Value co-creation and innovation:

the case of Portuguese firms

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Abstract

The central objective of this research is to study value co-creation as a key driver for innovation in the development and introduction of innovative products/services in the market, applied in Portuguese firms. It is also intended to perceive which of the co-creation procedures are more significant, as well as the propensity of the firms to obtain competitive advantage once they adopt co-creation procedures within their innovation process. Companies evolved into non-linear models of innovation; however, information management remained producer-centered, lacking the ability to carry out an adequate collection of the specific needs of users. Co-creation addresses the previous by having a customer-centered information management. Being a descendant of open innovation, it has a firm driven strategy. Also, co-creation includes user innovation within its procedures to co-create, being the most holistic perspective in terms of value creation with customer, as its procedures encompass all type of users. To feed the empirical research, it was used secondary data from Community Innovation Survey (CIS), particularly from 2016 Portuguese edition. CIS is conducted periodically every two years since 1992, mostly in European countries, to provide information on innovation topics per type of sector, by collecting firms' responses. To test the data, in accordance with the research hypotheses formulated, it was created five logit models. Between expected and unexpected results according to the literature review, ultimately, co-creation reveals itself as a stimulant key driver for innovation, which consequently unlocks paths to leverage competitive advantages, by its application within the companies' innovation process.

Keywords: Innovation; Open Innovation; User Innovation; Co-Creation; Development of innovative products / services; CIS.

1. Introduction

The currently very competitive market requires that companies resort to new approaches of innovation and product development in order to survive and grow. The investment in a broader range of offerings is becoming less able to guarantee differentiation (Prahalad and Ramaswamy, 2002, 2004). Furthermore, Ogawa and Piller (2006) also introduced that the company's failure in assessing and meeting its own customer's needs is one of the main reasons for unsuccessful penetration of a new product in the market. To address this problematic issue, a solution resides in entailing the concepts of open innovation, particularly co-creation, in the New Product Development Process. According to Auh et al. (2007), Prahalad and Ramaswamy (2004), Vargo and Lusch (2004) and Martovoy and Dos Santos (2012), co-creation supports active participation of the customer jointly with the company in the innovation process. Customers are engaging with this new form of value creation, enhanced by the Internet's consumer-centric culture, which promotes the customer empowerment through interactivity, speed and openness to information (Prahalad and Ramaswamy, 2002). This translates into a shift of paradigm regarding the traditional, economical and company-centric concepts to a novel consumer-centric view, where the costumer is integrated as an active player of the value creation process, capable of influencing both its methods and structure, through the high quality interactions between himself and a firm, which allows both parties to co-create special experiences together. Therefore, in other words, a company can listen to customers more effectively and co-create new products with them, which will respond accurately to their specific and complex needs, providing leverage to the competitive advantage of such companies and hence, enhancing the chances to be successful (Prahalad and Ramaswamy, 2002,

2004; Hoyer et al. 2010; Papageorgiou, Efstathiades and Milikouri, 2017). O'Hern & Rindfleisch (2010) defined a typology regarding numerous forms of customer co-creation as a collaborative New Product Development (NPD) activity, in which customers are of essence in the NPD process. Piller et al. (2011) presented another typology, broader and holistic, but with same purpose. These typologies, to be analyzed further, we will be important to sustain the use of CIS (2016) secondary data to feed the research. In the light of the above, the main research question that arises is the following: is co-creation a key driver for companies to develop and introduce new innovative products and services in the market? Also, the empirical research will seek to answer the following questions: (1) By employing co-creation within their innovation process, will firms be more likely to successfully introduce new and innovative products and services in the market? (2) If co-creation is adopted and applied within the innovation process of the company, will it allow these companies to leverage a competitive advantage over competitors? (3) Which co-creation procedures are more significant to the creation and development of new innovative products and services? Given the questions and challenges in the scope of this research, the main objective is to study value co-creation as a key driver for innovation in the development and introduction of innovative products/ services in the market, applied in Portuguese firms. In this sense, this research will take co-creation as its conceptual framework. The study's theoretical support is based on the consideration that innovation is a non-linear, evolutionary, complex and interactive process between the company and its environment, in which the customer has a vital role within the company's innovation process. It is also the theoretical support that allows the creation of the conceptual bridge between co-creation and the CIS, with the purpose of feeding the empirical research that was intended to be built with secondary data validated by Eurostat, in order to study co-creation as a key driver for innovation in the development and introduction of new and innovative products/ services in the market, applied in Portuguese firms. In more detail, this research intends to study the following aspects: (1) The application of co-creation within the companies' innovation process, and the propensity to innovate and introduce new and innovative products/services in the market; (2) The relation between the application of co-creation and the obtainment of competitive advantage; (3) The identification of the most significant co-creation procedures for creating new and innovative products and services. These aspects are directly linked to the study of co-creation within the innovation process of firms, particularly in the Portuguese ones, as well as its influence on the development of new and innovative products/services. Moreover, in order to materialize this study, hypotheses will be formulated to be tested based on a quantitative approach using, econometric models.

