

Elements of the Persistence in Innovation: Systematic Literature Review

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ABSTRACT

The persistence of innovation is a topic that has been used in recent years. Companies must be in continuous production of innovations to achieve a competitive advantage in the market and for this, it is necessary to have elements that positively influence the persistence of innovating. The objective of the article is to describe the elements that positively influence the persistence of innovation through a systematic literature review in the range of the last 10 years (2010–2019). As a result, 34 articles were obtained and it was identified that investment in R & D, human resources and knowledge management positively influences the persistence of innovation.

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1. INTRODUCTION

Innovation is a topic that has been analyzed in recent years. Thinking about the growth of a company without generating innovation is almost impossible. Companies can open new markets with innovations in products, and innovations in the process can reduce costs, which could increase the level of demand for products (Le Bas and Poussing2014). However, the action of innovating in in innovating in the medium and long term (Córcoles et al.2016). The replication of individual isolation would not be the best, since the probability of survival of a company increases if it specializes innovations by competitors could be avoided because the company generates skills that will be difficult to replicate. It should also be seen that isolated innovation can generate negative impacts within the firm; thinking of innovating in isolation could lead to process automation and replacement of human resources.

That is why currently, the company begins to develop the persistence of innovation and intends to create a systematic approach within the company, which will allow them to generate innovation in all possible periods. Persistence is generally associated with how the accumulation of knowledge contributes to the stability of innovation (Malerba and Orsenigo1999) and generating a novelty in the innovation system will lead to the next period increasing the probability of carrying out activities innovatively (Altuzarra2017). This system is not only composed of internal elements, such as knowledge management or human resources, but also can be formed by cooperation with other institutions (Badillo and Moreno2016;Arenas and Gonzalez2019). Public policies could also be considered as a fundamental element for the persistence of innovation since governments should encourage the development of science and technology to improve the competitive position of companies (Altuzarra2017).

From an innovation system, which will generate innovation in a persistent way, the company must manage different elements to generate benefits for long periods. This has been reflected in the scientific literature. Currently, many authors have presented their studies on issues of persistence in innovation and

determined the degree of influence (positive and negative) of different elements that influence persistence. These studies have generally been conducted based on context and, in many cases, with public information, which may be limited. That is why it is necessary to identify and collect current scientific knowledge to determine factors of persistence in common innovation. The best-known technique for reviewing and identifying topics in scientific knowledge is the literature review. This review can be carried out in many ways, the systematic being the best to identify the elements because it aims to collect and synthesize previous research.

Therefore, a systematic literature review can determine the constant effects found in the literature and discover the common elements that could be used to deepen future research (Snyder2019). For this paper, the research objective was to identify the common factors that positively influence the process of persisting in innovation. For this purpose, a systematic literature review was planned. To achieve the target raised, we defined a search protocol and a collection of scientific papers. In this protocol, we determined questions to be answered with the review. Then a search string was established, which subsequently has been translated for each database engine. Later, the inclusion and exclusion criteria were applied to present a statistical report of the findings, and among the main exclusion criteria, it could be mentioned that the articles are from the last ten years and are published in scientific journals. The second section refers to the findings in the articles. This part has been divided into two sub-sections. The first describes a definition of persistence according to the articles found. In this definition, three hypotheses are presented as the reasons why companies generate innovation persistently. In the second subsection, each of the elements found that, according to the authors, influence persistence is detailed. Elements are defined from internal characteristics of companies to external factors that support persistence. The role of leaders, knowledge management, R & D activities, and collaboration with institutions is highlighted. Finally, the conclusions and some recommendations for future work are presented.

2. METHODOLOGY

In this study, the literature review methodology will be carried out through systematic planning and execution. For this, the planning phase is defined through the procedure ofKitchenham et al. (2009). This procedure defines that planning should be carried out through 3 activities: (1) identification of the need for research, (2) preparation of research questions, and (3) development of review protocols. On the other hand, the execution will be defined using the processing ofArenas and Gonzalez(2018). This procedure defines a systematic review using the steps to be performed in the literature search:

(1) database selection, (2) exclusion criteria, (3) review of abstracts, and (4) review of complete articles. The following can be considered for the planning of this study:

1. Identification of the need. The persistence of innovation is a recent phenomenon. As described in the introduction, research is currently underway to determine factors that influence persistence. The objective of the literature review is to identify the elements that influence a company to innovate persistently according to the studies carried out in the last ten years.

Preparation of the questions. The questions that were answered with this study are:

- a) What types of studies were conducted to find persistence factors?
- b) What are the factors that positively influence the persistence of innovation?
- c) Are there linking factors with other institutions to generate persistent innovation in the company?

Kitchenham et al.(2009) describes that the structure of the questions must consider five elements: population, intervention, comparison, output, and context (PICOC). Table1describes each of these considered elements.

Table 1. Elements of population, intervention, comparison, output, and context (PICOC).

Population	Firm
Intervention	Persistence of innovation, strategy, sources of innovation, technological opportunities, persistence patterns, innovation policies, R & D activities, market dynamism, economy performance, company profit.
Comparison	Not considered.
Out	Case study, analysis, interviews, survey.
Context	Product innovation, service innovation, organizational innovation, process innovation, incremental, radical.

