Factors influencing innovation decision making in Portuguese firms

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Abstract: There is an undeniable positive effect of innovation for both firms and the economy, with particular regards to the financial performance of firms. However, there is an important role of the decision making process for the allocation of resources to finance the innovation process. The aim of this paper is to understand what factors explain the decision making process in innovation activities of Portuguese firms. This is an empirical study, based on the modern theoretical approaches, which has relied on five key aspects for innovation: barriers, sources, cooperation, funding; and the decision making process. Primary data was collected through surveys to firms that have applied for innovation programmes within the Portuguese innovation agency. Univariate and multivariate statistical techniques were used. Our results suggest that the factors that mostly influence the Portuguese firms' innovation decision-making processes are economical and financial (namely those related to profit increase and labour costs reduction).

Keywords: economical and financial factors; innovation; decision-making; SMEs; competitive advantage.

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1 Introduction

Innovation is widely accepted as the dominant factor in national economic growth and has been assuming, increasingly, a key role on competitiveness. Many researchers accept the importance of innovation as a crucial factor in business competitiveness (e.g., Becattini, 1999; Bouchikhi and Kimberly, 2001; Kemp et al., 2003; Kleinknecht and Oostendop, 2002; Klomp and Van Leeuwen, 1999) considering innovation as the long term key for business success and an element that allows improving domestic economies, through the resolution of socio-economic problems such as unemployment and productivity growth.

In light with this perspective the management of innovation has become, the core competence for modern organisations operating in competitive and globalised markets. In such a context, it is difficult to conceive a continually successful firm without innovation. In fact, many firms are facing major financial constraints hindering them from investing in innovative ambitious projects. Hence, there is a very close and evident relationship between funding and management abilities to engage into innovation projects.

Therefore innovation is based on trade-offs and thus management often faces decisions and choices (Heerkens, 2006). Exploring the process of decision making, with regards to innovation projects, seems to be highly relevant for the understanding of the limitations of business innovation; to assess which factors play a role in the process; and why it matters.

Therefore, both concepts of innovation and decision-making are intimately related. This link has been studied in recent years by a number of authors (e.g., Dacorso, 2000; Heerkens, 2006; Kessler, 2004; Kleinknecht and Mohnen, 2002; Vossen and Nooteboom, 1996).

The relevance of the 'innovation' and 'decision-making' concepts, their importance for achieving the organisational objectives, as well as the limited availability of studies exploring this issue in Portugal, justify the pertinence of this study. Thus, in order to carry out an explorative study on decision-making in innovation, the firms that benefited from financial support for their innovation projects, through the innovation agency (ADI) were considered as the population.

This research is especially relevant and informative for the decision-makers within firms where innovation plays an important role and for policy-makers. Our aim is to produce new and relevant information for business management and, taking into account the importance of innovation for business success and consequently on the overall economy, for public policy making. With this aim in mind, this research main objective is to identify which factors contribute to understand innovation decision-making in Portuguese firms, with particular regards to the economic and financial factors influencing the process at a corporate level.

This research is supported by a reference theoretical model developed from the current literature on the subject – innovation and decision making process in firms, which has resulted an empirical work for identifying factors that determine the decision to innovate in Portuguese firms. The resulting research model includes five key areas: obstacles, sources, cooperation, finance, and decision-making process in innovation.

This study used data, collected through a questionnaire, from firms that submitted applications for innovation programmes to the Portuguese ADI, resulting in a total of 36 responses (response rate of 37.5%). To empirically test the research hypotheses, we used univariate and multivariate statistical analysis.

This article is organised as follows: after an introductory section, a discussion of theoretical approaches to the process of decision making and business innovation is provided; Section 3 describes the methodology, the fourth section presents the results of research and, finally, in the fifth section, some research findings are presented, we explore the main limitations of this study and suggest lines of future research, as well as some recommendations for business and policy-makers in the conclusions.

2 The decision making process and business innovation

'Innovation' has numerous definitions. Each person, organisation or institution may have a specific concept of innovation, according to his or her experience (Batista, 1999). As stated by some authors (e.g., Cunha et al., 2006; Fonseca, 2002; Marques and Monteiro-Barata, 2006) the concept can vary widely, including issues as diverse as the launch of new products, the discovery of a new source of raw materials, a new manner of providing after-sales service, a new production process, the adoption of new technological solutions or work processes, different forms of entry into new markets, the establishment of new agreements with customers or suppliers, etc.

The roots of the discussion on innovation seem to be found in the early 20th century, with the fundamental contribution of Joseph Schumpeter who has analysed the role of innovation in the performance of firms and economies. Innovation is a central and present theme but already widespread both in literature and in practice management.

Since the mid 1970s there have been numerous explanatory models on how innovation processes should be developed in organisations (e.g., Morcillo, 1989; Porter, 1985; Pugel, 1978). Since then, much has been discussed on innovation, the nature, characteristics, sources and classification, in order to understand its role on the economic development. Innovation represents an opportunity for some, for others a threat, however, it the impact it has on our daily lives cannot be ignored, whether economically or socially, or by posing moral dilemmas (Freeman, 1975).