2. Literature review

2.1 Innovation

Chronologically, the concept of innovation has undergone considerable changes. Schumpeter firstly defined the concepts of economic development and entrepreneur as the actor responsible for innovation. In this sense, all the market entities embraced the linear and producer-centered models of innovation. In the late 70's, the rise of the interactive innovation model disrupts with the linear models, coincidentally with the foundation of the user innovation model. Further, the open innovation model also reinforces the importance of non-linear models. In spite of companies having evolved into non-linear models of innovation, the management of information still persisted producer-centered. This problem is addressed by co-creation, which arose in the beginning of the XXI century, a descendant of open innovation, however with a customer-centered management of information.

2.2 Co-creation

In the present research, in accordance with Prahalad and Ramaswamy (2004), two considerations are made: (1) the terms "customers", "consumers" or "users" are used interchangeably, throughout; (2) the term "offering" is used to designate both products and services, once the concept of co-creation is equally applicable either to "products" or "services", despite their conventional distinctions. The seminal authors, Prahalad and Ramaswamy (2004:8), stated that "Co-creation is about joint creation of value by the company and the customer, creating an experience environment in which consumers can have active dialogue and co-construct personalized experiences; product may be the same, but customers can construct different experiences". In other words, co-creation stands for innovating with users rather than to users, assuming their active participation in the innovation process (Auh et al. 2007; Prahalad and Ramaswamy, 2004; Vargo and Lusch, 2004). According to Martovoy and Dos Santos (2012), the entails the reconsideration of the customers' role in the development of innovation; once integrated in the latter, companies enhance their ability to listen to customers and respond to their specific needs, leveraging the competitive advantage of such companies. Prahalad and Ramaswamy (2004) also stated that the

interactions between consumers and companies in order to co-create exclusive experiences, are the path to unlock novel competitive advantage's sources. Co-creation shifts the paradigm regarding the economical concept of value. According to Prahalad and Ramaswamy (2002), the concept's view is "consumer-centric", being opposable to the traditional "company-centric" view. In the latter: the consumer is apart from the value creation process; the methods and structure of the process of value creation are decided by the company; there is solely one point of exchange, controlled by the company, that serves its main purpose and objective, which is to extract value in the form of money from the costumers. In the "consumer-centric" view: the costumer plays an active and key role, being able to influence the methods as well as the structure of the value creation process; the main objective is to create value for both parts, customer and company and, for that purpose, there are multiple points of exchange where the aforementioned parts can jointly co-create value. (Prahalad and Ramaswamy, 2002, 2004). While, traditionally, suppliers produced offerings and customers purchased them, currently customers are able to dialog with suppliers in every step of the product design and product delivery, a kind of engagement that can be seen as an interactive process of learning for both parts (Ballantyne, 2004). The consumer and the company jointly create value through the co-produced offerings, being this co-creation of value a useful objective that a company can rely on, regarding the gathering of knowledge, since it highlights the customers' point of view, it improves the company's process of identifying customers' needs and wants (Lusch and Vargo, 2006; Payne et al. 2008). Vargo and Lusch (2004) identified customer co-creation as a central premise regarding the marketing's new service-dominant logic, also known by the acronym S-D logic. The authors' S-D logic rests on a key assumption that resources do not own value per se; instead, the value is co-created with costumers when resources are used; S-D logic's value-creation process occurs when the value is co-created with the customer during interaction with and activation of a set of resources (Vargo and Lusch, 2004, 2008; Payne et al. 2008; Edvardsson et al. 2011). So, service-dominant logic attributes importance to the value-creating processes that involve the customer as a co-creator of value (Lusch and Vargo, 2008; Payne et al. 2008). On that account, S-D logic regards both goods and services as the central resources to be used within the service provision, which means that the customers access the experience of goods and services regarding the value-in-context and, consequently the exchange of value is no longer solely attached to the transaction alone (Lusch and Vargo, 2008; Edvardsson et al. 2011). Further and according to Vargo and Lusch (2004) and O'Hern and Rindfleisch (2010), customer co-creation is considerably related with S-D logic, once the latter requires that collaboration with customers occurs, creating value both through the stimulation and enhancement of customer learning, as well as through the extraction of the service-based benefits ingrained in products. O'Hern and Rindfleisch (2010) also state that there are several forms of customer co-creation, which they define as collaborative New Product Development activities, in which consumers are imperative in the process of NPD, assuming an active participation in terms of contribution and/or selection of the content of a new product offering. Piller et al. (2011) also present a typology for customer co-creation and conclude the importance of consumers for the process of NPD. Despite the aforementioned topic's literature being scarce, the evidence gathered so far points out that customer co-creation is positively related to many NPD metrics, namely, increased new product creativity, decreased time to market and reduced development costs (von Hippel, 2005; Grewal et al. 2006; Shah 2006; O'Hern and Rindfleisch, 2010).

