10.6977/IJoSI.202009_6(2).0005
J.P. Seclen-Luna, F. Ponce Regalado/ Int. J. Systematic Innovation, 6(2), 2020. 42-52

Exploring the Influence of Innovation Management Tools on Product Innovation- the Case of Peruvian Innovative Firms

Jean Pierre Seclen-Luna[1]* and Fatima Ponce Regalado[1]
[1] Department of Management, Pontifical Catholic University of Peru, Lima, Peru
*Corresponding author, E-mail: jseclen@pucp.pe
(Received 12 March 2020; final version received 14 August 2020)

Abstract

This paper investigates the influence of innovation management tools on product innovation in 84 Peruvian companies that received public funding to carry out innovation projects. The empirical exploratory study is based on a comprehensive questionnaire for collecting data and is analysed using a binary Probit method. The results indicate that although the use of tools is scarce in Peruvian companies, innovation management tools influence product innovation. Furthermore, all the evidence shows that innovation management is important, and therefore the innovation process must be structured and systematized.

Keywords: Innovation Process; Innovation Management; Product Innovation; Tools.

1.Introduction

Innovation management has gained popularity in research and practice because of its positive effects on firm performance (Khosravi, Newton and Rezvani, 2019). Therefore, there is a body of empirical research which supports the notion that utilizing appropriate tools can assist firms to achieve better performance when launching new products (Cooper and Edgett, 2008). Keupp, Palmié and Gassmann (2012) suggest that the strategic management of innovation is concerned with using appropriate strategic management techniques and measures to augment the impact of the firm's innovation activities on its growth and performance (p.368). Our study analyses to what extent firms' product innovation is enhanced by innovation management tools, especially when NPD tools are an important driver of successful innovation (Keupp et al., 2012; De Waal and Knott, 2019). This raises the following research question: Is there a relationship between the innovation management tools and product innovation? Although literature is extensive and varied on the NPD process and successful new product outcomes (Cooper, 2019), analysis on NPD tools (De Waal and Knott, 2019) or innovation management tools (Keupp et al., 2012) has received less attention, especially in emerging economies. Thus, our research contributes to understanding whether the use of innovation management tools and product innovation are related in emerging contexts.

From a technical perspective, one of the main barriers to conducting studies on innovation in Peruvian companies is the lack of databases with up-to-date contact information, as well as the lack of confidence in and diffusion of the innovation topic (Yrigoyen, 2013). The strategy to reduce this obstacle was to contact institutions that have developed a link with these companies. Using this method, the empirical exploratory analysis is based on a sample of 84 Peruvian innovative firms that were financed with public funds to develop innovation projects. A comprehensive questionnaire for collecting data is used and is analysed through the binary Probit method. The results illustrate that there is a relationship between the use of innovation management tools and product innovation. Furthermore, the evidence shows that innovation management is important, and therefore the innovation process must be structured and systematized (Tidd, Bessant and Pavitt, 2005; Martínez-Costa, Jimenez-Jimenez and Castro-del-Rosario, 2018).

The structure of the paper is as follows: The next section introduces the literature review and conceptual framework on innovation management, which then leads to the research hypotheses. The third section details the databases and tests the assumptions. The empirical results are provided in the fourth section. Finally, the fifth section provides some brief conclusions, limitations, and future research.

