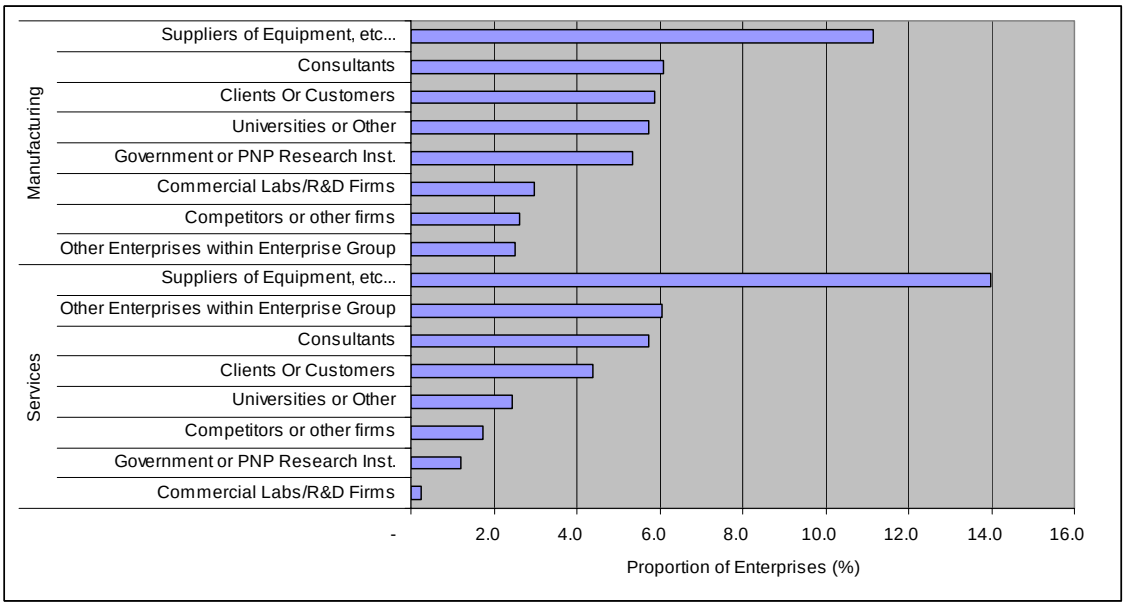


Figure 43 – Highly Relevant Cooperation Partners in Manufacturing and Services

Both Manufacturing and Services share the same cooperation preference for the most likely highly relevant cooperation partners: "suppliers of equipment, materials, components or software", almost double the second choice for highly relevant cooperation partners. The remaining partners' preferences are almost identical for both sectors with changes in their order. However, in Manufacturing the "cooperation with other enterprises in the same group" falls to the last position, while in Services it occupies a strong second in preference.

A comparison with CIS II values for Portugal and with the previous European average, in what concerns the relevance of innovation sources, is provided in the next figure for the Manufacturing sector.

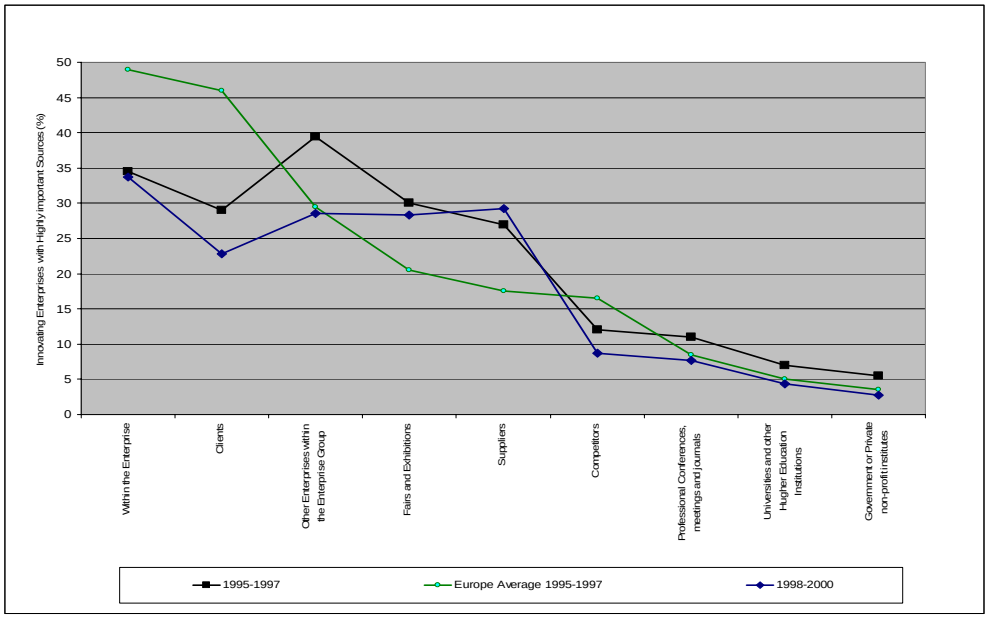


Figure 44 – Innovating Sources of Highly Importance for Manufacturing – CIS II EU Average

With the important exception of the sources within the enterprise group that has decreased slightly bellow the CIS II European average dropping 11 percentage points, the profile of the Portuguese innovation sources for the Manufacturing sectors is equivalent to the previous in CIS II. This is a robust result that also occurs in the Services sector (see Figure 45). In both figures, it is possible to see that although some of the values for the preferences in CIS III dropped, they do it mainly by lowering all of the observed profile, sometimes more than others, nevertheless, in a consistent almost "interlinked" way.

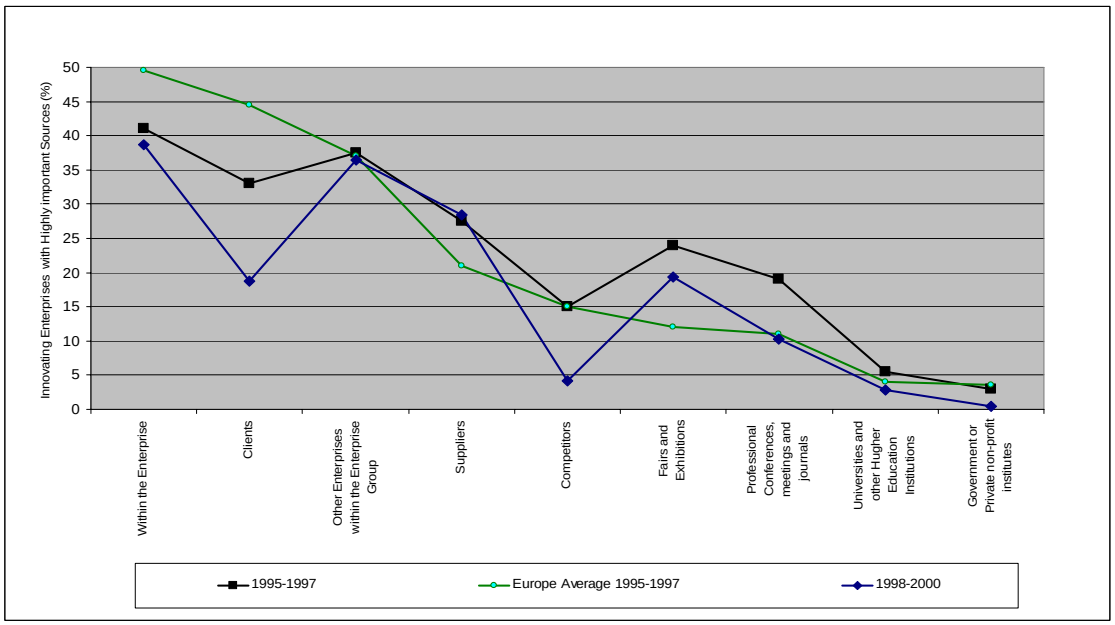


Figure 45 - Innovating Sources of Highly Importance for Services – CIS II EU Average

IV.4.b. Innovation Barriers

The innovation barriers perception by the enterprises and their reporting, are a major tool for recognizing the problems emerging in the innovation process. As known, the innovation process is full of failures and setbacks that many times provide the basis for future innovations. Nonetheless, it is important to recognize if there is more to it, i.e. if there are systemic imperfections within the innovation process that should be corrected or even eliminated. Again, from a number of situations described in the reviewed literature, a set of barriers towards innovation could be identified. The CIS III surveyed some of these problems that hinder the innovation process, which are detailed next.

The CIS provides data concerning the shortcomings of the innovation activities: if they were delayed, not initiated or canceled (see next figure). The largest proportion of enterprises reported that they had projects seriously delayed, in services or manufacturing, either innovator or non-innovator. The second largest proportion was of those firms that reported that their activities didn't even start. The canceled activities were of minor importance when compared with the two other shortcomings.

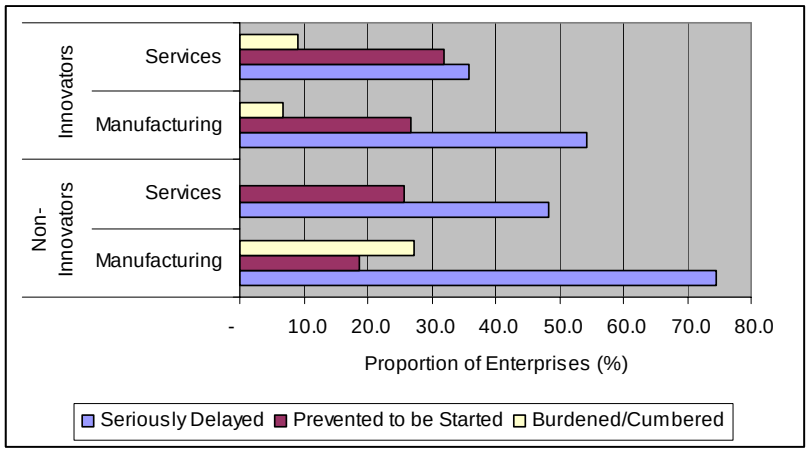


Figure 46 - Enterprise with Innovating Activity

In what concerns the non-innovators in the Services sector, there are no canceled projects and in Manufacturing, canceled projects were reported in higher proportion than the ones that didn't start.

The enterprises not performing any innovating activity were asked for a set of factors to justify their options: if innovation oriented activities were not justifiable due to prior innovations, due to market conditions or due to other hampering factors.

	Prior Innovations	Market Conditions	Factors impeding Innovation
Manufacturing	23.8	60.6	74.4
Services	20.0	58.5	57.5

Table 25 – Innovating Activities Failure Factors
(Proportions of Enterprises, %)

One could see from the previous table that for the Manufacturing sector, "other factors impeding innovation" are the large proportion of answers and that the market conditions are also highly valuated. In the Services sector, both these referred factors had equivalent weights in failing to engage in innovating activities. Prior innovation development presents a small fraction on both sectors, i.e. the development of a previous innovation that hinders innovating activity is not significant.

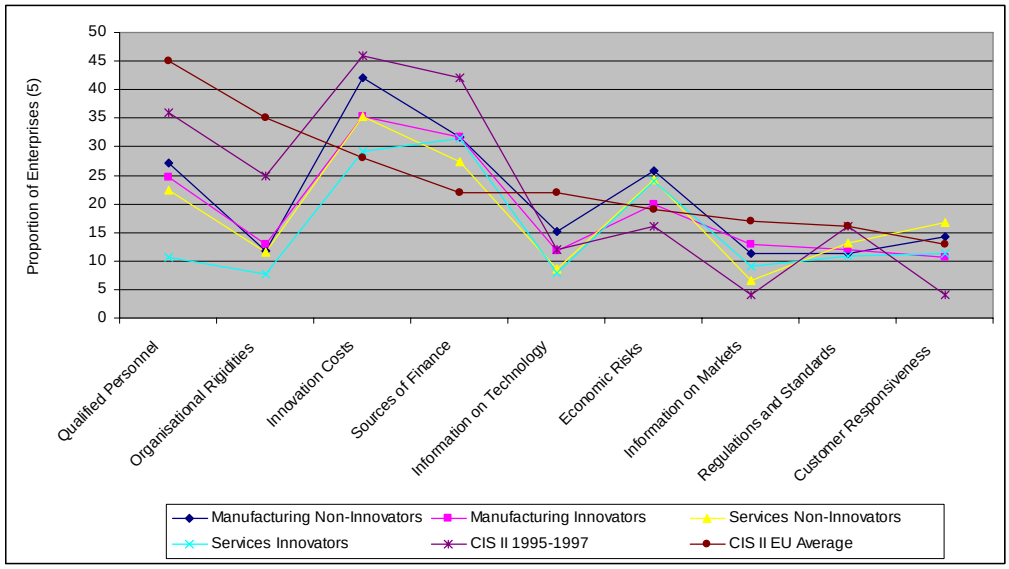


Figure 47 – Innovation Barriers of Higher Importance for the Manufacturing Sector

The innovation barriers reported in both sectors followed closely the same profile obtained in CIS II. In the Services sector it could be observed a drop in both innovators and non-innovators from the CIS II values. However, this is of course more drastic in the innovating companies. The manufacturing sector although with more problems concerning the innovation barriers, decreased its perceptions on the barriers or even surpassed some of the barriers. The latter is consistent nonetheless, with the improvement in the indicators of innovation extension and therefore with the evidence of less problems. This barriers profile, appear in what could be perceived as an intrinsic characteristic of the Portuguese economy.

IV.4.c. Innovation Effects

The innovation objectives collected in CIS II were changed to the effects observed in the end of the innovation process. Therefore, only enterprises achieving innovation replied. Their degree of relevance will be measured by the effects reported as having a high to low or not relevant degree of impact. A set of nine effects is analyzed for both the Manufacturing and the Services sector, divided by effects associated to the products, to the processes and other additional effects. For that reason, they will be presented in the next figures without comparison with the CIS II values for Portugal and the EU average.

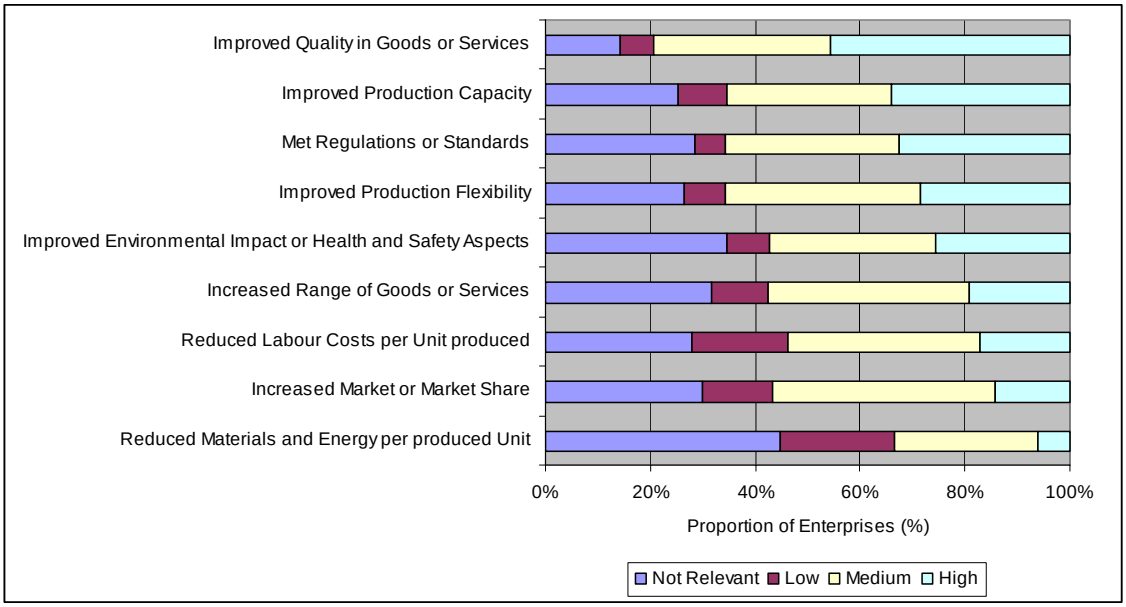


Figure 48 – Effects of Innovation in the Manufacturing sector

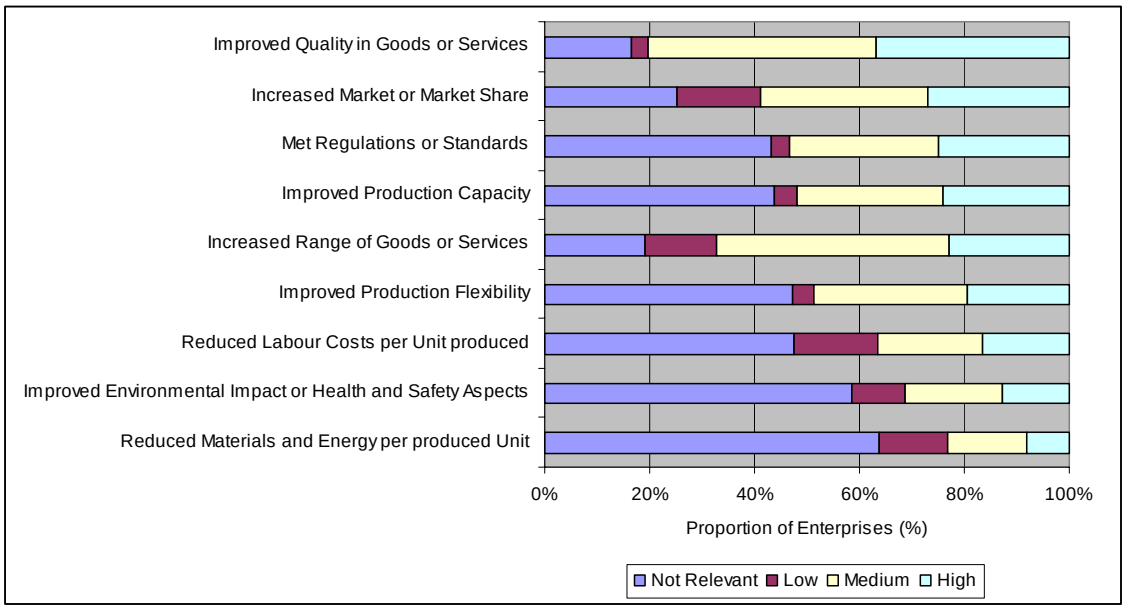


Figure 49 - Effects of Innovation in the Services sector

Despite having some differences between both, Manufacturing and Services consider the improvement in quality as the more important innovation effect. The following important effects for Manufacturing are those generally linked with the core of industrial activity: meeting regulations and standards, production capacity and flexibility. Services however, give their second best importance to the ones linked to marketing and also functional activity: increasing market and market share; increasing the range of services; meeting regulations and standards; and improving capacity and flexibility.

