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Applied Innovation by SMEs for RDI Certification Purposes

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Abstract

This paper aims at bringing the analysis of innovation from a macro perspective down to the level of SMEs (small and medium enterprises) activities (a micro perspective), pointing out their contributive inputs to the economy. For that purpose, a study has been conducted based on the full population of certified SMEs, according to a RDI (research, development and innovation) standard in one specific EU country, using statistical data from Eurostat and other sources, complemented with an opinion study set on criteria established upon practical and theoretical models. The criteria were established upon currently worldwide-accepted concepts (the Oslo Manual) and new theoretical developments in the understanding of innovation in the creation and generation of value, and technological and cultural innovation. A panel of experts from the fields of value management, innovation, economics, quality assurance and management systems auditing, performed an opinion study using a focus group methodology.

A closer analysis of innovation at the micro level (for SMEs) gives insight into potential innovation and innovative management inputs and to new innovation strategies and policymaking. A better understanding of how innovation impacts the creation and generation of value, how the technological innovation process affects ultimate productive output, and how SMEs may take advantage of cultural innovation, may be drawn from the conclusions of the study.

Keywords: innovation, value, technological innovation, cultural innovation.

1. Introduction

The study of innovation in the private sector is a constant need, because its productive effects have a tremendous influence on the growth of the economy, as demonstrated by some empirical studies (Mowen and Rosenberg, 1979). However, quantifying, evaluating, and comparing innovation, at the level of needed competencies and of the used practices, is a complex issue, difficult to solve, for those organization that have the mission and the intention of doing that (Frenkel, Maital and Grupp, 2000).

Sometimes, these realities make it difficult to reach a vast, precise and detailed understanding of the different dimensions of innovation, mainly at the final output and outcome levels. One of the hardest challenges is measuring the complex processes that influence the capacity of an organization to innovate, in order to improve its managerial capability (Cordero, 1990). Measuring innovation is highly important for political and economical agents, but also for academic researchers. Unless the constructs related to the phenomenon of innovation are measurable, using methods commonly accepted, there is the possibility of different evaluations of the same effect producing conflicting results, wasting technological advances in the different terminologies (Adams, Bessant and Phelps, 2006). The constant new proposals to measure different aspects of innovation, to provide answers to companies and academia, in order to understand the efficacy of the taken actions (Kim and Oh, 2002), makes the full exercise very much fragmented, as well as the results. A potential consequence of such fragmentation is that most empirical studies identify the exclusive focus of many organizations, when evaluating inputs and outputs of innovation, at the levels of costs, time-to-market and number of new products, ignoring the processes involved (Cordero, 1990).

The existing studies about the Portuguese reality (i.e.: COTEC, 2014; Innovation Union Scoreboard, 2014; Community Inquiry on Innovation, 2012) mostly provide macro and "meso-level" (intermediate) results, not specifying the type of innovation that companies produce at their micro level.

Despite those studies trying to correlate their findings to data that reflects the implementation of innovation and innovation management concepts, there still remains a gap at the macro results-characterization level as to the impact of innovation at the micro level.

This study tries to highlight the importance of focusing on the "object", understood as a product (good or service), and on the "subject", understood as an organization (i.e. strategy and executed activities), as recipients of actions developed in innovation processes. I argue that there is a need to characterize the object and subject of innovation actions so that the macro results obtained may be enlarged and implemented more usefully. Our empirical results are directed at the innovation agents, aiming at supplying a structured result frame in terms of incidence, type and innovation process used by the analyzed companies, focusing on their tangible and intangible outputs. This study contributes to translate information from the macro and meso-level to the micro reality level of companies, based on qualification criteria by areas of innovation. In that sense, it should also contribute to help companies to draw up strategies and action plans that will increment the results of the efforts undertaken in innovating.

This study is structured in the following way: first, we will present the theoretical framework, making reference to the main macro studies available to the market, reproducing their main outputs in relation to the innovation status quo, and identifying potential missing conclusions. Second, we include the criteria used for qualifying the different types of innovation developed by companies, as well as the generic results obtained by each one. Next, we describe the study's methodology, focusing on the micro aspects of innovation. This allows for a deeper reflection on the potential influences that each type of innovation may have on the economy. Finally, we present the results, it then being possible to identify potential strategy or action errors that can be explored in future studies. This provides room for new decisions to be made, leading to a type of innovation that'll create or generate more value for all the economic agents involved and also for the country.