2.3 Co-creation as part of open innovation

Co-creation is an integrant part of the open innovation concept, so that the latter considers that the internal use of external knowledge and the external use of internal knowledge enhances a company's innovation and its market expansion (Chesbrough et al. 2006; Martovoy and Dos Santos, 2012). Currently, we experience a very competitive and complex market, an environment where companies should present novel approaches both to innovation and product development, in order to survive and/or grow. New Product Development arises as the most important process, as well as a main source to a company leverage competitive advantage (Papageorgiou et al. 2017). NPD process *per se* is difficult to manage due to the complexity of customers' needs, as well as the difficulty in collecting and identifying those through traditional marketing methods (von Hippel, 2005). According to Ogawa and Piller (2006), the company's failure in assessing and satisfying its own customers' needs is one of the main reasons for unsuccessful penetration of a new product in the market. A solution to this problem is attaching the concept of open innovation, especially, co-creation in the NPD Process, so that new products can be co-created to meet both customers' requirements and needs, enhancing the chances of success for the company (Hoyer et al. 2010; Papageorgiou et al. 2017). Furthermore, the importance of exploring and using customer-generated solutions has been

evidenced by numerous leading innovation researchers and practitioners, namely Prahalad and Ramaswamy (2004), von Hippel (2005), O'Hern and Rindfleisch (2010).

2.4 The rising of co-creation and the role of the customers

To succeed at NPD, two types of information are required: (1) information regarding customer needs and (2) information that allow to best fulfil the aforementioned needs (Thomke and von Hippel, 2002; von Hippel 2005, O'Hern and Rindfleisch, 2010). The most precise and detailed knowledge for the first type of information is generally owned by the costumers, while for the second type of information, the same happens to the companies (manufacturers or providers, for products and services, respectively). This disparity regarding knowledge generates a condition of information asymmetry (von Hippel, 2005). Traditionally, companies have benefited from exploring the information asymmetry between them and the individual customer, before the rising of the costumers' empowerment, which was enhanced by technological advances which able them to be networked, active and informed (Prahalad and Ramaswamy, 2004). Furthermore, companies tried to manage this asymmetry by resorting to numerous marketing research methods to collect accurate information regarding their customers' needs. Von Hippel (2005) states that those methods mostly provide customers' low fidelity needs and/or wants, while costumers have high fidelity needs, which are complex and, according to Simonson (2005), idiosyncratic, being hard both to measure and properly implement. Therefore, most of new product failures are pinned on the company's inability to precisely evaluate and satisfy customer needs (Ogawa and Piller, 2006; O'Hern and Rindfleisch, 2010). In order to address the information asymmetry condition, Thomke and von Hippel (2002) and von Hippel (2005) offered means to solve it, providing customers with tools and information that capacitate them to integrate the NPD process proactively. The notorious growth regarding the involvement of customers in the Co-creation's logic of value creation is due to the phenomenon of costumer empowerment. This research acknowledges that Prahalad and Ramaswamy (2002:7) exploited the latter in The Five Powers of the Connected Consumer. Such empowerment of costumers and the growing number of customers as active players in the value creation process, in opposition to the traditional NPD paradigm and the "company-centric" view, is also being enhanced by: (i) the recent cultural developments, such as, the users' growing distrust and skepticism regarding marketing communications, the increased news coverage of corporate scandals (e.g. Facebook, Volkswagen, Banco Espírito Santo), documentaries of big business and anti-corporate websites, which also snowballed other active forms of costumer resistance, like brand avoidance and culture jamming (Klein, Smith and John, 2004; Kozinets and Handelman, 2004; O'Hern and Rindfleisch, 2010); (ii) the act of consumption itself does not totally fulfill customers' needs (O'Hern and Rindfleisch, 2010) as well as, according to Prahalad and Ramaswamy (2004), customers *per se*, who are experiencing a market filled with a broader range of offerings than ever before, still feel not completely satisfied. Cognitive psychology points out that, in order to satisfy deep-rooted psychological needs, creative contributions are more effective (Csikszentmihalyi, 1996), rather than the notion of material objects per se. As a result, customers, as co-creators, may experience and collect psychological benefits that consumption by itself cannot offer and fulfill (Pietrykowski, 2004). In conclusion, the increase of customer empowerment enhances customer co-creation since it motivates the costumers to play an active role in the NPD process jointly with the company, also developing their NPD knowledge and skills, in addition to connecting them with proactive communities of likewise customers / co-creators.