An interesting exercise is to compare the relevance of the objectives of innovation reported in CIS II by the enterprise involved in innovation activities with the effects reported in CIS III by the enterprises that achieved innovation. This will be conducted by evaluating the respective proportions of enterprises declaring highly relevant objectives/effects (only for the manufacturing sector). In the Manufacturing sector in CIS II the main objective was to improve quality (around 70%). For the CIS III, the reported effect of more relevance and proportion was the improvement in quality of goods and services (46%). The second and third more referred objectives were to increase market or market share (around 44%), and to reduce labor costs (around 40%). The effects were respectively to improve production capacity (34%) and meeting regulations or standards (33%). In fourth in the order of importance of the objectives, appears the flexibility of production (around 38%) and in the effects, the same production flexibility (29%). The objective to increase the range of goods or services (around 31%) and the reduction of environmental damage (around 27%) follows on the list with the corresponding effects of environmental damage (26%) – now merged with health and safety issues – and increase in the range of goods and services (19%). The last four objectives in the list were to comply with

regulations and standards (around 25%), to reduce the consumption of energy (around 22%), to reduce the consumption of materials (around 22%), and to substitute products (around 18%). The corresponding effects were reduced labor cost per unit produced (17%), increased market or market share (14%) and reducing materials and energy (6%). From the details presented, it is clear that the range of proportions of highly relevant effects is reduced when compared with the range in the objectives reported in CIS II. Although, the main objective was related to the main effect observed as relevant, two expectations were not accomplished in the desirable level. They were: increase the market or market share; and to reduce labor costs. A similar analysis to the Services sector revealed an equivalent discrepancy between the desirable objectives in CIS II and the observed effects in the CIS III.

Chapter V Interpretation and Discussion

In the previous chapter, it has been presented a set of bivariate descriptive analysis to the innovation data for Portugal from the CIS III. The results of this exploratory analysis, allow the identification of explanatory variables that could be included in multivariable model approaches. However, the main goal of this work is to test a model already presented in the literature (and not to develop a new one), in order to verify its consistency towards the identification of determinants of innovation in Portugal. However, it is clear that researchers developing and improving multivariate models to test possible determinants of innovation in Portugal, will benefit and eventually capture new insights from the results discussed here. On the other hand, it should be noted that the CIS III captured some of the interactive nature of the innovation process, but does not involve the measurement of all the systemic characteristics recognized in the innovation models developed on the scholarly work presented in Chapter 2. Therefore, the interpretation and discussion of the CIS III results in this chapter will be constrained by these conditions. Even so, the implications of the results will be discussed in terms of policy design.

V.1. Determinants of Innovation in Portugal

The determinants of innovation for Portugal have been recently studied. For the sake of comparability and because it is not our purpose to develop it, the multivariate model under test will be the one developed for Portugal that breeds on the most recent empirical work on Portuguese innovation data from the CIS II (Conceição and Heitor, 2002; Conceição et al., 2003). Nonetheless, it should be noted that the analysis of the determinants of innovation is complemented by a cross-country comparison with other EU member states that provided CIS III data. This benchmarking of reference indicators will provide a view of the positioning of Portugal in the EU context and also clarify some preconceived ideas that could affect negatively policy design and implementation.

V.1.a. A Regression Analysis

The model to be used for testing is the one proposed by Conceição and Heitor for Portugal specificities that resulted from the analysis of the CIS II and from the scholarly work on innovation theories presented in Chapter 2. This model was only developed for the Manufacturing sector, and a similar analysis is of great interest on the Services sector. However, adaptations of the model will be undertaken due to the different characteristics of

Manufacturing and Services. It is not enough to stress that, although a statistical relationship could be found in the data, it cannot per se determine the existence of causality as inferences are supported in theories.

The model of Conceição and Heitor was developed based on two characteristics correlated with innovation in all known innovation studies, firm size and the integration of a firm into a group. It was added an additional characteristic of the Manufacturing sector to this "uncondioned" model, which presented interesting results in bivariate analysis, the technological intensity[17]. The model[18] considered innovation as a dichotomous dependent variable (1 if a firm innovates, 0 otherwise), and it is constructed by using as explanatory variables the firm dimension (Log of number of employees), the integration into a Group, the technology intensity (divided in two dummy variables High/Medium-High and Medium Low).

$$\mathrm{Innov}_i = a + b * \mathrm{Group}_i + c * \mathrm{Log(no.Employees)}_i + d * \mathrm{HiMHTech}_i + f * \mathrm{MLTech}_i + \mathrm{err}$$

Equation 1 - Model on the Characteristics of Innovative Manufacturing Enterprises by Conceição and Heitor

The results obtained in the construction of this model and using CIS II data (see Table 26) showed that the sector effects were not strong determinants of innovation (when the size of the firm and the integration of the firms were controlled). However, when considering only two groups of firms by technological intensity, the firms belonging to the High/Medium-High technology group had more probability to innovate than the average firm (when the size of the firm and the integration of the firms were controlled). This was a characteristic that was not linked to a simple sector effect but was determined to be a characteristic of a large group of sectors that have in common belonging to the High/Medium-High technology category.

CIS II	***coefficient***	***Standard Deviation***	***p-values***
Intercept	-1.773	0.2562	0.0000
Group	0.474	0.1435	0.0009
LogEmp	0.224	0.0625	0.0003
HiMHTech	0.757	0.1380	0.0000
MLTech	0.163	0.1163	0.1614

Source: (Conceição and Heitor, 2002; Conceição et al., 2003)

Table 26 - Results of the Logistic Regression for Manufacturing for CIS II data

[17] As proposed by OECD in the Oslo Manual (OECD, 1992, 1996) and used in Chapter 4.

[18] See (Conceição and Heitor, 2002; Conceição et al., 2003) for complete insights on the model development.

The results of a logistic regression applied to the CIS III data are displayed in the table below.

CIS III	*coefficient*	*Standard Deviation*	*p-values*
Intercept	2.454	0.073	0.0000
Group	0.218	0.054	0.0001
LogEmp	1.249	0.047	0.0000
HiMHTech	0.547	0.052	0.0000
MLTech	0.589	0.041	0.0000

Table 27 – Results of the Logistic Regression for Manufacturing[19]

As presented in Table 27, all the coefficients were positive and showed to be significant at less than 1% with lower standard deviations. However, both technology intensity variables presented similar coefficients, a situation that did not occur with CIS II data. Another change was that the coefficient of *LogEmp* (firm size) is significantly higher than any of the other variables. With CIS II data this did not occur and the High/Medium-High coefficient was dominant over "integration into a group" and "integration into a group" over firm size. With CIS III data, firm size appears as the cause more explanatory of innovation, surpassing the effects of technological intensity and even of "integration into a group". The constant passed from a negative value in CIS II to a positive value in CIS III.

These results do not condition the surfacing of other factors influencing innovation that certainly occur as expected from theory. Even so, it appears that with a great probability innovation occurred in Manufacturing within larger enterprises that belonged to a High/Medium-High or Medium-Low technology sector, and were integrated into a group. Further refinements of the evaluated model could expand the analysis into additional determinants of innovation and support the robustness of the model[20].

For the services sector Conceição and Heitor did not developed a model. However, one should try to evaluate the Services sector. A possibility it is to modify the model for manufacturing by aggregating some of the businesses within services by 2 digits NACE using the classification provided by OECD in the Oslo Manual for Services (see Table 28).

[19] A PROBIT regression presented results equally statistically significant with similar relations between the coefficients, although with lower values in absolute terms.

[20] Conversely, the unconditioned model with only group and LogEmp showed the same level of significance and the relations of the coefficients was also similar.

Sector	NACE
Wholesale Trade	51
Transport and Storage	60-63
Post and Telecommunications	64
Financial Intermediation	65-67
Computer and Related Activities	72
Research and Development	73
Architectural, Engineering Activities and Other Technical Activities (Technical Testing and Analysis)	74 (only 74.2 and 74.3)

Table 28 – Business Classification in Services for Model Analysis

$$\text{Innov}_i = a + b * \text{Group}_i + c * \text{Log(no.Employees)}_i + \sum_{j=1}^{6} d_j * \text{Sector}_{ij} + \text{err}$$

Equation 2 - Model on the Characteristics of Innovative Services Enterprises by Conceição and Heitor

However, the logistic regression analysis of the model in Equation 2 resulted inconclusive, with the coefficients being statistically not significant for most of the variables. The unconditioned model with "integration into a Group" and *LogEmp* showed the same behavior as in Manufacturing, with all coefficients being statistically significant at less than 1% and with higher influence of the size of the enterprise in the probability to innovate.

	coefficient	*Standard Deviation*	*p-values*
Intercept	1.770	0.110	0.0000
Group	0.211	0.059	0.0003
LogEmp	1.179	0.080	0.0000

Table 29 – Unconditioned Model Logistic Regression Results for Services

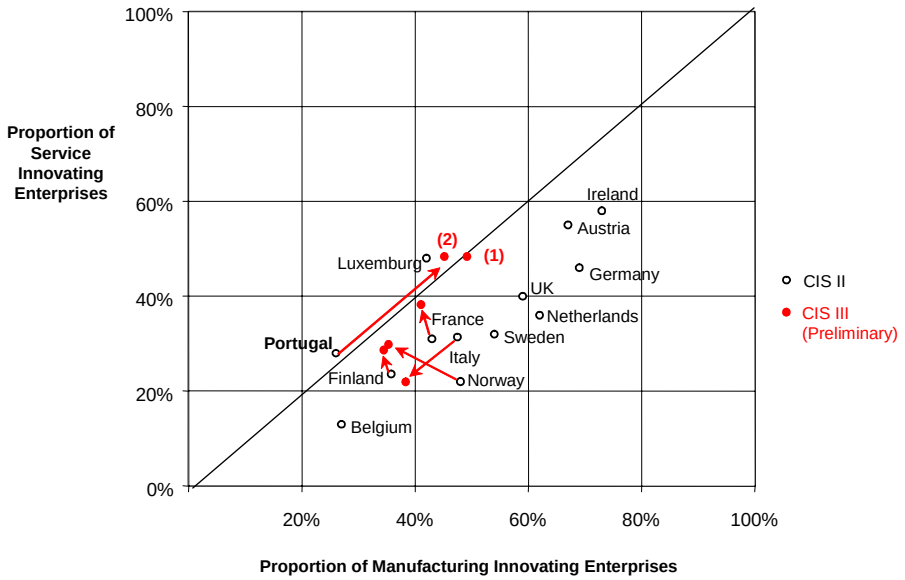
As a final note, it should be stressed that the determinants of innovation evaluated present only a partial view of the innovation process. Due to the overall increase in all the innovation output indicators for enterprises, pervasive for all sectors of activity, these determinants could be less perceptive from the descriptive analysis of the CIS III indicators surveyed. Nonetheless, in confrontation with the existent innovation theories, a number of hypotheses concerning other explanatory variables could be tested and more robust and explanatory models developed. Moreover, the cross-time comparison with CIS II and eventually CIS IV will provide a cross-sectional view of the dynamics of the evolution of the Portuguese innovation system that no doubt will be enlightening for the comprehension of its determinants of innovation.

V.1.b. Cross-country Analysis

Due to delays in the process of data validation by Eurostat and the EU member states involved in the exercise, the CIS III data is not available from Eurostat for final comparison at the present date. However, some countries released trough their National Statistic Institutes reports on the CIS III exercise that should be considered as preliminary but nonetheless could provide the context necessary for the evaluation of the Portuguese path. From the countries releasing reports on the CIS III data some do note provide data that could be neither directly nor indirectly comparable with the CIS variable definitions (e.g., using broader innovation definitions, aggregating different industries, etc.). Therefore, some of these values will not be presented nor discussed here in detail although they are available.

The cross-country analysis will be performed using only two frameworks, again due to data availability. First, a comparison of innovative enterprises in Manufacturing and Services will be performed along with the trajectories from CIS II for some countries. This extension of innovation analysis will provide a view of the dynamics of innovation having as a background the contrast between the Manufacturing and the Services sectors for each country and therefore is an important output measure for benchmarking exercises. Secondly, a comparison of an input innovation indicator, namely the share of the total expenditure in innovating activity with the corresponding output in terms of the proportion of innovative enterprises will be presented. The same reasons referred before are applicable to the utility of this instrument. Yet, it will provide a complementary and crucial point of view already referenced in CIS II: it was observed that countries in a short range of share of expenditure reported diversified outputs in terms of the proportion of innovative enterprises achieved. This result has significant implications because it shows that different efficiencies are attained for an equivalent level of financial input. Therefore, other factors are of high importance to the innovation output as the innovation theories predict and should be searched and identified before any further policy enforcement.

In Figure 50, the path of the Portuguese evolution could be observed against the results of CIS II for the other countries of the EU with the exception of Greece and Spain (no data for Services in CIS II). Because the results of the CIS III for almost all of the countries are not yet available for comparison, we will used only data from the current available national reports to point out the possibility of the current Portuguese position and trajectory in the EU.



(1) For comparison with the data of 1995-1997 some Sub sectors (NACE 63, 73, 74.3 e 64 except 64.2) and the Manufacturing Enterprise in between 10 and 20 employees which were part of the CIS 3 survey are not considered

(2) Includes the results not considered in (1).

Note: Final disaggregated and comparable results are not yet available for the other participants in the exercise.

Source: For data not result of this research - Eurostat (CIS II[21]), National Statistic Institutions (remaining countries, CIS III)

Figure 50 – Innovative Enterprises by sector and CIS Trajectories in the European Context (Modified from Conceição and Heitor, 2002)

From the available reports for the CIS III from UK, Germany and Spain one can expect that innovation decreases slightly in the reference period in Germany, although they perform yearly surveys not directly comparable to CIS III; that in the UK the percentages of all innovators decreased although they provided results with a broadened innovation definition[22]; and that in Spain the innovation in Manufacturing sector as increased sharply from 29% in CIS II to an unspecified number between 43% and 68% (the variation depends on the considered sectors).

From Figure 50, it could be observed that the increase in performance of Portugal was more or less equivalent in Manufacturing and in Services, maintaining the characteristic already observed in the CIS II of equivalence in the innovation proportion in both sectors. The cause for this increase is not clearly visible from the exploratory analysis in Chapter 4. Some input

[21] It should be noted that the weight calibration process due ton non-response bias was performed by Eurostat in CIS II as a black box, with no information available regarding its calculation. In CIS III the calibration process was developed by the countries participating in the exercise in an open way subject to scrutiny and evaluation. Therefore, comparisons with the CIS II data should take this into account.

[22] The UK decreased its innovation output so dramatically that they performed an additional study on the comparability of the CIS II and CIS III, based on the equivalence of both samples (Frenz, 2002). The study concluded for the validity of the data, but comparable CIS III values are not yet available.

indicators have increased and/or varied its distribution (innovative enterprises, allocated resources), other of more systemic nature remained stable (sources of information and cooperation), others that innovation theories indicate as important were surveyed for first time in CIS III (Public Funding distribution, Non-technology innovation, innovation effects vs. objectives) and are of no relative direct use yet, and should not *per se* justify the observed results. Further more profound systemic analysis of the results should be of great utility to clarify these issues.

It is too early to call but it is expectable from the reading of the preliminary reports of the member states that Portugal would have a higher rate of growth than the European average in what concerns innovation output and therefore is on the right direction towards catching up with the European average. Nonetheless, it should be noted that from the trajectories observed from other countries, Portugal who is a latecomer on innovation output performance could be in counter-cycle and face in the future similar drops in performance. Although data is not available for all countries, it is relevant to note that all the five observed trajectories had diverse performances and is not visible yet a common trend within the EU.

The second framework of evaluation as referred before is an analysis of the input vs. output in what concerns innovation, namely the "Expenditure in Innovating activities as a share of Turnover" vs. the "proportion of innovation" for each country. The analysis will be presented only for the Manufacturing sector again due to data availability - only three countries have available CIS III data at the present time (see Figure 51).

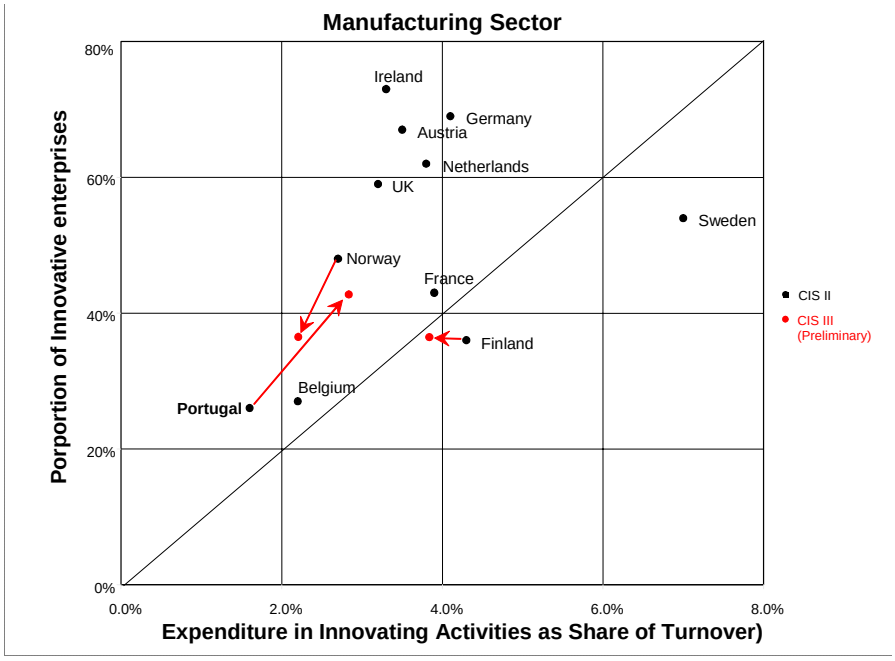


Figure 51 – Input vs. Output of Innovation in the Manufacturing Sector
(Modified from Conceição and Heitor, 2002)

From the observed results for the Manufacturing sector, Portugal's performance increased also significantly. However, it should be noted that for the same level of share of expenditure diversified outcomes are obtained, suggesting also different levels of efficiency. This is especially clear in the trajectory of Finland from CIS II to CIS III, where it reduces its share of expenditure but maintains the level of output (although it has reported a change in the distribution of its expenditure). Again, the three reported countries have different trajectories supporting three different efficiencies in achieving innovation. This figure provides relevant information for policy design. It is not sufficient to increase inputs to achieve more innovation or even necessary when a certain level is already achieved as in the case of Finland. The composition and distribution of these inputs, the interlinking and feedback effects quality and quantity between all the players in the innovation process, the role of the effectiveness of non-technical innovations in dynamic changes processes within an organization restructuring - all of these and others should be taken into account when designing policies.

A complementary evaluation is missing in this analysis due to the lack of data, but nonetheless is worthwhile referring: the output in the performance of firms vs. the efforts made by them to innovate. This measurement could be extracted partially from the CIS III by considering the share of turnover due to product innovations (process innovation impact is not measured, although it is of utmost importance as well as the impact of non-technical innovation)[23] and the efforts could be clearly measure through the share of Turnover devoted to innovating activities. This framework would complement the analysis by providing a measurement of the efficiency of the performance of the firms and therefore of the innovation system.

[23] (Share of) Value added is a more indicated measurement but although collected in CIS III in Portugal it was not subject of statistical treatment and it was also not asked for innovation impact on the value added.

