Innovation in Portuguese Firms, using CIS2010

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Abstract:
Community Innovation Survey Innovation 2010 (CIS 2010) is used in this work to study the innovation level in Portuguese Firms. We use factorial analysis to identify the determinants and obstacles to innovation in Portuguese firms. The sources of innovation and cooperation to innovation are also analysed. After identifying the factors, the main sources of innovation are identified as well as the key cooperation partners. An innovation variable, was computed from the innovation variables in the CIS 2010 survey and, using a multivariate linear regression, this variable is studied as a dependent variable from the independent variables, described above, in order to investigate the effect of these variables in innovation. From the total of variables considered, only eight are significant to explain the innovation levels: Production costs and impacts on health and environment; Process and product innovation; Competitors or other enterprises in the same sector in others countries in Europe and in Portugal; Type of co-operation partner; Suppliers of equipment, materials, components, or software, in China or India; Universities or other higher education institutions in Portugal and Institutional and others sources of information.

Key-Words: Innovation, Community Innovation Survey, CIS, Multivariate Statistical Analysis

1 Introduction

The Community innovation survey, abbreviated as CIS, is conducted in every European Union (EU) Member State to collect data on innovation activities in enterprises, i.e. on product innovation (goods or services) and process innovation (organisational and marketing aspects). (Eurostat, s.d.)

The role of innovation in national economic growth is widely accepted. It is fundamental for competitiveness, business success and an essential element to solve socio-economic problems such as unemployment and productivity growth (Braga & Braga, 2013) thus the positive effect of innovation for both firms and the economy is undeniable.

CIS defines "A product innovation is the market introduction of a new or significantly improved good or service with respect to its capabilities, user friendliness, components or sub-systems." (CIS, 2010). In the other hand "A process innovation is the implementation of a new or significantly improved production process, distribution method, or supporting activity."

The CIS covers areas such as new or significantly improved goods or services, and the introduction of new or significantly improved processes, logistics or distribution methods. It also gives information on the characteristics of innovation activity at the enterprise level, thereby creating a better understanding of the innovation process and the effects of innovation on the economy. (Eurostat, s.d.)

In Portugal, several authors study innovation, for example (Araújo & Costa, 2014), (Marques, et al., 2012), (Inhan, et al., 2013), (Correia & Rua, 2016) technology innovation, innovation within the cluster of Douro, innovation on the Portuguese healthcare sector organizations and innovation in knowledge intensive business services (KIBS) are addressed.

Eurostat (Eurostat, 2016) provides the data collected through the Community Innovation Survey (CIS). This survey, based in innovation questions is part of the EU science and technology statistics. The survey is administered every two years, to firms operating in the EU member states.

The CIS is a survey of innovation activity in enterprises (Eurostat, 2016). The harmonised survey is designed to provide information on the innovativeness of sectors by type of enterprises, on the different types of innovation and on various aspects of the development of an innovation, such as

the objectives, the sources of information, the public funding, the innovation expenditures etc.

The survey also includes the concepts of organisational innovation and Marketing innovation. "An organisational innovation is a new organisational method in your enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by your enterprise." and "A marketing innovation is the implementation of a new marketing concept or strategy that differs significantly from your enterprise's existing marketing methods and which has not been used before." (CIS, 2010). We intend to consider all these aspects of enterprises innovation and, motivated by the studies of (Braga & Braga, 2013) and (A. Correia, 2017), the goal is to analyse how key aspects for innovation: barriers, sources, cooperation, funding and the decision making process influence innovation firms. The data used is the same used in the previous mentioned works, the CIS 2010.

This paper includes five sections. In the first section the subject of innovation and the CIS2010 content is presented. In the second the particular case of the CIS Portuguese dataset is explained and some well know exploratory statistics from the data are underline. In Section 3, an innovation variable, was computed from the innovation variables in the CIS 2010 survey, some exploratory analysis from these variables are presented and determinants and obstacles to innovation in Portuguese firms are identified. The sources of innovation and cooperation to innovation are also analysed, such as the sources of innovation and the key cooperation partners. In the fourth section, we used a multivariate linear regression to study the innovation levels, having into account the overhead variables. The last part is dedicated to the presentation of the conclusions.