2.Conceptual Framework and Hypotheses

2.1 Innovation Process

Based on the Oslo Manual (OCDE and EUROSTAT, 2005), innovation can be understood as a final product or process that makes it possible to combine technical, financial, productive, organizational, and commercial capabilities to create or improve a product. On the other hand, research and practice in the innovation process have been deeply influenced by certain models that play different roles and influence decisions, as well as indicating good management practices (Salerno, De Vasconcelos-Gomes, Da Silva, Bagno and Freitas, 2015). Many studies have sought to understand the innovation process, but scholars have not yet been able to identify a clear prototypical process for the management of innovation (Gupta, Tesluk and Taylor, 2007). Innovation can be understood as a process that transforms specific inputs into outputs (Tidd et al., 2005; Sattler, 2011). In this vein, several authors have classified these activities using their own conceptual model of the innovation process (Sattler, 2011). For Damanpour (1991) the innovation process has three stages: the generation, development, and implementation of new ideas. Cooper, Edgett and Kleinschmidt (2002) found that many successful companies employ formal innovation processes with well-defined decision criteria, which can be composed of different phases and subprocesses, from the generation of ideas to the launch of the new product onto the market. Bessant and Tidd (2011) state that this process starts with a new idea and ends with the end user through marketing and commercialization activities. Therefore, since innovation appears to be seen as a process, various authors made their contributions on the stages of this process with certain similarities and differences in the limitations, quantity or denominations of each stage (Seclen-Luna, 2019). In any case, having some kind of innovation process is better than not having any process at all (Kahn, 2019).

Based on models that are currently widely accepted and referenced for their practical relevance, such as Cooper's 'Stage-Gate' (2014) and Gaubinger, Rabl, Swan & Werani 's (2014) model, we can understand that a 'standard and basic' innovation process has at least five phases that are interactive and simultaneous: management of ideas, product concept, product development, product implementation and product commercialization (Seclen-Luna, 2019). Though a unique model does not exist, as it cannot be generalized or followed by many companies, the 'standard and basic' innovation process attempts to show the importance of the innovation process since many companies successfully employ different types of innovation processes (Cooper et al., 2002; Tidd et al., 2005).

2.2 Innovation Management

Although there is considerable literature showing that competitive success depends on the management of innovation in an organization (Dodgson, Gann and Phillips, 2014), the few structured studies on this topic have not been able to establish a consensus on the nature of innovation management (Adams, Bessant and Phelps, 2006). This is mainly because companies are heterogeneous and can apply different strategies to manage their innovation process (Seclen-Luna and Barrutia-Güenaga, 2019). Martínez-Costa et al., (2018) state that the implementation of the standardized innovation management systems (e.g. UNE 166.000) promotes all types of innovations.

Innovation management has gained increased popularity in research and practice because of its positive effects on firm performance (Khosravi et al., 2019). In this way, a body of empirical research supports the notion that utilizing appropriate tools can assist firms to achieve better performance in launching new products (Cooper and Edgett, 2008). Therefore, the use of tools (methods and techniques) can help to create successful innovation management, particularly, after having been tested and refined by organizations according to their specific situation (Alegre, Lapiedra and Chiva, 2006) and the inclusion of relevant indicators (Dziallas and Blind, 2019). In the same vein, Keupp et al., (2012) suggest that the strategic management of innovation is concerned with using appropriate strategic management techniques and measures to augment the impact of the firm's innovation activities on its growth and performance (p.368).

Although in previous studies a list of 76 established tools haves been identified from the literature (De Waal and Knott, 2010), we believe that the selected tools differ widely in levels of abstraction and discipline base, and collectively they represent a broad scope of innovation activity areas. Thus, we did not set out to include all existing innovation management tools (Table 1), but to cover a full set of categories of tool functions in the context of 'conventional' business innovation (Seclen-Luna and Barrutia-Güenaga, 2019).

Table 1 Innovation Management Tools

Phase of Innovation Process	Tools
Management of Ideas	Brainstorming TRIZ Collaborator's mailbox ideas FMEA Customer surveys Strategic surveillance Focus groups Patents analysis
Product Concept	Design and simulation Cost-Benefit analysis Target costing Road-mapping
Product Development	R&D costing PERT Road-mapping QFD
Product Implementation	Production test Quality audits Six Sigma 5 S
Product Commercialization	Advertising Press conference Sales test Post-Launch analysis