V.2. Policy Design Implications

> *"Public policymakers increasingly acknowledge the importance of technology and innovative activities for national economic performance. But in debating and devising policies, the emphasis remains on the incentive structures that are central to mainstream economics, rather than on the competencies and the institutions that embodied them, which are central to evolutionary economics. This will change only when public officials are more familiar with evolutionary economics."*
>
> Keith Pavitt (Pavitt, 1999)

Innovation is recognized today as a competitive advantage and, even today, a cost of staying in the marketplace. Nevertheless, it remains inherently uncertain, disorderly, evolving in complex systems, subject to changes of many sorts at many different places in the innovating organizations. Therefore, it is difficult but not impossible to measure and demands close coordination of adequate technical knowledge and excellent market judgment in order to satisfy economic, technological, and often other type of constraints – all simultaneously.

One of the contributions of this research work, if not the most important, is to provide some of the basis for innovation policy design. However, one should be conscientious of the constraints and strengths of the CIS III methodology. Until now, the CIS III methodology has proven to be an excellent instrument of benchmarking exercise, providing comparable indicators in a number of variables that are useful for follow up of the best practices, for evaluating trajectories and to clarify countries specificities. Nonetheless, they do not provide measures on some essential situations discussed in the literature of innovation theories, as indicators of knowledge production, mediation and use[24] (technological and non-technological innovation) and evolve to the analysis of a systemic model of innovation. However, these new frontiers in the measurement of innovation do not provide yet established methodologies for its measurement, although some experiences have been performed[25] (Sirilli, 2003). Therefore, knowing that innovation goes beyond innovation expenditure in general[26], that innovation occurs more in large enterprises than in smaller ones, that innovation affects the performance of firms is not

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[24] Knowledge management covers any intentional and systematic process or practice of acquiring, capturing, sharing and using productive knowledge, wherever it resides, to enhance learning and performance in organizations (OECD definition).

[25] See the French Survey on Knowledge Management at http://www.insee.fr or the DISKO survey in Denmark http://www.business.auc.dk/disko/

[26] The R&D "solitaire" innovation expenditure view, although existent is also no longer dominant. However, the knowledge that there are more innovation expenditures is also not enough.

enough to design public innovation policies. Nonetheless, the summary of the principal results analyzed in this research work will provide some sense of the diversity of the innovation process that one expects to be useful to policy design.

- At the national level, a result of 44.3% innovating enterprises was achieved in the reporting period. Manufacturing and Services reached similar growths, respectively 42.4% and 48.7%. This Manufacturing-Services sector analysis is a fundamental dimension to assess innovation activity. Nonetheless, it is noted in the evolution of enterprises that more and more provide both goods and services in complement due to a product-service market strategy. This important innovation setting is not currently evaluated in CIS although fostered by EU policies. A proportion of 71.3% of the enterprises introducing product innovations declared to have introduced novel innovative products, whereas in the manufacturing sector, the same proportion was of 70.1%.

- The results obtained for the share of turnover of innovating enterprises due to Product Innovation are lower than the ones obtained in CIS II: a share of turnover of about 38% in CIS II and of 31% for CIS III for all enterprises introducing innovation in the Manufacturing sector; and approximately 40% in CIS II and 29.5% in CIS III for those that introduced Novel Innovations. Nonetheless, the Share of Turnover is higher in Manufacturing than in Services for the enterprises introducing Novel Innovations. The significant increase in innovative enterprises may have brought into play a set of more inefficient enterprises in capturing financial outcomes of innovation, or innovations may not be in a high growing or mature phase in the marketing cycle. In Services, although more innovative and 52% higher in terms of Total Turnover of innovative firms, the financial outcome obtained from innovation in terms of share of Turnover is lower than in Manufacturing.. More insightful studies on these or other possibilities are of great importance, due to their impact in the economic development, and could have crucial consequences at the policy level

- Patent application data distribution in CIS II is consistent with the distribution of valid patents in CIS III, probably due to a change in the status of the applications into valid patents during the CIS time frame. There is also a higher number of patenting activity for the innovating enterprises as opposed to non-innovators integrated into a group. However, the only clear characteristic is that the Portuguese companies ignore or do not choose to use patenting as a protection tool. Other protecting methods surveyed are used in relatively low proportions even in the innovating companies, although higher than

patenting. Three main other protection methods are used: “lead-time advantage over competitors”, “secrecy” and “trademarks.

- Innovations were developed mainly in house (including enterprise group) roughly 50% more than those developed in cooperation and by other enterprises or institutions, with process innovators relying significantly more on cooperation than simply on outsourcing. The great majority of companies prefer to innovate internally to the firm or group and smaller companies search for more external help than larger ones, probably due to the lack of critical mass.

- The cutoff point for analyzing innovation regarding dimension is moving, and another refinement of the classification is needed, mainly in Small and Medium Size classes to consider similar classes in terms of innovation achievement to Small (10 to 49), Medium (50 to 499) and Large (over 500 employees).

- The effort rate of firms engaged in innovative activity increased for numbers above 95% and a clear effectiveness was achieved in larger companies in Services. In national terms this performance follows the rule of thumb regarding the analysis of innovation by dimension: smaller firms are less effective than larger ones.

- In the Manufacturing sector, the smaller companies capture more share of the turnover due to product innovations from novel products than larger ones. In the Services Sector this preponderance occurs in the medium size classes. There is also a similar level of innovation in most of the sectors considered by technological intensity within Manufacturing showing pervasiveness in the increase of the share of innovating companies in the Portuguese economy. The results in the services sector show also a significant increase in the proportion of innovative enterprises for all sectors.

- The proportion between innovators that are part of a group and those that are not is higher in the Manufacturing sector than in the Services sector, a characteristic also verified in CIS II. And in CIS III new firms provide more innovative companies in the Services sector than older firms and the inverse is observed in the Manufacturing sector.

- The most innovative regions are “Lisboa e Vale do Tejo” and “Centro”. The “Norte” region has a share of approximately 41%, the “Alentejo” region 31% and the “Algarve” region has almost 16% of innovating enterprises. All present a similar magnitude in the

effectiveness of innovating (activity innovating enterprises over those with innovating activity) of more than 90%.

- The national market obtains the preference of almost 50% of the Innovating enterprises and, with less importance, the International market 28%. Nonetheless, Services disregard the national market when compared with Manufacturing innovators.

After this performance of the Portuguese innovation system, an important point should be pointed to the policymakers. How to sustain this level of innovative activity and increase its efficiency? This is clearly related with the other information surveyed in CIS III, concerning the firms' options, the systemic characteristics that surround them and others that complement them.

- A larger proportion of enterprises were engaged in the "Acquisition of Machinery and Equipment" in Manufacturing. Nonetheless, engagement in "Internal R&D", followed by "Training Activities are now second in preference. The profile of innovation engagement in the Services sector provides diversified patterns of choices. It could be seen that the profile of expenditure changed significantly from CIS II to CIS III. The expenditure in the "Acquisition of Machinery" activity decreases from 35% to 17% in its importance This place has been occupied by the expenditure on "Design, Training and Marketing" Still, the more radical change was the trade-off between the expenditure on the "Acquisition of Other External Knowledge" (from 45% to 5%) for the expenditure on "External R&D", a complete change in attitude towards the innovative activity.

- The innovation intensity presents a difference in efforts from small to large firms in Manufacturing (ratio between the total of Innovation Expenditure and the Turnover of the firm). In the Manufacturing sector small size companies allocate significantly more financial efforts to obtain innovation and achieve poorer results. In the Services Sector this relation is not observed. It should be also mentioned that the EU was contributing in the reference period of CIS III with public funding for one in each four enterprise in Manufacturing and one in each ten for services. In what concerns the human resources, non-innovating enterprises show a very small proportion of enterprises with R&D personnel, although innovating enterprises do not present significant numbers.

- A larger proportion of innovating enterprises implement strategic and organizational changes than non-innovating enterprises. A larger proportion of enterprises in the

Services sector introduced more strategic and organizational changes than the enterprises in the Manufacturing Sector. The most implemented option by innovating companies in both sectors was to change organizational structures followed by the implementation of new corporate strategies. It should be noted that in the Services sector advanced management techniques were consistently implemented.

- The sources of information more relevant (High and Medium relevance) for the innovating companies in the Manufacturing sector were clearly "within the enterprise", "suppliers", "fairs", "within the group", and "clients or customers". Both Manufacturing and Services share the same cooperation preference for the most likely highly relevant cooperation partners: "suppliers of equipment, materials, components or software", which almost double the second choice for highly relevant cooperation partners.

- The largest proportion of enterprises reported that they had projects seriously delayed, in services or manufacturing, either innovator or non-innovator. Additionally, the innovation barriers reported in both sectors followed closely the same profile obtained in CIS II: first, "Innovations costs", then "Sources of Finance" and after "Qualified Personnel". This barriers profile appears in what could be perceived as an intrinsic characteristic of the Portuguese economy.

- In the Manufacturing and services sector in CIS II the main objective was to improve quality (around 70%). For the CIS III, the reported effect of more relevance and proportion was consistently the "improvement in quality of goods and services".

The frequency of use of indicators in the design and evaluation of policies should be encouraged but one should not forget the methodological issues of gathering the data and of presenting clear measurable definitions to be answered. The response rates of the CIS are falling and the insistence from policymakers to increase the frequency of the data gathering (at least for some indicators) is prejudicial of obtaining valid results[27]. Therefore, a compromise within the existing surveys and the elaboration of larger surveys in larger periods of time and smaller versions in more short periods should be considered to guarantee higher response rates and further validity to the data. In complement, other more specific survey could and should be developed to complement the CIS III.

[27] The response rate for CIS III in Ireland, a reference example of recent economic growth, was only 17% invalidating all the conclusions.

As an example of a possible implication on the innovation studies on policy design is the relation between innovation and productivity studied for Portugal with CIS II data by Conceição et al. (Conceição and Heitor, 2002; Conceição and Veloso, 2002; Conceição, 2003). The first results showed that in the short run innovating enterprises had a decrease in productivity when compared with non-innovators. This fact, although counterintuitive, produces an incentive towards non-innovating, although in the long run the productivity increases. Therefore, policy design should take this into consideration and develop an incentives system that breaks this barrier by inducing firms to compromise to the innovation process. Nonetheless, any financial incentive should be carefully sought in order not to become an economic rent for the companies.

In addition to the hypothesis of research work to be developed in the future, a special attention should be considered regarding the development of a multivariate model that could be applied to the Services Sector. The Services sector is especially important in the Portuguese economy in what concerns innovation and presents some distinct characteristics from other EU member states. Therefore it should be useful to implement specific surveys and studies trying to capture more information regarding the innovation process and therefore in concordance with the evolving innovation system theories to produce a representative multivariate model for the Services sector.

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Chapter VI Annexes

VI.1. Portuguese National Questionnaire

Inquérito Comunitário à Inovação(CIS III)

Questionário relativo ao processo de inovação na empresa referente a 1998-2000

N.º 3

MINISTÉRIO DA CIÊNCIA E DA TECNOLOGIA
OBSERVATÓRIO DAS CIÊNCIAS E DAS TECNOLOGIAS

Terceiro Inquérito Comunitário à Inovação

INQUÉRITO DO SISTEMA ESTAT´STICO NACIONAL (Lei 6/89 de 15 de Abril) DE RESPOSTA OBRIGATÓRIA, REGISTADO NO INE SOB O Nº 9328, VÁLIDO ATÉ 31/12/2001

Este questionário é constituído por um conjunto de questões relativas à introdução, ou de actividades ligadas à introdução, de produtos e processos novos ou significativamente melhorados na indústria e nos serviços no período 1998-2000. É fundamental que todas as empresas respondam às perguntas indicadas, independentemente de terem introduzido ou não inovações. Só assim se poderão comparar níveis de inovação das empresas portuguesas com as empresas dos outros países comunitários.
Agradeçemos que leia calmamente o questionário pergunta a pergunta antes do respectivo preenchimento.

Para esclarecimentos contactar:

> ISABEL SOUDO

Telefone: 21 8452090
Fax: 21 8463432
E-mail: inovacao.oct@netc.pt

A preencher pela empresa (Responsável pelo preenchimento):

Nome _____
Função na Empresa _____
Telefone _____
Fax _____
E-mail _____

Notas importantes de preenchimento

1. *Todos os campos de preenchimento com números devem ser preenchidos colocando os* **algarismos da direita para a esquerda** *deixando em branco os espaços que ficarem livres.*
   ex. ☐☐☐126

2. *Os valores monetários podem ser dados quer em* ***contos****, quer em* ***euros****, devendo, no entanto, utilizar-se a* **mesma unidade monetária ao longo de todo o questionário**. *Sempre que a pergunta exige uma resposta com valores monetários tal é indicado através da colocação das palavras "****contos****" e "****euros****" a seguir ao campo de preenchimento,* ***devendo riscar-se a unidade monetria que no se utiliza****.*

00 Informação geral sobre a empresa

Define-se empresa como uma organização definida juridicamente, com balanço próprio, submetida a uma direcção que pode ser tanto uma entidade jurídica como uma entidade física e constituída com o fim de exercer, num ou vários locais, uma ou várias actividades de produção de bens e serviços.

Nome da empresa _____

Morada _____

Código postal ☐☐☐☐ - ☐☐☐

Localidade _____ Concelho _____ Distrito _____

Actividade Principal (CAE Rev. 2) ☐☐☐☐☐ Número de pessoa colectiva ☐☐☐☐☐☐☐☐☐

0.1 A sua empresa é parte de um grupo de empresas?

Sim ☐ Em que país se localiza a sua sede? _____

Não ☐

0.1.1 Qual o ano de fundação da empresa (no nosso país)? ☐☐☐☐

0.2 Entre 1998 e 2000 ocorreu na sua empresa alguma das seguintes mudanças significativas?

	Sim	Não
Aumento do volume de vendas em 10 % ou mais devido a fusão com outra empresa	☐	☐
Redução do volume de vendas em 10 % ou mais devido à venda ou encerramento de parte da empresa	☐	☐

0.3 Indique o tempo médio de vida do produto (bem ou serviço) mais importante para a sua empresa antes de ser substituído ou significativamente melhorado:

Menos de 1 ano ☐ 1-3 anos ☐ 4-6 anos ☐ 7-9 anos ☐ Mais de 9 anos ☐ Impossível dizer ☐

0.4 Qual o mercado geográfico mais importante para a empresa? *Escolher a alternativa mais apropriada*

Local/ regional (até uma distância de cerca de 50 km) em Portugal ☐
Local/ regional (até uma distância de cerca de 50 km) mas incluindo Espanha ☐
Nacional (para além de 50 km) ☐
Internacional (para além de 50 km) ☐

Informação económica sobre a empresa

		em 1998	em 2000
■0.5	Volume de negócios[1] vendas de bens e serviços *(incluido exportações e excluindo apenas o I.V.A.)*	em contos **ou** euros	em contos **ou** euros
■0.6	Volume de exportações (apenas)	em contos **ou** euros	em contos **ou** euros
■ 0.7	Investimento bruto em capital fixo[2] *(excluíndo o I.V.A.)*	em contos **ou** euros	em contos **ou** euros
■ 0.8	Valor acrescentado bruto[3]	em contos **ou** euros	em contos **ou** euros
■ 0.9	Custos com o pessoal[4]	em contos **ou** euros	em contos **ou** euros
■ 0.10	Características do pessoal ao serviço[5]		
■ 0.10.1	Total de pessoal ao serviço	em 1998	em 2000
	Escolaridade		
■ 0.10.2	Pessoal ao serviço que completou ensino superior *(concluiram cursos universitários ou politécnicos)*	em 1998	em 2000
■ 0.10.3	Pessoal ao serviço que completou o 12.º ano	em 1998	em 2000
	Qualificação/Funções		
■ 0.10.4	Pessoal ao serviço cuja qualificação corresponde a: quadros, profissionais altamente qualificados e profissionais qualificados	em 1998	em 2000

1 *Para instituições de crédito: receitas de juros e similares; para seguradoras: receitas brutas de prémios recebidos.*

2 *Aquisição de equipamentos, terrenos e construções.*

3 *Obtido pela diferença entre as vendas e o consumo intermédio, isto é, os bens e serviços consumidos pela empresa no seu processo produtivo.*

4 *Inclui todas as despesas efectuadas que revertem a favor do pessoal ao serviço (remunerações, despesas com segurança social,…).*

5 *Média anual. Se não for possível indicar a média anual, indicar os valores para o final de cada ano. O pessoal ao serviço inclui as pessoas que, no período de referência, participaram na actividade da empresa qualquer que tenha sido a duração dessa participação, nas seguintes condições: a) pessoal ligado à empresa por um contrato de trabalho, recebendo em contrapartida uma remuneração; b) pessoal ligado à empresa/instituição, que por não estar vinculado por um contrato de trabalho, não recebe uma remuneração regular pelo tempo trabalhado ou trabalho fornecido (p.ex.: proprietários-gerentes, familiares não remunerados, membros activos de cooperativas); c) pessoal com vínculo a outras empresas/instituições que trabalharam na empresa/instituição sendo por esta directamente remunerados.*

Inovação

A inovação corresponde, no âmbito deste questionário, à introdução no mercado de um produto (bem ou serviço) novo ou significativamente melhorado, ou à introdução por parte da empresa de processos novos ou significativamente melhorados. A inovação pode ser baseada em novos desenvolvimentos tecnológicos, em novas combinações de tecnologias existentes, ou na utilização de outro tipo de conhecimento adquirido pela empresa.

Atenção: ler "Anexo" sobre inovação antes de continuar a preencher o questionário.

01 Inovação de produto

A inovação de produto corresponde à introdução no mercado de um produto (bem ou serviço) novo ou significativamente melhorado relativamente às suas características fundamentais, às suas especificações técnicas, ao software ou outros componentes imateriais incorporados, às utilizações para que foi concebido, ou à facilidade de utilização. A inovação tem que ser nova para a empresa; não tem que ser necessariamente nova no mercado servido pela empresa. A inovação pode ter sido desenvolvida tanto pela empresa como fora dela. Modificações de natureza unicamente estética e a mera venda de inovações totalmente produzidas e desenvolvidas por outras empresas não se podem considerar inovações.

Em "Anexo" apresentam-se exemplos de inovações.

■ 1.1 **Durante o período de 1998-2000, a sua empresa introduziu no mercado algum produto (bem ou serviço) novo ou significativamente melhorado no contexto da empresa?**

Sim ☐ Quem desenvolveu esses produtos? ***Indique apenas a alternativa mais adequada***

- Principalmente a sua empresa ou grupo a que pertence ☐
- A sua empresa em cooperação com outras empresas ou instituições ☐
- Principalmente outras empresas ou instituições ☐

Não ☐ *passar para a questão 2 (página seguinte)*

■ 1.2 **Por favor, faça uma descrição sucinta do mais importante produto (bem ou serviço) novo ou significativamente melhorado** *(por favor escreva com letra de imprensa).*

_____

_____

_____

_____

_____

■ 1.3 **Por favor estime a distribuição da percentagem de volume de negócios[6] de 2000 entre:**

Vendas de produtos novos ou significativamente melhorados introduzidos no período de 1998–2000. ☐☐☐%

Vendas de produtos não modificados ou apenas marginalmente melhorados e introduzidos no período de 1998-2000[7]. ☐☐☐%

Volume de Negócios Total em 2000 1 0 0 %

■ 1.4 **Durante o período de 1998-2000, a sua empresa introduziu no mercado algum produto (bem ou serviço) novo ou significativamente melhorado no contexto do mercado servido pela empresa?**

Sim ☐ Contribuição da venda destes produtos para o volume de negócios em 2000: ☐☐☐%

Não ☐

6 Para instituições de crédito: receitas de juros e similares; para seguradoras: receitas brutas de prémios recebidos.

7 Bens e serviços totalmente desenvolvidos e produzidos por entidades terceiras devem ser incluídos nesta rubrica.

02 Inovação de processo

A inovação de processo corresponde à adopção de métodos de produção novos ou significativamente melhorados, assim como de meios novos ou significativamente melhorados de fornecimento de serviços e de distribuição de produtos. O resultado da inovação de processo terá que ter um impacte significativo na produção, qualidade dos produtos (bens ou serviços) ou custos de produção e de distribuição.
A inovação tem que ser nova para a empresa; não tem que ser necessariamente nova no mercado servido pela empresa. A inovação pode ter sido desenvolvida tanto pela empresa como fora dela. Modificações de natureza unicamente organizacional ou de gestão não se podem considerar inovações.