2. Statistical, Normative and Theoretical Framework

2.1 Existing Statistical Studies

a) The "Innovation Barometer" (Cotec, 2014) analyses Portugal's and a total of another 51 countries' competitiveness in macro form, basing the process on four dimensions that can be divided into pillars for analysis: (i) Conditions – institutional environment, information and communication technologies, infrastructure and utilization; (ii) Resources – human capital, financing and investment; (iii) Processes – networking and entrepreneurship, knowledge application and technology incorporation; and, (iv) Results – economic and innovative impacts.

Globally, Portugal comes in at 29th on the ranking of the 52 countries that make up the analyzed sample. For the "conditions" and "processes" dimensions, Portugal is placed above average by comparison to the rest of the countries in the sample, but, in the "resources", it's a little below average. For the "results" dimension, Portugal is quite a lot below average and even below the average taken of the Southern European countries (Spain, Greece, Italy and Portugal). This last dimension is the one that has the poorest classifications out of all four. In comparison to countries with similar dimension (Austria, Belgium, Finland, Netherlands and Ireland), Portugal has a poorer performance in all dimensions, being that the largest gap in reference to the other countries is in the "results" dimension. By observing the indicators, it is evident that the "results" dimension is Portugal's biggest weakness in the macro framework in which the study was undertaken. This says nothing at the micro levels, and the results are of very little use to companies, in order to develop innovation strategies, as the study does not point out the specific areas of companies' weaknesses, in particular.

b) The "Innovation Union Scoreboard" (European Union, 2014) analyses the innovation competitiveness in European Union (EU) countries in a macro framework composed of 3 types of indicators that are made up of eight innovation dimensions as follows: (i) Enablers – human capital, investigation system and financing and support; (ii) Firm Activities – company investments, entrepreneurship and connections, and intellectual property; and, (iii) Outputs – innovative and economic effects.

This study provides a macro vision of the status quo of every country in the EU based on the

information supplied by the different economic agents via Eurostat and other sources.

In general terms, Portugal presents itself as a "moderate innovator", ranking below the EU average and with a poor position in the "results" dimension, more specifically in the "economical effects" indicator. Like the Cotec study, the information does not provide clear clues to companies, in order to develop new innovation actions at the micro level.

c) The "Community Inquiry on Innovation" (CIS, 2012) presents key indicators that describe innovation activities and standards in the business sector. It includes the resources and investments realized with innovation activities in the companies, the different types of innovation activities undertaken (product, process, organizational, marketing), the degree of novelty of the innovation (only for the company, market, country and for the European and international markets), the effectiveness of the methods used to maintain or increase the competitiveness of the product and process innovations, the degree of importance attributed to strategy and, finally, the obstacles that may infer on the company reaching its goals. It's a meso-level analysis of innovation segmented by sectors and types of activity.

The CIS results (2012) indicate that 54,5% of Portuguese companies developed innovation activities (product, process, organizational, marketing), with 41,2% indicating having developed product and/or process innovation, 33% introduced organizational innovations and 32,6% introduced marketing innovations (including innovation activities which were abandoned or incomplete). An "innovative company" is one that introduces an innovation, even if only internally. It's not necessary to be considered as such by the market. This leaves expectations for innovation very low, and leads to miss-representing results that may induce deviated perceptions of the status quo of innovation in companies.

From the same study, and out of the national total, 19,3% of companies innovated in terms of goods and 16,6% in services whilst 20,1% innovated their production processes, 12,4% their logistic, delivery or distribution methods and 24,4% innovated their process support activities.

The study goes further and presents results about the way in which the product/process innovation was gained: 14,5% based their innovation on R&D activities realized internally, 9,2% on external acquisition of R&D, 25,2% on new machinery, equipment, software and infrastructure acquisitions, 7,1% on the acquisition of knowledge from other companies or institutions and 30,9% in all other possible areas of innovation. In total, 41,2% of the companies developed at least one of the five activities mentioned.

In relation to organizational innovation, 24,0% innovated their business practices by better organizing procedures, 25,8% in new methods for organizing responsibility and decision making processes and 15,1% in new methods applied to organizing external relations with other companies or public institutions. In total, 33,0% applied at least one of the three mentioned methods.

In relation to marketing innovation, 17,9% innovated through significant changes to their product packaging or aesthetics/appearance, 18,4% through new techniques or means of communication for the promotion of their goods or services, 10,5% through product distribution/allocation methods in new sales channels and 17,7% through new pricing policies for their products. In total, 32,6% applied at least one of the four mentioned methods.

Despite the finer and more detailed picture in this study of the innovation status, it still presents results only at the meso-level, which are of little use to companies seeking detailed information that can be specifically used to develop innovation actions, at the product, processes, organization and market levels. Therefore, there is a need to go further in detail of the innovations produced by companies, if one desires to induce and help companies to innovate, mainly at the product (good or service) level.