2 CIS Portuguese dataset

The Portuguese CIS2010 dataset is the data used in our research. This data results from the application of the CIS2010 survey about innovation activities carried out by companies, in the period 2008 to 2010 in Portugal, collected through surveys to firms that have applied for innovation programmes within the Portuguese innovation agency, (Araújo & Costa, 2014).

The goal is to analyse how determinants of innovation, obstacles to innovation, sources of innovation and cooperation to innovation contributes to innovation in Portuguese firms.

According to the report, "Principais resultados do CIS2010 - Inquérito Comunitário à Inovação" (DGEEC, 2016) (*Main results of CIS2010 - Community Innovation Survey*), in Portugal, 61% of the companies carried out innovation activities (product, process, organizational, marketing, and abandoned or incomplete innovation activities) and 47% indicated having developed activities of technological innovation (product, process, abandoned or incomplete innovation activities). Of the companies that had developed technological innovation activities, 45.9% of the total expenditure on innovation activities was devoted to in-house research and development (R&D), followed by 41.1% with acquisition of machinery, equipment and software.

Of the total number of companies responding to the CIS2010, 24.1% successfully and simultaneously introduced product and process innovations in the period 2008-2010 and 5.8% of companies abandoned innovation before its completion (DGEEC, 2016).

"Improve quality of goods or services" (51.1%) and "Enter new markets or increase market share" (41.4%) are the objectives that firms considered the most important for the introduction of their innovations.

Economic factors ("Innovation costs too high" and "Lack of funds within your enterprise or group") were considered as the main obstacles to innovation for firms with and without innovation activities.

The most mentioned organizational innovation types are: "New methods of organising work responsibilities and decision making" and "New business practices for organising procedures", 29.1% and 26.3%, respectively.

"New media or techniques for product promotion" was the most popular type of marketing innovation (21.0%), followed by "Significant changes to the aesthetic design or packaging of a good or service" (17.8%) and "New methods of pricing goods or services" (17.6%).

(Braga & Braga, 2013) showed that factors that mostly influence the Portuguese firm's innovation decision-making processes are economical and financial (namely those related to profit increase and labour costs reduction).

The purpose of this study is to perform factorial analysis to determine the factors that are determinants and the obstacles to innovation and to study how they influence the firms innovation. An initial approach is done by (A. Correia, 2017). In this work a more detailed analysis of the innovation behaviour is done. Similar to the previous approach the sources of innovation and cooperation to innovation are also analysed and considered. The results are compared with the results o presented in (Braga, et al., 2013) and (A. Correia, 2017).

3 Data Analysis and results

In this section begins with the presentation of some exploratory results. Then Factor analysis of the Determinants and Obstacles to innovation are performed. Sources of innovation and Cooperation to innovation are approached through descriptive analysis. Then an innovation variable, computed from the innovation variables in the survey, using a multivariate linear regression, is study in order to investigate the effect of these variables in innovation.

3.1 Exploratory results

During the three years, 2008 to 2010, 1818 (30%) of the 6160 Portuguese enterprises respondents to the questionnaire, introduced "New or significantly improved goods" (INPDGD) and 1422 (23%) introduced "New or significantly improved services" (INPDSV), with 40% of firms referring to have Product Innovation.

During this period, 1806 (29.3%) introduced "New or significantly improved methods of manufacturing or producing goods or services" (INPDGD). 1077 (17.5%) introduced "New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services" (INPSLG). 2166 (35.2%) introduced "New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing" (INPSSU). In total, 2846 (46.2%) firms had Process Innovation.

Within the total firms inquired, 2694 (43.7%) have Organisational innovation as they introduced improvements in their organization. 2074 (33.7%) introduced of "New business practices for organising procedures" (ORGBUP), 2126 (34.5%) introduced "New methods of organising work responsibilities and decision" (ORGWKP) and 1233 had "New methods of organising external relations with other firms or public institutions" (ORGEXR).