Em "Anexo" apresentam-se exemplos de inovações.

■ 2.1 Durante o período de 1998-2000, a sua empresa adoptou processos de produção novos ou significativamente melhorados, incluindo meios de fornecimento de serviços ou de distribuição de produtos?

Sim ☐ Quem desenvolveu esses processos? *Indique apenas a alternativa mais adequada*

- Principalmente a sua empresa ou grupo a que pertence ☐
- A sua empresa em cooperação com outras empresas ou instituições ☐
- Principalmente outras empresas ou instituições ☐

Não ☐ *passar para a questão 3*

■ 2.2 Por favor, faça uma descrição sucinta do mais importante processo novo ou significativamente melhorado *(por favor escreva com letra de imprensa).*

_____
_____
_____
_____
_____

03 Actividades de inovação incompletas ou abandonadas

■ 3.1 Até ao fim de 2000, a sua empresa desenvolveu, mas ainda não concluíu, projectos orientados para o desenvolvimento ou introdução de produtos (bens ou serviços) ou processos novos ou significativamente melhorados, incluindo actividades de investigação e desenvolvimento[8] (I&D)?

Sim ☐
Não ☐

■ 3.2 Durante o período 1998-2000, a empresa abandonou actividades em curso orientadas para o desenvolvimento ou introdução de produtos (bens ou serviços) ou processos novos ou significativamente melhorados, incluindo actividades de investigação e desenvolvimento(I&D)?

Sim ☐
Não ☐

■ *Empresas que responderam não ao conjunto das questões 1.1, 2.1, 3.1 e 3.2, devem passar para a questão 10.1.2 (pág. 10)*

8 *A I&D na empresa compreende todo o trabalho criativo empreendido numa base sistemática com vista a aumentar a reserva de conhecimentos da empresa, assim como a utilização dessa reserva no desenvolvimento de novas aplicações, tais como produtos (bens/serviços) ou processos novos ou significativamente melhorados (incluindo investigação em software).*

04 Despesa em actividades orientadas para a inovação em 2000

■ 4.1 A empresa esteve envolvida nas seguintes actividades de inovação em 2000?

Por favor indique, assinalando "sim", se a sua empresa esteve envolvida durante 2000 nas seguintes actividades orientadas para a introdução de produtos (bens/serviços) ou processos novos ou significativamente melhorados baseados em ciência, tecnologia ou outras áreas de saber. Subsequentemente, estime as despesas correspondentes em 2000, incluindo as despesas associadas a actividades abandonadas ou não concluídas. Assinale "não" para as actividades em que a empresa durante 2000 não esteve envolvida. Se sim, por favor estime a despesa em 2000, incluindo despesas com pessoal e investimento (sem depreciação) – em contos ou euros.

		Sim	Não	
Investigação e desenvolvimento realizados na empresa (I&D interna)	A I&D na empresa compreende todo o trabalho criativo empreendido numa base sistemática com vista a aumentar a reserva de conhecimentos da empresa, assim como a utilização dessa reserva no desenvolvimento de novas aplicações, tais como produtos (bens/serviços) ou processos novos ou significativamente melhorados (incluindo investigação em software).	☐	☐	☐☐☐☐☐☐ *em contos **ou** euros*
Aquisição de serviços de I&D (I&D externa)	As mesmas actividades mencionadas acima, mas executadas por outras empresas (mesmo que sejam do grupo da sua empresa) ou por entidades públicas ou privadas de I&D.	☐	☐	☐☐☐☐☐☐ *em contos **ou** euros*
Aquisição de maquinaria e de equipamento	Maquinaria avançada, hardware ou outros equipamentos ligados especificamente a produtos (bens/serviços) ou processos novos ou significativamente melhorados.	☐	☐	☐☐☐☐☐☐ *em contos **ou** euros*
Aquisição de outros conhecimentos externos	Aquisição de conhecimento externo, sob a forma de patentes, licenças, know-how, marcas, software e outros tipos de conhecimento externo para implementar as inovações da sua empresa	☐	☐	☐☐☐☐☐☐ *em contos **ou** euros*
Formação	Formação interna ou externa especificamente orientada para o desenvolvimento ou introdução de inovações	☐	☐	☐☐☐☐☐☐ *em contos **ou** euros*
Introdução de inovações no mercado (marketing)	Actividades de marketing internas ou externas à empresa directamente orientadas para a introdução no mercado dos produtos (bens/serviços) novos ou significativamente melhorados (pode incluir estudos de mercado, testes de mercado, publicidade de lançamento; deve excluir a constituição de redes de distribuição para comercializar as inovações)	☐	☐	☐☐☐☐☐☐ *em contos **ou** euros*
Projecto industrial e outros tipos de preparação para a produção ou distribuição de inovações	Outros procedimentos e preparações técnicas não contemplados acima, necessários para a introdução de produtos (bens/serviços) ou processos novos ou significativamente melhorados	☐	☐	☐☐☐☐☐☐ *em contos **ou** euros*

Despesa total em inovação em 2000 ☐☐☐☐☐☐ *em contos **ou** euros*

05 Investigação e desenvolvimento realizados na empresa (I&D)

Se a sua empresa teve actividades de I&D internas:

■ 5.1 Qual o pessoal ao serviço na empresa que esteve afecto a investigação e desenvolvimento em 2000?
(inclui tanto pessoas do departamento de investigação e desenvolvimento como fora dele, desde que envolvidas em investigação e desenvolvimento)

(em total de ETI[9]) : ☐☐☐☐

Exemplo:

As actividades de I&D da empresa foram desenvolvidas por pessoal a tempo integral e a tempo parcial.
Como proceder ao cálculo do Equivalente a Tempo Integral (ETI)?

Investigadores :
Um indivíduo A ocupa-se a 100% em actividades de I&D durante todo o ano na Empresa - Tempo Integral
Um indivíduo B ocupa-se a 100% em actividades de I&D durante 6 meses (1/2 ano) na Empresa - Tempo Parcial
Um indivíduo C ocupa-se a 25% em actividades de I&D durante todo o ano na Empresa - Tempo Parcial
Um indivíduo D ocupa-se a 30% em actividades de I&D durante 4 meses (1/3 ano) na Empresa - Tempo Parcial

Indivíduo	Percentagem de tempo em I&D	Percentagem de tempo em I&D no ano	Tempo Integral	Tempo Parcial	ETI
A	100%	100% x 1ano = 100%	1	-	1.0
B	100%	100% x 1/2ano =50%	-	1	0.5
C	25%	25% x 1ano = 25%	-	1	0.25
D	30%	30% x 1/3ano =10%	-	1	0.1
total		1.9	1	3	

■ 5.2 No período de 1998-2000, de que forma se desenrolaram as actividades de I&D na empresa?

Continuadamente ☐
Ocasionalmente ☐

[9] *ETI: "equivalentes a tempo integral"; calculam-se a partir da fracção (calculada em %) do tempo que cada indivíduo dedicou a actividades de I&D na empresa; o total resulta do somatório das fracções de cada pessoa.*

06 Efeitos das inovações introduzidas durante 1998-2000 na empresa

A inovação pode ter vários efeitos nas actividades da empresa. Indique, para as várias alternativas em seguida, o grau de impacte verificado no fim de 2000 fruto das inovações introduzidas no período de 1998-2000.

		Grau de impacte			
		Alto	Médio	Baixo	Irrelevante
Efeitos associados aos produtos	Alargamento da gama de produtos (bens/serviços)	☐	☐	☐	☐
	Entrada em novos mercados ou aumento da quota de mercado	☐	☐	☐	☐
	Melhoria da qualidade dos produtos (bens/serviços)	☐	☐	☐	☐
Efeitos associados aos processos	Melhoria da flexibilidade de produção	☐	☐	☐	☐
	Aumento da capacidade de produção	☐	☐	☐	☐
	Redução dos custos de trabalho por unidade produzida	☐	☐	☐	☐
	Redução do consumo de energia e de materiais por unidade produzida	☐	☐	☐	☐
Outros efeitos	Melhoria do impacte ambiental ou de outros aspectos associados à segurança ou saúde	☐	☐	☐	☐
	Cumprimento com regulamentações e normas	☐	☐	☐	☐

07 Financiamento público da inovação

O financiamento público inclui apoio financeiro sob a forma de subsídios ou empréstimos, assim como de garantias bancárias. As vendas a entidades públicas não devem ser consideradas.

■ 7.1 **No período de 1998-2000 a sua empresa recebeu algum tipo de apoio financeiro público para apoiar actividades orientadas para a inovação?**

Apoio de:	*Sim*	*Não*
Autoridades locais ou regionais	☐	☐
Governo	☐	☐
União Europeia	☐	☐

■ 7.2 **A sua empresa recebeu financiamentos quer do 4º (1994-98) quer do 5º (1998-2002) Programa Quadro da União Europeia para investigação e desenvolvimento?**

Sim ☐
Não ☐

08 Cooperação na área da inovação entre 1998-2000

A cooperação na área da inovação significa a participação activa em actividades de I&D e em outras actividades de inovação com outras organizações (tanto empresas como outras entidades). A cooperação não implica que ambos os parceiros retirem benefícios comerciais imediatos. A simples contratação ao exterior da empresa, sem qualquer colaboração activa da empresa, não é considerada cooperação.

■ 8.1 A sua empresa estabeleceu algum acordo de cooperação para actividades de inovação com outras empresas ou instituições durante o período 1998-2000?

Sim ☐

Não ☐ *passar para a questão 9 (página seguinte)*

■ 8.2 Por favor indique o tipo de organização com quem colaborou e respectivo país ou região de origem

Admitem-se várias respostas

Tipo de parceiros	Nacional	UE*/ EFTA**	UE-PC***	EUA	Japão	Outra
Outras empresas do grupo	☐	☐	☐	☐	☐	☐
Fornecedores de equipamento, de materiais, de componentes ou de software	☐	☐	☐	☐	☐	☐
Clientes	☐	☐	☐	☐	☐	☐
Concorrentes	☐	☐	☐	☐	☐	☐
Consultores	☐	☐	☐	☐	☐	☐
Laboratórios comerciais ou empresas de I&D	☐	☐	☐	☐	☐	☐
Universidades ou outras instituições de ensino superior	☐	☐	☐	☐	☐	☐
Laboratórios do Estado, institutos de I&D governamentais ou instituições privadas sem fins lucrativos	☐	☐	☐	☐	☐	☐

■ 8.3 Por favor indique a importância dos parceiros para o desenvolvimento de actividades de inovação

Tipo de parceiros	Alta	Média	Baixa	Nenhum parceiro
Outras empresas do grupo	☐	☐	☐	☐
Fornecedores de equipamento, de materiais, de componentes ou de software	☐	☐	☐	☐
Clientes	☐	☐	☐	☐
Concorrentes	☐	☐	☐	☐
Consultores	☐	☐	☐	☐
Laboratórios comerciais ou empresas de I&D	☐	☐	☐	☐
Universidades ou outras instituições de ensino superior	☐	☐	☐	☐
Laboratórios do Estado, institutos de I&D governamentais ou instituições privadas sem fins lucrativos	☐	☐	☐	☐

* *União Europeia (Bélgica, Dinamarca, Alemanha, Grécia, Espanha, França, Irlanda, Itália, Luxemburgo, Holanda, Áustria, Portugal, Finlândia, Suécia e Reino Unido)*

** *EFTA- European Free Trade Association (Islândia, Liechtenstein, Noruega, Suiça)*

*** *UE Países Candidatos (Bulgária, Chipre, República Checa, Estónia, Hungria, Letónia, Lituânia, Malta, Polónia, Roménia, Eslováquia, Eslovénia e Turquia)*

09 Fontes de informação para a inovação entre 1998-2000

Esta questão diz respeito à identificação das principais fontes de informação das quais resultaram sugestões para projectos de inovação ou que contribuiram para a implementação de inovações. Por favor indique a importância atribuída às diferentes fontes de informação mencionadas em seguida.

Fonte de Informação:		Se utilizada, importância: Alta	Média	Baixa	Não utilizada
Fontes internas	Dentro da própria empresa	☐	☐	☐	☐
	Outras empresas do grupo	☐	☐	☐	☐
Fontes de mercado	Fornecedores de equipamento, de materiais, de componentes ou de software	☐	☐	☐	☐
	Clientes	☐	☐	☐	☐
	Concorrentes	☐	☐	☐	☐
Fontes institucionais	Universidades ou outras instituições de ensino superior	☐	☐	☐	☐
	Laboratórios do Estado, institutos de I&D governamentais ou instituições privadas sem fins lucrativos	☐	☐	☐	☐
Outras fontes	Conferências, reuniões e publicações científicas ou profissionais	☐	☐	☐	☐
	Feiras, mostras de produtos	☐	☐	☐	☐
	Empresas de consultoria	☐	☐	☐	☐

10 Factores que dificultam a inovação

10.1.1 Durante o período de 1998-2000, houve actividades orientadas para a inovação que:

	Sim	Não
foram seriamente atrasadas?	☐	☐
nem sequer foram iniciadas?	☐	☐
foram canceladas?	☐	☐

Passar para a questo 10.2 (pgina seguinte)

10.1.2 Ausência de actividades orientadas para a inovação

(Apenas para Empresas que responderam no ao conjunto das questes 1.1, 2.1, 3.1 e 3.2 e que devem continuar daqui o preenchimento do questionrio at ao fim)

Durante o período de 1998-2000, alguma das razões seguintes foi relevante para que a empresa não tivesse tido quaisquer actividades orientadas para a inovação?

	Sim	Não
Não se justificavam actividades orientadas para inovação, dado que havia inovações introduzidas anteriormente	☐	☐
Não se justificavam actividades orientadas para inovação, dadas as condições do mercado da empresa	☐	☐
Existiram factores que dificultaram a inovação	☐	☐

■ 10.2 Factores que dificultaram a inovação

Se a empresa sentiu dificuldades no desenvolvimento de actividades de inovação ou nem sequer as iniciou entre 1998-2000, por favor indique a importância de cada um dos factores de impedimento.

Factores de impedimento		Grau de importância: Alto	Médio	Baixo	Não relevante
Factores económicos	Percepção de riscos económicos excessivos	☐	☐	☐	☐
	Custos de inovação demasiado elevados	☐	☐	☐	☐
	Falta de fontes de financiamento apropriadas	☐	☐	☐	☐
Factores internos	Estrutura organizacional pouco flexível	☐	☐	☐	☐
	Falta de pessoal qualificado	☐	☐	☐	☐
	Falta de informação sobre tecnologia	☐	☐	☐	☐
	Falta de informação sobre mercados	☐	☐	☐	☐
Outros factores	Regulamentação e normas	☐	☐	☐	☐
	Falta de receptividade dos clientes às inovações	☐	☐	☐	☐
	Reduzida dimensão do mercado	☐	☐	☐	☐

11 Patentes e outros métodos de protecção

■ 11.1.1 **Durante o período de 1998-2000, a sua empresa, ou alguma outra empresa do mesmo grupo submeteu pedidos de patentes para proteger invenções ou inovações por elas desenvolvidas?**

patente.

		Total Bens /serviços/processos	Dos quais: Apenas bens /serviços
Sim ☐	*Por favor indique o número de pedidos*[9]	☐☐☐	☐☐☐
Não ☐			

■ 11.1.2 **A sua empresa, ou outra empresa do mesmo grupo, tinha patentes válidas no fim de 2000 para proteger invenções ou inovações por elas desenvolvidas?**

		Total Bens /serviços/processos	Dos quais: Apenas bens /serviços
Sim ☐	*Por favor indique o número de patentes válidas*[9]	☐☐☐	☐☐☐
Não ☐			

■ 11.1.3 **Que percentagem do volume de negócios, em 2000, estava protegido por patentes ou patentes pedidas?**

Proporção das vendas 2000 ☐☐☐ % Impossível responder ☐

■ 11.2 **Durante o período 1998-2000, a sua empresa, ou alguma outra empresa do mesmo grupo, recorreu aos seguintes métodos para proteger invenções ou inovações desenvolvidas pela empresa?**

		Sim	Não
Métodos formais	Registo de padrões de design	☐	☐
	Marcas Registadas (Trademarks)	☐	☐
	Direitos de Autor (Copyright)	☐	☐
Métodos estratégicos	Segredo	☐	☐
	Complexidade de concepção	☐	☐
	Antecipação face aos concorrentes na introdução da inovação	☐	☐

[9] Pedidos de patentes ou patentes concedidas às mesmas invenções em países diferentes devem contar como a mesma (uma única)

12 Outras mudanças estratégicas e organizacionais importantes

Até esta altura, este questionário tem-se debruçado sobre produtos (bens ou serviços) ou processos novos ou significativamente melhorados. Esta última questão está associada a outros melhoramentos criativos que podem ter sido desenvolvidos pela empresa.

12.1 Durante o período de 1998-2000, a empresa desenvolveu alguma das seguintes actividades?

		Sim	Não
Estratégia	Implementação de estratégias novas ou significativamente alteradas	☐	☐
Gestão	Implementação de técnicas de gestão avançadas por parte da empresa	☐	☐
Organização	Implementação de estruturas organizacionais novas ou significativamente alteradas	☐	☐
Marketing	Mudanças significativas nas estratégias ou conceitos de marketing da empresa	☐	☐
Mudanças estéticas (ou outras de carácter subjectivo)	Mudanças significativas de carácter estético, de design ou de outro tipo com carácter subjectivo em pelo menos um produto	☐	☐

Muito obrigado por ter disponibilizado o seu tempo e colaborado com o Observatório das Ciências e das Tecnologias (Ministério da Ciência e da Tecnologia).

Agradecemos a devolução do questionário preenchido, utilizando o envelope de resposta sem franquia (RSF) junto enviado.

VI.2. Portuguese Questionnaire to Non-Respondents

Fax

Para:	[inserir o nome da empresa] [inserir o nome do contacto]	**De:**	Observatório das Ciências e das Tecnologias/ xxxxxxxxxxx
Fax:	[inserir o n.º de fax de destino]	**Pág.:**	2
		Data:	03-05-2002
Assunto:	Inquérito Comunitário à Inovação 2001 – Questionário às Não-Respostas		

● **Nota:** Este é um serviço automático de envio de FAX da xxxxxxx, dirigido especificamente à empresa em epígrafe, não podendo ser respondido por outras, mesmo que pertencendo ao mesmo grupo. Por favor utilize os contactos da página seguinte para enviar ou pedir esclarecimentos sobre o Inquérito.