2.2 Norms Applied to Innovation

Despite the importance of innovation and innovation management, for businesses in general, the world movement for standardization has taken a little too long in reacting to such necessity in this issue. Nonetheless, the last decade has brought with it a set of normative documents that support innovation management best practices, first at the level of some countries (Spain, Portugal, Brazil, Mexico, Germany and United Kingdom), and later at the level of international standardization organizations (CEN and ISO).

Despite all existing difficulties to overcome cultural and methodological barriers (Clausen and Elvestad, 2015), as a result of the EU diversity, one of the more recent normalization documents in the innovation field is the European Norm "Innovation Management – Part 1: Innovation Management System" (CEN/TS 16555-1:2013), published with a "Technical Specification" that aims at guiding organizations to introduce, develop and maintain a

systematic management framework for innovation practices based on an Innovation Management System. This management system should allow organizations to become more innovative so that they may have more success with the innovations applied to products, services, processes, organizational design and business models. To do so, the management system should include all the activities necessary to generating innovation on a continuous basis, whatever the size of the company, in the areas of organizational context, leadership and strategy, planning, innovation facilitation factors, management processes, performance evaluation and system improvements.

Published prior to CEN/TS 16555-1:2013, the Portuguese Norm "Research, Development and Innovation Management (RDI): System Requisites for RDI management" (NP4457:2007) establishes the certification requirements for an RDI management system. The conceptual structure of the Norm follows three principles: (i) The need to generalize the use of the chain-linked model (Kline and Rosenberg, 1986) in the knowledge economy; (ii) Accommodate the concepts of the Oslo Manual from the OECD (2005); and, (iii) Consider innovation in industry (goods), services (supplying of intangibles), traditional sectors (low-tech) and the more sophisticated ones (high-tech). The management principle inherent to the norm is based on the organization's interaction with various external agents via three different interfaces that can assume different forms according to internal and external factors that influence the organization's needs.

According to IPAC records (March, 2015), there are 164 organizations in Portugal certified by the Portuguese norm. The published records present the name of the entity, the area of certification and activity code, in accordance with an IPAC reference document – "Process for the accreditation of certification entities".

2.3 Concepts and Criteria for Innovation

Classification

In the 1930's, Shumpeter presented one of the first definitions of innovation, as referred to by the Oslo Manual (OECD, 1997), in which he identifies five types of innovation: (i) introduction of a new product or qualitative change in existing product; (ii) new industrial process; (iii) opening of a new market; (iv) development of a new raw-material source or of another kind of input, and (v) changes in industrial organizations.

Deriving from those principles, the Oslo Manual (OECD, 2005), defines four types of innovation, for evaluation purposes: (i) Product innovation: introduction of a new good or service or a significantly improved good or service, in relation to its use or characteristics, (technical specifications, material components, incorporated software, ease of use); (ii) Process innovation: implementation of a new or significantly improved production or distribution method (technical changes, equipments, software); (iii) Marketing innovation: implementation of new marketing methods with significant changes in product conception, packaging, positioning, promotion or pricing; and, (iv) Organizational innovation: implementation of new organizational methods in terms of business practices, functional organization or in relation to company's external relationships.

In collecting data, innovation focuses on two areas: "object" – the product (good or service) to which the specific innovation refers to; and "subject" – an organization (activities and strategies that lead to innovation). Innovation can be seen as the introduction of a new product or improved product that is accepted by the market (consumers).

Kim and Mauborgne (1999) defend that innovation creates value through product attribute performance, even if they aren't originated in technological innovation. This can be represented by a value curve, translating the various product attributes or, in other words, the value proposal for the consumer. By altering the attributes' performance, individually or in group, the product's value is also altered and this, depending on the different types of results obtained, can lead to different types of innovation (Fernandes and Martins, 2011): breakthrough, adding-value, turning-around and up-grading.

Technological and cultural innovations, which generate aggregated value to product or to organizational procedures being properly accepted by the market, are created by technological and cultural processes, respectively. Technological innovation is the result of an organization's actions towards developing technology-based innovation. Cultural innovation is a consequence of a market's behavioral changes, induced by a new product (good or service), being those external to the organization (Fernandes, 2014).

The innovation types qualification in the sample is based on five areas of evaluation and their criteria, as presented in table 1. The evaluation areas 1 and 2 derive from Oslo Manual (2005) principles, the evaluation area 3 derives from Kim and Mauborgne theory (1999) and adapted by Fernandes and Martins (2011), and the evaluation areas 4 and 5 derive from

Fernandes theory (2014). The criteria definitions derive from interpreting the mentioned theories in face of feedback obtained from the panel of experts. The qualification attributed to each criterion derived from the discussion held with the panel of experts and the evaluation carried out was based on a binary criterion (yes or no) in terms of its verification.

