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## Article

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Article

# Absorptive Routines and the Economic Impact of Incremental Innovations: Developing Continuous Improvement Strategies

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**Abstract:** The important influence that incremental innovation has, both on the organization's results and on the development of disruptive innovations in a synergistic relationship of positive sum, makes it necessary to deepen its study. In the context of absorptive capacity, this paper aims to contribute to the construction of a specific model of routines for more efficient exploitation. The empirical study was carried out in a sample of Spanish manufacturing companies of the PITEC Panel. The results show the superiority of the market as a source of knowledge compared to other sources with more complex knowledge, but not adjusted to the needs of a minor improvement. In addition, the management of external knowledge is a process whose phases are interrelated, so the routines and resources used must contribute to enriching the external knowledge previously acquired and not be redundant. Therefore, that would mean an inefficient allocation of resources for obtaining and exploiting continuous innovation.

**Keywords:** continuous improvement; incremental innovation; absorptive capacity; sources of knowledge; profitability

## 1. Introduction

In current contexts, characterized by high technological and market obsolescence, innovation is a fundamental mechanism for companies to achieve competitive advantages. For this reason, both researchers and managers are constantly searching for methods and practices to improve and promote the organization and management of new product development processes [1]. In this sense, we understand innovation as a complex dynamic process developed through a series of practices that allow new or improved products to be introduced into the market according to the system that adopts them [2–4].

This novelty or improvement reaches different degrees, both from the point of view of its scope of application—whether the novelty extends into an industry or is a pioneer at world level [5]—and from the point of view of the novelty it represents for the status quo of its scope—radical or incremental innovation [6,7].

Although innovation is a valuable organizational outcome in itself, there is significant controversy both in the definition of the concept [1,8] and in the possible superiority of some types of innovation over others [9,10]. Traditionally, radical innovation has been associated with industry-leading companies and with the best strategic option for followers or losers who wish to reverse their situation [4]. In this context, many studies consider that radical innovations are the best bet for companies because,

while incremental innovations can allow large companies to remain competitive in the short term, only radical innovations can change the rules of the game, leading the way in the long term [11]. Therefore, the importance of incremental innovation has traditionally been underestimated [12].

However, many studies have analyzed the complementarity between both types of innovation—radical and incremental innovation [1]. In this way, the study of their value should be considered both independently but also as part of their joint action to achieve higher levels of productivity [13,14]. In a company, most of the economic benefits from innovation come from the flow of incremental or sustained innovations that accumulate over time. Therefore, a more appropriate innovation strategy should include both types of innovation [7,10,15,16].

Incremental innovation implies a predictable change in the routines of the innovation process, which follows a logical extension of the existing knowledge and technological base [17,18]. For all these reasons, this type of innovation is associated with continuous improvement strategies that, through methods or routines already used, imply small improvements because of ongoing efforts [3,19–21]. In fact, exotic future innovation strategies that break with the organization's natural evolutionary course are often based on the slow and constant approach to incremental innovation [22]. The underestimation that this type of innovation has suffered justifies the lack of sufficient empirical evidence to guide how to articulate those specific capacities and routines that facilitate the different phases of the process for obtaining and making incremental innovations profitable [8,17].

Innovations, in general, and incremental ones, in particular, require valuable external knowledge that through systematic processing that gives the organization a new cognitive map that responds to the needs of clients and markets [7] (p. 2302). Therefore, mastering the acquisition and transfer of external knowledge within this process is fundamental, but requires specific and sometimes novel management skills and routines [23]. As a result, recent works have related the concept of knowledge absorption to the development of incremental innovations [24–26]. However, the empirical literature associated with the capacities to accumulate and manage this knowledge is still scarce and incomplete [8]. To fill this gap, the present paper aims to provide new empirical evidence for the development of the process to obtain different results associated with incremental innovation.