OBSERVATÓRIO DAS CIÊNCIAS E DAS TECNOLOGIAS

Assunto: **Inquérito Comunitário à Inovação – 2001 -** *("Inquérito do Sistema Estatístico Nacional – Lei 6/89 de 15 de Abril – de resposta obrigatória, registado no INE sob o nº 9328, válido até 31/12/2001, posteriormente estendida até 31/03/2002)*

Lisboa, 3 de Maio de 2002

Exmo(a) Senhor(a),

Durante o último trimestre de 2001, enviámos a V. Exa. o **Inquérito Comunitário à Inovação- 2001**, solicitando resposta ao mesmo até 31 de Dezembro p.p., estendendo posteriormente num segundo contacto esta data até 31 de Março, não tendo ainda assim obtido a resposta da sua empresa. Este questionário destina-se exclusivamente às empresas que não responderam ao questionário anteriormente enviado pelo correio e é também de carácter obrigatório.

A informação será tratada com toda a confidencialidade e usada unicamente para fins estatísticos, nomeadamente para a produção de indicadores de Inovação nas empresas portuguesas. Nos termos da Lei, os dados a publicar serão sempre apresentados de forma a garantir o total anonimato. Aguardamos e agradecemos o envio do presente questionário preenchido por fax para o fax n.º xx.xxx.xx.xx, até ao final da próxima semana.

Número de Pessoa Colectiva:_____	[inserir n.º base de dados XXXX]
Actividade Principal (CAE):_____	Número Total de Empregados em 31/12/2000_____
1.	Durante o período de 1998-2000, a sua empresa introduziu no mercado algum produto (bem ou serviço) novo ou significativamente melhorado no contexto da empresa? Sim □ Não □
2.	Durante o período de 1998-2000, a sua empresa adoptou processos de produção novos ou significativamente melhorados, incluindo meios de fornecimento de serviços ou de distribuição de produtos? Sim □ Não □
3.	Durante o período de 1998-2000, a empresa abandonou ou não concluiu projectos ou actividades em curso orientados para o desenvolvimento ou introdução de produtos (bens ou serviços) ou processos novos ou significativamente melhorados, incluindo actividades de Investigação e Desenvolvimento (I&D)? Sim □ Não □
Ver notas explicativas em Anexo	

Com os nossos melhores cumprimentos,

O Vice-Presidente,

(Prof. Rui Santos)

Anexo: Exemplos de Inovação

Considera-se que a inovação, de acordo com a definição do questionário, pode ser de dois tipos: **inovação de Produto** (bens ou serviços) e **inovação de Processo**.

1 – **Inovação de Produto** (bens ou serviços), permitindo, designadamente:

um melhor desempenho do produto ou do serviço;

um alargamento das possíveis aplicações do produto ou do serviço.

Exemplos: alteração do tipo de materiais utilizados, introdução de produtos ecológicos numa gama de artigos, incorporação de "chips" electrónicos, utilização de sistemas de cartão de cliente, recurso a serviços de atendimento telefónico ao cliente, desenvolvimento de actividades bancárias e de seguros electronicamente, utilização de serviços de internet e de comércio electrónico (embora a mera criação de um site de informação sem serviços on-line não se considere uma inovação).

2 – **Inovação de Processo**, que se pode manifestar na melhoria do desempenho:

- **do próprio processo**, levando a que:

os processos se tornem melhor integrados ou mais automatizados;

aumente a flexibilidade;

melhore a qualidade;

melhore a segurança ou se reduzam os danos ambientais.

Exemplos: melhorias na logística de armazenagem (como, por exemplo, sistemas de *order picking*), seguimento e localização de expedições (*tracking and tracing*), interligação entre comunicação de dados e transporte de mercadorias, sistemas de código de barras, processamento óptico da informação, sistemas dedicados (*expert systems*), software para integração de funções, primeira utilização de ferramentas CAD/CAE. Considera-se que a certificação *ISO* é uma inovação apenas quando está directamente relacionada com a introdução de processos novos ou melhorados.

- **dos procedimentos de logística e controlo**, permitindo que:

melhore o planeamento e a rota de mercadorias;

aumente a flexibilidade na distribuição;

melhore o controlo de stocks.

Exemplos: sistemas de automatização de pedidos/compras, sistemas de minimização de stocks (*just-in-time*), sistemas auxiliares computorizados para logística.

VI.3. Output from the CALMAR Calibration Routine

```
                        CIS 3 - Portugal - Non-Responses Weight Calibration


                      *********************************
                      ***   Paramètres de la macro   ***
                      *********************************


Table en entrée                    DATA      =  NONRESP.DATA
 Pondération initiale              POIDS     =  WEIGHT
 Pondération Qk                    PONDQK    =  __UN
 Identifiant                       IDENT     =  ID

Table des marges                   DATAMAR   =  MARGES
 Marges en pourcentages            PCT       =  NON
 Effectif de la population         EFFPOP    =

Méthode utilisée                   M         =  2
 Borne inférieure                  LO        =
 Borne supérieure                  UP        =
 Seuil d'arrêt                     SEUIL     =  0.0001
 Nombre maximum d'itérations       MAXITER   =  15

Table contenant la pond. finale    DATAPOI   =  NONRESP.SORTIE
 Mise à jour de la table DATAPOI   MISAJOUR  =  OUI
 Pondération finale                POIDSFIN  =  PONDFIN
 Label de la pondération finale    LABELPOI  =  pondération RAKING RATIO
 Contenu de la table DATAPOI       CONTPOI   =  OUI

Edition des poids                  EDITPOI   =  OUI
 Statistiques sur les poids        STAT      =  OUI

Contrôles                          CONT      =  OUI
Table contenant les obs. éliminées OBSELI    =  OUI
Notes SAS                          NOTES     =  NON
```

CIS 3 - Portugal - Non-Responses Weight Calibration

Comparaison entre les marges tirées de l'échantillon (avec la pondération initiale)
et les marges dans la population (marges du calage)

Variable	Modalité ou variable	Marge échantillon	Marge population	Pourcentage échantillon	Pourcentage population
AINNACT	1	15924.37	12758	66.85	53.55
	2	7898.02	11067	33.15	46.45

CIS 3 - Portugal - Non-Responses Weight Calibration

Méthode : raking ratio
Premier tableau récapitulatif de l'algorithme :
la valeur du critère d'arrêt et le nombre de poids négatifs après chaque itération

Itération	Critère d'arrêt	Poids négatifs
1	0.49367	0
2	0.08963	0
3	0.00280	0
4	0.00000	0

CIS 3 - Portugal - Non-Responses Weight Calibration

Méthode : raking ratio
Deuxième tableau récapitulatif de l'algorithme :
les coefficients du vecteur lambda de multiplicateurs de Lagrange après chaque itération

Variable	Modalité	lambda1	lambda2	lambda3	lambda4
AINNACT0	1	-0.19884	-0.22143	-0.22169	-0.22169
AINNACT0	2	0.40124	0.33935	0.33736	0.33736

CIS 3 - Portugal - Non-Responses Weight Calibration

Méthode : raking ratio
Comparaison entre les marges finales dans l'échantillon (avec la pondération finale)
et les marges dans la population (marges du calage)

Variable	Modalité ou variable	Marge échantillon	Marge population	Pourcentage échantillon	Pourcentage population
AINNACT	1	12758	12758	53.55	53.55
	2	11067	11067	46.45	46.45

CIS 3 - Portugal - Non-Responses Weight Calibration

Méthode : raking ratio
Rapports de poids (pondérations finales / pondérations initiales)
pour chaque combinaison de valeurs des variables

Obs	AINNACT0	Effectif combinaison	Rapport de poids
1	1	1017	0.80116
2	2	858	1.40124

CIS 3 - Portugal - Non-Responses Weight Calibration

Méthode : raking ratio
Statistiques sur les rapports de poids (= pondérations finales / pondérations initiales)
et sur les pondérations finales

The UNIVARIATE Procedure
Variable: _f_ (Rapport de poids)

Moments

N	1875	Sum Weights	1875
Mean	1.07575652	Sum Observations	2017.04348
Std Deviation	0.29903674	Variance	0.08942297
Skewness	0.17034942	Kurtosis	-1.9730868
Uncorrected SS	2337.42633	Corrected SS	167.578654
Coeff Variation	27.7978091	Std Error Mean	0.00690596

Basic Statistical Measures

Location		Variability	
Mean	1.075757	Std Deviation	0.29904
Median	0.801162	Variance	0.08942
Mode	0.801162	Range	0.60008
		Interquartile Range	0.60008

Tests for Location: Mu0=0

Test	-Statistic-		-----p Value------	
Student's t	t	155.7722	Pr > |t|	<.0001
Sign	M	937.5	Pr >= |M|	<.0001
Signed Rank	S	879375	Pr >= |S|	<.0001

Tests for Normality

Test	--Statistic---		-----p Value------	
Shapiro-Wilk	W	0.633993	Pr < W	<0.0001
Kolmogorov-Smirnov	D	0.36316	Pr > D	<0.0100
Cramer-von Mises	W-Sq	55.54792	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	339.9015	Pr > A-Sq	<0.0050

Quantiles (Definition 5)

Quantile	Estimate
100% Max	1.401237
99%	1.401237
95%	1.401237
90%	1.401237
75% Q3	1.401237
50% Median	0.801162
25% Q1	0.801162
10%	0.801162
5%	0.801162
1%	0.801162
0% Min	0.801162

Extreme Observations

Lowest			Highest		
Value	ID	Obs	Value	ID	Obs
0.801162	4765	1875	1.40124	4755	1868
0.801162	4759	1871	1.40124	4756	1869
0.801162	4758	1870	1.40124	4760	1872
0.801162	4753	1866	1.40124	4763	1873
0.801162	4752	1865	1.40124	4764	1874

CIS 3 - Portugal - Non-Responses Weight Calibration

Méthode : raking ratio
Statistiques sur les rapports de poids (= pondérations finales / pondérations initiales)
et sur les pondérations finales

The UNIVARIATE Procedure
Variable: __wfin (Pondération finale)

Moments

N	1875	Sum Weights	1875
Mean	12.7066667	Sum Observations	23825
Std Deviation	14.122376	Variance	199.441504
Skewness	1.64128463	Kurtosis	2.20496815
Uncorrected SS	676489.712	Corrected SS	373753.379
Coeff Variation	111.141469	Std Error Mean	0.3261423

Basic Statistical Measures

Location		Variability	
Mean	12.70667	Std Deviation	14.12238
Median	5.87492	Variance	199.44150
Mode	28.52617	Range	77.26738
		Interquartile Range	16.96861

Tests for Location: MuO=0

Test	-Statistic-		-----p Value------	
Student's t	t	38.9605	Pr > |t|	<.0001
Sign	M	937.5	Pr >= |M|	<.0001
Signed Rank	S	879375	Pr >= |S|	<.0001

Tests for Normality

Test	--Statistic---		-----p Value------	
Shapiro-Wilk	W	0.767112	Pr < W	<0.0001
Kolmogorov-Smirnov	D	0.211033	Pr > D	<0.0100
Cramer-von Mises	W-Sq	28.74177	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	157.3143	Pr > A-Sq	<0.0050

Quantiles (Definition 5)

Quantile	Estimate
100% Max	78.068543
99%	53.894395
95%	44.635939
90%	30.814293
75% Q3	19.772678
50% Median	5.874921
25% Q1	2.804067
10%	1.813030
5%	1.602324
1%	1.222573
0% Min	0.801162

Extreme Observations

Lowest			Highest		
Value	ID	Obs	Value	ID	Obs
0.801162	3296	1316	64.5606	3204	1281
0.801162	1686	632	78.0685	873	325
0.801162	568	194	78.0685	875	326
0.901307	1413	513	78.0685	942	354
1.201743	4759	1871	78.0685	1031	378

CIS 3 - Portugal - Non-Responses Weight Calibration

Méthode : raking ratio

Contenu de la table Nonresp.SORTIE contenant la nouvelle pondération PONDFIN

The CONTENTS Procedure

Data Set Name:	NONRESP.SORTIE	Observations:	1875
Member Type:	DATA	Variables:	2
Engine:	V8	Indexes:	0
Created:	13:40 Thursday, December 5, 2002	Observation Length:	16
Last Modified:	13:40 Thursday, December 5, 2002	Deleted Observations:	0
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:			

-----Engine/Host Dependent Information-----

Data Set Page Size:	4096
Number of Data Set Pages:	8
First Data Page:	1
Max Obs per Page:	252
Obs in First Data Page:	176
Number of Data Set Repairs:	0
File Name:	C:\(. . .)\my SAS files\v8\CIS 3\data\nonresp\sortie.sas7bdat
Release Created:	8.0202M0
Host Created:	WIN_PRO

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Informat	Label
1	ID	Num	8	0	BEST12.	BEST32.	
2	PONDFIN	Num	8	8			pondération RAKING RATIO

CIS 3 - Portugal - Non-Responses Weight Calibration

****
*** BILAN ***
****

```
*
*   Date : 05 DECEMBRE 2002           Heure : 10:30
*
*   Table en entrée : NONRESP.DATA
*
*   Nombre d'observations dans la table en entrée  : 1875
*   Nombre d'observations éliminées                : 0
*   Nombre d'observations conservées               : 1875
*
*   Variable de pondération : WEIGHT
*
*   Nombre de variables catégorielles : 1
*   Liste des variables catégorielles et de leurs nombres de modalités :
      AINNACTO (2  )
*   Taille de l'échantillon (pondéré) : 23822
*   Taille de la population           : 23825
*
*   Méthode utilisée : raking ratio
*   Le calage a été réalisé en 4 itérations
*   Les poids ont été stockés dans la variable PONDFIN de la table NONRESP.SORTIE
```

VI.4. Eurostat Recommendations on how to deal with merge or shut-downs of enterprises in CIS 3

The life of an enterprise is very dynamic and a lot of things like for example merging or shut-downs, can have happened that you were not aware of when the survey sample was made. Eurostat gives some guidance on how to deal with these enterprises by giving examples of different situations that you might face in the CIS 3 survey. The classifications used in the text are over-coverage (i.e. the concerned firm should not have been included in the sample) and non-respondents.

Note that the observations for the enterprises that are being treated as over-coverage should not be included in the final results. All variables for these enterprises will be put to zero in the data treatment. The over-coverage enterprises will though keep the weights that they were given in the sample. No new enterprises will be added in the sample afterwards to compensate for the over-coverage and there will be no sample correction.

Over-coverage

- Enterprises that were not active during the reference period 1998-2000.
- Enterprises with less than 10 employees.

Non-respondents

- Enterprises that are resting or are out of business but were active at the reference period.

Mergers

Merge between the smaller enterprise A and the larger enterprise B before or early during the reference period.

- If both enterprises are included in the sample then the small enterprise A will be treated as over-coverage and the large enterprise B will be asked to send in answers for both A and B. The weight for enterprise B will remain the same and will not change
- If only the small enterprise A is included in the sample, enterprise A will be treated as over-coverage.
- If only the large enterprise B is included in the sample enterprise B will be asked to send in answers for both enterprises A and B. Note that enterprise B will keep the same weight as it was given in the sample.

If the smaller enterprise A and the larger enterprise B have merged late during the reference period separate answers for enterprises A and B will be requested. If this request can not be fulfilled and only a common answer for both enterprises will be delivered, the quantitative questions will be divided into appropriate proportions between the enterprises. The qualitative questions for enterprise A will be put as item-non response and these will later on be imputed.

VI.5. List of variables included in the CIS III Data Processing

Variable	Question
ID	Name of the enterprise
NUTS	Address
NACE	Main activity
GP	Enterprise part of a group
HO	Country of head office
EST	Enterprise established in reference period
TURNINC	Turnover increased by 10%
TURNDEC	Turnover decreased by 10%
SIGMAR	Enterprise's most significant market
TURN98	Total turnover in 1998
TURN	Total turnover in 2000
EXP98	Exports in 1998
EXP	Exports in 2000
INVTA	Gross investment in tangible goods in 2000
EMP98	Total number of employees in 1998
EMP	Total number of employees in 2000
EMPHI	Number of employees with higher education in 2000
INPDT	Introduced onto the market a new or significantly improved product
INPDTW	Who mainly developed these products
TURNIN	New or improved products introduced during 1998-2000
TURNUNG	Unchanged or marginally modified products during 1998-2000
INMAR	Enterprise introduced new or improved products on the market
TURNMAR	Share of new or improved products to market
INPCS	Introduced onto the market a new or significantly improved process
INPCSW	Who mainly developed these processes
INON	Enterprise with ongoing innovating activities
INAB	Enterprise with abandoned innovation activities
RRDIN	Engagement in intramural R&D
RRDINX	Expenditure in intramural R&D
RRDEX	Engagement in extramural R&D
RRDEXX	Expenditure in extramural R&D
RMAC	Engagement in acquisition of machinery
RMACX	Expenditure in acquisition of machinery
ROEK	Engagement in other external knowledge
ROEKX	Expenditure in other external knowledge
RTR	Engagement in training
RMAR	Engagement in market introduction of innovation
RPRE	Engagement in design, other preparation
ROTHX	Expenditure in training, market introduction and other preparation
RTOT	Total innovation expenditure
RDPER	Number of persons involved in intramural R&D
RDENG	Type of engagement in R&D
ERANGE	Increased range of goods or services
EMAR	Increased market or market share
EQUA	Improved quality in goods or services
EFLEX	Improved production flexibility
ECAP	Increased production capacity
ELBR	Reduced labor costs per produced unit
EMAT	Reduced materials and energy per produced unit
EENV	Improved environmental impact or health and safety aspects

Variable	Question
ESTD	Met regulations or standards
FUNLOC	Public funding from local or regional authorities
FUNGMT	Public funding from central government
FUNEU	Public funding from the EU
FUNRTD	Funding from EU's 4th or 5th RTD
Co	Cooperation arrangements on innovation activities
Co11	Other enterprises within enterprise group : National
Co12	Other enterprises within enterprise group : EU/EFTA
Co13	Other enterprises within enterprise group : EU-CC
Co14	Other enterprises within enterprise group : US
Co15	Other enterprises within enterprise group : Japan
Co16	Other enterprises within enterprise group : Other
Co21	Suppliers of equipment, etc. : National
Co22	Suppliers of equipment, etc. : EU/EFTA
Co23	Suppliers of equipment, etc. : EU-CC
Co24	Suppliers of equipment, etc. : US
Co25	Suppliers of equipment, etc. : Japan
Co26	Suppliers of equipment, etc. : Other
Co31	Clients or customers : National
Co32	Clients or customers : EU/EFTA
Co33	Clients or customers : EU-CC
Co34	Clients or customers : US
Co35	Clients or customers : Japan
Co36	Clients or customers : Other
Co41	Competitors or other firms … : National
Co42	Competitors or other firms … : EU/EFTA
Co43	Competitors or other firms … : EU-CC
Co44	Competitors or other firms … : US
Co45	Competitors or other firms … : Japan
Co46	Competitors or other firms … : Other
Co51	Consultants : National
Co52	Consultants : EU/EFTA
Co53	Consultants : EU-CC
Co54	Consultants : US
Co55	Consultants : Japan
Co56	Consultants : Other
Co61	Commercial laboratories /R&D enter. : National
Co62	Commercial laboratories /R&D enter. : EU/EFTA
Co63	Commercial laboratories /R&D enter. : EU-CC
Co64	Commercial laboratories /R&D enter. : US
Co65	Commercial laboratories /R&D enter. : Japan
Co66	Commercial laboratories /R&D enter. : Other
Co71	Universities or other … : National
Co72	Universities or other … : EU/EFTA
Co73	Universities or other … : EU-CC
Co74	Universities or other … : US
Co75	Universities or other … : Japan
Co76	Universities or other … : Other
Co81	Government or PNP research inst. : National
Co82	Government or PNP research inst. : EU/EFTA
Co83	Government or PNP research inst. : EU-CC
Co84	Government or PNP research inst. : US
Co85	Government or PNP research inst. : Japan