Relative to Marketing innovation 2431 (39.5%) firms innovated. 1343 (21.8%) made "Significant changes to the aesthetic design or packaging of a good or service" (MKTDGP), 1596 (25.9%) improved "New media or techniques for product promotion" (MKTPDP), 776 (12.6%) improved "New methods for product placement or sales channels"
(MKTPDL) and 1184 (19.2%) introduced "New methods of pricing goods or services" (MKTPRI).

Then we can define measures of innovation:

- Product (good or service) innovation: INOV_PS = INPDGD + INPDSV – this variable can assume the values 0, if the firm do not have innovations in product neitheir in services in the considered period; 1 if the firm enterprise introduced new or significantly improved goods or services and 2 if the enterprise introduced both.
- Process innovation: INOV_Process= INPSPD + INPSLG + INPSSU, with possible values between 0 (no items selected) and 3 (all items selected).
- Organisational innovation: INOV_Org = ORGBUP + ORGWKP + ORGEXR, with values between 0 (no items selected) and 3 (all items selected).
- Marketing innovation: INOV_M= MKTDGP + MKTPDP + MKTPDL + MKTPRI, with values between 0 (no items selected) and 4 (all items selected).

We can also consider the total among of innovation as INOV= INOV_PS+ INOV_Process+ INOV_Org+ INOV_M wich can assume values between 0 and 10.

3.2 Determinants of innovation

To achieve the benefits of innovativeness, in terms of economic growth and competitiveness of firms, it is important to understand its determinants, (Wojnicka-Sycz & Sycz, 2016).

With the objective of study the determinants of innovation is essential to consider the information sources (in 6.1 CIS question), the objectives for activities to develop product or process innovations (in 7.1 CIS question) and the factors for organisational innovations (in question 9.2). The answers to these questions can be 3="High", 2="Medium", 1="Low" or 0="Not used". Our goal is to identify similar behaviour of the items and to define the corresponding latent variables.

In a previous work, (A. Correia, 2017), all the determinants (in questions items are considered simultaneously, because it was considered to be studying different types of determinants of innovation.

For that propose we can use the Principal Component Analysis and to extract the principal factors using Varimax rotation method, with Kaiser Normalization. This technique was performed with SPSS (version 23).

3.2.1 Information Sources

The determinants of innovation concerning with information sources are present in 6.1 CIS question: "During the three years 2008 to 2010, how important to your enterprise's innovation activities

were each of the following information sources?". The answers includes Internal Information sources (variable SENTG), Market sources (SSUP, SCLI, SCOM, SINS), Institutional sources (SUNI and SGMT) and Other sources (SCON, SJOU and SPRO).

Table 1- Information sources

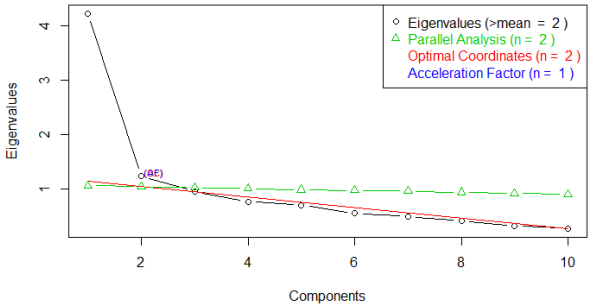
Variables		Individual MSA	F2	F1
SENTG	Within your enterprise or enterprise group	0.85		0.636
SSUP	Suppliers of equipment, materials, components, or software	0.92		0.614
SCLI	Clients or customers	0.81		0.790
SCOM	Competitors or other enterprises in your sector	0.86		0.664
SINS	Consultants, commercial labs, or private R&D institutes	0.91	0.683	
SUNI	Universities or other higher education institutions	0.81	0.824	
SGMT	Government or public research institutes	0.80	0.848	
SCON	Conferences, trade fairs, exhibitions	0.84	0.516	
SJOU	Scientific journals and trade/technical publications	0.83	0.610	
SPRO	Professional and industry associations	0.90	0.632	
	N		6	4
	Explained Variance		30.52	24.08
	Cronbach's α		0.833	0.689

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) in a Factorial analysis is 0.847 and thus this approach is adequate. The individual Measures of Sampling Adequacy (MSA) are presented in the Table 1.