Following these theories within business strategy, several studies have been directed towards the development of innovations. Authors such as Aaker (1998a, 1998b), Ansoff and McDonnell (1993), Engel et al. (2000), Fahey and Randall (1994), Grant (1998), Gupta (2008), Kotler (1997), Ohmae (1988), Porter (1998), Prahalad and Hamel (1990) and Schewe and Hiam (1998), among others, have shown that innovation leads to competitiveness, concluding that the organisation's future depends on it, however, it implies investments which returns are not guaranteed given that the associated probability of failure is high.

Therrien (2002) argues that the two biggest obstacles to innovation are related to the firms' inability to spare some of their staff to develop innovative projects in progress, due

to production requirements, and to the high costs of developing new and/or improved products or processes.

Innovation-oriented activities (R&D, market research, information gathering on new technologies) are expensive, since they imply, in addition to direct costs, opportunity costs, by allocating resources that would be used in 'normal' production (Marques and Monteiro-Barata, 2006). Despite these conditions, managers seem to understand the meaning of business innovation and its importance to the sustainability of firms, the reason why this issue is increasingly taken into account in business decision-making. Bouchikhi and Kimberly (2001) summarise their ideas expressed in two statements:

1 firms need to innovate to survive or, otherwise, they face the possibility of extinction

2 the wide recognition of this necessity, as well as the difficulty in stimulating and supporting innovation and entrepreneurial spirit in business, have generated a research and consulting industry.

In this sense, the search for sustainable competitive advantage increasingly depends on innovative entrepreneurship, always bearing in mind that innovation is considered, according to Marques and Monteiro-Barata (2006), as a cumulative process of learning that goes beyond research and development (R&D) and in which the organisational and management aspects play a key role. Despite the risk and uncertainty lead by innovation, if successful, it can produce a significant impact on the economic and financial results of firms.

Marques and Monteiro-Barata (2006) also added that it is based on this belief or expectation in the relationship between innovation and good performance that firms are induced to create systems to encourage creative ideas, to implement tools for fostering creativity in decision-making processes and problem-solving, to build a culture that facilitates experimentation and to allocate resources to formal and informal activities that are likely to generate profitable innovation. Innovation is, thus, a key element in improving economic and financial performance of firms and hence of national economies.

Despite the various authors' consensus, with respect to the benefits that innovation potentially has on business, Dantas (2001) points out a number of variables acting as barriers to innovation:

1 the size of the organisation and the available resources (technological, financial and humans)

2 the corporate culture

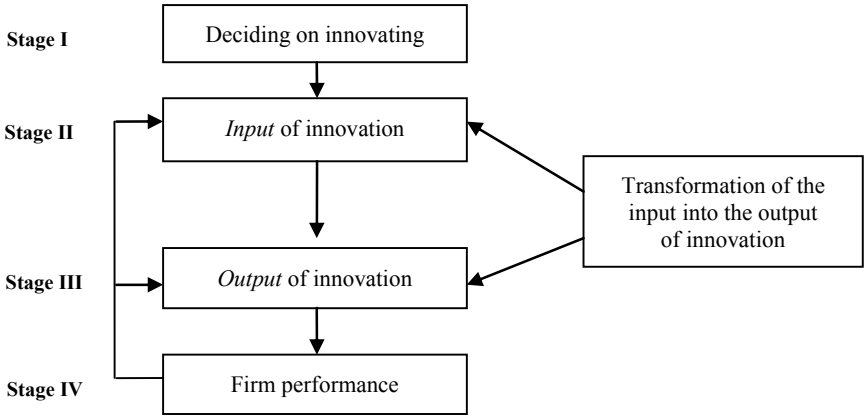
3 the role of government (the educational system and national effort in R&D).

In this context, and according to Teotónio and Moreira (2006), investing in modernisation of the business has been a priority in Portuguese economic policy in order to make firms able to respond effectively to challenges in the global market. In this sense, efforts have been made in order develop policies supporting innovative activities, based on highly qualified human resources. Over the last decade, several initiatives have been launched in this area within the III European Support Framework (QCA), of the National Strategy Reference Framework (QREN), through the Incentive Program for Economic Modernisation (PRIME), the Institute of Support to small and Medium Enterprises and Innovation (IAPMEI), the ADI, among others.

Due to the growing intensity of international competition and to the increase in the costs of research in most industries, it is also frequent a growing cooperation between different institutions in order to carry out research projects (Freire, 2000). Tidd et al. (2005) argue that companies cooperate primarily to reduce costs and the risks of (technological) development or to entry into a market, to reduce development time and commercialisation of new products and to achieve economies of scale in production.

It is also important to note that the activity of innovation is not an exclusive responsibility of R&D function, as it can happen anywhere within the organisation. All employees can contribute with ideas for improvement, "above all, it has to be, a permanent state of mind shared by all members of the organization" (Dantas, 2001, referring to several authors, among them, Carneiro, 1995; Dussage and Ramanantsoa, 1987; Morcillo, 1997). With regard to external sources, Dantas (2001) argues that innovation activities are often triggered by contributions from third parties with whom the firm maintains contact, including customers, suppliers and distributors. Therefore, the decision to innovate is very important for firms because it triggers a series of actions, from the moment it is made; in particular, it requires the allocation of the required resources for the innovation process (Figure 1).