Recognizing the need to further develop a specific mapping of resources, measurements, guidelines, routines and capabilities to enable more efficient exploitation of incremental innovation [26,27], the contribution of the proposed study is twofold. First, to enrich the treatment of absorptive routines, we focus on the existing individual and joint relationships between the processes of the absorptive capacity phases. In the area of absorptive capacity, the joint analysis of its different phases has traditionally been based on the PACAP-RACAP structure, accepted by the literature [25,28,29]. However, this concept still requires further analysis in a number of respects, which would limit the idea of an always equitable distribution of resources between the different phases of the absorptive process [30]. Thus, both absorptive processes require specific activities and routines, which will require that the organization, with a zero-sum philosophy, must efficiently distribute its efforts and resources, which are limited, among them considering the objective pursued [31].

In the second place, the present study intends to contribute to the analysis of the innovative result, by differentiating the obtaining of an incremental innovative result (functional performance) from the generation of economic benefit (economic performance) from said result. Success is considered as the economic performance that follows the launch of some innovation [32]; therefore, to associate routines and resources in the improvement of a given innovative result, considering its impact on the income statement, would represent a significant advance in the literature.

To achieve these goals, the present research addresses the following main research questions:

1. Does a source of knowledge have a different effect on the obtaining of economic performance related to incremental innovation?
2. Do operating routines have a different effect on the obtaining of economic performance related to incremental innovation?

3. Are there any moderating effects between the dimensions of absorptive capacity to obtain economic results from incremental innovation?

The empirical study was carried out in a sample of Spanish manufacturing companies of the PITEC Panel using multiple linear regression models, due to the quantitative nature of the dependent variable. This method tries to fit linear models between a dependent variable and more than one independent variable. The individual results indicate that the market as a source of external knowledge of the absorptive capacity will allow the organization to improve the impact of incremental innovations on turnover largely than the other sources analyzed. This result is consistent with the approach of external knowledge search strategies [33,34] to the superiority of some sources over others.

When the joint effect between the phases of absorptive capacity is analyzed, the relationship is more complex. According to the results, special attention should be paid to the acquisition routines, as they will completely condition the convenience of certain routines throughout the absorptive process. Considering the importance of the organization being up to date with new developments and changes in the market so that incremental innovations can be reflected to a greater extent in the income statement, that type of knowledge that already provides this information does not require routines that complement it in this sense. However, the sources of knowledge that are least in contact with the market—companies from the same group—must be complemented a posteriori with exploitation routines related to this market.

## 2. Theory and Hypothesis

Within the framework of the literature on Innovation Management, an important research stream has focused on identifying the factors that influence the strategic potential of innovations, depending on whether they are incremental or radical in nature. In this sense, it is worth highlighting several studies that focus the analysis of its relevance on aspects such as the market share of the company that develops the innovation [17] or the sector to which it belongs [9]. However, in this paper, in line with recent studies that support a dualistic perspective in the development of innovations, we consider that radical and incremental innovations are interrelated, and that their potential should be assessed in relative rather than absolute terms. In addition, both types of innovation are “determinants of a company’s success, as they are different in nature and impact the company in different ways” [10] (p. 872). Companies that develop successful innovation strategies tend to make pyramid-shaped strategies, so that at the top of the pyramid there are only a few significant innovative bets, a larger number of promising ideas are tested in the trunk, and a large number of incremental innovations are found at the base [35]. Consequently, the correct development and exploitation of incremental innovations will favor radical innovations, in a synergistic relationship of positive sum [15] to achieve long-term gains [27].

For a product to be considered a novelty, it must be perceived by the market as providing new practical benefits and reliable functions [36]. Incremental or continuous innovations consist of some minor but substantial modification or improvement that contributes, within a framework of continuity, to increasing the efficiency of the process or the satisfaction of the user or client [3,18]. It includes product design and quality; process improvements; new technological and organizational arrangements; and new supply and sales practices.

Incremental innovation can be useful in a wide range of sectors and businesses, with the common point that it does not require high costs or disbursements for its development [37]. For example, it is critical in certain sectors by promoting increased price competition among drug manufacturers, leading to cost savings in the health care sector [9].