The present study is limiting the population of companies and intervention to everything related to persistence that knows persistence from different perspectives, strategy, policies, among others. As it is not being compared with other research, the “Comparison” field is being left empty.

Although you have all the necessary criteria to structure the questions, it is necessary to translate these criteria into a language that can be used to consult the different scientific databases. For this, mathematical logic is being used to carry out query strings that can be understood by the different database engines.

In the case of the population, the following chain was determined:

“firm” or “enterprise” or “company”

In the case of the intervention, the following were considered:

“innovation” and (“persistent” or “persistence”) and (“strategy” or “strategies” or “strategic” or “source” or “policy” or “persistence patterns” or “technological opportunities” or “R & D” or “business sector” or “Market dynamics” or “profit”)

The words used for the output would be:

“analysis” or “interview” or “case study” or “case studies” Finally, the

words used for the context would be:

“innovation” and (“product” or service” or “process” or “organization”) and (“incremental” or “radical”)

2. Development of revision protocol. To reduce research bias, it is necessary to define the following protocols:

- a. Primary Investigations. To have quality in the research found, only research from primary sources will be selected. Publications in journals.
- b. Database selection. While there is a lot of databases containing scientific papers, it has been determined that the study selects articles from the following databases: Scopus, Web of Science, ProQuest, and EBSCO.
- c. Extraction strategy. Each database has a different query language, so it is necessary to translate the elements of PICOC into different languages. For Scopus, the query was as follows:

(TITLE-ABS-KEY (“firm” OR “firms” OR “enterprise” OR “enterprises” OR “company” OR “companies”) AND TITLE (“innovation” OR “innovations”) AND (“persistent” OR “persistence”)) AND TITLE-ABS-KEY (“innovation” AND (“strategy” OR “strategies” OR “strategic” OR “source” OR “policy” OR “persistence patterns” OR “technological opportunities” OR “R & D” OR “business sector” OR “Market dynamics” OR “profit”)) AND TITLE-ABS-KEY (“innovation” AND (“product” OR “service” OR “process” OR “organization”)))

For Web of Science. the query was as follows:

TI=(“firm” OR “firms” OR “enterprise” OR “enterprises” OR “company” OR “companies”) AND TI=((“innovation” OR “innovations”) and (“persistent” or “persistence”)) AND TS=(“innovation” and (“strategy” or “strategies” or “strategic” or “source” or “policy” or “persistence patterns” or “technological opportunities” or “R & D” or “business sector” or “Market dynamics” or “profit”)) AND TS=(“innovation” and (“product” or “service” or “process” or “organization”))

For ProQuest, the query was as follows:

(“firm” OR “firms” OR “enterprise” OR “enterprises” OR “company” OR “companies”)AND ti((“innovation” OR “innovations”) AND (“persistent” OR “persistence”)) AND (“innovation” AND (“strategy” OR “strategies” OR “strategic” OR “source” OR “policy” OR “persistence patterns” OR “technological opportunities” OR “R & D” OR “business sector” OR “Market dynamics” OR “profit”)) AND (“innovation” and (“product” or “service” or “process” or “organization”))

For EBSCO, the query was as follows:

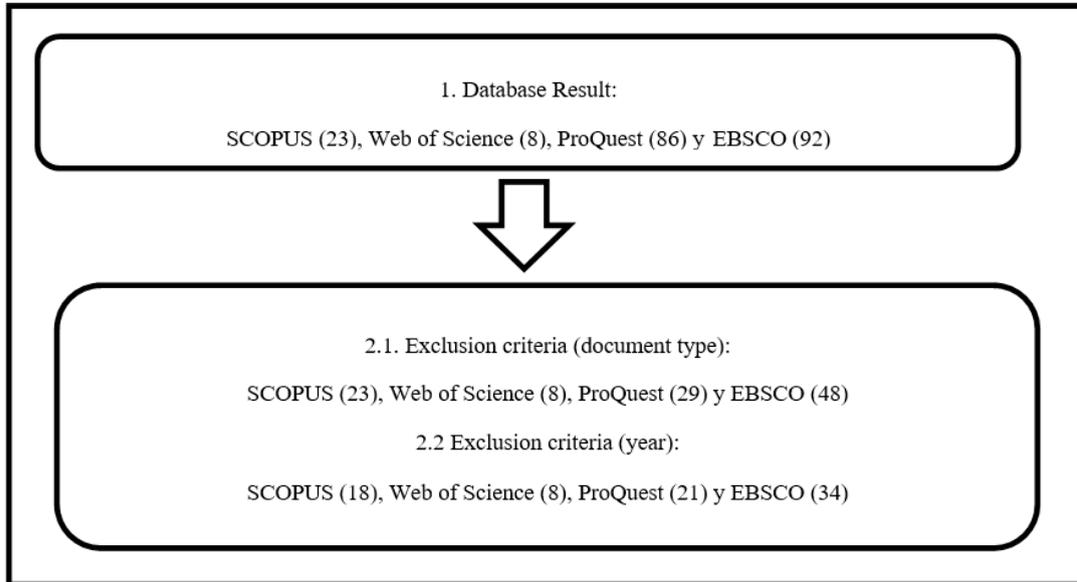
(“firm” OR “firms” OR “enterprise” OR “enterprises” OR “company” OR “companies”) AND TI ((“innovation” OR “innovations”) and (“persistent” or “persistence”)) AND (“innovation” and (“strategy” or “strategies” or “strategic” or “source” or “policy” or “persistence patterns” or “technological

opportunities” or “R & D” or “business sector” or “Market dynamics” or “profit”)) AND (“innovation” and (“product” or “service” or “process” or “organization”)) Additionally, as a strategy, we applied a filter to the year of publication. In this case, current literature is being considered, that is, from the year 2010.