2.5 Building blocks of interactions for Co-creation of value

Prahalad and Ramaswamy (2004) proposed a system for co-creation of value, based on building blocks of interactions that occur between the company and the costumers, in order to facilitate the co-creation experiences. The building blocks entail four elements: *dialog*, *access*, *risk-benefits* and *transparency*, which form the acronym DART. *Dialog* infers interactivity and engagement in order to enable an active two-way equally connection, with the goal of developing a joint solution between problem solvers, the company and the costumer. Rules of engagement must be defined, access and transparency to information in both sides must be preserved, being essential to a meaningful dialogue, as well as mandatory, so that information asymmetry can be surpassed as well as, enabling the jointly process of value creation and making it trustworthy, beyond the traditional view. In addition, dialog, access and transparency can clearly grant the costumer the ability to perform a risk-benefit analysis on the duality of action and decision they incur. As consumers become more involved with firms in the co-creating experience they jointly develop, and once the firms reveal more information regarding the risks related to their offerings, the costumers may be keen to deal with more responsibility regarding their own, inherent,

exposition to the risk. (Prahalad and Ramaswamy, 2002). Furthermore, by assessing the four dimensions of DART, companies can evaluate their institutional promptness, like whether their policies and structures allow them to perform activities towards strategic and successful value co-creation, jointly with their customers (Mazur and Zaborek, 2014; Taghizadeh et al. 2016; Albinsson et al. 2016). According to Prahalad & Ramaswamy (2002), DART's premises should be respected in full, so that the co-creation experience for the creation of value, in the form of offerings, is valid. The typologies of customer co-creation presented as follows, despite being different, both respect the previous.

2.6 Typology of customer co-creation (4 types)

According to O'Hern and Rindfleisch's (2010:89) typology, at the early stages of developing a new product, two distinct activities are required: "(1) the *contribution* of novel concepts and ideas, and (2) the *selection* of which specific concepts and ideas should be pursued." Firms can co-create value with the customers, giving them space to both perform contributions to the NPD process, as well as for the selection of those contributions. The customers' degree of empowerment and autonomy throughout these two activities forms the conceptual basis of the typology. O'Hern and Rindfleisch (2010) suggest that the way and procedure used by customers to input contributions for the NPD process, can vary from being totally fixed and predefined by the company, to being totally open. The selection process regarding those contributions can be defined either by the company or by the consumers themselves. When organized throughout two dimensions, the processes of contribution and selection origin four different types of customer co-creation (figure 5), namely: (1) *Collaborating*, (2) *Tinkering*, (3) *Co-designing* and (4) *Submitting*. This typology presents a solution for typifying the activities of co-creation with respect to the New Product Development, establishing a bridge between conceptual terms and the applicability of the CIS 2016. Additionally, O'Hern and Rindfleisch (2010) did not consider lead users as a specific form of co-creation; however, they attest that lead users have an important role in specific types of co-creation.

2.7 Typology of customer co-creation (8 types)

According to the authors of this typology, there are three major extant approaches to gathering information from the customers for the purpose of the Innovation Process, which are different from each other, considering the degree of customer involvement. They are: (1) "Listen into" the customer domain, (2) "Ask" customers and (3) "Build" with customers (Piller et al. 2011:37). The authors characterize the first and the second approaches as conventional, due to the use of traditional methods to identify customer information, such as feedback systems, market research and inquiries. Unlike the first two approaches, in which consumers remain apart from companies in the innovation process, the third approach promotes an active consumer's involvement in the development of innovative products and services, jointly with the company.