Based on [38] definition, we can affirm that incremental innovations imply minor modifications, but that when carried out in a cumulative process, they are of great importance. For this reason, this type of innovation is associated with continuous improvement strategies, which imply small improvements in a line of continuity that allows companies to generate a culture of permanent innovation [3,19–21,39]. If we consider incremental innovation as a deviation from stability, it adds a breadth that in the

long term leads to greater efficiency, exploitation, skill development and a more varied repertoire of solutions [15] that will favor future radical innovation. Incremental innovation plays an important role in the continuous search for new ways that allow companies to achieve competitive advantages of differentiation in the market [1]. Consequently, this innovation is important to increase market share [12].

The association between absorptive capacity and types of innovation has attracted the attention in numerous recent works [8,40]. For example, they establish a positive relationship between absorption capacity and financial sustainability through open innovation [41]. Within the same line of argument set out above, the processes of absorption of external knowledge will contribute through differentiated resources, procedures and routines to obtaining two types of innovation—radical and incremental. In this context, the role of routines as stable patterns of collective behavior that enable resources to respond to various external and internal stimuli should be highlighted [42].

According to [28] proposal, absorptive capacity is a sequential set of routines grouped into two factors—PACAP and RACAP. Thus, although PACAP focuses on the analysis and understanding of external knowledge, RACAP focuses its greatest attention on the combination and integration of new knowledge into the base of those previously accumulated in the company as well as its incorporation into the company's activities. Thus, PACAP has traditionally been associated with radical innovations through the acquisition and assimilation of heterogeneous knowledge [43], while the development of RACAP would require a culture that fosters stability and control in the transformation and exploitation of new knowledge [25,44] and, therefore, more in line with obtaining incremental innovations [45]. Moreover, as it is developed through more formalized routines, it is more predictable in terms of later returns [15].

Therefore, we can consider both as different concepts that would require distinct types of structures, objectives and absorptive strategies [44,46]. PACAP will depend on the ability of employees to use the knowledge absorbed and RACAP will be related to the high motivation of employees to be able to contribute to organizational efficiency. However, the ability and motivation of employees are not a sufficient condition in themselves, as they require the presence of other subsidiary aspects, such as routines, practices and procedures [47–49].

### *Hypotheses*

In the first phase of the absorptive process, acquisition, both the different relationships that the organization maintains with different actors, under different systems of governance that act as sources of knowledge [50–52], and its previously accumulated specific knowledge base are of great importance [53]. Along the same lines, [54] already recognized that the stock of resources and capacities of the company is the origin of the asymmetries in the competition for access and use of new resources, as well as of the competitive advantages derived from the complementarity between resources.

Regarding the approach of the source of knowledge, the different sources will condition its subsequent absorption by the recipient company and, consequently, the innovative result obtained [18]. This framework considers the breadth and depth of relationships with sources of external knowledge as the factors that condition the innovative outcome of such knowledge [33]. On the one hand, wider access through multiple sources increases the innovative potential [55,56], without reaching an excessive level of diversity that will increase the complexity of the process [57]. In contrast, access to external knowledge through a limited number of sources can facilitate incremental innovation performance, while access to a wide range of sources can improve the innovator's radical innovation performance [55]. On the other hand, it is worth mentioning the study of the depth of these relationships [24], in terms of duration, confidence or cognitive proximity between organizations, and their effect on innovative performance. The higher the depth of relationships, the greater the absorption of tacit and complex knowledge directly related to radical innovation, what may hinder those ones of an incremental nature [58]. Therefore, this study considers the breadth and depth of relationships with third parties [56].

In our research we have chosen to differentiate between two models of alternative routines for accessing new knowledge, beyond the strict limits of the organization, and with particular implications for performance: (1) relations of an external nature—if the acquisition of knowledge is carried out through formulas in which the agents maintain a higher level of independence (either through specific interactions in the markets between independent companies or through more stable cooperation agreements)—and (2) relations of a quasi-external nature—if the acquisition is carried out through other knowledge—and technology-intensive organizations, but in which the company has significant holdings in the share capital.