In this research, following the 'standard and basic' innovation process, we focus on the use of those tools that are most used in the management of the innovation process (Dornberger and Suvelza, 2012; Seclen-Luna and Barrutia-Güenaga, 2019), as explained below. During the first phase, management of ideas, the use of the collaborators' mailbox, the brainstorming method for the generation of ideas (Moulin, Kaeri, Sugawara and Abel, 2016), the TRIZ method (Ilevbare, Probert and Phaal, 2013) and the Failure Mode and Effects Analysis (Behrani, Bazzaz and Sajjadi, 2012) for the selection of ideas, can help to select and evaluate ideas effectively. On the other hand, for the adequate search for ideas, opportunities and environmental threats, some basic methods are used such as the customer satisfaction survey (Morgan, Obal and Anokhin, 2018) and the focus groups. These can be complemented with other more advanced techniques, such as patent analysis (OuYang and Weng, 2011) and strategic surveillance, which are powerful tools that involve a deliberate comprehensive analysis of various actors and factors related to the company wishing to innovate (Seclen-Luna and Barrutia-Güenaga, 2019). Therefore, based on these arguments, the following hypotheses is offered:

Hypothesis 1: The use of tools for the management of ideas is associated with product innovation.

In the second phase, the concept of the product, the initial evaluation and the planning of activities are carried out, preparing the conditions for the execution of the project in a precise, coherent, and objective manner (Jissink, Schweitzer and Rohrbeck, 2019). Road-mapping is a very useful tool since it articulates foresight, direction and strategic planning in an integral way (De Alcantara and Luiz Martens, 2019). Furthermore, the use of plans, designs and simulation is important for the proof of the concept of a new product, since the preliminary technical viability of the product is verified (Ulrich and Eppinger, 2015). In recent years, the target costing for the economic-financial analysis, separate from the traditional cost-benefit analysis, has become one of the most commonly used tools by the most competitive companies due to its high effectiveness (Afonso, Nunes, Paisana and Braga, 2008). Therefore, based on these arguments, the following hypotheses is offered:

Hypothesis 2: The use of tools for the product concept is associated with product innovation.

In the third phase, product development, the management of R&D and technology acquire special relevance, since it has as a starting point the knowledge that the company has accumulated over time (Sattler, 2011). One of the most used techniques of support is the R&D costing, which consists of making a costing per unit of R&D, process, or activity (Lee, Jeong and Yoon, 2017). Furthermore, the PERT methodology (Mazlum and Güneri, 2015), the road-mapping for R&D activities (Yoon, Kim, Vonortas and Han, 2019), and the QFD method (Eldermann, Siirde and Gusca, 2017), are highly recommended. In short, this phase is important for the validation of the product which is 'materializing'. Therefore, based on these arguments, the following hypotheses is offered:

Hypothesis 3: The use of tools for product development is associated with product innovation.

The fourth phase, product implementation, begins with production tests where flexibility and control of production costs are required. However, if the product is new it could cause changes in the technical specifications, affecting the production process (Seclen-Luna and Barrutia-Güenaga, 2019). During the production process, it is essential for quality management to detect, analyse and find solutions to the problems that arise in the work area through quality audits and the 5S method (Heras,

Marimon and Casadesús, 2009). Furthermore, the use of advanced management methods such as the Six Sigma, are of great help and importance in the production phase (Parast, 2011). Therefore, based on these arguments, the following hypotheses is offered:
Hypothesis 4: The use of tools for product implementation is associated with product innovation.

The fifth phase, commercialization of the product, is characterized by launching a timely introduction of the new product to the market (Hansen and Birkinshaw, 2007). To do this, from the concept of the product the identification of consumer needs should have been raised and, in this phase, is complemented and deepened with operational marketing activities of a functional type. However, many of these activities are mixed for greater effectiveness. In this phase, the most common is the use of advertising and sales testing (Cooper, 2019). The percentage of sales that comes from the launch of the new product must also be known. Therefore, based on these arguments, the following hypotheses is offered:
Hypothesis 5: The use of tools for product commercialization is associated with product innovation.

Fig.1 presents the hypotheses formulated in a relationship model. The next section addresses the study methodology.