Figure 1 Stages of the innovation process



Source: Adapted from Marques and Monteiro-Barata (2006, p.118)

In this sense, it became necessary to better know the corporate decision-making process. The concept of 'decision making' is one's choice(s) amongst several alternatives, in order to achieve a solution that solves (or not) the problem. Most authors, e.g., Simon (1965) consider decision-making a rational and economic process. It is generally agreed that there is no management without decision making, regardless of the decision concerned, or to make the decision more accurate. Nogueira (2004) states that the right decisions in management are the key elements of organisational success, especially in times of turbulence, so this issue should be mentioned when one approaches business innovation.

In line with this perspective, Baumol (2002) refers to the key factor influencing business decisions in market economies – the maximisation of economic return. Similarly, some authors suggest that the decision-making in innovation is influenced by economic and financial factors (e.g., Conceição and Ávila, 2001; Dacorso, 2000; Felder et al., 1996; Kleinknecht, 2000; Kleinknecht and Mohnen, 2002; Klomp and

Van Leeuwen, 1999; Lööf et al., 2001; Mairesse and Mohnen, 2001; Marques, 2005; Vossen and Nooteboom, 1996).

Thus, according to the literature review, the following research hypotheses were formulated:

H1 Firms decide to innovate to improve their economic and financial performance.

H2 The existence of obstacles to innovation negatively influence the business decision to innovate.

H3 The information sources (internal, external and institutional) have a positive influence on business decision to invest in innovation activities.

H4 The existence of cooperation agreements with partner organisations positively contributes to the decision to innovate.

H5 The motivation to innovate is positively influenced by the availability of external funding to support innovation projects.

3 Methodology

3.1 Characterisation of population and data collection method

The methodological technique adopted in this study was a non-probabilistic sample, given the limitations in terms of the number of responses. Access to the population (for the purpose of this study) was done through the Portuguese ADI, and it considered all the firms taking part in programmes supporting innovation and technological development business managed by ADI under the 3rd European Community Support Framework, which was in operation between 2000 and 2006. Given the limited number of firms (116), it was decided to include the whole population in the study, although some had to be excluded because they had close down meanwhile or their addresses could not be found in the time frame. As a result, 96 firms were surveyed. The choice of this population was made in order to ensure that the firms really developed innovative projects.

In order to identify the main factors influencing innovation decision-making in the Portuguese firms, we opted for quantitative research, using a research questionnaire developed by the authors.

The statistical analysis of data began with the characterisation of firms through a univariate analysis of the questionnaire items regarding the profile of the firm. Subsequently a multivariate analysis was employed, using factor analysis techniques. The statistical procedures and data analysis were performed with access to Statistical Package for Social Sciences (SPSS).

The first step of elaborating the questionnaire was simplified as it closely followed the community innovation survey (CIS), developed by the EU, with regards to innovation. It is a major study of statistical nature aiming to evaluate the effects of innovation on products and processes in cross-industries European firms. These surveys, conducted every four years, are based on the guidelines established in the Oslo Manual (OECD) as well as the recommendations of Eurostat. In Portugal, these surveys were

conducted under the coordination of the Centre for Science and Technology (OCT) with support provided by National Statistics Institute (INE).

The questionnaire was aimed to understand how entrepreneurs and/or managers measure the extent of innovation activity in the business, the intensity of investment in innovation, the part of the turnover firms assigned to the commercialisation of new goods and services or significantly improved, the cooperation between firms or with other institutions for innovation or factors hindering innovation. Firms were asked to answer a questionnaire composed of two parts:

1 The first part concerned the general identification of the firm and it was stratified by the number of employees (size), location and sector. This part included a set of questions on the identification of the firm, such as business name, address, CAE and star-up year. It also included a number of questions in order to collect aggregate of data on economic and demographic aspects of the firm including, among others, the geographic markets where the firm was present, turnover, staff, etc.

2 The second part included closed questions and it was divided into several aspects of innovation: sources, objectives, obstacles, effects, cooperation and public funding. In addition, with regards to the range of products and services (innovation in the broadest sense), it sought to enquire about the establishment of new methods of production, supply and distribution; the introduction of changes in management and organisation of work and further organisational changes.

3.2 Definition of variables

The dependent variable used in the linear regression estimation was the determinants of corporate decision making in innovation, which has resulted from factor analysis of items contained in the questionnaire (objectives of the implementation of innovation and importance of each indicator for the decision to innovate), namely: profit and social impact, new markets and reduce operating costs, new products and reducing personnel costs, and increased sales.

The explanatory variables (or independent variables) are divided into four major groups: barriers to innovation, sources of innovation, cooperation and funding. Besides these, we have also analysed the firm size, region of origin and sector as variables for characterising the sample.

4 Results of the study

4.1 Characterisation of the sample

Through the analysis of univariate and multivariate descriptive the results obtained from the quantitative analysis are presented an analysed, starting with the characterisation of the firms and followed by the specification and interpretation of statistical methods.

Data was gathered through posted and e-mailed to entrepreneurs/managers of 96 firms involved in innovation projects, via the ADI, from whom 36 responses were received, corresponding to a response rate of 37.5%. The sample was stratified by the number of workers (size), location and sector (Table 1).