Table 1 Qualification criteria by areas of innovation evaluation.

Criteria	Qualification
Evaluation Area 1: Final results of innovation	
Goods for consumption	The effects of any innovation that reflects directly on the end consumer (medication, electric appliances)
Goods for Professional use	Benefits that are indirectly reflected on the end consumer (professional tools, application tools).
Goods for incorporation	They reach end consumers or professionals who apply or use them (mechanical pieces, packaging).
Consumer Services	Provided directly to the final consumer (customer service, treatment of physical or motor conditions or capacity).
Consumer services with the incorporation of goods	Consumer owned product for continued use and operation (electric room temperature control system installation, surveillance system installation)
Organizational Services	Services provided directly to organizations (technical consultancy, information and data supply services)
Organizational Services with the incorporation of goods	Organization owned product for posterior and continued use and operation (software installation, software, technology bases quality control mechanical systems
Internal technological processes	New technology development applied to operational and production processes (creation of new machinery, development of new manufacturing processes)
Internal management processes	Management, control and decision making (ICT, internal communication organization)
Internal marketing and networking processes	Cooperation with external agents to the company (distribution chains, sales and client assistance processes).
Evaluation Area 2: Innovation Scope	
Product functions	What the product supplies users/consumers as a result of the application of new technologies to products (wireless communications, control automatisms)
Product design	Shown through the adoption of new cultural and aesthetic preferences (format, colour, style)
Product inputs	Materials and ingredients used to manufacture a product as a result of investigation processes (disease treatment by medical equipments based on new technologies, usage of new prime materials).
Manufacturing processes in the organization	New technology development level (creation of new machines/machinery, development of new manufacturing processes)
Management processes in the organization	Management, control and decision making (ICT, internal communication)
Marketing processes in the organization	Marketing and networking processes with external agents to the organization (distribution chains, sales and client assistance processes).
Evaluation Area 3: Value created at the product or organizational level	
Breakthrough	Incomparable in many or all of its attributes to competing products (the first microwave oven, the first cell phone)
Adding-value	Superior performance in many or all of it's attributes when compared to

	competing products or processes (luxury watches and cars).
Turning-around	Alternative performances, despite being inferior to competitor products or processes, but still within consumers' parameters for acceptability, functioning as an economic alternative to the existent supply (second generation cell phones, low-cost furniture).
Up-grading	Similar to competitor products and organizations, differentiating themselves through the attributes most valued by consumers or clients (Zara, tourist packs)
Evaluation Area 4: Type of processes used to create technological innovation	
Planned/Structured	R&D focused on fundamental and applied investigation, developing new knowledge – know the why (drones, medicine).
Targeted/Objective driven	Satisfaction of very specific client needs with basis on design innovation so as to create meaning, desire and aesthetic qualities appreciated by the market – know for who (iPhone, Cirque du Soleil)
Adopted/Adapted	Imitation of existent products and processes using knowledge that exists in the market – know how (compacts for offices – photocopy, print, fax and scan machine; multifunction packaging systems).
Serendipitous/Stochastic	Fundamental and applied investigation that creates new knowledge but that results from serendipitous and stochastic situations, being that the result is unexpected (discovery of penicillin, creation of velcro)
Evaluation area 5: Cultural change	
Newoel	New technology induced behavioural changes in vast factions of the population (videoconference, mobile chatting)
Moral	New codes of conduct, rules and laws that lead to behavioural changes in vast factions of the population (seatbelt usage in cars, helmets).
Gnosil	Diffusion of knowledge on a certain subject or discipline that may affect consumers' lives, leading to changes in individual behaviour for small fractions of the population (jogging, civic duty participation).
Beutel	Adoption of new aesthetic styles applied to products and processes that alter consumer's individual behaviours for small fractions of the population (fashion and clothing, music).

3. Methodology

3.1 Method

The article reflects the result of a study based on the contribution of a panel of ten experts in the areas of value management (two), innovation (three), economy (one), quality assurance (three) and auditing of management systems subject to third party certification (one), using the same methodology as that is used by studies done by focus groups. The evaluation method used by the focus group followed what is generally presented a standard procedure by Kitzinger (1995), Gibbs (1997) and Grudens-Schuck et al. (2004). The goal was to carry out a qualitative evaluation of the available information. The use of experts in the evaluation exercise follows the practice in empirical opinion studies, even if using other methods like Delphy Technique (Adams et al., 2006)

The study underwent two distinct phases: the first in which the investigators determined the qualitative criteria that would serve as a basis for the later experts' evaluation, as identified in point 2.2; and a second in which the panel of experts met up to carry out individual evaluations of all the companies in the sample, based on the decided evaluation criteria and on the previously identified and gathered information. These results are in chapter 4.