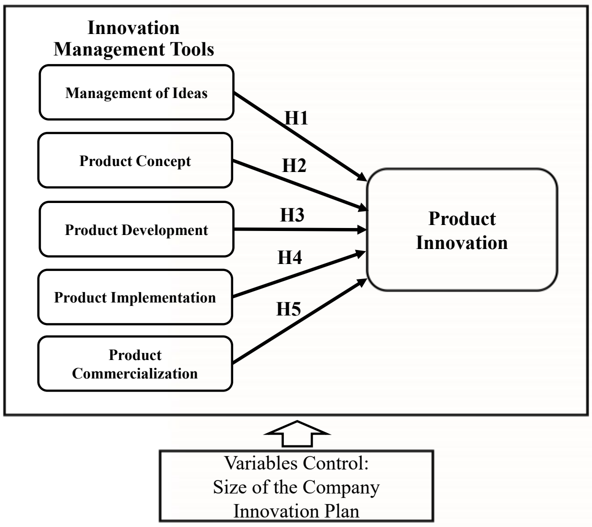

Fig.1 Relationship Model

3. Data Collection and Methodology

3.1 Data Description

In the decade 2005-2015, Peru had an average growth of 5.5% of its GDP and shows a macroeconomic strength. Its economic growth was driven by private investment. In fact, Peru ranks second in Latin America and the Caribbean as one of the best countries to do business with (World Bank Group, 2015). In terms of competitiveness, Peru is ranked 65 out of 143 countries according to the Global Competitiveness Report 2014-2015 but is ranked 116 in the Innovation Index (World Economic Forum, 2015). In the same vein, one of the main barriers to conducting studies on innovation in Peruvian companies is the lack of databases with up-to-date contact information, as well as the lack of confidence in and diffusion of the innovation topic (Yrigoyen, 2013). The strategy used reduce this obstacle was to contact institutions that have developed a link with these companies.

To ensure that the companies are innovative, we selected the Peruvian companies that were financed with public funds to carry out an innovation project. According to Innóvate Perú (executing agency of the Ministry of Production of Peru), the PIPEI, PITEI, PIMEN and PIPEA programs aim to strengthen the technological capacity for innovation in companies through the financing of innovation projects for the creation of a new product or process and its successful introduction into the market.

Between 2013 and 2015, 107 companies throughout Peru were financed by these programs and completed their respective innovation projects. Therefore, we assume that they have innovation capabilities. The final sample was 84 companies (of which 84% had less than 50 workers and 16% had more than 50 workers) obtaining a response rate of 78%. Table 2 summarizes the sample composition of firms. In this study, the unit of analysis is the innovation management. This choice is made because a company may have a different innovation process (Salerno et al., 2015) and use diverse tools for their innovation management (De Waal and Knott, 2010; Keupp et al., 2012; Dornberger and Suvelza, 2012; Seclen-Luna and Barrutia-Güenaga, 2019).

Table 2 Sample Composition (Percentage)

Industrial Branch	Firms
Software and Hardware Services	20.24
Metalworking Industry	10.71
Wood Industry	3.57
Transport Services	3.57
Business Consulting Services	11.90
Agroindustry	20.24
Ceramic Industry	3.57
Surgical Equipment Industry	3.57
Engineering Services	5.95
R&D Services	8.34
Others	8.34
Total	**100%**

To verify the hypotheses proposed, the empirical research was based on a probabilistic sampling of online surveys directed to the manager of the company or R&D director who participates in the decision-making for the company. The survey was carried out from April to July 2017 and contains a set of questions organized into three sections: the first focuses on the general characteristics of the companies, such as the type of property, manager's characteristics, number of workers, etc. The second section refers to innovation in the company where the focus is on the reasons why companies carry out innovation activities, as well as on the different types of expenses related to innovation and the innovation outcomes obtained in previous year before the survey. The third section focuses on the innovation process of companies, emphasizing the activities carried out and the use of tools for innovation management. In total, the questionnaire contained 27 questions that were initially tested for their content and structure through a pilot test with 10 companies.