Alliances and firms in which significant shareholdings are held, would be cognitively closer than the market and especially in sectors with a high technological component and for innovations requiring more complex knowledge [59–61]. Achieving collaborative innovations through collaborative networks is beneficial for companies with fewer resources such as small and medium enterprises (SMEs) [26]. Some works even support a positive relationship between certain cooperation agreements and the achievement of incremental or continuous innovation [62], although this does not translate into an increase in sales resulting from this innovation [10].

The sources of knowledge that offer greater certainty regarding commercial success will allow greater impact from incremental innovations on the income statement [18]. Therefore, considering that knowledge from the market greatly improves the extension and refinement of the current product [7], it would be an alternative and more attractive formula when it comes to making incremental innovations profitable. For this reason, knowledge from the market, although farther away from the company's current knowledge bases, carries fewer risks associated with the development of knowledge itself [63,64] or lower management and coordination costs than cooperation agreements [10,61,65]. In this sense, this source provides more explicit and less complex knowledge, so that can be easily applied to improve existing knowledge [66,67]. Moreover, this knowledge will enable the recipient company to overcome the so-called “organizational inertia” by breaking the rigidities of its own knowledge base [34,68].

Considering the above, we establish our first hypothesis:

**Hypothesis 1.** *In the context of potential absorptive capacity—PACAP—acquisition routines related to the purchase of knowledge in the market have a direct and significant effect on the economic impact of incremental innovation.*

Once the organization has managed to identify and acquire externally the knowledge that it has considered valuable, it could lose the richness that such knowledge possesses if it does not establish the routines and internal relationships to assimilate it correctly. In this phase, human resources take on a fundamental role. However, there is a substantial heterogeneity in the effectiveness of skills to generate different types of innovation. Skilled workers increase the absorption capacities [26]. In this sense, different skill sets or qualifications are required to assimilate knowledge efficiently to achieve or capitalize on incremental innovation, as opposed to radical one [69]. However, more empirical evidence is needed on the concrete practices that allow human resources to capitalize on innovations, in general, and incremental innovations, in particular [49,70].

Relying on the theoretical framework based on ability, motivation and opportunity [71,72], we will consider these three particularities when enriching the cognitive base to improve the assimilation of knowledge from abroad.

First, a well-organized environment supports the right conditions to assimilate knowledge and develop innovation [39]. Therefore, it must have a sufficient number of qualified technical specialist positions to develop the tasks of assimilation of external knowledge [70,73].

Second, we will highlight the role that training or qualification plays in the capacity of human capital to assimilate new knowledge [14,70]. In incremental innovation, a wide range of skills or qualifications in the workforce is important to enable them to assess and adapt the new knowledge acquired. Specifically, it benefits from training related to statistical, mathematical and database

management processing [37,69]. Therefore, higher education related to these subjects will favor the assimilation of the external knowledge previously acquired.

Third and finally, the behavior that a worker has when developing a task would be conditioned both by the cognitive training and the motivation [40]. Therefore, to conclude, we will analyze the compensation system, particularly through monetary compensation, as a motivating tool in the development of the assimilation process [74].

For all the mentioned reasons, we propose the following hypothesis in relation to the training of the workers involved in the dimension of assimilation of external knowledge:

**Hypothesis 2.** *In the context of potential absorptive capacity—PACAP—external knowledge assimilation routines moderate the relationship between acquisition routines and the economic impact of incremental innovation.*

Within the framework of the absorptive capacity achieved—RACAP—the transformation follows the assimilation component and allows the organization to develop and improve the routines through which it combines previous and new knowledge [75]. Ref. [28] (p. 195) defines transformation capacity as “the process of unbundling that helps the company to develop a new perceptual scheme or changes existing processes”. Thus, through this dimension the organization has to be able to adapt or reconfigure the new knowledge and/or organizational structures to its needs. Due to this reinterpretation of the existing knowledge base, some works have associated this dimension with radical innovation. However, most of the work has considered that improving access to and transformation of the knowledge base will favor its subsequent application to specific processes or products and, consequently, will optimize the commercial return on incremental innovations [7]. In this sense, the effectiveness of the innovation obtained will depend on the tools that the organization provides, so that the knowledge flows and the new knowledge is recombined with the existing stock of knowledge [70].