Despite the fact that the significance level of the Bartlett's Test of Sphericity is smaller than 5% reinforced its adequacy. With the Principal Components (PCA) method and according to the rule of thumb for extracting factors with eigenvalues greater than 1, in line with the scree plot, it is suggested that two factors must be extracted. Parallel Analysis and Optimal Coordinates methods also suggests the retention of two factors and acceleration factor suggests just one factor, as we can see in Figure 1. Then two factors are considered. The Variance explained by the factors is, approximately, 55% of the variance of the variables involved. The Rotated Component Matrix obtained is the **Erro! A origem da referência não foi encontrada.**.

The obtained factors are different from the obtained in (A. Correia, 2017) and (Braga & Braga, 2013). The main raison for that is the different number of variables considered. In this work, we consider three different factor analysis for Information Sources, objectives for activities to develop product or process innovations and the factors for organisational innovations, while in the previous works, all the items are considered simultaneously, because it was considered to be studying different types of determinants of innovation.

Figure 1 – Scree plot for Information Sources



The factors identified in this analysis are F1: Internal and market sources (F6 in (A. Correia, 2017)) and F2: Institutional and others sources of information (F4 and F5 in (A. Correia, 2017)), in accordance with CIS survey structure. Internal consistency measures (Cronbach's α) of reliability range indicates a good and moderate consistency of the measures.

3.2.2 Objectives for activities to develop product or process innovations

The objectives for activities to develop product or process innovations are considered determinants of innovation, and are presented in 7.1 CIS question: "How important were each of the following objectives for your activities to develop product or process innovations during the three years 2008 to 2010?". The answers includes ten items (ORANGE, OREPL, ONMOMS, OQUA, OFLEX, OCAP, OLBR, ORME, OREI and OHESY).

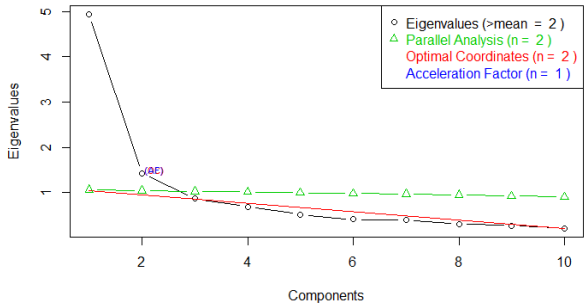
Table 2- Objectives

Variables		Individual MSA	F2	F1
ORANGE	Increase range of goods or services	0.78		0.839
OREPL	Replace outdated products or processes	0.92		0.583
ONMOMS	Enter new markets or increase market share	0.83		0.802
OQUA	Improve quality of goods or services	0.92		0.634
OFLEX	Improve flexibility for producing goods or services	0.90	0.651	
OCAP	Increase capacity for producing goods or services	0.88	0.684	
OLBR	Reduce labour costs per unit output	0.89	0.787	
ORME	Reduce material and energy costs per unit output	0.88	0.851	
OREI	Reduce environmental impacts	0.82	0.808	
OHESY	Improve health or safety of your employees	0.86	0.808	
	N		6	4
	Explained Variance		38.399	25.159
	Cronbach's α		0.891	0.754

KMO for this analysis is 0.871 indicating a good adequacy of the application of this methodology. The individual MSA are presented in the Table 2-

Objectives. All of there are greater than 0.5, then all variables are important in the analysis.
The significance level of the Bartlett's Test of Sphericity is smaller than 5%. Using PCA and observing the scree plot in Figure 2, two factors are considered, with Rotated Component Matrix presented in Table 2.

Figure 2 – Scree plot for Objectives



The factors identified in this analysis, similarly to (A. Correia, 2017), are F1: Sales and marketing innovation, F2: Production costs and impacts on health and environment. The Cronbach's α mesures indicates a good reliability of the measures.