Variable	Question
Co86	Government or PNP research inst. : Other
SENT	Sources from Within the enterprise
SGRP	Sources from Other enterprises within the enterprise group
SSUP	Sources from Suppliers of equipment, materials, etc.
SCLI	Sources from Clients or customers
SCOM	Sources from Competitors and other enterprises of same industry
SUNI	Sources from Universities or other higher education institutes
SGMT	Sources from Government or private non-profit research institutes
SPRO	Sources from Professional conferences, meetings, journals
SEXB	Sources from Fairs, exhibitions
HDLAY	Enterprise with innovation activity seriously delayed
HSTAR	Enterprise with innovation activity prevented to be started
HBUR	Enterprise with innovation activity burdened/cumbered
HPRIOR	No innovation activity due to prior innovations
HMAR	No innovation activity due to market conditions
HIMP	No innovation activity due to factors impeding innovation
HECO	Hampering factor : Economic risks
HCOS	Hampering factor : Innovation costs
HFIN	Hampering factor : Sources of finance
HORG	Hampering factor : Organizational rigidities
HPER	Hampering factor : Qualified personnel
HTEC	Hampering factor : Information on technology
HINF	Hampering factor : Information on markets
HFLEX	Hampering factor : Regulations and standards
HCUS	Hampering factor : Customer responsiveness
PAAP	Enterprise applied for at least a patent to protect inventions
PAVAL	Number of valid patents at end of 2000
PROREG	Protection through registration of design patters
PROTM	Protection through trademarks
PROCP	Protection through copyright
PROSEC	Protection through secrecy
PRODES	Protection through complexity of design
PROTIM	Protection through lead-time advantage over competitors
ACTSTR	Undertake implementation of new corporate strategies
ACTMAN	Undertake implementation of advanced management techniques
ACTORG	Undertake implementation of changed organizational structures
ACTMAR	Undertake changing enterprise's marketing concepts/strategies
ACTAES	Significant changes in aesthetic appearance
StrB	Stratum to which enterprise before when sampled
StrA	Stratum to which enterprise belong according to questionnaire
Weight	Weighting factors
WeightNr	Weights corrected due to non-response bias
Life	Average lifetime of most important product
InvTa98	Gross investment in tangible goods in 1998
CoGrp	Cooperation partner: Other enterprises within enterprise group
CoSup	Cooperation partner: Suppliers of equipment, materials, etc.
CoCli	Cooperation partner: Clients or customers
CoCom	Cooperation partner: Competitors and other firms
CoCon	Cooperation partner: Consultants
CoRd	Cooperation partner: Commercial laboratories /R&D enterprises
CoUni	Cooperation partner: Universities or other higher education inst
CoGmt	Cooperation partner: Government or PNP research institutes
PaNb	Number of patent applications for goods/services/process

Variable	Question
PaNbPdt	Number of patent applications for goods/services
PaVNb	Number of valid patents at end of 2000 for goods/services/processes
PaVNPdt	Number of valid patents at end of 2000 for goods/service
TurnPa	Percentage of turnover covered by patent application

VI.6. Rate of Non-responses after the CIS III Data Processing

All Values in Percentage (“.” = Zero)

Variables	Small	Medium	Large	Mining and quarrying	Manufacturing	Service	Total
Id	.	.	.	.	.	.	.
Nuts	.	.	.	.	.	.	.
Nace	.	.	.	.	.	.	.
Gp	0.5	0.6	1.2	.	0.6	0.7	0.6
Ho	3.3	1.2	2.8	.	2.8	1.6	2.2
Est	.	.	.	.	.	.	.
TurnInc	.	.	.	.	.	.	.
TurnDec	.	.	.	.	.	.	.
SigMar	.	0.2	.	.	.	0.2	0.1
Turn98	.	.	.	.	.	.	.
Turn	.	.	.	.	.	.	.
Exp98	.	.	.	.	.	.	.
Exp	.	.	.	.	.	.	.
InvTa	15.4	8.5	3.5	6.7	10.8	13.0	11.4
Emp98	.	.	.	.	.	.	.
Emp	.	.	.	.	.	.	.
EmpHi	.	.	.	.	.	.	.
InPdt	.	.	.	.	.	.	.
InPdtW	0.5	.	.	.	.	0.6	0.2
TurnIn	.	.	.	.	.	.	.
TurnUng	.	.	.	.	.	.	.
InMar	0.7	0.6	1.7	.	0.9	0.8	0.9
TurnMar	5.4	1.6	4.0	.	3.6	3.2	3.4
InPcs	.	.	.	.	.	.	.
InPcsW	1.4	0.4	0.7	8.3	0.7	0.5	0.8
InOn	.	0.3	.	.	0.2	.	0.1
InAb	.	0.2	1.2	.	0.2	0.2	0.2
RRdIn	4.4	4.2	0.6	15.4	3.1	3.7	3.5
RRdInX	.	.	.	.	.	.	.
RRdEx	4.4	4.2	0.6	15.4	3.1	3.7	3.5
RRdExX	.	1.0	.	100.0	.	.	0.4
RMac	4.4	4.2	0.6	15.4	3.1	3.7	3.5
RMacX	.	.	.	.	.	.	.
ROek	4.4	4.2	0.6	15.4	3.1	3.7	3.5
ROekX	.	.	.	.	.	.	.
RTr	4.4	4.2	0.6	15.4	3.1	3.7	3.5
RMar	4.4	4.2	0.6	15.4	3.1	3.7	3.5
RPre	4.4	4.2	0.6	15.4	3.1	3.7	3.5
ROthX	.	.	.	.	.	.	.
RTot	4.4	4.2	0.6	15.4	3.1	3.7	3.5
RdPer	12.9	8.5	14.8	.	10.4	14.7	11.7
RdEng	8.1	4.1	.	.	2.7	7.4	4.1
ERange	4.4	6.1	2.8	7.7	4.7	4.8	4.8
EMar	4.4	6.1	2.8	7.7	4.7	4.8	4.8
EQua	4.4	6.1	2.8	7.7	4.7	4.8	4.8
EFlex	4.4	6.1	2.8	7.7	4.7	4.8	4.8
ECap	4.4	6.1	2.8	7.7	4.7	4.8	4.8
ELbr	4.4	6.1	2.8	7.7	4.7	4.8	4.8
EMat	4.4	6.1	2.8	7.7	4.7	4.8	4.8
EEnv	4.4	6.1	2.8	7.7	4.7	4.8	4.8
EStd	4.4	6.1	2.8	7.7	4.7	4.8	4.8

Variables	Small	Medium	Large	Mining and quarrying	Manufacturing	Service	Total
FunLoc	0.9	0.6	1.7	.	0.9	1.1	0.9
FunGmt	1.6	0.6	2.2	.	1.2	1.5	1.3
FunEU	1.6	0.6	1.7	.	1.2	1.1	1.2
FunRtd	3.8	4.2	5.6	.	4.5	4.1	4.3
Co	.	.	.	.	.	.	.
Co11	.	1.7	.	.	.	1.8	0.7
Co12	.	1.7	.	.	.	1.8	0.7
Co13	.	1.7	.	.	.	1.8	0.7
Co14	.	1.7	.	.	.	1.8	0.7
Co15	.	1.7	.	.	.	1.8	0.7
Co16	.	1.7	.	.	.	1.8	0.7
Co21	.	1.0	.	.	.	1.3	0.4
Co22	.	1.0	.	.	.	1.3	0.4
Co23	.	1.0	.	.	.	1.3	0.4
Co24	.	1.0	.	.	.	1.3	0.4
Co25	.	1.0	.	.	.	1.3	0.4
Co26	.	1.0	.	.	.	1.3	0.4
Co31	.	1.0	.	.	.	1.3	0.4
Co32	.	1.0	.	.	.	1.3	0.4
Co33	.	1.0	.	.	.	1.3	0.4
Co34	.	1.0	.	.	.	1.3	0.4
Co35	.	1.0	.	.	.	1.3	0.4
Co36	.	1.0	.	.	.	1.3	0.4
Co41	.	1.0	.	.	.	1.3	0.4
Co42	.	1.0	.	.	.	1.3	0.4
Co43	.	1.0	.	.	.	1.3	0.4
Co44	.	1.0	.	.	.	1.3	0.4
Co45	.	1.0	.	.	.	1.3	0.4
Co46	.	1.0	.	.	.	1.3	0.4
Co51	.	1.0	.	.	.	1.3	0.4
Co52	.	1.0	.	.	.	1.3	0.4
Co53	.	1.0	.	.	.	1.3	0.4
Co54	.	1.0	.	.	.	1.3	0.4
Co55	.	1.0	.	.	.	1.3	0.4
Co56	.	1.0	.	.	.	1.3	0.4
Co61	.	1.0	.	.	.	1.3	0.4
Co62	.	1.0	.	.	.	1.3	0.4
Co63	.	1.0	.	.	.	1.3	0.4
Co64	.	1.0	.	.	.	1.3	0.4
Co65	.	1.0	.	.	.	1.3	0.4
Co66	.	1.0	.	.	.	1.3	0.4
Co71	.	1.0	.	.	.	1.3	0.4
Co72	.	1.0	.	.	.	1.3	0.4
Co73	.	1.0	.	.	.	1.3	0.4
Co74	.	1.0	.	.	.	1.3	0.4
Co75	.	1.0	.	.	.	1.3	0.4
Co76	.	1.0	.	.	.	1.3	0.4
Co81	.	1.0	.	.	.	1.3	0.4
Co82	.	1.0	.	.	.	1.3	0.4
Co83	.	1.0	.	.	.	1.3	0.4
Co84	.	1.0	.	.	.	1.3	0.4
Co85	.	1.0	.	.	.	1.3	0.4
Co86	.	1.0	.	.	.	1.3	0.4
SEnt	1.3	1.1	.	.	0.5	1.8	0.9
SGrp	1.3	1.3	.	.	.	2.0	0.8

Variables	Small	Medium	Large	Mining and quarrying	Manufacturing	Service	Total
SSup	1.3	1.1	.	.	0.5	1.8	0.9
SCli	1.3	1.1	.	.	0.5	1.8	0.9
SCom	1.3	1.1	.	.	0.5	1.8	0.9
SUni	1.3	1.1	.	.	0.5	1.8	0.9
SGmt	1.3	1.1	.	.	0.5	1.8	0.9
SPro	1.3	1.1	.	.	0.5	1.8	0.9
SExb	1.3	1.1	.	.	0.5	1.8	0.9
HDlay	19.7	24.3	20.6	30.8	21.3	22.5	21.8
HStar	21.3	29.6	23.9	30.8	25.3	25.1	25.3
HBur	21.6	29.6	23.9	30.8	25.4	25.1	25.4
HPrior	1.4	3.1	1.3	.	0.7	4.9	1.9
HMar	1.2	2.8	1.3	.	0.7	4.2	1.7
HImp	1.8	3.1	1.3	.	1.1	4.9	2.2
HEco	4.6	3.1	6.3	7.7	4.5	3.4	4.3
HCos	4.6	3.1	6.3	7.7	4.5	3.4	4.3
HFin	4.6	3.1	6.3	7.7	4.5	3.4	4.3
HOrg	4.6	3.1	6.3	7.7	4.5	3.4	4.3
HPer	4.6	3.1	6.3	7.7	4.5	3.4	4.3
HTec	4.6	3.1	6.3	7.7	4.5	3.4	4.3
HInf	4.6	3.1	6.3	7.7	4.5	3.4	4.3
HFlex	4.6	3.1	6.3	7.7	4.5	3.4	4.3
HCus	4.6	3.1	6.3	7.7	4.5	3.4	4.3
PaAp	.	.	.	.	.	.	.
PaVal	.	.	.	.	.	.	.
ProReg	0.1	0.6	2.3	.	0.5	0.9	0.6
ProTm	0.8	1.1	3.5	.	1.4	1.1	1.3
ProCp	1.1	1.9	3.5	6.7	1.6	1.6	1.7
ProSec	2.3	1.7	3.1	2.2	2.2	2.2	2.2
ProDes	2.0	1.4	3.9	.	2.0	2.3	2.0
ProTim	2.1	1.9	4.2	.	2.3	2.5	2.3
ActStr	0.1	.	0.4	.	0.1	0.2	0.1
ActMan	0.5	0.3	0.4	.	0.4	0.5	0.4
ActOrg	0.4	0.3	0.4	2.2	0.3	0.4	0.4
ActMar	0.2	0.2	0.4	.	0.2	0.4	0.2
ActAes	0.1	0.3	0.4	.	0.2	0.4	0.2
Life	11.1	11.6	9.7	15.6	10.0	13.2	11.1
InvTa98	14.8	8.8	4.6	15.6	10.2	13.7	11.4
CoGrp	19.0	29.3	26.1	50.0	32.2	16.1	26.4
CoSup	25.5	21.2	24.4	66.7	26.9	14.1	23.2
CoCli	48.9	34.6	40.7	66.7	38.5	41.0	39.7
CoCom	57.4	44.2	47.7	66.7	48.1	47.4	48.1
CoCon	44.7	34.6	34.9	66.7	39.1	30.8	36.7
CoRd	57.4	46.2	40.7	66.7	45.5	47.4	46.4
CoUni	48.9	34.6	30.2	33.3	32.7	42.3	35.9
CoGmt	44.7	41.3	33.7	66.7	36.5	43.6	39.2
PaNb	18.5	30.6	37.1	.	31.3	25.8	29.6
PaNbPdt	13.6	4.0	31.8	.	21.7	4.3	15.9
PaVNb	34.1	41.4	44.4	.	37.6	48.6	40.3
PaVNPdt	14.8	14.7	56.0	.	30.9	11.1	26.7
TurnPa	.	4.5	14.5	.	6.2	6.8	6.4

VI.7. Third Community Innovation Survey Results

Table 1 : Realised sample and estimated population size

NACE	BREAKDOWN	[1]	[2]	[3]
10-14	**Mining and quarrying**			
	Total	45	362	12.4%
	Small [10-49]	23	310	7.4%
	Medium-sized [50-249]	22	51	42.8%
	Large [> 250]	0	2	0.0%
15-37	**Manufacturing sector**			
	Total	1,275	16,194	7.9%
	Small [10-49]	625	12,171	5.1%
	Medium-sized [50-249]	456	3,446	13.2%
	Large [> 250]	194	578	33.6%
15-16	Food products; beverages and tobacco	156	1,895	8.2%
17-19	Textiles and leather	264	5,422	4.9%
20-22	Wood, pulp and publishing	175	1,981	8.8%
23-24	Coke and chemicals	60	444	13.5%
25-26	Rubber and other non-metallic	144	1,682	8.6%
27-28	Basic metals and fabricated metal products	123	1,733	7.1%
29	Machinery and equipment NEC	61	819	7.4%
30-33	Electrical and optical equipment	108	468	23.1%
34-35	Transport equipment	106	308	34.4%
36-37	Manufacturing NEC and recycling	78	1,442	5.4%
40-41	**Electricity; gas and water distribution**	21	61	34.6%
51,60-67,72-73,74.2-3	**Service sector**			
	Total	534	7,209	7.4%
	Small [10-49]	313	6,045	5.2%
	Medium-sized [50-249]	160	986	16.2%
	Large [> 250]	61	178	34.3%
51	Whole sale trade and commission trade	167	4,810	3.5%
60-63	Transport and storage	146	1,314	11.1%
64	Post and telecommunications	17	64	26.5%
65-67	Financial inter-mediation	104	442	23.5%
72	Computer and related activities	36	241	14.9%
73	Research and development	2	8	23.7%
74.2	Engineering services	49	283	17.3%
74.3	Testing and analysis	13	45	28.6%

[1] = Number of enterprises in the realised sample
[2] = Estimated number of enterprises in the frame population

[3] = Coverage [Number of enterprises in the realised sample / Number of enterprises in the population]

Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 2 : Number of and percentage of different kind of innovating enterprises (weighted)

NACE	BREAKDOWN	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
10-14	**Mining and quarrying**	135	37.2%	137	38.0%	8	2.3%	8	2.3%	135	37.2%	25	7.0%	3	0.8%
15-37	**Manufacturing sector**														
	Total	6862	42.4%	7254	44.8%	4335	26.8%	3029	18.7%	5033	31.1%	2825	17.4%	387	2.4%
	Small [10-49]	4302	35.3%	4563	37.5%	2618	21.5%	1597	13.1%	2964	24.4%	1520	12.5%	131	1.1%
	Medium-sized [50-249]	2144	62.2%	2258	65.5%	1378	40.0%	1137	33.0%	1735	50.3%	1020	29.6%	228	6.6%
	Large [> 250]	416	72.0%	433	74.9%	339	58.7%	295	51.1%	335	57.9%	285	49.3%	29	5.0%
15-16	Food products; beverages and tobacco	906	47.8%	927	48.9%	534	28.2%	357	18.8%	681	35.9%	290	15.3%	29	1.5%
17-19	Textiles and leather	1684	31.1%	1909	35.2%	925	17.1%	736	13.6%	1270	23.4%	704	13.0%	87	1.6%
20-22	Wood, pulp and publishing	716	36.1%	805	40.7%	240	12.1%	139	7.0%	656	33.1%	274	13.8%	31	1.6%
23-24	Coke and chemicals	293	66.0%	313	70.4%	267	60.0%	207	46.6%	147	33.0%	258	58.1%	42	9.5%
25-26	Rubber and other non-metallic	805	47.9%	810	48.2%	582	34.6%	481	28.6%	549	32.7%	275	16.4%	31	1.8%
27-28	Basic metals and fabricated metal products	924	53.3%	933	53.8%	593	34.2%	229	13.2%	721	41.6%	364	21.0%	68	3.9%
29	Machinery and equipment NEC	413	50.4%	420	51.3%	185	22.5%	124	15.1%	347	42.3%	222	27.1%	27	3.3%
30-33	Electrical and optical equipment	230	49.2%	239	51.0%	190	40.6%	160	34.2%	181	38.7%	146	31.1%	40	8.6%
34-35	Transport equipment	155	50.3%	155	50.3%	123	40.0%	105	34.0%	121	39.4%	59	19.1%	10	3.4%
36-37	Manufacturing NEC and recycling	735	51.0%	744	51.6%	696	48.3%	492	34.1%	360	25.0%	233	16.2%	22	1.5%
40-41	**Electricity; gas and water distribution**	43	70.3%	43	70.3%	30	49.5%	14	23.2%	31	51.0%	21	34.8%	6	9.3%
51,60-67,72-73,74.2-3	**Service sector**														
	Total	3508	48.7%	3613	50.1%	2279	31.6%	1657	23.0%	2208	30.6%	1222	16.9%	264	3.7%
	Small [10-49]	2659	44.0%	2751	45.5%	1802	29.8%	1254	20.7%	1514	25.0%	802	13.3%	133	2.2%
	Medium-sized [50-249]	712	72.2%	725	73.6%	359	36.4%	299	30.3%	573	58.1%	308	31.2%	101	10.2%
	Large [> 250]	137	76.9%	137	76.9%	118	66.2%	104	58.3%	122	68.5%	112	62.7%	29	16.5%
51	Whole sale trade and commission trade	2218	46.1%	2268	47.1%	1507	31.3%	1185	24.6%	1227	25.5%	532	11.1%	168	3.5%
60-63	Transport and storage	540	41.1%	551	41.9%	253	19.3%	78	6.0%	376	28.6%	274	20.8%	3	0.2%
64	Post and telecommunications	59	92.7%	59	92.7%	56	87.8%	56	87.8%	29	45.3%	21	32.0%	0	0.0%
65-67	Financial inter-mediation	312	70.5%	317	71.6%	213	48.2%	119	26.9%	270	60.9%	137	30.9%	40	9.0%
72	Computer and related activities	179	74.1%	200	83.0%	136	56.4%	133	55.2%	133	55.2%	130	54.0%	50	20.6%
73	Research and development	8	100.0%	8	100.0%	0	0.0%	0	0.0%	8	100.0%	8	100.0%	0	0.0%
74.2	Engineering services	173	61.1%	175	61.8%	97	34.1%	72	25.3%	152	53.8%	99	34.8%	0	0.0%
74.3	Testing and analysis	19	42.9%	35	76.2%	16	35.7%	13	28.6%	13	28.6%	22	47.6%	3	7.1%