3.2 Population and sample

The study's population is composed of the 164 companies certified by the Portuguese Norm "Research, Development and Innovation Management (RDI): RDI management system requirements" (NP4457:2007) and that population appear publically listed on the

"National Data Base for Certified Management Systems" by IPAC (2015). The sample corresponds to 100% of the identified population.

3.3 Data collection

The data collected refers to: (i) description and code for certification scope, in accordance with the "National Data Base for Certified Management Systems" by IPAC (2015). The coding method used by the certification body is very definitive and specific in scope, providing a clear understanding of the innovation scope in which firms have achieve their certification and, therefore, the type of innovation that they produce at the product o processes level; (ii) description of the activity and products (goods and services) supplied, as referred by company's websites; and, (iii) management reports made available online by the companies (when existing).

3.4 Data treatment

An individual analysis of each company was carried out for each defined evaluation criterion. The evaluation was carried out in accordance with binary criterion (yes or no) in terms of verification.

So as to simplify this study, only the main evidence of RDI developed by each company was considered, despite many of them would develop innovations in more than one area - products and processes, for example. This determination was validated by the certification code, and consequent description, provided by the certification body (IPAC). This decision was made based on the impossibility of determining, using only the available information, all the RDI activities that the companies developed in a clear and unequivocal way. An individualized and more contextual evidence of the produced innovation by each company was undertaken, in accordance to the theoretical line that signs that innovation is evolving into a more contextual approach (Ortt and van der Duin, 2008).

In 92.1% of the sample, the panel of experts reached a consensus. In 7.9% of all evaluations, equivalent to 13 cases, the result was reached by vote, all referring to the "final results of innovation" criterion.

4. Study results and discussion

4.1 Results of the innovation and scope of the innovation

The results show that 94.5% of the companies are developing innovation activities around the products (goods and services) and only 5.5% focus their main innovation activity on their own organization, as we will see later.

In more detail, out of those 94.5% of companies that focus their innovation mainly on the product, 26.6% innovate in their goods and 68.3% in their services, as shown in table 2.

Table 2 Final result of the innovation

Good (Tangible)			**Service (Intangible)**			
			For consumers		For organizations	
Consumer	Professional	Integration	Service	Service with product	Service	Service with product
GC	GP	GI	SC	SCP	SO	SOP
14	15	14	5	1	46	60
8.5%	9.1%	8.5%	3.0%	0.6%	28.0%	36.6%
TOTAL: 26.6%			TOTAL: 68.3%			

The largest fraction of the sample (36.6%) develops innovation in the services they supply to other organizations, incorporating some kind of product in the service. The second largest fraction of the sample (28%) only innovates in services supplied to other organizations. The sum of these two fractions (64.6%), plus the sum of the fractions that represent goods for professionals and for incorporation on other goods (17.1%), indicates that an overwhelming majority of the companies that make up the sample (82.2%), works in the business-to-business market (B2B). In the opinion of the panel of experts, this reality represents a fragility in that very same relationship due to the lack of direct contact with those that determine the acceptance of the innovation (the consumers).

In terms of the scope of innovation, divided by specific areas in which it's carried out, the results are as shown in Table 3.

Table 3 Final result of the innovation

Product (Object)			Organization (Subject)		
Function	Design	Input	Process	Management	Marketing
PF	PD	PI	OP	OMn	OMk
148	1	6	6	1	2
90.2%	0.6%	3.7%	3.7%	0.6%	1.2%
TOTAL: 94.5%			TOTAL: 5.5%		

From the results, 90.2% of the main innovations produced by companies focus on products functions (goods and services), while the innovation at new inputs and in organizational processes level out at 3.7% each. The other indicators are practically irrelevant for the discussion. The panel of experts is of the opinion that these results represent a failure in focusing on the creation of something "new", being the existing verified focus set on changing something that already exists at product characteristic and attribute levels. This preference for product innovation is confirmed by other empirical studies that point out in the same direction (Parisi, *Schiantarelli and Sembenelli*, 2006). The focalization on innovations of products is in accordance with what Gunday, *et al.* (2011) named as critical driver to the performance on innovating companies, in other words, the product innovation functions as the fulcrum to the development of other innovations at the process, organization activities and marketing levels.