For all these reasons, transformation is closely related to organizational memory. The need to have an updated organizational memory with the routines that allow. On the one hand, the retention, renewal or elimination of knowledge, according to the needs that arise [75–78]. On the other hand, access to this memory for the right people, will condition the success in the subsequent exploitation of this resource, and, consequently, the maintenance of related competitive advantages, by avoiding the use of “old solutions to solve new problems” [79].

The objective of the organization is to reorient itself towards the design of tools that facilitate the storage and subsequent access to the new knowledge base by those agents that can contribute to the innovation process and, in this way, continue the process of continuous learning. The future application of knowledge is facilitated when the right people have access to the necessary valuable knowledge and know where it is located [80]. To this end, a knowledge management policy and systems must be designed to capture, standardize, store and retrieve knowledge, and to facilitate the combination and dissemination of its different expressions [29,81].

That organizations use new technologies that could facilitate organizational innovations [82]. In this knowledge transformation process, a higher level is reached with the so-called knowledge mining, developed through data analysis technologies, and involving the enrichment of knowledge between repositories [83]. Among the most current repositories in organizations, those of a technical character stand out, which are formed from the use of technologies that allow the access, distribution or contribution of knowledge, such as newsletters, websites, intranets or online discussion forums [76,84]. These technologies include data mining, which develops storage functions, and data analysis to help users, usually at the managerial level, make the most of their data and achieve a proactive approach to problem solving [85]. For its proper functioning, the development of routines that promote habits in technological use is required [86].

In this sense, information systems and technologies (ICTs) support the organization, location, distribution and sharing of knowledge. For example, the use of these new technologies as cloud

services “allows you to virtualize where you are physically facilitating the use of the information from any device or context, expanding the framework for their use” [87].

Companies with high technological support have, among other advantages, greater possibilities to expand internationally, achieve product innovations and generally obtain better organizational results [34,88]. Consequently, the appropriate use of ICT skills is considered a key organizational variable that allows, on the one hand, competitive advantages to be created and maintained and, on the other, incremental innovations to be generated [81,84,89,90].

**Hypothesis 3.** *In the context of the absorptive capacity achieved—RACAP—transformation routines have a direct and significant effect on the economic impact of incremental innovation.*

Finally, exploitation refers to the company’s ability to commercially apply the new knowledge and achieve the planned organizational objectives [91]. So, we talk about routines that allow firms to redefine and/or extend existing competencies, and/or create new ones through the knowledge that has previously been acquired, assimilated and transformed.

These routines are conditioned by the dominant logic of the organization in which they are developed [92]. In this way, transformed knowledge is incorporated into concrete operations [28]—that is, with a clear productive purpose [93].

However, not all the external knowledge that is captured must or can be exploited, since it is important to consider the influence of the dynamic environment on the exploitation of the new knowledge generated. In dynamic environments, products and services resulting from absorptive capacity may quickly converge to industry standards [28,94], and quickly become obsolete to demand [95]. Accordingly, operational units need to be selective in their absorptive capacity and only exploit those aspects that are most likely to yield benefits [29].

Given that the exploitation phase includes a set of routines directly linked to the market [29], we consider the existence of favorable effects of the efforts made in this type of routines in obtaining incremental innovations with commercial impact. This is a consequence of the need to respond through them to a practical problem or market request—present or future—in a somewhat novel state.

Within this phase, the company’s efforts to integrate various processes and technologies to reconfigure operations according to market needs, as well as its own information on the uses and functionalities of the products desired by its customers, should be highlighted [29,96,97].

For this reason, the operating routines that allow the application of the new knowledge to the production process will be analyzed first. Through this application, greater flexibility and production capacity can be achieved, improved or innovative products can be obtained and direct costs or environmental impact can be reduced [98,99].

Second, we consider market-oriented operating routines, developed by increased market knowledge, which contributes to improved organizational performance [100]. It can be obtained using certain technologies, such as social media, which are external sources to support innovations [82]. This knowledge will include information and knowledge about the product market, such as customer behavior and needs, competitors’ actions and market conditions [101]. From it, the development of exploitation routines more adjusted to the new characteristics of the market is achieved. These include significant changes in product design or packaging of goods and services, the use of new techniques or channels for product promotion, or the establishment of new methods or prices for product repositioning on the market.