Piller et al. (2011:39) refer to "Build" with customers as the genus of Co-creation, defining the latter as the activities performed between the company and the customers, in which they assume an active role in the designing of offerings (O'Hern and Rindfleisch, 2010; Piller and Ihl 2009). Furthermore, customer co-creation is regarded as the junction of the customer centric perspective concerning the innovation process, sustained within a firm-driven strategy. The company is responsible both for promoting the interaction and providing the proper tools to customers, so they are provided with the conditions to co-create innovative offerings with the firm. Here, the position of those firms diverges from the firms that innovate under User Innovation, which merely assume the task of identifying and capturing lead user's innovations, being user centered, even strategically. Besides, and since Piller et al. (2011) goals are also related to the enlargement of the information pool regarding need, authors recognized the importance that lead users, as per von Hippel's lead user theory (1986), have, due to their special characteristics, in the innovation process, including them in it for the sake of the need information they possess. Therefore, Piller et al. (2011) present a holistic typology sustained in co-creation as a multidimensional approach, a new point of view of open innovation. This approach is set on the collaborative ways of participation that customers can assume in the innovation process, which is promoted by an explicit firm strategy concerning open innovation. This research acknowledges that, since this typology's terms are very specific, to delve the understating it is recommended to consult Piller et al. (2011:40-50). This typology comprises eight types of co-creation: (1) *Idea Contest*, (2) *Idea Screening through customers*, (3) *Communities of Creation for idea generation*, (4) *Product-related Discussion Forums*, (5) *Toolkits for User Innovation*, (6) *Toolkit for Customer Innovation (configuration in mass customization setting),* (7) *Communities of Creation for Concept and* (8) *Development and Technical problem solving,* and also *Virtual Concept Testing and Trading*. The presented typology offers another solution for typifying the activities and procedures of co-creation with respect to the New Product

Development. Since this typology is built around three dimensions, instead of two like the previous depicted typology of O'Hern and Rindfleisch (2010), it presents the double of the types of co-creation, eight in total. Another difference between typologies is the inclusion of lead users as a form of co-creation with the toolkits for user innovation, whereas in the first typology presented, the lead user did not represent a specific form of co-creation, performing just a role within particular types of it. Despite the differences, the typologies are equal in terms of the bridge they establish between conceptual terms and the applicability of the CIS 2016.

2.8 Value co-creation as a key-driver for innovation in the development and introduction of innovative products/ services in the market

Both typologies of customer co-creation, 4 types and 8 types, presented a solution for typifying the activities of co-creation, with respect to the NPD. Despite their differences, concerning the partition of the activities within the respectively types of co-creation they propose, as well as the different role that the lead user from user innovation plays inside the typologies, the latter also present similarities. The procedures inherent to these typologies, by which the interactions with the customers are made, as well as the procedures that the typologies themselves exclude as forms of co-creation, are coincident, even literally, with the ones presented in the CIS (2016) survey's section H, particularly in question 10.1 and question 11.1, which will reveal two major findings. The first major finding resides on CIS's question 10.1, specifically in "information on users and customers, and developing understandings on their needs" (CIS, 2016:13-14). For the latter, it is observable that: (i) The information was not necessarily used to the co-creation of innovative products or services, as the procedures used for collecting information from the user do not respect DART (Prahalad and Ramaswamy, 2002, 2004); hence, the co-creation experience for the creation of value in the form of offerings could not be valid. (ii) Typology of Customer Co-creation (4 types), differentiates Co-creation from traditional procedures of customer inquiry, as presented in CIS's question 10.1. (iii) Typology of Customer Co-creation (8 types), identifies the CIS procedures to collect the information from the user, present in this part of the question 10.1, as not suitable for co-creation. The second major finding, taking into account the CIS survey's section H: "Participation of users in innovation activities and in the production of innovative products" (CIS, 2016:13-14), specifically questions 10.1, 11.1, acknowledges that: (1) in question 10.1, there is an accordance between the "different ways of including customers and users in innovation activities and development of innovative products" (CIS, 2016:13-14) and the procedures (ways) for customer co-creation of innovative products and services, regarding both typologies; (2) for question 11.1: "Did your enterprise introduced new or modified products (goods and/or services) in the market between 2014 and 2016 that were partially or totally developed by customers and/or users of the product?" (CIS 2016:14), both typologies of customer co-creation include procedures for the generation of partially or totally developed products/services by the user, for a firm commercialize. Therefore, the aforementioned information reveals the CIS's procedures that the typologies themselves include as forms of co-creation. This conceptual bridge between the research and the CIS, regarding the two major findings previously explored, sustains the applicability of the CIS survey (2016) to study the value co-creation as a key driver for innovation in the development of innovative products/services.