From these two evaluations results, providing us a "meso" vision of RDI in Portugal, it's very difficult to establish a direct relation between these results and those of the Community Inquiry on Innovation – CIS (2012), as identified in point 2. The specificity of the sample under study, RDI certified companies, in comparison to the generality and amplitude of the sample used by CIS (companies of all dimensions) may be one of the causes of not being possible to compare both studies to one another. Another cause is related to the singular focus used in this study on the most evident RDI activity practiced by the companies against the plurality of activities of RDI expressed in the CIS study results.

4.2 Value innovation

Innovations have always a recipient as target (who accepts it), and this is always a direct beneficiary of value creation and value generation. The final value, resulting from innovation, is normally designated as "customer value". This value is the result of the preference and perceptional evaluation made by the customer, in relation to the attributes, attributes' performance, and other outcomes resulting from use situations (Woodruff, 1997, p.142). Many customer value concepts include the idea of *trade-off* between quality and price (benefits versus sacrifice). Business customers (B2B) are more concerned with the *trade-off* between functionalities, services and benefits of business relationships and the monetary and non-monetary sacrifices related to specific objectives (Lapierre, 2000; Ulaga, 2003). The experts in the panel kept all that in mind when evaluation this part of the study.

The overwhelming majority of innovation by value produced by the companies in the sample is situated in "Up-grading innovation", as in table 4.

Table 4 Types of value innovation

Breakthrough	Added-value	Turning-around	Up-grading
4	1	0	159
2.4%	0.6%	0.0%	97.0%
TOTAL: 100.0%			

This type of innovation, in accordance with the panel of experts, is translated in less value generated for the products, and derives itself from new combinations of productive factors that are based on operative efficiency and design (at the functionality level). The consequence of such fact is the reduced

effects that this type on innovation has on the value curve of products, and consequently, on the economy.

The 2.4% of companies that seem to develop "breakthrough innovation" are, theoretically, those which generate more added value to products. According to Verspagen (1995), the "high-tech" companies, in the particular case of this study those in the biology and pharmaceutical industries, are those that benefit more from R&D activities and, consequently, generate more value.

One company, 0.6% of the sample, develops "adding-value innovation". This belongs to an industrial activity considered as "low-tech", still focusing on market niches with specific needs and wants that value its products. The fact that no company focus on "turning-around innovation" indicates that all of them try to bet on RDI strategies that generate more added value. Still according to Verspagem (*op. cit.*), higher ratios resulting from obtained results (return on investment, sales volume) versus the cost of R&D are part of high-tech companies, what seems not to be the case in all extension of this study.

4.3 Technological innovation process

The importance of measuring the technological innovation comes from the need to distinguish between technical innovation and administration innovation, referring the first to technology and the last to social structure (Evans, 1966). Technical innovation includes products, processes and technology used to produce products (goods or services), while administrative innovation is concerned with organizational structure, administrative processes and human resources (Gopalakrishnan and Damanpour, 1997). A large majority of companies develops technological innovation through processes that limit themselves to being adoption/adaption of already existing technological innovations (96,3%), as illustrated in table 5. This is generally translated by the acquisition of existing technology. Only 1,8%, corresponding to three companies in the sample, were able to unequivocally demonstrate that they mainly produce innovation through fundamental science-based R&D, developing and delivering new products to the world. Only one company, or 0,6% of the sample, recognizably produces innovation based on new product design, to satisfy specific consumer needs. The first conclusion denotes an incremental innovation style and the other two, mainly the second, targets a radical innovation style (Ettlie, Bridges and O'Keefe, 1984). The last two conclusions refer to companies developing products targeting specific needs and wants of consumers.

Table 5 Technological innovation process

Planned	Targeted	Adopted	Serendipitous
3	1	158	0
1.8%	0.6%	96.3%	0.0%
TOTAL: 98.8%			

It's worthy of mentioning that 1.2% out of this sample represents two companies, both of which have not any activities related to technological innovation in their IDI certification, excluding themselves of the real force (technology) behind the perpetual increment of the quality of life (Grossman and Helpman, 1994, p.24).

4.4 Cultural innovation process

The existing literature is very scarce on the subject of cultural innovation implying the use of products (goods or services), which will lead to a change in behavior of some specific consumer groups. Yet, we may find some authors who try to find the factors that may explain the variations in the adoption of innovation, more at the organizational level, known as *varience sociologists* (Gopalakrishnan and Damanpour, *op. cit*). In the same field, some authors try to identify the innovation processes in some cultural industries, acting in some market niches, where they produce a product with a cultural dimension (Islam, Toraldo and Mercúrio, 2015). Nevertheless, one of the two dimensions of novelty (newness) in innovative products, related to the effect in their market orientation, is the consumer perspective (the second is the company perspective), which is related to the extension of the innovation and how this is compatible with the experiences and patterns of consumption in consumers. This novelty dimension reflects the extension of the change of behavior required by

consumers to adopt a new product (Lawton and Parasuraman, 1980).