3.2 Description of Variables

The dependent variable is product innovation and is measured through a dummy variable where the firm reported the carryout innovation over the last year. The independent variables are all the tools mentioned, according to the five phases of the innovation process, and is measured through a Likert scale of three points: 1 = non-use; 2 = occasional use; 3 = very frequent or systematic use. The positive scale values (from '1' to '3') allows a sufficient degree of differentiation in the valuation of the analysed variables. In addition, it is important to clarify that in this section of the questionnaire, in these questions there was an 'other' option where the respondent could indicate the use of another type of tool. In terms of the analysis of the internal consistency of the scale, an alpha Cronbach value of $\alpha = 0.635$ was obtained for the first phase, $\alpha = 0.751$ for the second phase, $\alpha = 0.879$ for the third phase, $\alpha = 0.647$ for the fourth phase, and $\alpha = 0.713$ for the fifth phase, which indicates a considerable reliability level in all variables. Table 3 provides a definition of the variables used in this study.

Table 3 Definition of Variables

Variable	Definition	Scales
Product Innovation	Firm reported the carryout innovation during the last year	Dichotomous
Tools	Any structured aids, managerial or technical in nature, that support the innovation processes	Ordinal
Innovation Plan	Firm reported that it has a plan to carryout innovations	Dichotomous
Firm's size	Number of total workers	Logarithm

3.3 Method and Regression Model

In accordance with our research objectives, we estimate the relationship between innovation management tools and product innovation, using the Binary Probit method by Eviews. The equation describing this relationship takes the form:

$$Product\ Innovation_i = \beta_0 + \beta_1\, IMTools_i + \Omega_i + \vartheta_i + \varepsilon_i \quad (1)$$

…where the sub-index i refers to the firms. $IMTools_i$ is a vector of innovation management tools. Ω_i refers to size (nº workers), ϑ_i refers to the innovation plan; and ε_i is the error term. Furthermore, in accordance with the aims of the research at hand, we used the principal regression model (1) to depict how innovation management tools are related to product innovation. That is, we adjusted a regression for each phase of the 'standard and basic' innovation process, assuming as independent variables, the innovation management tools and their influence on product innovation. In addition, we use the Binary Probit method due to the data being cross-sectional.

4. Result and Discussions

From a descriptive perspective, the first characteristics to highlight in the companies analysed are that they do not have an innovation plan (55%). Despite this, the results indicate an average of 72.6% of the companies carried out product innovation in the last year, obtaining an average of 2 new products each. Furthermore, regarding the innovation management, the use of tools is scarce (Table 4). For instance, in the fuzzy-front end of the innovation process, in the generation of ideas, on average 62% of companies do not use the collaborators' mailbox to generate ideas, 58% of companies do not use the TRIZ methodology to generate and solve problems, and the FMEA is also not widely used by companies (63%).

Table 4 Use of Innovation Management Tools (Percentage)

Phase of Innovation Process	Tools	Non-Use	Occasional Use	Systematic Use
Management of Ideas	Brainstorming	37	30	33
	TRIZ	58	28	14
	Collaborator's mailbox ideas	62	32	6
	FMEA	63	30	7
	Customer surveys	45	36	19
	Strategic surveillance	43	32	25
	Focus groups	60	22	18
	Patents analysis	81	17	2
Product Concept	Design and simulation	42	26	32
	Cost-Benefit analysis	35	38	27
	Target costing	50	30	20
	Road-mapping	62	27	11
Product Development	R&D costing	58	16	26
	PERT	56	12	32
	Road-mapping	60	21	19
	QFD	70	10	20
Product Implementation	Production test	38	31	31
	Quality audits	46	39	15
	Six Sigma	85	14	1
	5 S	65	24	11
Product Commercialization	Advertising	45	33	22
	Press conference	71	25	4
	Sales test	57	31	12
	Post-Launch analysis	56	31	13

On the other hand, the results indicate that a firms' decision to use tools in their NPD process, is a critical determinant of their product innovation. In this way, equation (1) is estimated. Tables 5, 6, 7, 8 and 9 show the regression models of innovation management tools and product innovation, as explained below.