2.1. *Classification of Articles*

After determining the planning of the literature review, the execution is carried out. For this, the search in the different databases had to be carried out. This result gave about 209 items, of which 23 were found in Scopus, 8 in Web of Science, 86 in ProQuest, and 92 in EBSCO. Figure1 shows the result of the execution.

Figure 1. Execution process.



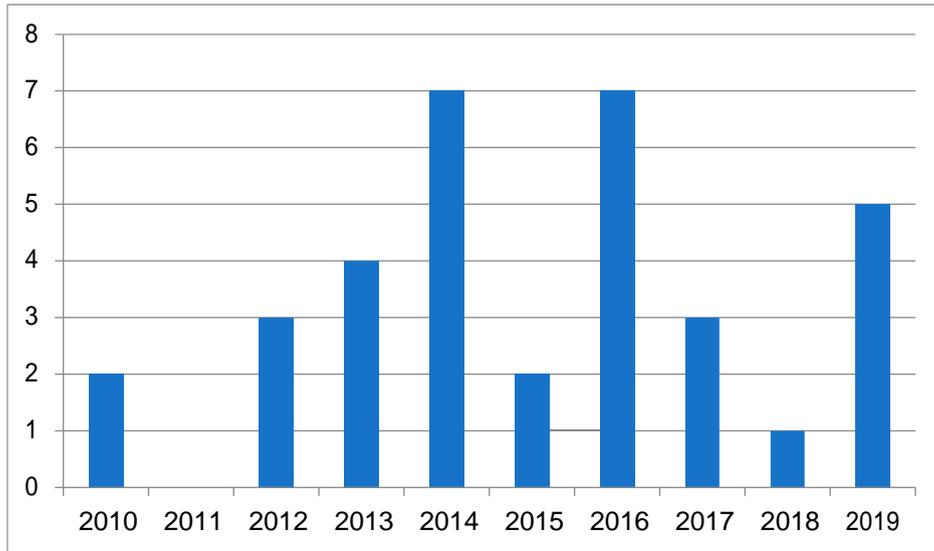
As shown in Figure1, the database that contributed the most articles to the literature review is EBSCO. While initially ProQuest and EBSCO had resulted in 86, 92 articles were mainly news, proposals, and theses, which had to reject restriction protocols. Exclusion of articles was also made for the year of publication and it is appreciated that the decrease in articles was minimal, which shows that the studies of the persistence of innovation are recent; the result used 81 articles. After the exclusion and before reviewing the abstracts and articles, it is necessary to eliminate those that are duplicated in the databases. Thirty-eight duplicate articles were found, so 43 were selected to review the summary and the article in general.

The 43 articles were used for reading and 9 were excluded since they did not have a direct relationship with the persistence of innovation. Three further articles were excluded because they were observed to show a relationship, but not on the persistence of policies of a company and how these could influence innovation. Another item was excluded because it was a photographic case study of the camera industry of how companies were constantly leading the market and did not necessarily make the connection with the management of the innovation. An article was also found that related to the persistence in the monopoly of the market.

2.2. *Statistical Data*

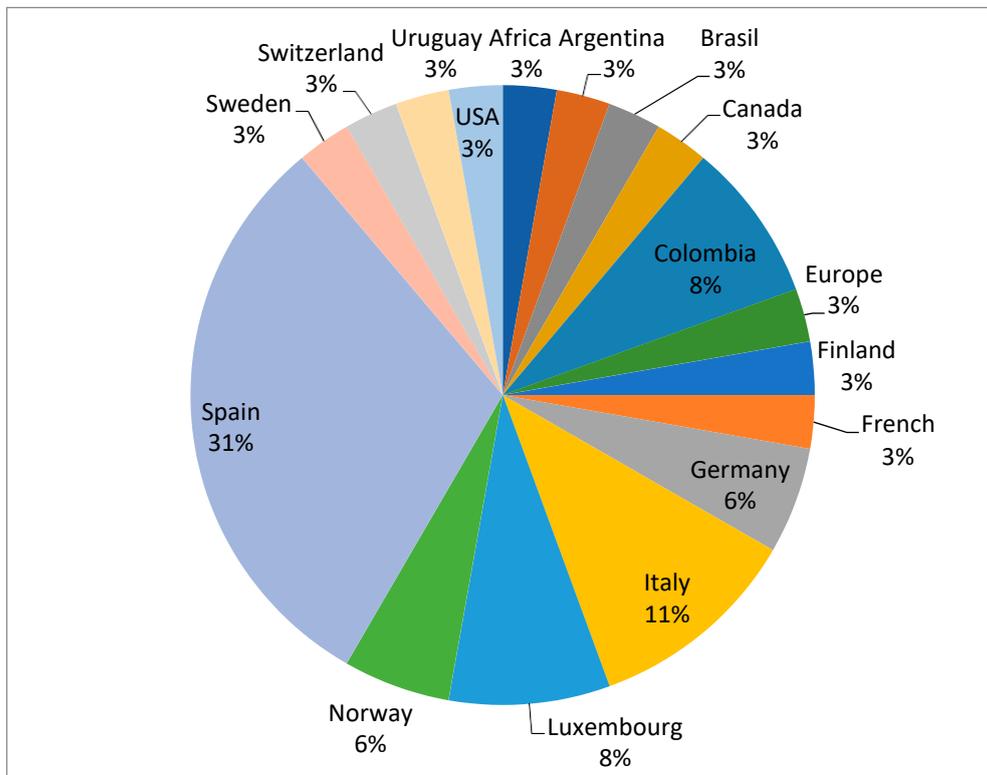
Figure2 shows the evolution of articles that have been published since 2010. It is observed that almost every year, except in 2011, at least one scientific article has been published, which may imply that it is a subject of study. On the other hand, the “Research Policy” journal has 7 scientific articles, followed by “Small Business Economics” with 4 articles. The distribution of the articles by the country of the study is also shown in Figure3. A strong influence of studies in Europe can be evidenced, with Spain being the main contribution country. At the Latin American level, Colombia, Brazil, Argentina, and Uruguay contributed to the literature.