[1] = Number of innovating enterprises (innovation introduced into the market)
[2] = Percentage of innovating enterprises, of number of enterprises in the population
[3] = Number of enterprises with innovating activity
[4] = Percentage of enterprises with innovating activity, of number of enterprises in the population
[5] = Number of product innovators (goods or services)
[6] = Percentage of product innovators (goods or services), of number of enterprises in the population
[7] = Number of novel innovators (products new for the market)
[8] = Percentage of novel innovators (products new for the market), of number of enterprises in the population
[9] = Number of process innovators
[10] = Percentage of process innovators, of number of enterprises in the population
[11] = Number of enterprises which had not yet completed innovation activities
[12] = Percentage of enterprises which had not yet completed innovation activities, of number of enterprises in the population
[13] = Number of enterprises which had abandoned innovation activities
[14] = Percentage of enterprises which had abandoned innovation activities, of number of enterprises in the population

Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 3a : The enterprises' most significant market (weighted), innovators

MARKET	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Local/regional within your country	1,755	1,525	215	14	25.6%	35.5%	10.0%	3.5%
Local/regional within your neighbouring countries	228	155	71	3	3.3%	3.6%	3.3%	0.7%
National	3,043	2,073	822	148	44.3%	48.2%	38.3%	35.6%
International	1,835	548	1,036	251	26.7%	12.7%	48.3%	60.3%

Service sector (51,60-67,72-73,74.2-3)								
Local/regional within your country	1,078	929	125	24	30.7%	34.9%	17.5%	17.4%
Local/regional within your neighbouring countries	105	102	3	0	3.0%	3.9%	0.4%	0.0%
National	2,099	1,488	504	107	59.8%	56.0%	70.8%	78.2%
International	226	140	81	6	6.4%	5.2%	11.3%	4.4%

[1] = Number reported for all innovating enterprises
[2] = Number reported for small innovating enterprises
[3] = Number reported for medium-sized innovating enterprises
[4] = Number reported for large innovating enterprises
[5] = Proportion for all, as percentage of innovating enterprises
[6] = Proportion for small, as percentage of small innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized innovating enterprises
[8] = Proportion for large, as percentage of large innovating enterprises
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 3b : The enterprises' most significant market (weighted), non-innovators

MARKET	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Local/regional within your country	3,295	3,134	156	5	35.3%	39.8%	12.0%	3.3%
Local/regional within your neighbouring countries	403	328	72	2	4.3%	4.2%	5.6%	1.1%
National	3,711	3,160	486	66	39.8%	40.2%	37.3%	40.7%
International	1,923	1,247	588	89	20.6%	15.8%	45.2%	54.9%
Service sector (51,60-67,72-73,74.2-3)								
Local/regional within your country	1,486	1,352	123	11	40.1%	39.9%	44.8%	27.8%
Local/regional within your neighbouring countries	50	50	0	0	1.4%	1.5%	0.0%	0.0%
National	1,880	1,738	117	26	50.8%	51.3%	42.5%	62.4%
International	282	246	32	4	7.6%	7.3%	11.5%	9.8%

[1] = Number reported for all non-innovating enterprises
[2] = Number reported for small non-innovating enterprises
[3] = Number reported for medium-sized non-innovating enterprises
[4] = Number reported for large non-innovating enterprises
[5] = Proportion for all, as percentage of non-innovating enterprises
[6] = Proportion for small, as percentage of small non-innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized non-innovating enterprises
[8] = Proportion for large, as percentage of large non-innovating enterprises
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 4 : Share of turnover due to new or improved products (weighted)

NACE	BREAKDOWN	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
10-14	**Mining and quarrying**	633,080	270,829	7,322	6,823	1.2%	1.1%	2.7%	2.5%
15-37	**Manufacturing sector**								
	Total	81,235,772	55,136,452	12,509,577	9,225,088	15.4%	11.4%	22.7%	16.7%
	Small [10-49]	16,078,584	6,083,158	1,203,826	454,793	7.5%	2.8%	19.8%	7.5%
	Medium-sized [50-249]	26,374,071	16,431,525	2,353,814	1,502,141	8.9%	5.7%	14.3%	9.1%
	Large [> 250]	38,783,117	32,621,769	8,951,937	7,268,153	23.1%	18.7%	27.4%	22.3%
15-16	Food products; beverages and tobacco	13,960,145	8,351,015	886,507	368,068	6.4%	2.6%	10.6%	4.4%
17-19	Textiles and leather	15,588,669	8,056,901	1,200,127	713,713	7.7%	4.6%	14.9%	8.9%
20-22	Wood, pulp and publishing	10,014,594	6,016,782	577,477	258,648	5.8%	2.6%	9.6%	4.3%
23-24	Coke and chemicals	4,627,525	4,110,828	404,885	270,819	8.7%	5.9%	9.8%	6.6%
25-26	Rubber and other non-metallic	9,605,253	6,588,358	1,137,455	754,340	11.8%	7.9%	17.3%	11.4%
27-28	Basic metals and fabricated metal products	5,578,079	3,909,198	685,025	333,220	12.3%	6.0%	17.5%	8.5%
29	Machinery and equipment NEC	3,138,306	1,893,516	612,086	409,985	19.5%	13.1%	32.3%	21.7%
30-33	Electrical and optical equipment	6,376,850	5,888,108	1,864,577	1,345,891	29.2%	21.1%	31.7%	22.9%
34-35	Transport equipment	9,885,326	8,731,247	4,604,125	4,417,238	46.6%	44.7%	52.7%	50.6%
36-37	Manufacturing NEC and recycling	2,461,024	1,590,499	537,312	353,164	21.8%	14.4%	33.8%	22.2%
40-41	**Electricity; gas and water distribution**	10,790,699	10,732,910	4,278,398	4,261,619	39.6%	39.5%	39.9%	39.7%
51,60-67,72-73,74.2-3	**Service sector**								
	Total	103,839,030	78,578,524	13,550,367	7,399,004	13.0%	7.1%	17.2%	9.4%
	Small [10-49]	22,152,400	10,401,572	2,079,721	886,651	9.4%	4.0%	20.0%	8.5%
	Medium-sized [50-249]	28,110,063	23,248,326	3,895,678	3,260,299	13.9%	11.6%	16.8%	14.0%
	Large [> 250]	53,576,566	44,928,627	7,574,968	3,252,054	14.1%	6.1%	16.9%	7.2%
51	Whole sale trade and commission trade	39,105,752	21,850,800	4,051,091	2,887,190	10.4%	7.4%	18.5%	13.2%
60-63	Transport and storage	6,653,109	4,230,370	805,958	148,177	12.1%	2.2%	19.1%	3.5%
64	Post and telecommunications	5,743,165	5,334,731	559,392	340,344	9.7%	5.9%	10.5%	6.4%
65-67	Financial inter-mediation	49,898,418	45,207,575	6,954,291	2,912,409	13.9%	5.8%	15.4%	6.4%
72	Computer and related activities	1,668,598	1,430,630	1,016,779	984,906	60.9%	59.0%	71.1%	68.8%
73	Research and development	7,360	7,360	0	0	0.0%	0.0%	0.0%	0.0%
74.2	Engineering services	583,731	371,492	133,301	96,736	22.8%	16.6%	35.9%	26.0%
74.3	Testing and analysis	178,897	145,567	29,556	29,242	16.5%	16.3%	20.3%	20.1%

[1] = Total turnover for all enterprises (thousands of Euro)
[2] = Total turnover for innovating enterprises (thousands of Euro)
[3] = Turnover of new or improved products for the enterprise (thousands of Euro)
[4] = Turnover of new or improved products for the market (thousands of Euro)
[5] = Share of turnover of new or improved products for the enterprise, of total turnover for all enterprises
[6] = Share of turnover of new or improved products for the market, of total turnover for all enterprises
[7] = Share of turnover of new or improved products for the enterprise, of total turnover for innovating enterprises
[8] = Share of turnover of new or improved products for the market, of total turnover for innovating enterprises

Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 5 : Innovation expenditure (weighted)

NACE	BREAKDOWN	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
10-14	**Mining and quarrying**	633,080	270,829	4.6%	10.8%	29,159	969	0	28,143	25	25
15-37	**Manufacturing sector**										
	Total	81,235,772	55,136,452	2.8%	4.1%	2,287,458	248,804	161,389	1,588,630	52,689	236,032
	Small [10-49]	16,078,584	6,083,158	3.4%	8.9%	543,161	25,272	11,789	472,727	8,138	25,314
	Medium-sized [50-249]	26,374,071	16,431,525	2.4%	3.9%	634,249	86,023	52,152	404,886	26,578	64,607
	Large [> 250]	38,783,117	32,621,769	2.9%	3.4%	1,110,048	137,509	97,448	711,017	17,973	146,111
15-16	Food products; beverages and tobacco	13,960,145	8,351,015	2.1%	3.6%	297,668	26,686	17,355	197,351	8,571	47,693
17-19	Textiles and leather	15,588,669	8,056,901	2.2%	4.2%	340,170	28,286	5,750	258,197	8,307	39,645
20-22	Wood, pulp and publishing	10,014,594	6,016,782	5.9%	9.9%	593,021	19,839	14,285	492,282	4,009	62,607
23-24	Coke and chemicals	4,627,525	4,110,828	2.0%	2.2%	90,486	31,575	5,138	31,392	1,617	20,780
25-26	Rubber and other non-metallic	9,605,253	6,588,358	2.2%	3.2%	210,556	11,919	36,992	147,949	7,420	6,277
27-28	Basic metals and fabricated metal products	5,578,079	3,909,198	1.9%	2.7%	105,807	12,850	7,377	69,305	3,716	12,562
29	Machinery and equipment NEC	3,138,306	1,893,516	4.4%	7.4%	139,485	12,605	7,633	108,157	6,027	5,057
30-33	Electrical and optical equipment	6,376,850	5,888,108	3.1%	3.3%	195,014	75,914	39,172	59,008	4,543	16,375
34-35	Transport equipment	9,885,326	8,731,247	2.4%	2.7%	237,303	21,104	25,666	167,426	5,471	17,638
36-37	Manufacturing NEC and recycling	2,461,024	1,590,499	3.2%	4.9%	77,947	8,026	2,023	57,562	3,009	7,398
40-41	**Electricity; gas and water distribution**	10,790,699	10,732,910	0.5%	0.5%	49,404	1,746	2,116	25,670	11,578	8,300
51,60-67,72-73,74.2-3	**Service sector**										
	Total	103,839,030	78,578,524	2.6%	3.5%	2,749,358	284,997	801,931	508,180	134,810	1,019,518
	Small [10-49]	22,152,400	10,401,572	1.2%	2.6%	274,604	36,439	15,652	108,666	14,834	99,057
	Medium-sized [50-249]	28,110,063	23,248,326	1.3%	1.6%	360,851	21,599	76,537	175,750	18,820	68,176
	Large [> 250]	53,576,566	44,928,627	3.9%	4.7%	2,113,903	226,959	709,742	223,764	101,156	852,285
51	Whole sale trade and commission trade	39,105,752	21,850,800	0.9%	1.6%	353,864	5,194	76,885	112,207	12,749	146,900
60-63	Transport and storage	6,653,109	4,230,370	12.2%	19.1%	808,494	32,663	639,468	129,866	3,316	3,186
64	Post and telecommunications	5,743,165	5,334,731	2.8%	3.1%	162,831	7,110	20,988	100,296	2,831	31,609
65-67	Financial inter-mediation	49,898,418	45,207,575	2.6%	2.8%	1,281,622	187,353	58,648	108,189	109,042	818,386
72	Computer and related activities	1,668,598	1,430,630	6.3%	7.4%	105,690	40,901	3,905	41,986	4,960	13,942
73	Research and development	7,360	7,360	3.8%	3.8%	283	76	207	0	0	0
74.2	Engineering services	583,731	371,492	4.6%	7.3%	27,073	6,804	393	13,965	1,128	4,784
74.3	Testing and analysis	178,897	145,567	5.3%	6.5%	9,502	4,896	1,438	1,672	786	711

[1] = Total turnover for all enterprises (thousands of Euro)
[2] = Total turnover for innovating enterprises (thousands of Euro)
[3] = Innovation intensity, all enterprises (total innovation expenditure as percentage of turnover for all enterprises)
[4] = Innovation intensity, innovating enterprises (total innovation expenditure as percentage of turnover for innovating enterprises)
[5] = Total innovation expenditures (thousands of Euro)
[6] = Expenditures on intramural R&D (thousands of Euro)
[7] = Expenditures on extramural R&D (thousands of Euro)
[8] = Expenditures on acquisition of machinery and equipment (thousands of Euro)
[9] = Expenditures on acquisition of other external knowledge (thousands of Euro)
[10] = Expenditures on design and other preparations (thousands of Euro)

Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 6 : Public funding of innovation (weighted)

SOURCE	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Local or regional authorities	219	179	34	6	3.2%	4.2%	1.6%	1.5%
Central government	1,087	536	423	127	15.8%	12.5%	19.7%	30.6%
European Union	1,785	883	722	181	26.0%	20.5%	33.7%	43.5%
EU Framework programme	1,308	555	601	152	19.1%	12.9%	28.0%	36.6%

Service sector (51,60-67,72-73,74.2-3)								
Local or regional authorities	4	2	0	2	0.1%	0.1%	0.0%	1.6%
Central government	279	254	15	11	8.0%	9.6%	2.0%	7.8%
European Union	403	317	71	15	11.5%	11.9%	10.0%	10.7%
EU Framework programme	242	171	63	8	6.9%	6.4%	8.9%	6.0%

[1] = Number reported for all innovating enterprises
[2] = Number reported for small innovating enterprises
[3] = Number reported for medium-sized innovating enterprises
[4] = Number reported for large innovating enterprises
[5] = Proportion for all, as percentage of innovating enterprises
[6] = Proportion for small, as percentage of small innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized innovating enterprises
[8] = Proportion for large, as percentage of large innovating enterprises
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 7 : Effects of innovation reported as high degree of impact (weighted)

EFFECT	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Increased range of goods or services	1,318	677	485	156	19.2%	15.7%	22.6%	37.6%
Increased market or market share	977	511	364	103	14.2%	11.9%	17.0%	24.8%
Improved quality in goods or services	3,126	1,972	976	178	45.6%	45.9%	45.5%	42.8%
Improved production flexibility	1,944	1,215	616	113	28.3%	28.3%	28.7%	27.2%
Increased production capacity	2,315	1,489	728	98	33.7%	34.6%	33.9%	23.6%
Reduced labour costs per produced unit	1,181	777	342	62	17.2%	18.1%	16.0%	15.0%
Reduced materials and energy per produced unit	418	220	162	36	6.1%	5.1%	7.5%	8.6%
Improved environmental impact or health and safety aspects	1,746	1,232	402	112	25.4%	28.6%	18.7%	27.0%
Met regulations or standards	2,217	1,464	643	110	32.3%	34.0%	30.0%	26.4%
Service sector (51,60-67,72-73,74.2-3)								
Increased range of goods or services	791	586	145	60	22.5%	22.0%	20.3%	44.0%
Increased market or market share	933	809	87	37	26.6%	30.4%	12.2%	27.0%
Improved quality in goods or services	1,280	1,034	172	74	36.5%	38.9%	24.1%	54.4%
Improved production flexibility	669	551	87	31	19.1%	20.7%	12.3%	22.5%
Increased production capacity	837	714	101	22	23.9%	26.9%	14.2%	16.3%
Reduced labour costs per produced unit	571	495	64	12	16.3%	18.6%	9.0%	8.8%
Reduced materials and energy per produced unit	278	245	28	4	7.9%	9.2%	4.0%	2.8%
Improved environmental impact or health and safety aspects	439	409	18	11	12.5%	15.4%	2.6%	7.8%
Met regulations or standards	867	733	104	29	24.7%	27.6%	14.6%	21.4%

[1] = Number reported for all innovating enterprises
[2] = Number reported for small innovating enterprises
[3] = Number reported for medium-sized innovating enterprises
[4] = Number reported for large innovating enterprises
[5] = Proportion for all, as percentage of innovating enterprises
[6] = Proportion for small, as percentage of small innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized innovating enterprises
[8] = Proportion for large, as percentage of large innovating enterprises

Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 8 : Sources of information reported as high importance (weighted)