Furthermore, the two typologies for customer co-creation, 4 types and 8 types, proposed by O'Hern and Rindfleisch (2010) and Piller et al. (2011) respectively, acknowledge that, regarding the typologies' procedures for co-creation, also defined as collaborative New Product Development activities, the customers are the actors that play the main role for the process of NPD. In spite of the aforementioned topic's literature being scant, the evidence collected so far points out that customer co-creation is positively related with many NPD metrics, such as increased new product creativity, decreased time to market and reduced development costs (von Hippel, 2005; Grewal et al. 2006; Shah 2006; O'Hern and Rindfleisch, 2010). Additionally, Prahalad and Ramaswamy (2004), von Hippel (2005), O'Hern and Rindfleisch (2010), Piller et al. (2011), Martovoy and Dos Santos (2012), among others, reinforce the importance of exploring and using customer-generated solutions, as the path to unlock new competitive advantage's sources. Despite the different considerations regarding the type of consumer to be used to perform customer generated solutions, the extant literature converges in the importance of exploring and using the customers within the NPD. Customer co-creation turns out to be the most suitable innovation model to study the intention of companies to create innovative offerings jointly with the user as, since it is derived from open innovation, co-creation is customer centric in terms of the innovation process, but firm-driven in regard to the strategy; it is the most holistic perspective since it includes all the procedures of involving users in innovation activities and in the NPD, including procedures for both the lead users linked to user innovation, as well as for the regular users (non-lead users),

being capable to co-create value and offerings with a company. As a result, regarding the main objective, this research highlights a factor that can influence companies in the development of new innovative products and services, which is: "Different ways of including customers and users in innovation activities and development of innovative products". The literature review, in consonance with the accordance between the research's concepts and the CIS's survey, that grants the applicability of the survey to the present study, constitutes the rationale for the formulation of Research Hypotheses.

3. Research Hypotheses

Following the previous, the hypotheses to be tested empirically, in order to determine whether the variables included in the model have a significant influence in a company's innovation process, translated in the development of innovative products/ services, are as follows: Hypothesis 1: Users as a resource in innovation activities, joint brainstorming, co-development and joint content production is positively related to the propensity for the company to develop innovative products/ services. Hypothesis 2: Utilization and commercialization of products and services modified by users is positively related to the propensity for the company to develop innovative products/ services. Hypothesis 3: Utilization and commercialization of products and services developed by users is positively related to the propensity for the company to develop innovative products/ services. The three hypotheses presented aim to determine if the procedures of including customers and users in innovation activities and development of innovative products/ services (explanatory variables) influence the company's ability to develop and introduce in the market new and innovative products/services (response variable).

4. Methodology

Secondary data provided by the CIS 2016 was used, being trustworthy, once it is validated by Eurostat. Applied in Portugal, the CIS section that was analyzed covers 4337 firm responses. From these 4337 innovative companies: 1682 (38.8%) considered important the procedures that include "development forums, such as platforms of development provided by the company to collect ideas from users and user communities; software and content production, crowdsourcing, etc." (CIS, 2016:13); 2498 (57,6%) considered important the procedures that allowed the user to modify the firm's existing offerings; 2300 (53%) considered important the procedures that allowed the user to develop new products and services. The latter three groups of procedures to co-create form the three independent variables, named as co-creation variables. The main objective is to depict the firm's development and introduction of innovative products/ services in the market, developed partially or totally by users, which constitutes the dependent variable. In order to be able to materialize this objective and, in accordance with the literature review, the variables of co-creation are considered regarding the co-creation role as a key driver to firms' development of new and innovative offerings. The analysis was performed in 5 stages: in the first stage it was only included in the model I the control variables, which were selected according to co-creation literature (Markovic & Bagherzadeh, 2018); from the second to the fourth stage, it was included the controls and a just a co-creation variable at a time, respectively (Model II to IV). Finally, it was included the control variables and all the independent variables with respect to the three co-creation variables (Model V), presented as follows (equation 1):

$$A_i = \beta_0 + \beta_1 C_1 + \beta_2 C_2 + \beta_3 C_3 + \beta_4 D + \beta_5 E + \beta_6 F + \beta_7 G + \beta_8 H + \beta_9 I + \beta_{10} J + \varepsilon_i \quad \textbf{(1)}$$

Where: A_i = innovation (product / services) introduced in the market; β = coefficient, C_i = co-creation procedures, D = technological intensity, E = public financial support, F = size of the firm, G = international orientation of the firm, H = functionally new/ improved products introduced, I = new/ improved services introduced, J = aesthetically new/ improved products introduced and ε_i = residuum; index i represents the unit of analysis: the firm.