Table 1 Characterisation of the sample

Size	*%*	*Region of origin*	*%*
Micro	5.5	Lisboa	25.0
Small	58.3	Porto	36.1
Medium	16.7	Aveiro	25.0
Large	19.5	Leiria	8.3
		Santarém	2.8
		Setúbal	2.8
		Sector	
Textiles	2.8	Large retailers	11.1
Chemicals and oil production	22.2	Transports, travelling and tourism	11.1
Equipment machinery	25.0	Telecommunications and post	2.8
Medical equipment	13.9	Other services activities	11.1
Total number of observations: 36			

The table shows that most of firms are small organisations and are located in Lisboa, Porto or Aveiro. Not surprisingly, about half of the firms operate in the chemicals or equipment industry, where innovation seems to play a more important role than in other sectors. Despite the fact that innovation can take place in any sector of activity, some of them are more open to innovation, or at least take advantage of innovation support programmes more actively. These are probably sectors in which innovation plays a more important role in terms of competition and competitiveness.

4.2 Statistical procedures

In order to identify the factors that influence the innovation strategy of firms, we have used a factorial analysis of the items contained in the questionnaire. The aim of applying this statistical technique was to obtain a small number of factors that can be used to identify the structural relationships between the innovation strategies defined by firms and the barriers to innovation, sources of innovation, cooperation and funding.

Factor extraction was based on principal components method through the varimax[1]. The common factors retained are those that display an eigenvalue above 1, in accordance with the scree plot and the percentage of retained variance as, according to Maroco (2007), using a single criterion may lead to retention of plus/minus factors than those relevant to describe the underlying structure. To assess the validity of the exploratory factor analysis we used the KMO[2] criterion, with the classification criteria defined in Maroco (2007). The scores from each subject under examination in each of the retained factors were obtained by the method of Bartlett[3], i.e., weighted least squares method.

4.2.1 Determinants of innovation decision making

The factorial analysis of main components for the study of 11 variables relating to the objectives of the firm in relation to decision-making on innovation included 36 firms. Given an observed KMO = 0.741, we proceeded to exploratory factor analysis, since the

factorability of the correlations matrix is average. The model consistency was assessed by Cronbach's alpha[4].

According to the rule of thumb for extracting factors with eigenvalues greater than 1, in line with the scree plot, it is suggested that four factors are extracted (profit and social impact; new markets and operational costs reduction; new products and staff cost reduction; increase in sales) which accounts for around 73.6% of the total variability. The process of factor analysis started by eliminating variables with factorial weights under | 0.50 | from the component matrix. No items were eliminated, allowing eleven variables in the study.

Table 2 shows how the 11 items were grouped into four factors; the eigenvalues for the factors; the percentage of explained variance; and internal consistency of the factors based on the coefficients of Cronbach's alpha.

Table 2 Determinants on innovation decision-making; factorial analysis of principal components, with varimax rotation

	Factor 1 Profit and social impact	*Factor 2 New markets, operational costs reduction*	*Factor 3 New products and staff costs reduction*	*Factor 4 Increase in sales*
Compliance with regulations and norms	0.885			
Improvements on environmental impact, on safety and health	0.798			
Profit increase	0.696			
Entry in new markets or increase of the market share		0.853		
Reduction in the costs of production or commercialisation		0.763		
Reduction on energy/raw materials consumption		0.672		
Reduction in labour costs			0.818	
Increase in the range of products			0.766	
Improvements on production flexibility			0.536	
Improvements on the quality of products				–0.660
Increase in turnover				0.670
N	3	3	3	2
Average	14.023	13.361	10.806	8.278
Variance	89.342	75.723	55.990	13.292
Standard deviation	9.452	8.702	7.483	3.646
Explained variance (%)	*21.463*	*21.302*	*17.761*	*13.088*
Consistency *Cronbach's* α	*0.789*	*0.738*	*0.666*	*–0.045**

Notes: KMO = 0.7641 and Bartlett sphericity test = 155.020 (sig: 0.000).
*A logistic regression could not be applied as the factor is not consistent (Cronbach's $\alpha < 0$).

The analysis for the internal consistency of each factor revealed acceptable values for all the factors, except for the factor 4, displaying an alpha value rejecting consistency. Thus, the latter factor was not used as an explanatory factor on innovation decision-making.

4.2.2 Obstacles to innovation

The factorial analysis of main components for the ten variables relating to obstacles to innovation included 36 firms. With an observed KMO = 0.784, we proceeded to exploratory factor analysis, since the factorability of the correlations matrix is average. The analysis of the consistency of the model was assessed by Cronbach's alpha.

According to the rule of thumb for extracting factors with eigenvalues greater than 1, in line with the scree plot, it is suggested that one factor is extracted (obstacles) which accounts for 68.34% of the total variability. The process of factor analysis started by eliminating variables with factorial weights under | 0.50 | from the component matrix. No items were eliminated, allowing ten variables in the study.

Table 3 shows the grouping of ten items distributed by a factor, the eigenvalues of the factor and the percentage of explained variance, and the internal consistency of the factor from the coefficient Cronbach's alpha.