SOURCE	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Within the enterprise	2,384	1,528	686	170	34.7%	35.5%	32.0%	40.8%
Other enterprises within the enterprise group (a)	414	100	207	107	33.2%	30.6%	33.3%	36.1%
Innovating Enterprises that are part of a group	1,246	328	622	295				
Suppliers of equipment,material,components or software	1,992	1,280	581	132	29.0%	29.8%	27.1%	31.6%
Clients or customers	1,586	1,069	422	95	23.1%	24.8%	19.7%	22.9%
Competitors and other enterprises from the same industry	590	362	186	42	8.6%	8.4%	8.7%	10.2%
Universities or other higher education institutes	316	210	81	25	4.6%	4.9%	3.8%	6.0%
Government or private non-profit research institutes	188	49	91	48	2.7%	1.1%	4.2%	11.5%
Professional conferences;meetings;journals	550	349	147	54	8.0%	8.1%	6.9%	12.9%
Fairs and exhibitions	1,931	1,165	652	114	28.1%	27.1%	30.4%	27.5%
Service sector (51,60-67,72-73,74.2-3)								
Within the enterprise	1,318	919	324	75	37.6%	34.5%	45.4%	55.0%
Other enterprises within the enterprise group (a)	401	173	174	54	36.9%	28.5%	47.6%	47.7%
Innovating Enterprises that are part of a group	1,086	608	365	114				
Suppliers of equipment,material,components or software	997	770	168	58	28.4%	29.0%	23.6%	42.7%
Clients or customers	645	560	44	42	18.4%	21.1%	6.1%	30.3%
Competitors and other enterprises from the same industry	145	120	16	9	4.1%	4.5%	2.3%	6.7%
Universities or other higher education institutes	41	20	15	6	1.2%	0.8%	2.1%	4.2%
Government or private non-profit research institutes	14	5	8	1	0.4%	0.2%	1.1%	1.0%
Professional conferences;meetings;journals	279	166	84	29	8.0%	6.3%	11.8%	21.4%
Fairs and exhibitions	681	605	66	10	19.4%	22.7%	9.3%	7.1%

[1] = Number reported for all innovating enterprises
[2] = Number reported for small innovating enterprises
[3] = Number reported for medium-sized innovating enterprises
[4] = Number reported for large innovating enterprises
[5] = Proportion for all, as percentage of innovating enterprises
[6] = Proportion for small, as percentage of small innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized innovating enterprises
[8] = Proportion for large, as percentage of large innovating enterprises
[a] = The reference population is all the innovating enterprises belonging to an enterprise group
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table9a : Innovating enterprises involved in co-operation by partner (weighted)

PARTNER	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Other enterprises within the enterprise group (a)	172	28	73	71	42.1%	56.1%	35.4%	46.6%
Innovating Enterprises Cooperating that are part of a group	410	50	207	153				
Suppliers of equipment,material,components or software	765	264	387	113	69.6%	70.8%	72.2%	60.1%
Clients or customers	404	90	238	76	36.8%	24.1%	44.3%	40.3%
Competitors and other enterprises from the same industry	179	10	159	11	16.3%	2.7%	29.6%	5.8%
Consultants	418	88	274	56	38.1%	23.6%	51.1%	29.8%
Commercial laboratories/R&D enterrprises	203	7	157	39	18.5%	1.9%	29.3%	20.5%
Universities or other higher education institutes	395	62	234	99	35.9%	16.6%	43.6%	52.4%
Government or private non-profit research institutes	368	81	191	96	33.5%	21.7%	35.6%	50.9%
Total	1,098	373	536	189				
	[9]	[10]	[11]	[12]				
Service sector (51,60-67,72-73,74.2-3)								
Other enterprises within the enterprise group (a)	212	109	65	37	65.1%	65.5%	58.3%	80.2%
Innovating Enterprises Cooperating that are part of a group	325	167	112	47				
Suppliers of equipment,material,components or software	490	282	161	47	77.3%	73.0%	84.2%	82.8%
Clients or customers	154	120	27	8	24.3%	31.1%	13.9%	13.3%
Competitors and other enterprises from the same industry	61	50	6	5	9.6%	13.0%	3.0%	8.4%
Consultants	202	95	73	34	31.8%	24.6%	38.0%	59.5%
Commercial laboratories/R&D enterrprises	9	2	5	2	1.4%	0.5%	2.6%	3.8%
Universities or other higher education institutes	86	37	35	13	13.6%	9.7%	18.5%	23.5%
Government or private non-profit research institutes	42	8	27	7	6.6%	2.0%	14.0%	13.1%
Total	634	386	191	57				
	[9]	[10]	[11]	[12]				

[1] = Number of enterprises with co-operation with relevant partner, all
[2] = Number of enterprises with co-operation with relevant partner, small
[3] = Number of enterprises with co-operation with relevant partner, medium-sized
[4] = Number of enterprises with co-operation with relevant partner, large
[5] = Relevant partner as proportion of innovating enterprises with co-operation, all
[6] = Relevant partner as proportion of innovating enterprises with co-operation, small
[7] = Relevant partner as proportion of innovating enterprises with co-operation, medium-sized
[8] = Relevant partner as proportion of innovating enterprises with co-operation, large
[9] = Number of innovating enterprises with co-operation, all
[10] = Number of innovating enterprises with co-operation, small
[11] = Number of innovating enterprises with co-operation, medium-sized
[12] = Number of innovating enterprises with co-operation, large
[a] = The reference population is all the innovating enterprises belonging to an enterprise group
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 9b : Innovating enterprises involved in co-operation by region (weighted)

REGION	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
National	942	323	458	161	85.8%	86.6%	85.4%	85.3%
EU/EFTA	556	135	305	116	50.6%	36.1%	56.8%	61.7%
EU Candidate countries	10	0	5	6	0.9%	0.0%	0.9%	2.9%
US	81	53	16	12	7.4%	14.2%	3.0%	6.3%
Japan	15	3	9	2	1.3%	0.8%	1.7%	1.3%
Other	97	0	88	9	8.8%	0.0%	16.4%	4.6%
Total	1,098	373	536	189				

Service sector (51,60-67,72-73,74.2-3)								
National	558	331	173	55	88.0%	85.7%	90.3%	95.9%
EU/EFTA	205	118	55	33	32.3%	30.5%	28.6%	57.4%
EU Candidate countries	3	0	3	0	0.5%	0.0%	1.7%	0.0%
US	46	15	20	11	7.2%	3.8%	10.6%	19.1%
Japan	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Other	61	55	3	3	9.6%	14.3%	1.5%	4.9%
Total	634	386	191	57				

[1] = Number of enterprises with co-operation with relevant region, all
[2] = Number of enterprises with co-operation with relevant region, small
[3] = Number of enterprises with co-operation with relevant region, medium-sized
[4] = Number of enterprises with co-operation with relevant region, large
[5] = Relevant region as proportion of innovating enterprises with co-operation, all
[6] = Relevant region as proportion of innovating enterprises with co-operation, small
[7] = Relevant region as proportion of innovating enterprises with co-operation, medium-sized
[8] = Relevant region as proportion of innovating enterprises with co-operation, large
[9] = Number of innovating enterprises with co-operation, all
[10] = Number of innovating enterprises with co-operation, small
[11] = Number of innovating enterprises with co-operation, medium-sized
[12] = Number of innovating enterprises with co-operation, large

Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 10a : Hampering factors reported as high importance for enterprises with innovation activity (weighted)

FACTOR	[1]	[2]	[3]	[4]	[5]	[6]
Manufacturing sector (15-37)						
Excessive perceived economic risks	605	21.3%	231	17.0%	85	25.4%
Innovation costs too high	1,009	35.6%	618	45.6%	119	35.3%
Lack of appropriate sources of finance	755	26.6%	494	36.5%	109	32.4%
Organisational rigidities within the enterprise	256	9.0%	351	25.9%	50	14.7%
Lack of qualified personnel	655	23.1%	409	30.1%	98	29.0%
Lack of information on technology	359	12.7%	218	16.1%	66	19.6%
Lack of information on markets	366	12.9%	273	20.2%	49	14.5%
Insufficient flexibility of regulations or standards	475	16.7%	107	7.9%	5	1.4%
Lack of customers responsiveness to new goods or services	420	14.8%	135	9.9%	17	5.0%
Total	2,838	[7]	1,355	[8]	337	[9]

Service sector (51,60-67,72-73,74.2-3)						
Excessive perceived economic risks	225	21.5%	389	42.5%	8	3.1%
Innovation costs too high	344	32.8%	373	40.8%	26	10.2%
Lack of appropriate sources of finance	326	31.1%	470	51.5%	26	10.2%
Organisational rigidities within the enterprise	65	6.2%	5	0.5%	61	23.9%
Lack of qualified personnel	148	14.1%	29	3.1%	72	28.0%
Lack of information on technology	71	6.7%	54	6.0%	52	20.3%
Lack of information on markets	123	11.8%	52	5.7%	20	7.7%
Insufficient flexibility of regulations or standards	21	2.0%	123	13.5%	6	2.4%
Lack of customers responsiveness to new goods or services	109	10.4%	209	22.9%	7	2.7%
Total	1,046	[7]	913	[8]	258	[9]

[1] = Number of innovating enterprises with relevant hampering factor and innovation activity seriously delayed
[2] = Relevant hampering factors in proportion of innovating enterprises with innovation activity seriously delayed
[3] = Number of innovating enterprises with relevant hampering factor and innovation activity prevented to be started
[4] = Relevant hampering factors in proportion of innovating enterprises with innovation activity prevented to be started
[5] = Number of innovating enterprises with relevant hampering factor and innovation activity burdened/cumbered with other serious problems
[6] = Relevant hampering factors in proportion of innovating enterprises with innovation activity burdened/cumbered with other serious problems
[7] = Number of innovating enterprises with innovation activity seriously delayed
[8] = Number of innovating enterprises with innovation activity prevented to be started
[9] = Number of innovating enterprises with innovation activity burdened/cumbered with other serious problems
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 10b : Hampering factors reported as high importance for enterprises with no innovation activity (weighted)

FACTOR	[1]	[2]	[3]	[4]	[5]	[6]
Manufacturing sector (15-37)						
Excessive perceived economic risks	204	9.7%	1,397	26.1%	1,980	30.3%
Innovation costs too high	500	23.8%	2,035	38.0%	3,180	48.7%
Lack of appropriate sources of finance	392	18.7%	1,441	26.9%	2,324	35.6%
Organisational rigidities within the enterprise	194	9.2%	536	10.0%	827	12.7%
Lack of qualified personnel	344	16.4%	1,268	23.6%	2,030	31.1%
Lack of information on technology	214	10.2%	699	13.0%	1,083	16.6%
Lack of information on markets	172	8.2%	558	10.4%	819	12.5%
Insufficient flexibility of regulations or standards	151	7.2%	464	8.7%	736	11.3%
Lack of customers responsiveness to new goods or services	216	10.3%	851	15.9%	1,096	16.8%
Total	2,100	[7]	5,362	[8]	6,529	[9]

Service sector (51,60-67,72-73,74.2-3)						
Excessive perceived economic risks	71	10.1%	384	18.7%	620	30.6%
Innovation costs too high	103	14.7%	494	24.0%	895	44.2%
Lack of appropriate sources of finance	15	2.1%	406	19.7%	643	31.8%
Organisational rigidities within the enterprise	39	5.6%	205	10.0%	296	14.6%
Lack of qualified personnel	89	12.6%	391	19.0%	510	25.2%
Lack of information on technology	35	4.9%	214	10.4%	219	10.8%
Lack of information on markets	28	4.1%	127	6.2%	168	8.3%
Insufficient flexibility of regulations or standards	39	5.5%	231	11.2%	339	16.7%
Lack of customers responsiveness to new goods or services	62	8.8%	251	12.2%	420	20.7%
Total	702	[7]	2,059	[8]	2,023	[9]

[1] = Number of Non-innovating enterprises with relevant hampering factor and no innovation activity due to prior innovations
[2] = Relevant hampering factors in proportion of non-innovating enterprises with no innovation activity due to prior innovations
[3] = Number of Non-innovating enterprises with relevant hampering factor and no innovation activity due to market conditions
[4] = Relevant hampering factors in proportion of Non-innovating enterprises with no innovation activity due to market conditions
[5] = Number of Non-innovating enterprises with relevant hampering factor and no innovation activity due to factors impeding innovation
[6] = Relevant hampering factors in proportion of Non-innovating enterprises with no innovation activity due to factors impeding innovation
[7] = Number of Non-innovating enterprises with no innovation activity due to prior innovations
[8] = Number of Non-innovating enterprises with no innovation activity due to market conditions
[9] = Number of Non-innovating enterprises with no innovation activity due to factors impeding innovation
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 11a : Patents and other protection methods (weighted), innovators

METHODS	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Number of Enterprises submitting Patent applications	363	125	166	72	5.3%	2.9%	7.7%	17.2%
Number o Enterprises Owning Valid Patents	677	310	282	86	9.9%	7.2%	13.1%	20.7%
Registration of design patterns	295	133	101	61	4.3%	3.1%	4.7%	14.7%
Trademarks	1,216	492	552	172	17.7%	11.4%	25.7%	41.4%
Copyright	164	76	63	24	2.4%	1.8%	3.0%	5.8%
Secrecy	1,329	657	546	127	19.4%	15.3%	25.4%	30.6%
Complexity of design	845	439	344	62	12.3%	10.2%	16.0%	14.9%
Lead-time advantage on competitors	1,572	758	657	156	22.9%	17.6%	30.6%	37.6%

Service sector (51,60-67,72-73,74.2-3)								
Number of Enterprises submitting Patent applications	261	145	94	22	7.5%	5.5%	13.2%	16.4%
Number o Enterprises Owning Valid Patents	199	119	56	24	5.7%	4.5%	7.8%	17.6%
Registration of design patterns	285	237	14	35	8.1%	8.9%	1.9%	25.4%
Trademarks	677	469	163	45	19.3%	17.6%	22.9%	33.3%
Copyright	46	21	9	16	1.3%	0.8%	1.2%	11.7%
Secrecy	433	343	62	28	12.4%	12.9%	8.8%	20.3%
Complexity of design	312	222	66	25	8.9%	8.3%	9.3%	17.9%
Lead-time advantage on competitors	551	421	97	32	15.7%	15.8%	13.7%	23.7%

[1] = Number reported for all innovating enterprises
[2] = Number reported for small innovating enterprises
[3] = Number reported for medium-sized innovating enterprises
[4] = Number reported for large innovating enterprises
[5] = Proportion for all, as percentage of innovating enterprises
[6] = Proportion for small, as percentage of small innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized innovating enterprises
[8] = Proportion for large, as percentage of large innovating enterprises
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 11b : Patents and other protection methods (weighted), non-innovators

METHODS	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Number of Enterprises submitting Patent applications	270	212	55	3	2.9%	2.7%	4.2%	2.0%
Number o Enterprises Owning Valid Patents	388	262	115	11	4.2%	3.3%	8.8%	6.6%
Registration of design patterns	84	30	52	1	0.9%	0.4%	4.0%	0.9%
Trademarks	845	588	232	25	9.1%	7.5%	17.8%	15.7%
Copyright	15	0	15	0	0.2%	0.0%	1.2%	0.0%
Secrecy	558	431	107	20	6.0%	5.5%	8.2%	12.4%
Complexity of design	274	238	26	10	2.9%	3.0%	2.0%	6.0%
Lead-time advantage on competitors	482	331	140	11	5.2%	4.2%	10.8%	6.9%

Service sector (51,60-67,72-73,74.2-3)								
Number of Enterprises submitting Patent applications	70	59	10	1	1.9%	1.7%	3.7%	3.0%
Number of Valid patents	135	122	12	1	3.6%	3.6%	4.2%	3.0%
Registration of design patterns	5	0	0	5	0.1%	0.0%	0.0%	12.6%
Trademarks	258	214	37	8	7.0%	6.3%	13.3%	19.1%
Copyright	23	13	10	0	0.6%	0.4%	3.6%	0.0%
Secrecy	183	144	39	0	4.9%	4.3%	14.2%	0.0%
Complexity of design	45	11	34	0	1.2%	0.3%	12.5%	0.0%
Lead-time advantage on competitors	217	172	45	0	5.9%	5.1%	16.4%	0.0%

[1] = Number reported for all non-innovating enterprises
[2] = Number reported for small non-innovating enterprises
[3] = Number reported for medium-sized non-innovating enterprises
[4] = Number reported for large non-innovating enterprises
[5] = Proportion for all, as percentage of non-innovating enterprises
[6] = Proportion for small, as percentage of small non-innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized non-innovating enterprises
[8] = Proportion for large, as percentage of large non-innovating enterprises
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 12a : Other important strategical and organisational changes (weighted), innovators

ACTIVITY	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Strategy	3,321	1,742	1,307	272	48.4%	40.5%	61.0%	65.3%
Management	2,564	1,305	1,000	259	37.4%	30.3%	46.6%	62.4%
Organisation	3,508	1,918	1,308	283	51.1%	44.6%	61.0%	68.0%
Marketing	2,160	1,240	734	186	31.5%	28.8%	34.2%	44.8%
Aesthetic change	3,070	1,604	1,205	261	44.7%	37.3%	56.2%	62.8%
Service sector (51,60-67,72-73,74.2-3)								
Strategy	1,773	1,321	370	82	50.6%	49.7%	52.0%	60.0%
Management	1,757	1,322	344	91	50.1%	49.7%	48.3%	66.3%
Organisation	2,264	1,708	464	92	64.5%	64.2%	65.1%	67.1%
Marketing	1,463	1,057	331	76	41.7%	39.7%	46.5%	55.5%
Aesthetic change	1,314	919	325	70	37.5%	34.6%	45.7%	51.0%

[1] = Number reported for all innovating enterprises
[2] = Number reported for small innovating enterprises
[3] = Number reported for medium-sized innovating enterprises
[4] = Number reported for large innovating enterprises
[5] = Proportion for all, as percentage of innovating enterprises
[6] = Proportion for small, as percentage of small innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized innovating enterprises
[8] = Proportion for large, as percentage of large innovating enterprises
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.

Table 12b : Other important strategical and organisational changes (weighted), non-innovators

METHODS	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Manufacturing sector (15-37)								
Strategy	1,452	1,044	365	43	15.6%	13.3%	28.1%	26.8%
Management	1,137	756	338	43	12.2%	9.6%	26.0%	26.4%
Organisation	1,436	1,002	389	45	15.4%	12.7%	29.9%	27.6%
Marketing	1,136	846	258	32	12.2%	10.8%	19.9%	19.5%
Aesthetic change	1,535	1,097	392	45	16.4%	13.9%	30.1%	27.9%
Service sector (51,60-67,72-73,74.2-3)								
Strategy	1,037	894	129	14	28.0%	26.4%	47.2%	33.8%
Management	914	789	107	18	24.7%	23.3%	39.2%	44.5%
Organisation	1,180	1,010	139	31	31.9%	29.8%	50.9%	75.3%
Marketing	998	883	97	18	27.0%	26.1%	35.4%	43.9%
Aesthetic change	617	554	37	26	16.7%	16.4%	13.7%	62.9%

[1] = Number reported for all non-innovating enterprises
[2] = Number reported for small non-innovating enterprises
[3] = Number reported for medium-sized non-innovating enterprises
[4] = Number reported for large non-innovating enterprises
[5] = Proportion for all, as percentage of non-innovating enterprises
[6] = Proportion for small, as percentage of small non-innovating enterprises
[7] = Proportion for medium-sized, as percentage for medium-sized non-innovating enterprises
[8] = Proportion for large, as percentage of large non-innovating enterprises
Note: All values except the number of enterprises in the realised sample are rounded to integer. Therefore, some aggregations may not correspond precisely to the expected sum due to the weighting effect. Nonetheless, all the ratios presented are calculated in full without rounded values.