Therefore, we contrast the hypothesis as follows:

**Hypothesis 4.** *In the context of the absorptive capacity achieved—RACAP—external knowledge exploitation routines moderate the relationship between transformation routines and the economic impact derived from incremental innovation.*



Complementary to this line of research, it is an interesting contribution to deepen the possible differences in the moderating role of RACAP in the PACAP and impact of incremental innovation relationship. That is, when the effort devoted to potential absorptive capacity is not accompanied by an effort to develop the absorptive capacity, the sustainability of the business may be limited [29,102]. Proper development of the exploitation phase (RACAP) would increase the effect of exploration (PACAP) on results [103]. In this sense, the RACAP phase would have a moderating effect on the relationship between PACAP and the economic impact of incremental innovation, as the way in which the company transforms and applies new knowledge is key to this relationship [102]. It must be noted that PACAP phase has traditionally been associated with more radical and/or unincorporated innovation, while the RACAP phase has been linked to incremental or continuous innovation.

**Hypothesis 5.** *In the context of absorptive capacity, RACAP moderates the relationship between PACAP and the economic impact of incremental innovation.*

Figure 1 represents the hypotheses of the individual and joint relationships of the potential absorptive capacity with the impact on turnover of the incremental innovations that make up the complete analysis model.

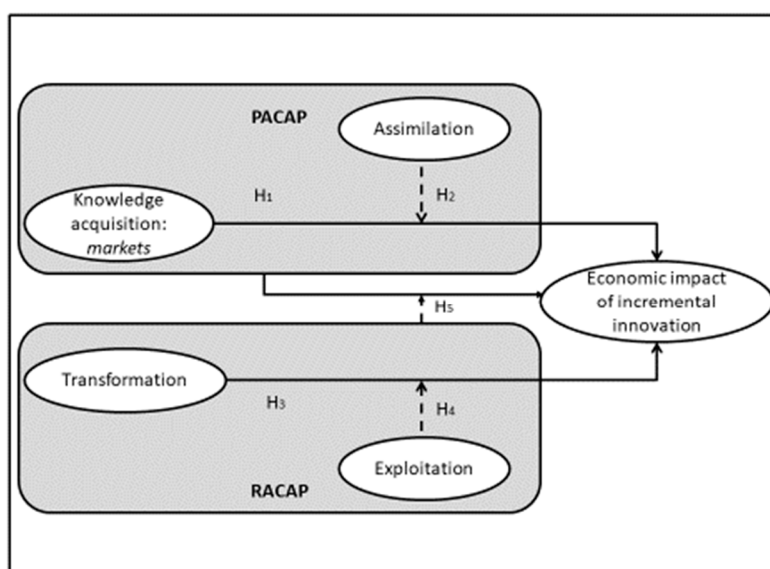


Figure 1. Model of analysis.

### 3. Method

We use multiple regression because we study the possible relationship between several independent variables and another dependent variable. The initial sample of the study is made up of 12,838 companies that respond to the Technological Innovation Panel (PITEC), a statistical instrument for monitoring the innovation activities of Spanish companies. This panel is the result of the joint effort of the Spanish Foundation for Science and Technology (FECYT), the National Statistics Institute (INE) and the Cotec Foundation, together with the advice of a group of academic experts.

The sample finally chosen to test the hypotheses is that made up of manufacturing companies according to the CNAE-2009 classification. In addition, the sample has been stratified according to the level of technological intensity according to the OECD criteria, establishing a list of sectors according to the degree of importance of technology and R&D intensity. The total number of companies for which data were valid for all variables in the period analyzed was 9612, representing 74.9% of the total.

As for the measurement of the variables, this has been carried out according to the indicators included in the above-mentioned survey. Based on the analysis of the variables included in PITEC

and the review of the previous literature, the survey indicators with the greatest theoretical or content validity were selected deductively [104].