Table 3 Obstacles: factor analysis of principal components, with varimax rotation

	Factor 1 *Obstacles to innovation*
Perception of excessive economic risks	0.787
Innovation costs too high	0.760
Lack of appropriate information sources	0.762
Organisation structure not flexible	0.880
Lack of skilled labour	0.851
Lack of information on technology	0.905
Lack of information on the markets	0.896
Norms and regulations	0.810
Weak customer openness	0.789
Reduced market size	0.811
N	36
Average	21.028
Variance	92.713
Standard deviation	9.629
Explained variance (%)	*68.34*
Consistency *Cronbach's* α	*0.947*

Notes: KMO = 0.784 and Bartlett sphericity test = 368,182 (sig.: 0.000).

The analysis for the internal consistency of the factor revealed excellent values for Cronbach's alpha. Thus, this factor will be used when we test the research model.

4.2.3 Sources of innovation

The factorial analysis of main components for the ten variables relating to sources of innovation included 36 firms. As it was observed KMO = 0.707, and hence proceeded to exploratory factor analysis, the factorability of the correlations matrix is average. The analysis of the consistency of the model was assessed by Cronbach's alpha.

According to the rule of thumb for extracting factors with eigenvalues greater than 1, in line with the scree plot, it is suggested that three factors are extracted (external sources; internal and institutional sources; and other group firms and R&D laboratories) which accounts for 74.23% of the total variability. The process of factor analysis started by eliminating variables with factorial weights under | 0.50 | from the component matrix. No items were eliminated, allowing ten variables in the study.

Table 4 shows how the ten items were grouped into three factors; the eigenvalues for the factors; the percentage of explained variance; and internal consistency of the factors based on the coefficients of Cronbach's alpha.

Table 4 Sources of innovation: factor analysis of principal components, with varimax rotation

	Factor 1 External sources	*Factor 2 Internal and institutional sources*	*Factor 3 Other group firms and R&D laboratories*
Suppliers	0.786		
Competitors	0.767		
Conferences, meetings and scientific or professional publications	0.712		
Exhibitions	0.914		
Within the firm		0.923	
Customers		0.847	
Universities and other education institutions		0.743	
Consulting firms		0.561	
Other group firms			0.607
Government laboratories; governmental R&D institutions and other private non-profit organisations			0.894
N	36	36	36
Average	8.389	8.111	2.917
Variance	10.244	12.101	4.993
Standard deviation	3.201	3.479	2.234
Explained variance (%)	*30.072*	*26.787*	*17.407*
Consistency *Cronbach's* α	*0.865*	*0.827*	*0.579*

Notes: KMO = 0.707 and Bartlett sphericity test = 201.051 (sig.: 0.000).

The internal consistency analysis for each factor showed good values, except for factor 3, wherein the alpha value shows that the consistency factor is unacceptable. In this sense, the latter factor is not used when we tested the research model.

Thus, analysing how variables grouped into factors one can provide an interpretation for these factors: the first factor is related to the *external sources of the firm* (suppliers, competitors, conferences, meetings and scientific or professional publications, trade shows and exhibitions). The second factor is related to the *internal and institutional sources* (inside the firm, customers, universities or other educational institutions, consulting firms). The third factor is related to *other group firms and R&D laboratories* (other group firms, state laboratories, R&D institutes, and governmental or private non-profit institutions.

4.2.4 Cooperation to innovation

The factorial analysis of main components for the eight variables on cooperation included 36 firms. All variables that saturate more than a factor were eliminated (the criterion is the saturation coefficient 0.50). No items were eliminated, allowing eight variables in the study (KMO = 0.726 and Bartlett's sphericity test = 95.658 with significance: 0.000).

According to the rule of thumb for extracting the factors with eigenvalues greater than 1, it is suggested that three factors are extracted (institutional cooperation, cooperation with customers and competitors and cooperation with partners of the group and suppliers) which accounts for 69.52% of the total variability. The process of factor analysis started by eliminating variables with factorial weights under | 0.50 | from the matrix component.

Table 5 shows how the variables grouped into three factors; the eigenvalues for each factor; the percentage of explained variance; and internal consistency for each factor based on the Cronbach's alpha coefficient.

Table 5 Cooperation: factor analysis of principal components, after varimax rotation

	Factor 1 Institutional	*Factor 2 Customers and competitors*	*Factor 3 Partners of the group and suppliers*
Government laboratories; governmental R&D institutions and other private non-profit organisations	0.903		
Private laboratories or R&D firms	0.785		
Universities and other education institutions	0.680		
Consulting	0.508		
Customers		0.853	
Competitors		0.746	
Other group firms			0.816
Suppliers			0.701
N	36	36	36
Average	6.333	3.634	3.333
Variance	12.057	2.866	3.143
Standard deviation	3.472	1.693	1.773
Explained variance (%)	*27.595*	*24.714*	*17.214*
Consistency *Cronbach's* α	*0.768*	*0.611*	*0.364*

Notes: KMO = 0.726 and Bartlett sphericity test = 95.658 (sig.: 0.000).