Figure 2. Papers distributed per year.



Another analysis that allows you to conduct a systematic literature review is the exploration of the topics described by the researchers. Upon reviewing the titles of the articles, it can be noted that there are words widely used by the studies. Figure 4 represents a word cloud title, where the dimensions of the words are determined by the number of times that they were mentioned in the studies. This word cloud allows us to obtain information on recurring words and the correlation between persistence and various factors (persistent innovation).

Figure 3. Paper countries.



3. DISCUSSION

In this section, the result of reading the different articles will be presented. First, persistence has to be defined in the different studies. Then, the elements that influence the persistence of innovation will be presented according to the results obtained in the research.

3.1. *Definition of the Persistence of Innovation*

Innovation is defined as the set of actions performed by an institution that aim to create some novelty in its products or processes. At present, innovation is related to the institutional strategy, so this action is essential for institutions that want to generate some competitive advantage. Companies carry out innovation processes and have in common an input, which could be the investment in R & D, and an output, the result or product. This process in isolation could generate contradictory impacts. It could generate new jobs, although if the company performs innovation individually, the impact can bring problems. For example, if a product created by innovation replaces a current one, it may require fewer employees for its production. The same could happen with process innovations, where an invention in the production process could lead to fewer workers needed. In this area, we started talking about the persistence of innovation, that is, the constant creation of innovation can make companies keep their workers and continue generating innovation (Bianchini and Pellegrino 2019).

A firm, in a competitive environment, must be constantly innovating, unlike a monopolistic company (Le Bas and Scellato 2014). That is why in recent years studies have been carried out on the persistence of innovation and many hypotheses emerged from these investigations. Le Bas and Scellato (2014) describe three hypotheses related to the persistence of innovation: “accumulation of knowledge”, “success-breeds-success” and the concept of “sunk costs” in R & D activities.

The hypothesis of “knowledge accumulation” was presented by Rosenberg (1982) and describes that persistence can be given through radical inventions followed by incremental improvements that increase the potential of the initial invention. It should be noted that innovation generates a learning process and makes the company discover new ideas (Weitzman 1996). In that same idea, the persistence of innovation allows the knowledge and technological capabilities of the company to increase (Clausen et al. 2012). This effect is not only limited to internal sources of knowledge and capacity (Ayllón and Radicic 2019). Experts conclude that the persistence of innovation comes from the accumulation of knowledge that was obtained in the development of the product plus the success that the organization had in the market, which suggests that the persistence of innovation is due to the same nature of knowledge, that is, that innovation is cumulative and is used to generate new knowledge (Triguero et al. 2014a).

The second hypothesis was presented by Mansfield (Altuzarra 2017). He introduced the term “success-breeds-success” and this hypothesis refers to an innovation that will generate success and this gives the company more technological opportunities, causing innovation to be generated. In the “success-breeds-success” hypothesis, innovation feeds the profitability that in turn will finance innovation activities (Latham and Bas 2006) and unlike the first hypothesis, economic successes play a fundamental role. Cefis and Ciccarelli (2005) have observed that companies that generate innovations systematically obtain profits and have a strong incentive to continue innovating.

The third hypothesis presented relates to the “sunk costs in R & D” activities and, unlike the other hypotheses, is related to the investment in R & D that a company makes, and which are most likely not recoverable (Le Bas and Scellato 2014). This hypothesis is much more likely to happen in product innovations and this is because the R & D investments in process innovations are external,

rather than produced internally (Ayllón and Radicic 2019). The success of the innovations is related to financial limitations (Phillips 1971), which determines that the availability of funds, preferably internal, is essential for the presence of the innovative activity (Altuzarra 2017).