Given that knowledge management decisions do not immediately translate into innovative results, we considered it appropriate to incorporate a time lag [105]. Thus, the independent variables selected refer to 2010, while the dependent variables refer to 2012.

The phases of potential absorptive capacity, each of the quantitative dimensions has been previously normalized so that they are homogeneous and the resulting factor or factors are consistent.

### 3.1. Independent Variable: Absorptive Routines

Following the work of [28], the present paper reflects its complex nature and structures the construct around the main phases related to potential and realized absorptive capacity. Currently measurement methods are diverse and not clear [40].

As for the knowledge acquisition phase, and in accordance with the three alternative processes described in the proposed model, we propose a measurement through three dichotomous variables: (1) purchase of knowledge on the market, (2) cooperation with independent partners and (3) technological learning relationships with group companies (details are shown in Table 1).

**Table 1.** Absorptive capacity: measurement indicators.

Independent Variable: Absorptive Capacity							
Indicators (PITEC)							
Dichotomous Variable	Quantitative Variable		Dichotomous Variable		Dichotomous Variable		
Relations of an external nature: Market: purchase Cooperation: ○ Suppliers ○ Clients ○ Competitors ○ Universities and technology centers Quasi-external relationships: ○ Holdings in group companies	Capacitation: - Specialization positions (% researchers, technicians and assistants) - Formation of personnel who carry out R&D tasks (university graduates and PhDs)/total workforce) - Monetary remuneration R&D personnel		Facilitators to access, integration and distribution: - Advanced equipment, software and hardware - Standardization and process coding activities (maintenance systems or IT operations)		Operations: - Manufacturing methods, logistics and distribution systems and support activities - Other preparations for production and/or distribution Market: - Market research and other MK activities		
Reliability (Cronbach Alfa)	N.A.	KMO	0.675	KMO	0.812	KMO	0.775
		Bartlett's test	Sig: 0.000	Bartlett's test	Sig: 0.000	Bartlett's test	Sig: 0.000
		% Acum.	68.81	% Acum.	62.53	% Acum.	83.06
		Reliability (Cronbach Alfa)	0.821	Reliability (Cronbach Alfa)	0.688	Reliability (Cronbach Alfa)	0
		Remun.	0.862	Software	0.725	Support activities	0.871
		Train.	0.741	Norm.	0.725	Other preparations	0.994
		Spec.	0.879			Market research	0.144
							0.670
							0.848

In assimilation phase, we have included with respect to the total workforce, indicators relating to the experience acquired in specialization positions (researchers, technicians and assistants), the formation of personnel who carry out R&D tasks (university graduates and PhDs) and, finally, the monetary remuneration that R&D specialized workers receive for the development of their activity as a motivating factor.

With respect to the transformation phase, insofar as it refers to information systems useful for the capture, standardization, storage, combination, dissemination and retrieval of knowledge [24,29,81,106], we have included the indicators of the survey that expressly include the use of different information and communication systems and technologies, as well as the establishment of standardization and

codification systems for processes. These systems and technologies are as “enabling technologies”, whose penetration and use in companies is a fundamental basis for their competitiveness [87].

With regard to ICT, the use of free software for R&D activities allows workers to be more creative as “instruments open to knowledge” [107]. The acquisition of new machinery, equipment and advanced software and hardware is also envisaged. We complement the use of this equipment with the standardization and codification of processes, which allow for improved maintenance and operations of the transformation process.

Finally, as regards the operating phase, indicators have been incorporated that allow the collection of routines theoretically defined in the previous section, either to facilitate the incorporation of new knowledge into the company’s operations or to guide the processes regarding the commercialization and distribution processes, according to market uses and needs. Some works that have allowed us to consider these measures as valid from a theoretical or content point of view are those of [29,96,106].

For categorial independent variables, we used a Confirmatory Factor Analysis (CFA), developed according to the tetrachoric correlations matrix [108,109].