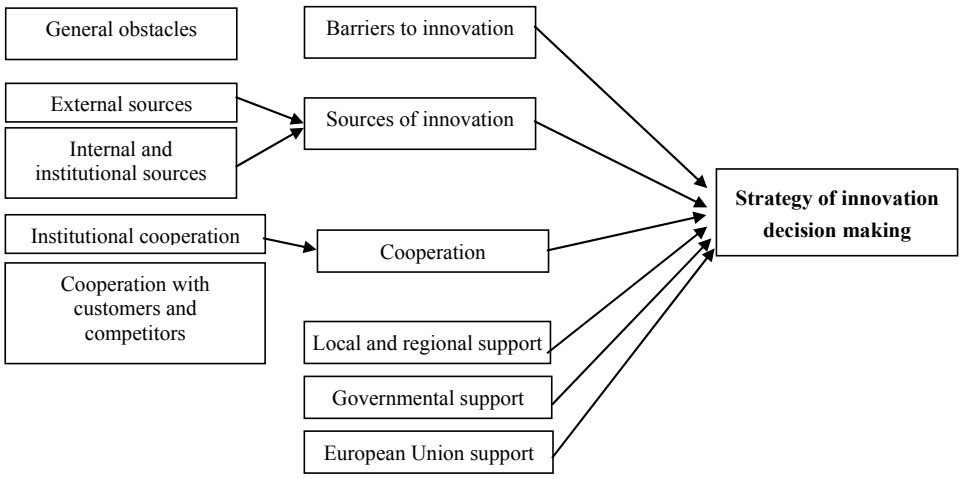
The analysis of internal consistency for each factor revealed good alpha values for all factors, except for the factor 3, wherein the alpha value shows that the consistency factor is unacceptable. In this sense, this factor was not used when we tested the research model.

Thus, analysing how variables grouped into factors we obtain the following interpretation for the factors found: factor 1 is related to the *Institutional Cooperation* (government laboratories, government R&D or private non-profit institutions, privately owned laboratories or R&D firms, universities or other educational institutions, consultants); the second factor is related to *cooperation with customers and competitors* (customers, competitors). The third factor refers to the *cooperation with partners of the group and suppliers* (the group's other partners, suppliers).

4.3 Results of the study

In order to identify the factors that influence the innovation strategy of firms, we have used a factorial analysis of the items contained in the questionnaire. The aim of applying this statistical technique was to obtain a small number of factors that could be used to identify the structural relationships between the innovation strategies defined by firms and the barriers to innovation, sources of innovation, cooperation and funding. The results of the factorial analysis can be found in Figure 2.

Figure 2 Empirical model: results of factorial analysis



Descriptive statistics of the reasons that lead firms to participate in innovation programmes, are summarised in Table 6.

In order to confirm (or not) the research hypotheses, and given the proposed research model, we proceeded, to the application of the statistical model that best suits the present study: a linear regression[5].

Table 6 Motivations for innovation

	Descriptive statistics				
	N	*Minimum*	*Maximum*	*Mean*	*Std. deviation*
Increasing in the range of products	36	.00	11.00	3.1944	2.84675
Entering new markets or increasing the market share	36	.00	9.00	3.5000	2.82337
Improving the quality of products	36	.00	10.00	4.2500	2.80179
Increasing the flexibility of production	36	.00	11.00	4.0833	3.49183
Reduction of staff costs	36	.00	11.00	3.5278	3.29056
Reduction of energy costs	36	.00	10.00	4.9444	4.24900
Sales increase	36	.00	11.00	4.0278	2.39626
Decrease in the costs of production of commercialisation	36	.00	11.00	4.9167	3.52440
Profit	36	.00	11.00	5.0278	3.51719
Valid N (listwise)	*36*				

In this study, we used the decision making to innovate in firms as the dependent variable, obtaining statistical significance to include all independent variables in the regression. The final model of multiple linear regression is given by:

$$\text{Decision-making in innovation} = B_0 + B_1 Obstacles + B_2 Sources\ of\ \ innovation + B_3 Cooperation + + B_4 Funding + \varepsilon$$

Estimates of β's are shown in Table 7:

Table 7 Motivations for the deciding to innovate

	Strategies in decision making (β_s)		
	Profit and social impact	*New markets, operational costs reduction*	*New products and staff costs reduction*
Obstacles	–0.317*	------	------
Sources			
External	0.370**	------	0.355*
Internal and institutional	------	------	0.499*
Cooperation			
Institutional	------	------	------
Customers and competitors	------	------	0.599*
Funding			
Regional	------	------	------
National	–0.613**	------	0.894*
European	0.647**	------	------
Constant	0.106	------	–0.304
R (0.931)	0.845	0.362	0.901
R^2 (0.866)	0.616	0.131	0.692
R^2 adjusted (0.854)	0.569	–0.087	0.665

Notes: *Significant at 1%; **significant at 5%.

The table shows that there are important differences in the approach to innovation processes by the different type of groups. The sample was divided into three groups. Each of these groups is driven by different motivations to enter innovation-related programmes:

- group I engages in innovation projects in order to increase profit or to cause a social impact
- group II seeks entering new markets and to reduce operational costs through innovation
- group III aims at discovering new products and the reduction of employment costs.

In what concerns to the first group, the firms that look at innovation in a profit and social impact perspective are also those who access to European sources to fund innovation. National public funding has a negative impact on their decision to innovate, which means that these firms do not use this source for funding innovation. In fact, this group of firms shows little appreciation for internal funds (regional, national) of a public nature. It is not, however, surprising that the external sources of innovation represent a positive influence in their decision-making process to innovate, while the obstacles have a negative impact on the decision.

Despite presenting the results for group II – firms that seeks new markets and to reduce operational costs, these are only indicative. There is no statistical significant to support the conclusions obtained for this group, given the statistics of the model. Therefore, none of the variables considered has contributed to explaining this factor.