Finally, innovation must be measured to indicate persistence and although it is often measured by the number of patents, it should be understood that patents are only one form of intellectual property protection but there are other ways to protect innovations from competitors (Altuzarra 2017). It could be measured by the size of the innovation activity, rather than the scope of economic activity. That is, persistence could be measured by the importance of previous innovations (Le Bas et al. 2015). More generally, persistence could be measured by entering or leaving the process. In the case of entry, it could be measured by the persistence in capital investment and in the case of exit it could be measured using constant results (Bartoloni and Baussola 2018).

3.2. Elements of the Persistence of Innovation

Throughout the literature, one of the elements found relates to the size of the company. Triguero and Córcoles (2013) conducted a study on the persistence of innovation in Spanish manufacturing companies and within their conclusions, they were able to determine positive impacts on the size of the company and subcontracting. That is to say that a large company has the capacity to manage many R & D projects and that this can lead to persistently generate innovations. Le Bas and Poussing (2014) reach the same conclusion, where the size of the company and the complexity of innovation interact positively. Older companies experience a significant productive premium (Bartoloni and Baussola 2018), which will allow a positive effect between the age of the company and innovation (Bartoloni 2012). However, the size must be accompanied by the professionalism of the company, that is, that the defined processes must be had and complied with so that this can help the innovation be carried out in the best way (Dieguez-Soto et al. 2016; Juliao-Rossi and Acero 2019). Although the age of the company can generate innovation, it is necessary to have other elements that can become influential for persistence. The study carried out by Triguero et al. (2014b) identifies that SMEs (Small and Medium Enterprises) could also persistently generate innovation to stay in the market and that is why companies can also count on other elements that influence persistence. One of them is R & D activities, in which many authors describe a direct relationship between R & D activity and persistence. The Mothe and Nguyen-Thi (2017) study analyzes the different impacts on organizational innovation and the study by Antonelli et al. (2012) analyzes the persistence of innovation in Italian companies. In both studies, they conclude that the link with R & D activities influences the persistence of innovation. It can be understood that the innovation of a company is (Triguero and Córcoles 2013; Triguero et al. 2013). Studies show that R & D activities support the based on R & D activities and these activities are conditional on the company's innovation experience creation of product and process innovations (Muinelo-Gallo and Martínez 2018; Triguero et al. 2014b; Córcoles et al. 2016) and it is concluded that the expenses accumulated in R & D decrease the probability of stopping innovation in the company. It should be understood that this is not simple, companies that search for access to external financial capital (Muinelo-Gallo and Martínez 2018). Finally, the R & D invest in R & D do it, usually, after overcoming their financial limitations and this they do through the activity is related to economic investment, and the greater the investment, the greater the persistence (Antonelli et al. 2012). The company could also invest in other issues with the goal of persistence in innovation. We have the acquisition of software and hardware, knowledge transfer and consulting (Muinelo-Gallo and Martínez 2018) and the acquisition of risk capital (Arvanitis and Stucki 2014); although this last investment does not influence if the company operates in an unstable environment (Suarez 2014).

The investment in R & D and the size of the company are very important characteristics of the company to support the persistence of innovation, however, other characteristics must be presented as influential factors. First, we have human capital (Chowhan et al. 2017), that is, companies must have leaders who are aware that persistent innovation in a company can lead to significant benefits. Among these leaders, the literature mentions managers, who must consider that innovation persistently is a valid strategy in times of crisis (Antonioli and Montresor 2019) and that this is achieved through strategies for creating complex innovations and not only making individual innovations (Le Bas and Poussing 2014; Clausen et al. 2012). On the other hand, the company must have the ability to have technological leaders, since it is a prerequisite for the persistence of product innovation; these leaders come to generate, more frequently, persistent innovations as opposed to laggards in technology (Fontana and Vezzulli 2016).

Another interesting factor within the characteristics of the company is the management of knowledge and this is because the persistence of innovation depends positively on the accumulability, appropriability, and generic knowledge base (Triguero et al. 2014a). Some authors determine that this activity is crucial for the persistence of innovation since the organization of knowledge, obtained in past works, is associated with the persistence of innovation (Le Bas et al. 2015) and allows the creation of protection through mechanisms of isolation of knowledge (stock of knowledge, physical location, technical location), which will allow a source of competitive resources for the future. It should be mentioned that the continuous updating of formal and informal knowledge through a long-term organizational routine contributes to knowledge management (Filippetti and Guy 2016). On the other hand, literature takes into account technology transfer activities and industrial design, as well as generate innovation over long periods (Muinelo-Gallo and Martínez 2018). training programs with influential factors to persistence, since these activities support a company to In the same idea of knowledge management, studies describe that knowledge will only serve if there are previous experiences of technology development and innovation in the company (Triguero et al. 2014a). The accumulation of knowledge and skills that they can obtain from past experiences of innovation is fundamental for persistence (Badillo and

Moreno2016).Bartoloni(2012) concludes that a company with consolidated innovative behavior would have a greater probability of future innovation compared to a company that innovates casually or accidentally. We understand that the persistence of innovation is driven by internal learning and the company's ability to develop new ideas; this has long-term implications for its performance of future innovations (Clausen and Pohjola (Muinelo-Gallo and Martínez2018;Lamperti et al.2016) and that the innovation history of a company is 2013). The probability of innovating in the current period increases when it has previously innovated crucial to understand the persistence in R & D (Triguero and Córcoles2013). This generated knowledge is different for product and process innovation (Juliao-Rossi and Schmutzler2016), although the two types show signs of persistence support, the importance and scale are different for the types of innovation (Clausen et al.2012). This conclusion was detailed byAltuzarra(2017), where his research concludes that the generation of product and process innovation generates different patterns in the persistence of innovation.