3.2.3 Factors for organisational innovations

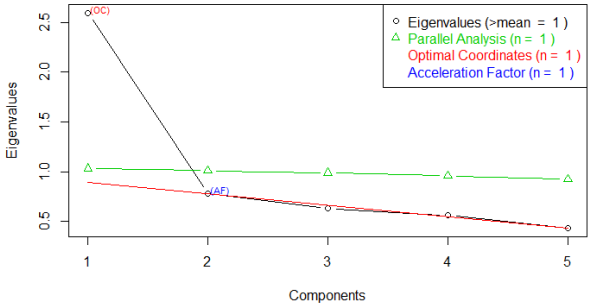
Factors for organisational innovations are explored in the question 9.2 of the survey: "How important were each of the following objectives for your enterprise's organisational innovations introduced during the three years 2008 to 2010 inclusive?". Performing a Factor Analysis just one factor is considered, as we can see in Table 3 and in the scree plot in Figure 3.

Table 3 – Factors for organisational innovations

Variables		Individual MSA	F1
ORORED	Reduce time to respond to customer or supplier needs	0.83	0.731
OROABL	Improve ability to develop new products or processes	0.78	0.789
OROQUA	Improve quality of your goods or services	0.78	0.785
ORORCO	Reduce costs per unit output	0.85	0.691
OROCIN	Improve communication or information sharing within your enterprise or with other enterprises or institutions	0.86	0.584
	N		
	Explained Variance		51.823
	Cronbach's α		0.759

KMO measure is 0.807 indicating a good adequacy of the Factor Analysis and the individual MSA's, presented in the Table 2- Objectives, are greater than 0.5, then all variables are important in the analysis. The significance level of the Bartlett's Test of Sphericity is smaller than 5%.

Figure 3 – Scree plot for Factors for organisational innovations



The factor identified in this analysis, similarly to (A. Correia, 2017) is Process and product innovation. The Cronbach's α measure indicates a good reliability.

Thus, independently of the individual or combined analysis of the determinants of innovation, the same innovation factors are identified, than in (A. Correia, 2017):

- F1: Production costs and impacts on health and environment,
- F2: Sales and marketing innovation,
- F3: Process and product innovation,
- F4: Institutional sources of information,
- F5: Others sources of information,
- F6: Market sources of information.

except in information sources once in this work just two factors are identified:

- Information Sources (2 factors):
  a. F1: Internal and market sources – F6 in (A. Correia, 2017),
  b. F2: Institutional and others sources of information – F4 and F5;
- Objectives for activities to develop product or process innovations (2 factors):
  a. F1: Sales and marketing innovation – F2,
  b. F2: Production costs and impacts on health and environment – F1;
- Factors for organisational innovations:
  a. F1: Process and product innovation – F3.

3.3 Obstacles to innovation

Innovation is not known without understand obstacles to innovation. The obstacles to innovation are widely studied, for example (Amara, et al., 2016), recently studied it in KIBS, based on a sample of Canadian KIBS firms. The author affirms that different obstacles will affect different forms of innovation, because a better understanding of obstacles to innovation would help improve theories explaining why some firms either do not innovate at

all or do not engage more intensively in innovation. Besides that, providing better evidence would help devising policies to aid firms surmount obstacles, thus increasing the innovation propensity of non-innovative firms or the innovation intensity of innovative firms. Obstacles to innovation can be considered at various levels: individual, group, firm and inter-organizational, as well as the regional/national level. The level studied will bear consequences for the obstacles that are identified and the ability to counteract them, according with (Karlsson & Stetler, 2015).

In CIS survey obstacles to innovation are present in question 8.1. The variables in this question assumes the values "High", "Medium", "Low" or "Not used", corresponding to the values 3 to 0. The statistical techniques employed to study this variables was factorial analysis, with the goal to define principal components of the obstacles to innovation. KMO obtained is 0,866 and the significance level of the Bartlett's Test is smaller than 5%, thus it is adequate to use this technique. Three factors are extracted with variance explained by the factors approximately 82% of the variance of the variables involved. The Rotated Component Matrix obtained is the Table 2, as the individual MSA. All of these are greater than 0.5, then all variables are important in the analysis.