5. Results

To test the data, five models, I to V, were created. As the results (table 1) for Model I to IV are straightforward, only the Model V (complete model) will be analyzed in depth. By analyzing the goodness of fit of this logistic regression model, it was observable that the chi-squared statistic presented the value of 457.14, with a proof value below to 1%-level of significance. The log-likelihood statistic, with the value of -1216.795 also confirms the overall significance of the model, when compared with the null model. Hereafter, taking into account the results, the research hypotheses will be tested and discussed, one by one. The results obtained regarding H_1 point out a marginal effect of -0.0106, significant at: 5%-level. These results present a significant and negative effect, which indicates that the procedures referent to H_1 restrain the propensity of the firms to develop and introduce innovative products / services in the market. The results with respect to H_2, have no statistical significance and, consequently, nothing can be concluded. The model's results regarding H_3 denote a marginal effect of 0.0744, significant at: 1%-level, which translates into a significant and positive effect.

Table 1 – Marginal effects

	Logit inclu (Model I)	Logit inclu (Model II)	Logit inclu (Model III)	Logit inclu (Model IV)	Logit inclu (Model V)
clufor (group of specific Co-creation procedures)		**0.0193***** (0.0048)			**-0.0106**** (0.0049)
cluada (user partially developed an offering)			**0.0498***** 0.0043		-0.0071 (0.0068)
cludev (user totally developed an offering)				**0.0661***** (0.0043)	**0.0744***** (0.0066)
Technological intensity	**-0.0114***** (0.0024)	**-0.0121***** (0.0024)	**-0.0107***** (0.0023)	**-0.0092***** (0.0023)	**-0.0085***** (0.0023)
Public financial support	**0.0100***** (0.0028)	**0.0093***** (0.0028)	**0.0085***** (0.0028)	**0.0073***** (0.0028)	**0.0074***** (0.0028)
Firm size (1, if LE)	0.0104 (0.0172)	0.0037 (0.0173)	0.0148 (0.0169)	0.0171 (0.0166)	0.0203 (0.0167)
International Orientation	**0.0393***** (0.0114)	**0.0395***** (0.0114)	**0.0317***** (0.0111)	**0.0291***** (0.0109)	**0.0278***** (0.0108)
lnpdgd (introduction of functional improvements)	**0.0590***** (0.0104)	**0.0568***** (0.0104)	**0.0483***** (0.0102)	**0.0392***** (0.0099)	**0.0393***** (0.0099)
lnpdsv (introduction of services)	**0.0400***** (0.0096)	**0.0363***** (0.0097)	**0.0272***** (0.0095)	**0.0221**** (0.0093)	**0.0236**** (0.0093)
Mktdgp (introduction of aesthetical improvements)	**0.0271***** (0.0094)	**0.0226**** (0.0094)	0.0117 (0.0093)	0.0058 (0.0091)	0.0075 (0.0091)
Observations	4337	4337	4337	4337	4337
Pseudo R^2	0.0619	0.0673	0.1121	0.1557	0.1581
Chi^2	178.85	194.45	324.18	450.22	457.14
Prob > Chi^2	0.000	0.000	0.000	0.000	0.000
Log-likelihood	-1355.940	-1348.138	-1283.273	-1220.253	-1216.795

Standard deviation between parentheses; p value (*** p<0.01, ** p<0.05, * p<0.1).

6. Discussion

Regarding the first hypothesis, which takes into account users as a resource in innovation activities, joint brainstorming and joint content production, its model's results reflect a significant and negative effect; such results are unexpected. In such wise, "development forums, such as development platforms provided by the enterprise to collect ideas from users and user communities; software and content production, crowdsourcing, etc." (CIS, 2016:13) are co-creation procedures that may be characterized as barriers to the firms' development and introduction of new offerings in the market. The variable associated with the first hypothesis contains more than one co-creation procedure. The negative results might be related to the inclusion of the term 'crowdsourcing' on the group of procedures. Estelles Arolas and González-Ladrón-De-Guevara (2012) reported the semantic misperception of the term, as well as the confusion between the terms crowdsourcing and crowdfunding. The literature on crowdsourcing, defines it as the outsourcing of a traditional job, usually performed by a firm worker, to a general large group of individuals as an internet's open call (Allon and Babich, 2020). Crowdfunding is defined as a dimension of the concept of crowdsourcing, which solely focuses on the raising of financial resources from the public, known as the "crowd", through specific online platforms (Gerber, Hui and Kuo, 2012). According to Walthoff-Borm et al (2018), companies engage on equity crowdfunding platforms as a "last resort", generally when the internal resources are scarce or even when they have no supplementary debt capacity. The same authors pointed out empirical evidence that denote that: companies registered on equity crowdfunding platforms are less profitable than their equivalents that are not. Even bearing in mind the fact that companies may consider the group of all co-creation procedures concerning the first hypothesis as not favorable to their innovation process, as well as, even having knowledge of the term and procedure of crowdsourcing, they also finding it not favorable to their innovation process,