The study that served as the based for this article set on a model that characterizes the causes and effects that will lead to the adoption of behavior changes by consumers, implying the usage of products, in which a product, even not being the main cause of that behavior change, is part of that process of cultural innovation (Fernandes, 2014).

This type of innovation is the one that, with the exception of one company, appears to be not mainly targeted by the companies of the sample, as seen in the results in table 6.

Table 6 Cultural innovation process

Neowel	Moral	Gnosil	Beutel
0	0	0	1
0.0%	0.0%	0.0%	0.6%
TOTAL: 0.6%			

The company that appears to have a clear involvement in a behavioral change process (cultural innovation) did this through the new design of its product, based on an identified aesthetic preference held by a niche of the market. Normally, this type of cultural innovation (Beutel) is the result of a *market-driven* strategy, that is set on the modification of products (Bennet and Cooper, 1981), in order to satisfy consumers and reduce the risk associated with the innovation process, leading the creation of products less radical in the long term, according to some authors (Hayes and Abernathy, 1980), or of products, less compatible with consumers' needs, that facilitate the adoption and acceptance of the innovation in a much faster manner, according to other authors (Cooper, 1979, Cooper and Kleinschmidt, 1987, Zeithmal, 1981). In relation to the prior value innovation analysis, this is the same company that develops "added-value innovation", which can explain its positioning in the cultural innovation realm.

4.5 Correlations between areas of activity and results

The reduced dimension of the sample and its enormous dispersion in various industries that lead to very different outputs in terms of RDI, do not allow us to establish any correlation between the types of innovation and what is forcing them to happen, as we can observe in table 7.

Table 7 RDI system main outputs

Industrial activities – goods producing	Quantity	Service activities	Quantity
Food products	2	Product trading	3
Footwear	1	Contracting/Construction	10
Electric meters	1	Consultancy to companies	22
Equipments for electrical networks	2	Graphic and industrial design	2
Electronic equipments	1	3D scanning and modeling	2
Foam	1	Energy distribution	1
Machinery and tools	5	Property management	2
Building materials	3	Logistic services	1
Medicines	3	Machining parts	3
Professional furniture/furnishings	2	Media	1
Moulds	6	Mobility system	2
Photovoltaic panels	1	Residue management	1
Toilet paper	1	Health services	3
Plastics	2	Road safety	1
School boards	2	Heating systems	1
Industrial Chemicals	2	Communication systems	5
Textiles	7	Information and data systems	6
Protective clothing	1	Management software	51
		Geographic location software	1
		Multimedia software	3
Total	43	Total	121

We should refer that out of the 22 companies that provide "consultancy to companies", 81.8% of these offer "services to other organizations" (SO) and their focus of innovation is on the functions of those services (PF). Out of these 22 companies, 82% develop RDI in the services they offer to other organizations (SO), 9% in their own internal technological processes (ITP), 4.5% on goods for professionals (GP), and 4.5% in services with goods for professionals (SOP). Much in the same way, 82% innovate in product functions (PF), 9% on product inputs (PI), and 9% in production processes (OP). All, without exception, carry out value improvement innovation (M) and adopt/adapt technological innovations developed by others.

Out of the 51 companies that work in the management software area, 84.3% develop RDI in the services they render to other organizations with the incorporation of goods (SOP) and the remaining 15.7% offer services to organizations (SO) not leaving any technology for their use. Even this study has not any connection with an international benchmarking RDI study for the information technologies sector (R&D+I International Benchmarking, 2013), this distribution is much in line with the last, where the percentage of firms that provide only services é below the percentage of those that leave some kind of good with the client, in this case software.

All, without exception, practice innovation focused on the functions of their services (PF), on the improvement (I) of their value curve, and via technological processes of adoption/adaption (A) of third party technology.

5. Conclusion

This study aimed at introducing a new understanding of innovation at the micro level, in companies, pointing out the outputs of their main innovation activities, and qualifying those results.

The results of innovation produced by firms, as a result of their own capability and capacity to innovate, are determined by many factors related with the internal organization and the market contexts (Rothwell, *et al*., 1974), but the development and evolution stage of firms is a critical aspect for innovation (Albernathy and Utterback, 1978). The same seems to be true when the analysis covers one or more regions, where the

more developed regions are more capable of generating innovations (Bilbao-Osorio and Rodriguez-Pose, 2004). Those concepts could not be validated by the study, as the information gathered was irrelevant in that sense. Nevertheless, the study seems to show that the capability and capacity of innovation is not related to some specific industries or outputs, as companies come from 38 different specific fields.