Table 5 Regression Model (Management of Ideas Phase)

Variable	Product Innovation Coefficient	Prob.
(Intercept)	-1.104790	0.3119
Size of the company	0.083583	0.7835
Innovation plan	0.203580	0.6908
Brainstorming	1.036451	0.0041
TRIZ	0.090334	0.7972
Collaborator's mailbox	0.074133	0.8564
FMEA	1.229219	0.0181
Customer surveys	-0.637204	0.1177
Strategic surveillance	0.252537	0.4201
Focus groups	-0.699512	0.0265
Patents analysis	-0.260144	0.6110
R-Squared (McFadden)	0.42	

According to the information shown in the previous table, we can distinguish two significant findings. First, that not all innovation management tools at the 'management of ideas phase' are relatively important. That is, there are certain tools such as brainstorming, FMEA and focus groups that are significant in the model. Therefore, these results show that there are differences between the innovation management tools of the 'management of ideas phase'. Second, even though the brainstorming, focus group and FMEA tools are significant, there are few companies that used these innovation management tools more frequently, for example, brainstorming (33%), focus group (18%) and FMEA (7%). One possible explanation for this non-use of tools may be due to the fact that the companies do not have personnel to be in charge of innovation activities (in fact, the companies analysed have an average of 5 workers dedicated to innovation activities). Likewise, SME owners are often unfamiliar with these techniques or do not find their value adequate for their needs. In this way, owners tend to be more intuitive and informal in the way they manage their innovation. In any case, the use of each technique or tool will depend on the knowledge and experience of the manager or person responsible, as well as the collaboration between the different areas or departments of the company (Hansen and Birkinshaw, 2007). Despite this, there is an association between these innovation management tools and product innovation. Therefore, these results support Hypothesis 1 and coincide with previous studies, such as those of Behrani et al. (2012) and Moulin et al. (2016), who found that both FMEA and brainstorming each have an influence on product innovation, respectively. Lastly, all this evidence suggests that the 'management of ideas phase' is relevant in the innovation process (Damanpour, 1991; Cooper at al., 2002; Bessant and Tidd, 2011).

Table 6 Regression Model (Product Concept Phase)

Variable	Product Innovation Coefficient	Prob.
(Intercept)	0.094287	0.8783
Size of the company	0.271563	0.1673
Innovation plan	-0.008233	0.9807
Design and simulation	0.148285	0.4569
Cost-benefit analysis	0.291792	0.2804
Target costing	-0.049890	0.8625
Road-mapping	-0.474415	0.1209
R-Squared (McFadden)	0.06	

As can be seen in Table 6, despite the fact that, on average, the analysed companies use these innovation management tools, these tools of the 'product concept phase' are not relevant in this phase due to the fact that we do not find these variables significant. One possible explanation for this is that Peruvian companies do not usually conduct consistent and appropriate technical, financial and market evaluations (Alvarado-Alarcón, Alegre-Valdivia, Martínez-Utía and Seclen-Luna, 2018). Hence, the innovation management tools considered in the model could not explain the probability of effect on product innovation. In fact, the tools analysed do not show any association with product innovation. Therefore, these results do not support Hypothesis 2. By contrast, many studies find that in this phase, the technical and financial assessment through cost-benefit analysis among other techniques is required (Ulrich and Eppinger, 2015). Even Cooper (2017) includes the evaluation of possible environmental, safety, health, and other problems, in his so called 'Build Business Case'.

Table 7 Regression Model (Product Development Phase)

Variable	Product Innovation	
	Coefficient	Prob.
(Intercept)	1.375607	0.0113
Size of the company	0.304949	0.1381
Innovation plan	0.980256	0.0430
R&D costing	0.395217	0.2794
PERT	0.005693	0.9843
Road-mapping	-1.041318	0.0204
QFD	-0.405848	0.2098
R-Squared (McFadden)	0.21	

According to the information shown in Table 7, we can distinguish two important findings. First, that not all innovation management tools at the 'product development phase' are important. In particular, we find that road-mapping is more important than other tools. Second, even though, on average, 19% of the companies analysed use this innovation management tool, we found that there is an association between road-mapping and product innovation. Therefore, these results support Hypothesis 3 and concur with previous studies, such as those of Yoon et al. (2019), who found that road-mapping presents relationships with product innovation. In any case, all this evidence suggests that the 'product development phase' is relevant in the innovation process (Sattler, 2011). On the other hand, the innovation plan is significant in this phase of the innovation process, while the size of the company is not significant. Perhaps a possible explanation for this result is that Peruvian companies have low levels of investment in R&D (Heredia-Perez, Geldes, Kunc and Flores, 2019; Seclen-Luna, Ponce and Cordova, 2020).