the inclusion of crowdsourcing may have driven to the results obtained, by the semantic confusion with crowdfunding. Despite the justification presented, in practical terms, the model reveals that the first hypothesis fits as a barrier to the company's ability to develop new innovative products and services. The second hypothesis associates the company's ability to develop innovative offerings, with the utilization and commercialization of products and services modified by users. Regarding the latter, since its results were statistically not significant, no conclusions can be drawn. However, this result fits as an important topic for future research. The typologies of co-creation converge in the integration of lead user from user innovation, within their types and procedures to co-create. Although the typology proposed by O'Hern and Rindfleisch (2010) does not differentiate the lead user from the non-lead user, it embraces both, in terms of their different capacities to co-create value. Moreover, Piller et al. (2011), who consider all types of users as capable to co-create value, included, as a type of co-creation within their typology, the *Toolkits for user innovation*. This type of co-creation includes procedures that the toolkits users, the so-called lead users, are more prone to perform. Thusly, once co-creation includes user innovation within its types and procedures to co-create, it would be interesting to get empirical evidence on these specific co-creation procedures, more connected with the intervention of the user with lead user characteristics. The third hypothesis links the company's ability to develop innovative products or services with the utilization and commercialization of products and services developed by users. The aforementioned respective results point out a significant and positive effect, as the marginal effect presents a value substantially positive in regard to the stimulation of the company to develop new and innovative offerings, corroborating the studies and empirical evidence that argue that co-creation is positively related to the NPD metrics (von Hippel, 2005; Grewal et al. 2006; Shah, 2006; O'Hern and Rindfleisch, 2010), that unlock the path to leverage competitive advantage to the firms (Prahalad and Ramaswamy, 2004; von Hippel, 2005; O'Hern and Rindfleisch, 2010; Piller et al. 2011; Martovoy and Dos Santos, 2012). Ultimately, the third hypothesis represents a stimulus for firms to develop and introduce new and innovative products/services in the market, by embracing third hypothesis' inherent co-creation procedures within their innovation process.

7. Conclusions

The main objective of this research is to study value co-creation as a key driver for innovation in the development and introduction of innovative products/services in the market, applied in the Portuguese firms. The literature review firstly regards to the explanation of the inherent contents of this study, in respect to the concept of innovation, its historical evolution until the emergence of the open innovation model and co-creation. Additionally, the literature review points out two co-creation typologies for the verification of the conceptual terminology and rationale's accordance with the CIS 2016. Despite the differences regarding the division of the activities within the types of co-creation they propose, the typologies are similar in terms of the procedures by which the interactions with customers are performed. Later, it is concluded that these procedures literally coincide with the methods described within the CIS 2016. In this sense, the applicability of the CIS 2016 to the study is concluded and its secondary data was used and analyzed. Applied in Portugal, the CIS section that was analyzed covers 4337 national responses from firms. After the validation of the goodness of fit of the logit regression models was assured, the data analysis was performed, to which ensued the discussion of the results. Three hypotheses were formulated by the decentralization of the same factor, by grouping the procedures of co-creation into three different groups of procedures to study. This fact is the responsible for the innovative and differentiator contribute of the present research. The main model (model V) reported three different outcomes and once the model's results for the third hypothesis are significant and considerably positive, they corroborate the extant literature that relates positively the co-creation to the NPD metrics, which consequently unlocks paths to leverage competitive advantages. Hence, co-creation is, in this sense, a stimulant key driver for innovation in the development of innovative products or services. Moreover, the results from the model allow to attend both the main objective as well as the secondary objectives depicted in the introduction. The main limitation is referent to the gap of empirical evidence on the research topic, co-creation and its procedures; thus, it was not possible to perform a direct comparison between model's results and other studies. In terms of future research, as Model II to IV presented positive and significant results for each of co-creation procedures separately but, when jointly analyzed in Model V, the results regarding the procedures to co-create do not remained aligned, more research in this specific topic is required, to understand the impact of the procedures separately and combined as well. Another proposed research is to develop and/ or repeat the empirical research carried out in this investigation with the CIS (2014) and the CIS (2018), in order to obtain information that promotes the evaluation

of the past and the evolutionary trends. In this perspective, it is considered that the repetition of this research in other countries that responded to the same or to a similar CIS could also enrich the study of the phenomenon of co-creation.

8. References

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