In order to reach higher stages of organizational development in the field of innovation, the adoption of standards and other norms for innovation management purposes can become fundamental tools (Pellicer, *et al.*, 2008). This could not be proved by the study, since it is not done any comparison between firms following standards and norms' prescriptions and others not doing so. However, even considering that the observation is only focusing on companies following some kind of standard prescription, the results don't indicate any special or specific benefits for such choice.

Despite indications that R&D creates more innovation in the private sector (firms) than in others (public or educational) (Bilbao-Osorio and Rodriguez-Pose, *op. cit.*), the study could not indicate that the result of developed RDI in certified firms is connected to the holding activity sector.

According to theory, "Breakthrough" and "Added-value" innovations are the types that are able to create the most economic value as a direct effect of RDI activities in a company. Only 3% of the sample fits into these two types of value innovation, which indicates that all other companies may ignore this factor. It seems to indicate that RDI efforts made by RDI certified companies aren't inducing high value creation (economic) in the market, not delivering the may be expected high economical impact to society.

In theory, the "Planned" and "Targeted" types of technological process innovation have more potential to create or generate value. Only 2,4% of the sample fits in this type of innovation, thus confirming the last conclusion. In fact, some may draw the conclusion that most firms in the sample are not taking economical advantage of their efforts to obtain RDI certification.

Finally, cultural innovation, deriving from behavioral changes in markets, is the type of innovation that, in theory, may induce the highest growth of market share and of product sales. The two sub-types of cultural innovation that most contribute to this are "Newel" and "Moral". One can verify that only 0,6% of the sample is clearly positioned as participating in a cultural innovation process, but not in any of the two sub-types of cultural innovation that generate most value to the economy. It seems that all companied, except one, have not assimilated the concept of cultural innovation, and, consequently, are missing one of the major sources of revenue linked to innovation.

These findings seem to be not in accordance or supporting the findings of the three studies that provided the initial statistical data analyzed in this study. In fact, the Innovation Barometer (Cotec, 2014), the Innovation Union Scoreboard (European Union, 2014) and the Community Inquiry on Innovation (CIS, 2012) seem all to have a very much more optimistic view of the level of innovation produced by companies in Portugal that what the focus group could come up in this study. Despite the fact that the methodologies used by the three surveys and by the focus group were completely apart, the former seem to point out that the innovation activities in Portuguese firms are still of some positive or relevant contribution to the economy, while the findings of this study seem to point out how weak the innovation of Portuguese firms seems to be and the low value that is created and induced into the economy.

It seems we should also deserve some consideration to the meaning of all this information to firms. The three official surveys have a wide scope in the used criteria, while this study focused on particular aspects (inputs, outputs, innovation processes) of individual companies. Theoretically, this last kind of information is of higher value to companies than a more holistic view of the economy in general. While an holistic type of information may b helpful to understand the context where firms are positioned and how that can influence their future innovation strategies, a more singular or individual information can be used to determine how well firms innovate and what needs to be done in order to improve the value of their innovation. This is of particular importance if firms want to determine the value created or generated by their innovation, either at a quantitative or qualitative dimension, in order to make choices regarding market and organizational strategies.

To conclude, this study seems to bring a new need in surveying the innovation and its effects: a further segmentation of the criteria to the very specific level of the value of the innovation outputs and outcomes.

6. Study limitations and future research

The study suffers from various limitations, namely: (i) it only reflects the opinion of a reduced number of individuals, even if they are experts in the disciplines

directly tied to innovation and RDI certification; (ii) limitations of available information via IPAC data base and the annual management reports published online by the companies, shortening the vision of RDI activities and their outputs; (iii) the sole focus of the study on the company's main innovation activity, the one that seemed more evident to the panel of experts, leaving out other RDI activities that may also have strong impacts on the economy; and, (iv) non-existent quantitative data referring to RDI activities at a micro level that could be used to establish, with the same scope of the used criteria, correlations for the validation of the opinions expressed in the study with the reality of the market.

Despite that, the results from this opinion study may serve as a starting point for a deeper understanding of some issues that should be brought up in the future.

The study is based on the classification given by a panel of experts, set on criteria with a large theoretical base. The aim was to obtain a more micro perspective of what innovation is and what it achieves in Portugal. However, the study leaves even more questions at the knowledge and best strategic management of innovation practices levels. These issues should be subject to future studies so as to contribute to the development of micro, meso and macro innovation policies that may create and generate higher value for the economy. The results also bring to the table the need to involve other agents in future studies at the sample level, the methodology applied to the study or the quantitative data presenting the results of the RDI activities developed by companies.

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