For firms in group III, the reduction of labour costs or the introduction of new products are the ultimate goal of innovation. Cooperation with customers and competitors positively influence the decision to innovate, with similar conclusions drawn from the sources of innovation, whether from internal and institutional sources, or external sources. This group of firms prefers to rely on national institutions as sources of funding for their innovation activity.

One should also highlight that, despite the fact that the Portuguese business structure is mostly composed of small firms, the sample of this study also includes large firms. Nevertheless, no differences with respect to firms' size were found and therefore the results presented in this study represent the Portuguese firms, regardless of size. The emphasis of this study was primarily directed to an analysis of innovation in SMEs, because they represent a large proportion of Portuguese firms.

In spite of the results obtained from the multiple linear regression model, reported above, Table 8 presents an overview of research hypotheses initially raised and the results obtained for each of them.

According to the results obtained, all initially considered hypothesis were. Most firms view innovation as the best way to create social impact and to introduce new products to market. However, as expected, increasing profit and reducing operational costs are in the top list of motivations, supporting the thesis that, ultimately, entrepreneurs are motivated by profit.

Table 8 Results of the research model hypotheses

Dimension		*Hypotheses*	*Results*
Decision-making in innovation	H1	Firms decide to innovate to improve their economic and financial performance.	Confirmed
Obstacles to innovation	H2	The existence of obstacles to innovation affects on the business decision to innovate.	Confirmed
Sources of innovation	H3	Information sources (internal, external and institutional) influence firms' decision to invest in innovation activities.	Confirmed
Cooperation	H4	The existence of cooperation agreements with partners positively contributes to the decision to innovate.	Partially confirmed
Funding	H5	The incentive to innovate is positively influenced by the availability of external funding to support innovation projects.	Confirmed

5 Conclusions

After the investigation, the first major conclusion is that the study of the motivations for the decision-making in business innovation remains a very relevant issue on the research agenda. This research has demonstrated its importance for most Portuguese firms, however, there are many research opportunities for applied research.

Although innovation deserves special attention in the literature, few studies have examined the economic and financial factors that determine the process of decision making in business innovation. Furthermore, most of the existing literature is mainly theoretical and empirical research to analyse the determinants of this decision, particularly with regards to entrepreneurial activity in Portugal is required. Moreover, these empirical studies have not used firms accessing to financial support to develop their innovation activity as a sample.

Due to the high dynamism associated to innovation processes, the identification of the factors that determine or influence the decision-making process is certainly an unfinished work, which should remain open to other methods and factors. With scientific research, our aim is to contribute with advances in knowledge that may also benefit businesses.

As mentioned earlier, factorial analysis allowed the extraction of three factors, however, only the following two showed significant influence on decision-making in innovation (Figures 3 and 4).

The results show that the economic and financial factors that influence decision making in innovation are related to the profit and staff costs reduction, which confirms the Hypothesis 1 that *firms decide to innovate to improve their economic performance and financial*. Indeed, Baumol (2002) suggests that one of the main factors influencing business decisions in market economies, is the maximisation of economic return. Other authors (e.g., Conceição and Ávila, 2001; Klomp and Van Leeuwen, 1999; Mairesse and Mohnen, 2001) suggest the weight of sales resulting from new or improved products, as the most commonly used variable in the process of decision making in innovation.

Figure 3 Results of the proposed research model (profit and social impact)

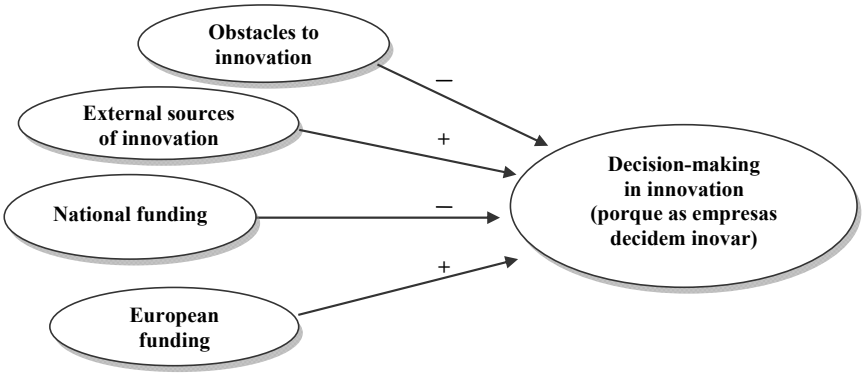
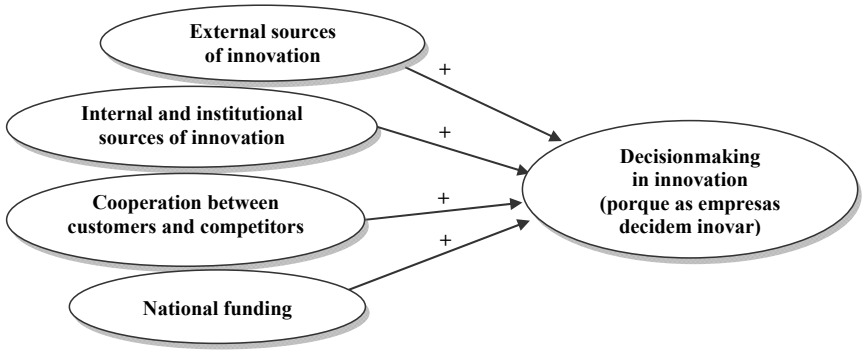


Figure 4 Results of the proposed research model (new products and reduction of staff costs)



In Hypothesis 2, it was assumed that *the existence of obstacles to innovation affects on the business decision to innovate*, which was confirmed, as can be seen in Figure 3. In fact, the existence of factors that difficult innovation activity hinder firms to engage in innovative programmes.