Table 4- Obstacles to Innovation
(Adapted from (A. Correia, 2017))

Variables		Individual MSA	F1	F2	F3
HTEC	Lack of information on technology	0.85	0,874		
HINF	Lack of information on markets	0.89	0,84		
HPER	Lack of qualified personnel	0.90	0,818		
HPAR	Difficulty in finding cooperation partners for innovation	0.96	0,698		
HDEM	Uncertain demand for innovative goods or services	0.87	0,492		
HDOM	Market dominated by established enterprises	0.89	0,479		
HFOUT	Lack of finance from sources outside your enterprise	0.84		0,867	
HFENT	Lack of funds within your enterprise or group	0.85		0,865	
HCOS	Innovation costs too high	0.93		0,787	
HMAR	No need because of no demand for innovations	0.73			0,875
HPRIOR	No need due to prior innovations by your enterprise	0.70			0,865
	N		6	3	2
	Explained Variance		30,42	23,91	17,54
	Cronbach's α		0,88	0,87	0,78

The factors identified in this analysis are F1: Knowledge and market factors, F2: Funding factors, F3:Reasons not to innovate.

The authors in (Braga & Braga, 2013) identified just one factor named Obstacles to Innovation.

3.4 Sources of innovation

Information sources are considered, by (Bach, et al., 2015), a catalyst for innovation improvement, and because of this it is particularly important to learn more regarding their impact on innovation performance. In the other hand (Gómez, et al., 2016) considered sources of information as determinants of product and process Innovation. Then is crucial to understand the behaviour of these sources to know the firms innovation.

The information in the survey about sources of innovation in CIS2010 is in the question 6.3. The corresponding variables of the 6.3 question are dummy variables then is not possible perform a factorial analysis, unlike the approach in (Braga & Braga, 2013).

Table 5 - Sources of Innovation
(Adapted from (A. Correia, 2017))

Type of co-operation partner	Portugal	Other Europe	United States	China or India	All other countries	Total	%
A.	305	179	36	13	50	583	13
B.	563	321	60	25	32	1001	23
C.	521	256	40	25	82	924	21
D.	224	124	27	7	20	402	9
E.	422	126	19	0	5	572	13
F.	475	81	18	2	14	590	13
G.	278	27	7	0	8	320	7
TOTAL	2788	1114	207	72	211	Total	
	63%	25%	5%	2%	5%	%	

A. Other enterprises within your enterprise group; B. Suppliers of equipment, materials, components, or software; C. Clients or customers; D. Competitors or other enterprises in your sector; E. Consultants, commercial labs, or private R&D institutes; F. Universities or other higher education institutions; G. Government or public research institutes

In Table 5 we present the Frequencies table from the Sources of Innovation. We can see that the main actors are located in Portugal (63% - 2788 answers), followed by other European countries (25% - 114 answers). Based on the sources of innovation mentioned refer to a higher number of firms that are B. Suppliers of equipment materials, components, or software and C. Clients or customers, with 1001(23%) and 924 (21%) answers, respectively.

3.5 Cooperation to innovation

According with (Lewandowska, et al., 2016) a review of the relevant literature reveals that innovativeness and internationalization of firms

may be enhanced by cooperation with various partners within networks. The type of co-operation partner considered most valuable for enterprise's innovation activities, in the data provided by question 6.4, are presented in Table 6.

Table 6 - Cooperation to innovation
(Adapted from (A. Correia, 2017))

	Frequency	Percentage
A. Other enterprises within your enterprise group	209	22%
B. Suppliers of equipment, materials, components, or software	237	24%
C. Clients or customers	240	25%
D. Competitors or other enterprises in your sector	28	3%
E. Consultants, commercial labs, or private R&D institutes	80	8%
F. Universities or other higher education institutions	133	14%
G. Government or public research institutes	41	4%
Total	968	

Firms refer as most important partner to innovation Clients or customers (25%), fallowed by Suppliers of equipment materials, components, or software (24%) and Other enterprises within your enterprise group (22%).

4 Main Variables to innovation

In this section, we analyse the importance of each variable studied above, to innovation. In order to do that, the variable INOV, defined in Section 3.1 Exploratory results, was used as dependent variable and the others variables, presented in Sections 3.2 Determinants of innovation, 3.3 Obstacles to innovation, 3.4 Sources of innovation and 3.5 Cooperation to innovation, are considered as independent variables, in a multivariate linear regression.