Following the characteristics of the company, one must mention a fundamental factor, which is the protection of innovation.Badillo and Moreno(2016) describe that companies that use intellectual property protection methods (patents, industrial design registration, trademark, or copyright) are more persistent in innovation. This finding was also discussed by other authors, where they describe patents as a fundamental factor for persistence (Fontana and Vezzulli2016) or other formal protection formats (Le Bas et al.2015). Although the patent is the most used strategy for persistence in innovation it is possible to generate other mechanisms such as industrial secrecy or strategies such as the cost of imitation use.

The literature describes other factors that are not related to the characteristics of the companies. On the one hand, the influence of a company's relationship with external entities is described. Alliances favor those companies that have resources to innovate but they are much more favorable for those companies with limited resources since they have access to interesting external resources (Lazzarini et al.2013). Although the relationship can occur in different ways,Bartoloni and Baussola (2018) refer to the fact that alliances between companies in the same group can generate an entrance for the development of new existing products and this is because older companies have a significant productivity premium that can be acquired by other companies in the same group. It is also necessary to highlight the relationship with science because it is possible to obtain access to researchers.Lamperti et al.(2016) recommend that innovation policies should be promoted where they are linked to research collaborations and mainly promoted by the state (Tavassoli and Karlsson2015). Other authors also describe the positive correlation between the relationship with scientific institutions and the persistence of innovation (Triguero et al.2014b;Badillo and Moreno2016).

Finally, demand and the business sector are also factors that could influence persistence. On the demand side, persistent innovations only make sense in a commercial context of the company and not due to some external influence, which suggests that the dynamism of the market is a decisive factor to participate in R & D and obtain innovations (Triguero and Córcoles2013) and that the productivity of a and Martínez2018). This correlation was also studied byAntonioli and Montresor(2019), where the research concludes that commercial activities help to increase the persistence of innovation provided that the functional objective of the company is consistent with the nature of innovation (Antonioli and Montresor2019). While on the sector side, research determines that high-tech companies positively correlate with persistence (Raymond et al.2010). The study byTriguero et al.(2014a) mentions that high-tech sectors are more likely to continue their innovative activity over time. This finding was also found byBartoloni and Baussola(2018), where they conclude that the relationship between productivity and technological levels is positive.Le Bas et al.(2015) also reached the same conclusion, where it determines that the computer-related sectors have a high positive correlation with the persistence in product and process innovation, while the financial sectors seem to have a positive correlation with the persistence of process innovation. Although the correlation is stronger in the high-tech sectors, the low-tech ones can also become persistent but only in process innovations (Clausen et al.2012). Table3shows a summary of the elements found in the papers.

Table 3. Elements found in papers.

Author	Size of the Company	R & D	Investment	Company Capabilities	Industry Relationship	Science Relationship	Innovation Background	Demand	Sector	Protection
(Altuzarra 2017)		X					x			
(Antonelli et al. 2012)		X	x							
(Antonioli and Montresor 2019)				X				x		
(Arvanitis and Stucki 2014)			x							
(Ayllón and Radicic 2019)				X				x	x	
(Badillo and Moreno 2016)	X	X		X		x	x			X
(Bartoloni and Baussola 2018)	X			X	x				x	
(Bartoloni 2012)	X		x	X			x			
(Bianchini and Pellegrino 2019)				X						
(Chowhan et al. 2017)				X						
(Clausen and Pohjola 2013)				X			x			
(Clausen et al. 2012)				X			x		x	
(Córcoles et al. 2016)		X					x		x	X
(Deschryvere 2014)	X	X						x		
(Dieguez-Soto et al. 2016)	X									
(Filippetti and Guy 2016)				X						
(Fontana and Vezzulli 2016)	X			X				x	x	X
(Guarascio and Tamagni 2019)				X						
(Juliao-Rossi and Acero 2019)	X									
(Juliao-Rossi and Schmutzler 2016)							x			
(Lamperti et al. 2016)					x	x	x		x	
(Lazzarini et al. 2013)					x					
(Le Bas and Poussing 2014)	X			X						
(Le Bas and Scellato 2014)	X						x			
(Le Bas et al. 2015)		X		X					x	X
(Mothe and Nguyen-Thi 2017)		X			x					
(Muinel-Gallo and Martínez 2018)		X	x	X			x	x	x	
(Raymond et al. 2010)									x	
(Suarez 2014)			x						x	
(Tavassoli and Karlsson 2015)					x					
(Friguero and Córcoles 2013)	X	X					x	x	x	
(Friguero et al. 2013)		X					x		x	
(Friguero et al. 2014a)	X	X		X		x			x	
(Friguero et al. 2014b)	X									

To identify the elements that influence the persistence of innovation in the studies selected by the systematic literature review, Table 3 is presented. It identifies all the selected articles and the relationship with each of the elements described above.