Kotler et al. (2000) argue that an innovation structure must have the means for the systematic generation of new ideas to implement in new products. These ideas can come from external sources, as well as internal sources (within the organisation), through formal research and development, participation of scientists, engineers, production personnel, executives, and especially sellers, due to their close contact with consumers.

Based on our results we conclude the acceptance of Hypothesis 3: *information sources (internal, external and institutional) influence firms in the decision-to invest in innovation activities*.

Hypothesis 4: *the existence of cooperation agreements with partner organisations contributes* positively to the decision to innovate is partly verified at the level of cooperation with customers and competitors, when the motivation for innovation is the introduction of new products and staff costs reduction.

This research has made clear that firms are motivated by different objectives; they prefer different funding mechanisms; and they prefer to access to different types of institutions. Given the Hypothesis 5: *the motivation to innovate is positively influenced by the availability of external funding to support innovation projects*, it was found that firms

that want to achieve higher levels of profit or social impact with their innovative activity access, mainly, to European funding, while companies seeking new products and staff costs reduction prefer to access to national funding.

It was also found that regional funding is not considered a determinant factor in the decision to innovate, which may show that firms do not recognise much importance to this type of support, or that it is not designed to meet their needs.

We have also observed that most of the firms are located in coastal areas. This provides a great policy opportunity, as hinterland located firms may be struggling to access to innovation support programmes.

Currently, it is difficult to conceive firms that continuously ensure their survival and sustainability without innovation. However, the Portuguese business consists mainly of small and medium-sized enterprises, struggling to develop innovation projects alone. In addition to financial support for innovation, governments must encourage cooperation between these firms and with the R&D centres and universities, facilitating thus SMEs' access of to innovation.

The lack of skilled staff is pointed out as one of the difficulties for the development of innovative practices. Therefore, it is urgent to adapt the Portuguese educational system to real business needs thus contributing to business improvement. It is also important to bear in mind the country's economic situation, currently characterised by high rates of graduate unemployment.

Last but not least, encouraging the registration of patents is recommended, by reducing the associated costs and creating a favourable legal system, which creates the basis for the commercial exploitation of innovations.

In our view, there are still many questions to explore with regard to business innovation. Innovation is a major contributor for the creation of competitive advantage. In a globalised and competitive world like today, innovation is seen as the solution and the window of opportunity for many firms. If innovation is successful, it will improve the firm's competitive position in the market it operates. However, failure can take it to a poor performance or even its closure. In this context, the various actors with responsibility for innovation should clearly define its strategic policy objectives in order to stimulate an innovative entrepreneurial environment.

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Notes

1 The most popular method for principal component rotation is varimax. This is an orthogonal method whose objective is, for each principal component, to extract only some significant weights with all the others being near zero. In other words, its objective is to maximise the variation of the weights of each principal component. The proportion of the explained variance for each principal component is constant, although distributed differently so that the difference between the contributions of the variables is maximised: increasing those that most contribute for forming the component and decreasing the weights of those that less contribute.

2 The method most commonly used to assess the quality of the data is the Kaiser-Meyer-Olkin (KMO) measure, proposed by Kaiser (1970) and Kaiser and Rice (1974), quoted in Maroco (2007). KMO is a measure of homogeneity of the variables, comparing, through simple

correlations, the observed partial correlations amongst variables. Although it lacks a rigorous test for the KMO values, in a general manner, these can be grouped as ≤ 0.5 – unacceptable;] 0.5–0.6 [– bad, although acceptable;] 0.6–0.7 [– mediocre;] 0.7–0.8 [– medium:] 0.8–0.9 [– good and] 0.9–1.0 [– excellent.

3 The Bartlett sphericity test assesses the hypothesis that the correlation matrix is an identity matrix, with a eigenvalue equal to one, and thus variables are not correlated. When the analysis of the principal components is applied to a correlation matrix, in order to assess the extent to which the data is adequate to the analysis, it consists in testing if, within the population, this matrix is an identity matrix, i.e., there are no significant correlation amongst the variables.

4 Cronbach's α is one of the most commonly used measures for an internal verification of a group of variables. It can also be defined as the correlation that one expects to obtain between the scale used in the study and other hypothetical scales within the same universe, with an equal number of items, that measure the same characteristic. The scale presented provides a good indication of how to assess its value as a measure of reliability: very good – alpha > 0.9; good – 0.8 < alpha < 0,9; medium – 0.7 < alpha < 0.8; weak – 0.6 < alpha < 0.7; unacceptable – alpha < 0.6.

5 A linear regression is, according to Ferreira (1999), used for the purpose of establishing a relationship, expressed by an equation which allows to estimate the value of a variable, according to one or more other variables.