Table 8 Regression Model (Product Implementation Phase)

Variable	Product Innovation	
	Coefficient	Prob.
(Intercept)	1.160529	0.0665
Size of the company	0.707212	0.0097
Innovation plan	0.585658	0.2431
Production test	0.338504	0.2452
Quality audits	0.253739	0.3916
Six Sigma	-2.071047	0.0002
5 S	-0.383201	0.2113
R-Squared (McFadden)	0.27	

According to the information shown in Table 8, we can appreciate two main findings. First, that not all innovation management tools at the 'product implementation phase' are important. In particular, we find that Six Sigma is more important than other tools. Therefore, these results show that there are differences between the innovation management tools of the 'product implementation phase'. Second, even though, on average, 85% of the companies analysed do not use this tool, we found that there is an association between Six Sigma and product innovation. Therefore, these results support Hypothesis 4 and concur with previous studies, such as those of Parast (2011), who found a relationship between the use of the Six Sigma and the innovative performance of companies. In any case, all this evidence suggests that the 'product implementation phase' is relevant in the innovation process (Seclen-Luna and Barrutia-Güenaga, 2019). On the other hand, the firm size is also significant in this phase of the innovation process. This is consistent with several studies which highlight that large enterprises have more opportunities to implement innovation activities (Annacchino, 2007; Leal-Rodríguez, Eldridge, Roldán, Leal-Millán and Ortega-Gutiérrez, 2015).

Table 9 Regression Model (Product Commercialization Phase)

Variable	Product Innovation	
	Coefficient	Prob.
(Intercept)	0.722110	0.2100
Size of the company	0.326771	0.1054
Innovation plan	-0.003522	0.9916
Advertising	0.289133	0.0229
Press conferences	-0.581700	0.0550
Sales test	-0.065972	0.8315
Post-launch analysis	-0.185228	0.5045
R-Squared (McFadden)	0.10	

According to the information shown in Table 9, we can distinguish two significant findings. First, that not all innovation management tools at the 'product commercialization phase' are important. In particular, we found that advertising is more important than other tools. Therefore, these results show that there are differences between the innovation management tools of the 'product commercialization phase'. Second, even though, on average, 22% of the companies analysed use this tool, we found that there is an association between advertising and product innovation. Therefore, these results support Hypothesis 5 and concur with previous studies such as those of Cooper (2019), who found a relationship between the use of advertising and the launch of a new product. In any case, all this evidence suggests that the 'product commercialization phase' is relevant in the innovation process (Hansen and Birkinshaw, 2007; Cooper, 2019).

5. Conclusion, Limitations and Future Research

5.1 Theorical Implications

Understanding the interplay between innovation management tools and product innovation (Keupp et al., 2012; Martínez-Costa et al., 2018) demands a conceptual framework that would help us understand these relationships in a context of emerging countries. The present research examines these relationships in Peruvian innovative firms to corroborate traditional theories that apply to Western economies on these issues. The evidence presented in this paper provides empirical support that there are relationships between the use of innovation management tools and product innovation; particularly in the management of ideas phase, brainstorming, the FMEA and focus groups. In the product development phase, road-mapping is particularly important whilst in the product implementation phase, it is the Six Sigma. In the product commercialization phase advertising is significant. However, in the product conceptualization phase no relationships have been evident. In any case, our findings go beyond established research into whether or not firms use particular NPD tools by considering the thoroughness of tool usage from a theoretical standpoint. All this evidence shows that innovation management tools do have an influence on product innovation (Keupp et al., 2012; Martínez-Costa et al., 2018; De Waal and Knott, 2019).