4. CONCLUSIONS

Persistence in innovation is a topic that is beginning to be discussed in the scientific literature. Authors agree that innovation should not be considered individually because it can generate negative consequences. Studies show that causal or isolated innovation can generate unemployment since the automation process could replace the work of a company's staff. In the studies found in the systematic literature review presented in this paper, Europe has been developing many studies, most of them using Community Innovation Surveys—Eurostat—and using Spanish companies as case studies.

In these studies, the authors used data analysis techniques, where it was possible to find models that can determine the most influential elements in innovation persistence. In most cases, a Probit or logistic regression model was used. In the case of South America, these types of studies are scarce. To the best of our knowledge, only two studies were conducted: one in Uruguay, and one in Brazil.

In terms of common elements that influence persistence in innovation, the analysis shows that the company's capabilities are often mentioned. That is those activities that a company carries out internally, including literature reviews, knowledge management, and human resources. In this last element, it is highlighted that the role of leaders must be encouraging innovation through strategies and/or keeping knowledge updated since the knowledge generated by previous innovations and R & D activities is essential to continue innovating.

On the other hand, the literature review indicates that product innovation allows the company to continue innovating in processes or products. The role played by R & D activities should also be highlighted; these activities produce new knowledge, which enables the company to generate radical innovation constantly. This activity is closely related to the investment of financial resources since the company must invest in issues that are possibly completely new, and a strategy that is working in recent years is the collaboration with science. This is reflected in the recommendations of the authors analyzed in this article. One of the most recurrent recommendations is to create policies that encourage collaboration with research institutions.

This article intended to find common elements that may affect persistence in innovation positively, to complement what was already achieved in previous research for certain contexts. To achieve persistence in innovation, a set of internal elements must be integrated and combined with the collaboration of external entities. Literature suggests that it is necessary to have the support of public policies that encourage research and development of new technologies.

Finally, the article raises some questions. The findings leave many questions that could be answered in future work. First, the universe analyzed was 34 papers and the following question remains, why was the field of analysis that produced the suitable 34 articles on the persistence of innovation so low? It is interesting to analyze a wider universe of innovation and see if this topic is something new, emerging, or of little interest. Secondly, from the literature reviewed, there were several mentions to Spanish companies, so the following question remains: Why is Spain providing more scientific literature than other countries? Third and last, the paper presents elements that could be related to current theories or models. Future work may relate to identifying the link between persistence in innovation and other topics. For example, the Strategic Niche Management (SNM) concept describes protection, alliances, and knowledge management as was also found in this work.

Conflicts of Interest:

The authors declare no conflict of interest.

References

1. Altuzarra, Amaia. 2017. Are there differences in persistence across different innovation measures? *Innovation: Management, Policy and Practice* 19: 353–71.
2. Antonelli, Cristiano, Francesco Crespi, and Guiseppe Scellato. 2012. Inside innovation persistence: New evidence from italian micro-data. *Structural Change and Economic Dynamics* 23: 341–53.
3. Antonioli, Davide, and Sandro Montresor. 2019. Innovation persistence in times of crisis: An analysis of Italian firms. *Small Business Economics*.
4. Arenas, Juan Jesus, and Domingo Gonzalez. 2018. Technology Transfer Models and Elements in the University-Industry Collaboration. *Administrative Sciences* 8: 19.
5. Arenas, Juan Jesus, and Domingo Gonzalez. 2019. Collaboration for R&D Projects between the Industry and External Agents: Evidence from Manufacturing Companies in Peru. *Latin American Business Review* 20: 37–60.
6. Arvanitis, Spyros, and Tobias Stucki. 2014. The impact of venture capital on the persistence of innovation activities of start-ups. *Small Business Economics* 42: 849–70.
7. Ayllón, Sara, and Dragana Radicic. 2019. Product innovation, process innovation and export propensity: Persistence, complementarities and feedback effects in Spanish firms. *Applied Economics* 513650–64.
8. Badillo, Erika Raquel, and Rosina Moreno. 2016. Are Collaborative Agreements in Innovation Activities Persistent at the Firm Level? Empirical Evidence for the Spanish Case. *Review of Industrial Organization* 49: 71–101.
9. Bartoloni, Eleonora. 2012. The persistence of innovation: A panel data investigation on manufacturing firms. *International Review of Applied Economics* 26: 787–810.
10. Bartoloni, Eleonora, and Maurizio Baussola. 2018. Driving business performance: Innovation complementarities and persistence patterns. *Industry and Innovation* 25: 505–25.
11. Bianchini, Stefano, and Gabriele Pellegrino. 2019. Innovation persistence and employment dynamics. *Research Policy* 48: 1171–86.