In order to study the effect of the dependent variables in innovation the model to be tested is:

$$Innovation = \beta_0 + \beta_1 \times Information\ Sources\ (Internal\ and\ market\ sources;\ Institutional\ and\ others\ sources\ of\ information) + \beta_2 \times Objectives\ (Sales\ and\ marketing\ innovation;\ Production\ costs\ and\ impacts\ on\ health) + \beta_3 \times Factors\ for\ organisational\ innovations\ (Process\ and\ product\ innovation) + \beta_4 \times Obstacles\ to\ innovation\ (Knowledge\ and\ market\ factors;\ Funding\ factors;Reasons\ not\ to\ innovate) + \beta_5 \times Sources\ of\ innovation\ (variables\ between\ C011\ to\ C075) + + \beta_6 \times Cooperation\ to\ innovation\ (PMOS)$$

A stepwise linear regression method is performed obtaining the Model Summary presented inTable 7. The significance level of the ANOVA test for the model is less than 5%, which indicates a significant model.

Table 7 – Model Summary for regression model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
8	0.470	0.221	0.213	2.339	1.949

The $R_a^2 = 0.221$, indicating that 22% of the variability of the innovation variable is explained by the variables considered.

Table 8 presents the significant variables for the model. With this table, we can conclude that the variable which more contributes to explain innovation levels is the second factor from the objectives (Production costs and impacts on health and environment) and the Organisational innovations (Process and product innovation) fallowed by CO42 (Competitors or other enterprises in your sector in others countries in Europe). PMOS (type of co-operation partner considered most valuable for the enterprises innovation activities is inverse to the order presented in the Table 6. CO41(Competitors or other enterprises in your sector in Portugal), CO24 (Suppliers of equipment, materials, components, or software, in China or India), CO61 (Universities or other higher education institutions in Portugal) and Institutional and others sources of information (F2 for Information Sources) also are significant to explain innovation in Portuguese Firms.

Table 8 – Coefficients of the liner regression

	UC		SC	t	Sig.
	B	Std. Error	Beta		
Objectives F2	0.71	0.1	0.22	6.0	0.00
Organisational innovations F1	0.62	0.1	0.19	5.7	0.00
CO42	0.79	0.3	0.10	3.1	0.00
PMOS	-0.17	0.0	-0.12	-3.6	0.00
CO41	0.55	0.2	0.09	2.7	0.01
CO24	1.16	0.5	0.08	2.3	0.02
CO61	0.47	0.2	0.09	2.6	0.01
Information Sources F2	0.31	0.1	0.09	2.6	0.01
UC: Unstandardized Coefficients SC: Standardized Coefficients					

5 Conclusion

Innovation is studied in this work from several perspectives namely: determinants, obstacles, sources and cooperation. These perspectives are then analysed as explanation of the innovation level using a regression multivariate model.

The determinants of innovation are studied using the answers of the questions 6.1 (about information sources), 7.1 (about objectives for activities to develop product or process innovations) and 9.2 (about factors for organisational innovations). For these analysis five factors are identified: Information Sources (F1: Internal and market sources and F2: Institutional and others sources of information; for Objectives for activities to develop product or process innovations (F1: Sales and marketing innovation and F2: Production costs and impacts on health and environment) and for Factors for organisational innovations (just one factor: Process and product innovation). For obstacles to innovation, three factors are identified: F1: Knowledge and market factors, F2: Funding factors, F3: Reasons not to innovate.

It was noticed that the principal sources of innovation are, in Portugal and in Europe, Suppliers and Clients. They are also the principal co-operation together with other enterprises in the same group.

With a multivariate regression linear model, within the above variables, are identified that ones that are significant to explain the innovation level. There are Production costs and impacts on health and environment; Process and product innovation; Competitors or other enterprises in the same sector in others countries in Europe; the type of co-operation partner; Competitors or other enterprises in the same sector in Portugal; Suppliers of equipment, materials, components, or software, in China or India; Universities or other higher education institutions in Portugal and Institutional and others sources of information.

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