5.2 Managerial and Policy Implications

This study contains two main implications; the first is suggesting that even though non-thorough use of NPD tools is commonplace in small firms, the use of innovation management tools has a positive influence on product innovation (Martínez-Costa et al., 2018; De Waal and Knott, 2019). Furthermore, all the evidence shows that innovation management is important, and therefore the innovation process must be structured and systematized (Tidd et al., 2005; Martínez-Costa et al., 2018; Seclen-Luna, 2019). The second implication suggests that it is important for regional and local governments to consider integrating links with external actors (i.e. KIBS or specialized suppliers, universities, etc.) to design an innovation policy for promoting the innovation management of companies, particularly the smaller ones, since KIBS can compensate or complement the innovation capabilities of their client companies (Muller and Zenker, 2001; Seclen-Luna and Barrutia-Güenaga, 2018).

5.3 Limitations and Future Research

Although these results are useful for their implications for business managers and policy makers, since it advances knowledge about how innovation process should be managed by companies (García and Calantone, 2002) in the Peruvian context, this study has limitations that suggest the need for future research. Firstly, owing to the sample only being made up of innovative companies financed by public programs, these results cannot be generalized, so they should be taken with some caution. Secondly, because the analysis carried out in this exploratory study is of a cross-sectional nature, it leads to the failure of trying to capture all the dynamics of the innovation process. For instance, to understand how companies make decisions for using a tool, we need to ask them how the implementation of an innovation process affects them, or even: Does the innovation process affect them? This question remains open for future research. Third, despite the relationships which are significant in our models, other factors not included in the current models may also play an important role. Thus, future research will need to corroborate the results in specific contexts (at sectoral and regional levels) in a long-term analysis to determine some of the causal mechanisms. Finally, it would also be very worthwhile to carry out comparative studies among emerging countries, which would help governments to improve their policies promoting innovation management.

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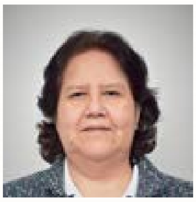
Acknowledgements

For their helpful comments on earlier drafts, our thanks go to two anonymous reviewers. Jean Pierre Seclen-Luna acknowledges financial support from the Directorate of Management Research (DGI) of the Pontifical Catholic University of Peru under the grant for research project number ID 000478-2016.

AUTHOR BIOGRAPHIES

Jean Pierre Seclen Luna is PhD and Professor of Business Management at the Department of Management of the Pontifical Catholic University of Peru (PUCP). He was previously researcher for the Economics and Business Faculty at the University of the Basque Country, Spain. He is currently member of the Latin-Ibero American Association for Technological Management (ALTEC), member of the International Advisory Board of the Basque Economic Review, Editor-in-chief of the '360 Journal of Management Sciences', and member of the Research Group on Innovation Management at the PUCP. His research activity is focused on the field of Business Economics, on issues such as innovation management, servitization, KIBS and business growth. His main publications have been in the Competitiveness Review, Journal of Regional Research, and the International Journal of Business Environment. He has numerous participations in international conferences. Lastly, he is a professor in the Doctorate in Strategic Management in the Consortium of Universities of Peru.



Fatima Ponce Regalado is an Associate Professor at the Department of Management of the Pontifical Catholic University of Peru (PUCP). She holds a Master's in Economics from the Pontifical Catholic University of Rio de Janeiro (Brazil) and Bachelor of Economics from the Pontifical Catholic University of Peru (PUCP). She is member of the Research Group on Innovation Management of the PUCP and of the editorial team 360: Revista de Ciencias de la Gestión. Her areas of interest are on innovation, regulation in telecommunications, ICTs and Development, Econometrics, Quantitative Methods. Her main publications have been in the Applied Econometrics and International Development Journal and the Journal AD-Minister. She is professor in the Master of Economics, Master in Regulation of Public Services and Master in Regulation, Management and Mining Economics at PUCP. Lastly, she is Member of the Administrative Tribunal for the Solution of User Claims of the public telecommunications regulatory body of Peru (OSIPTEL).