12. Cefis, Elena, and Matteo Ciccarelli. 2005. Profit Differentials and Innovation. *Economics of Innovation and New Technology* 14: 43–61.
13. Chowhan, James, Fred Pries, and Sara Mann. 2017. Persistent innovation and the role of human resource management practices, work organization, and strategy. *Journal of Management and Organization* 23: 456–71.
14. Clausen, Tommy, and Mikko Pohjola. 2013. Persistence of product innovation: Comparing breakthrough and incremental product innovation. *Technology Analysis and Strategic Management* 25: 369–85.
15. Clausen, Tommy, Mikko Pohjola, Koson Sapprasert, and Bart Verspagen. 2012. Innovation strategies as a source of persistent innovation. *Industrial and Corporate Change* 21: 553–85.
16. Córcoles, David, Angela Triguero, and María Carmen Cuerva. 2016. Comparing persistence of product and process innovation: A discrete-time duration analysis of innovation spells. In *Economics*. vol. 10.
17. Deschryvere, Matthias. 2014. R&D, firm growth and the role of innovation persistence: An analysis of Finnish SMEs and large firms. *Small Business Economics* 43: 767–85.
18. Dieguez-Soto, Julio, Antonio Durendez, Domingo Garcia-Perez-de-Lema, and Daniel Ruiz-Palomo. 2016. Technological, Management, and Persistent Innovation in Small and Medium Family Firms: The Influence of Professionalism. *Revue Canadienne Des Sciences de l'Administration/Canadian Journal of Administrative Sciences* 33: 332–46.
19. (accessed on 10 May 2017).
20. Filippetti, Andrea, and Frederick Guy. 2016. Skills and social insurance: Evidence from the relative persistence of innovation during the financial crisis in Europe. *Science & Public Policy (SPP)* 43: 505–17. AN=119212390&lang=es&site=ehost-live(accessed on 15 September 2017).
21. Fontana, Roberto, and Andrea Vezzulli. 2016. Technological leadership and persistence in product innovation in the Local Area Network industry 1990–1999. *Research Policy* 45: 1604–19.
22. Guarascio, Dario, and Federico Tamagni. 2019. Persistence of innovation and patterns of firm growth. *Research Policy* 48: 1493–512.
23. Juliaio-Rossi, Jorge Luis, and Julia Andrea Pinedo Acero. 2019. Persistence in the imitation of innovations in products in the manufacturing industry of Colombia. *Contaduría y Administración* 64: 1–15.
24. Juliaio-Rossi, Jorge Luis, and Jana Schmutzler. 2016. Persistence in generating and adopting product innovations: Evidence for manufacturing firms in a developing country. *Academia* 29: 125–46.
25. Kitchenham, Barbara, Pearl Brereton, David Budgen, Mark Turner, John Bailey, and Stephen Linkman. 2009. Systematic literature reviews in software engineering—A systematic literature review. *Information and Software Technology* 51: 7–15.
26. Lamperti, Francesco, Roberto Mavilia, and Marco Giometti. 2016. Persistence of innovation and knowledge flows in Africa: An empirical investigation. *Innovation and Development* 6: 235–57.
27. Le Bas, Chrstian, and Nicolas Poussing. 2014. Are complex innovators more persistent than single innovators? An empirical analysis of innovation persistence drivers. *International Journal of Innovation Management* 18.
28. Le Bas, Christian, and Giuseppe Scellato. 2014. Firm innovation persistence: A fresh look at the frameworks of analysis. *Economics of Innovation and New Technology* 23: 423–46.
29. Le Bas, C., C. Mothe, and T. U. Nguyen-Thi. 2015. The differentiated impacts of organizational innovation practices on technological innovation persistence. *European Journal of Innovation Management* 18: 110–27.
30. Malerba, Franco, and Luigi Orsenigo. 1999. Technological Entry, Exit and Survival: An Empirical Analysis of Patent Data. *Research Policy* 28: 643–60.
31. Mothe, Caroline, and Uyen Nguyen-Thi. 2017. Persistent openness and environmental innovation: An empirical analysis of French manufacturing firms. *Journal of Cleaner*

Production 162: S59–69.

32. Muínelo-Gallo, Leonel, and Macarena Martínez. 2018. Persistence and economic effects of technological innovations: A dynamic and sequential analysis of Uruguayan manufacturing firms. *Economics of Innovation and New Technology* 27: 693–716.
33. Phillips, Almarin. 1971. *Technology and Market Structure: A Study of the Aircraft Industry*. Lexington: Lexington Books.
34. Raymond, Wladimir, Pierre Mohnen, Franz Palm, and S. S. Sybrand Van der Loeff. 2010. Persistence of innovation in dutch manufacturing: Is it spurious? *Review of Economics and Statistics* 92: 495–504.
35. Rosenberg, Nathan. 1982. *Inside the Black Box: Technology and Economics*; Cambridge: Cambridge University Press.
36. Snyder, Hannah. 2019. Literature review as a research methodology: An overview and guidelines. *Journal of Business Research* 104: 333–39.
37. Suarez, Diana. 2014. Persistence of Innovation in Unstable Environments: Continuity and Change in the Firm's Innovative Behavior. *Research Policy* 43: 726–736.
38. Tavassoli, Sam, and Charlie Karlsson. 2015. Persistence of various types of innovation analyzed and explained. *Research Policy* 44: 1887–901.
39. Triguero, Angela, and David Córcoles. 2013. Understanding innovation: An analysis of persistence for Spanish manufacturing firms. *Research Policy* 42: 340–52.
40. Triguero, Angela, David Córcoles, and María Cuerva C. 2013. Differences in Innovation Between Food and Manufacturing Firms: An Analysis of Persistence. *Agribusiness* 29: 273–92.
41. Triguero, Angela, David Córcoles, and María Cuerva. 2014a. Measuring the persistence in innovation in Spanish manufacturing firms: Empirical evidence using discrete-time duration models. *Economics of Innovation & New Technology* 23: 447–68.