### 3.2. *Dependent Variable*

#### Impact of Incremental Innovation on Turnover

One of the results that has generated most controversy in empirical studies is related to the contribution of innovation to economic and/or financial results, due to the difficulty of establishing a direct effect between the innovation generated and the economic benefits of the organization. Therefore, the effect of the efforts made in the routines that form the absorption capacity on the operating results of the companies will be included in this work, since it is an aspect that requires new research [29,110], as there are contradictory results [111].

With the present study, and taking into consideration the two types of analysis (individual effects and moderating effects), we will try to obtain new empirical evidence that will allow us to improve our knowledge about the role of absorptive capacity in improving the company’s economic and financial results through the impact of the incremental innovation generated on them. In this case, we will take as a dependent variable the impact on the result of the incremental innovations [70], an indicator that is available in the PITEC database through the item that represents the percentage of turnover due to innovations in goods and services introduced in the period 2010–2012 that were only new for the company.

### 3.3. *Control Variables*

In order to removing interference that overshadow the analysis of the results, control variables have been considered to be those corresponding to the size (number of employees), age (the years from firm creation) and the sector to which the company belongs (according to the level of technological intensity).

The size of the organization indicates its ability to devote resources to developing new products [112]. The age of the organization “distorts the context in which innovation takes place” [112] (p. 287), both in terms of the improvement of some skills or abilities and in terms of the impediments caused by organizational inertia [59,112]. The industry variable has been included since having different levels of appropriation, there is evidence of its effect on innovation [70,113].

## 4. Results

This study discusses whether the incremental innovations generated have a significant impact on the company’s turnover. In short, are there innovations that really meet the needs of the market? For this purpose, the impact of incremental innovations on turnover is taken as a dependent variable. Given the quantitative nature of the dependent variable, multiple linear regression models are used in this case. Before carrying out the tests, we submit the data to the necessary tests to apply this statistical

technique. The models finally incorporated fulfilled the conditions regarding the behavior of the residues and the relationships between the independent variables, as well as between these and the dependent variable (see Table 2).

**Table 2.** Conditions for the application of linear regression models.

Phenomenon	Criterion	Test
Residues	Independence	<ul style="list-style-type: none"> <li>• Durbin-Watson (<math>1.5 &lt; DW &lt; 2.5</math>)</li> </ul>
	Normal	<ul style="list-style-type: none"> <li>• Sample size (<math>N &gt; 100</math>)</li> </ul>
	Homoscedasticity	<ul style="list-style-type: none"> <li>• Graphic analysis: ZPRED-ZRESID</li> </ul>
Dependence Relationship	Linearity	<ul style="list-style-type: none"> <li>• Graphic Analysis: partial regression diagram</li> </ul>
Independent Variables	Non-collinearity	<ul style="list-style-type: none"> <li>• Correlations lesser than 0.9</li> <li>• Being <math>R^2 \neq 0, \exists \beta \neq 0</math></li> <li>• <math>-1 &lt; \beta &lt; 1</math></li> <li>• Tolerance values away 0.01</li> <li>• VIF: not exceeding 10</li> </ul>

The following are the results related to the economic impact of incremental innovations. In model I (Table 3), which includes only the control variables, only the positive effects of the size variable are observed, which are also particularly relevant when the sector presents high levels of technological intensity. Correlations matrix in Appendix A.

**Table 3.** Control variables and economic impact of incremental innovations.

Model I Summary						
Variable result	F	gl	Sig. (bilateral)	Durbin-Watson	R Square	Ajusted R Square
Economic impact of incremental innovation	14.764	5	0.000	2.001	2%	2%
		Beta (standardized)	t	Sig.	Collinearity Statistics	
				Tolerance		VIF
Constant			-0.691	0.489		
Age		-0.006	-0.322	0.748	0.349	2.866
Sector		-0.037	-1.058	0.290	0.114	8.759
Size		0.063	2.999	0.003	0.323	3.100
Age*Sector		0.024	0.666	0.506		
Size*Sector		0.054	1.835	0.066		

Note: \* Join effect of the variables.

The following model (Table 4) considers the results containing the individual effects of absorptive routines on the economic impact of incremental innovations.

As can be seen in Table 5, the control variables are not significant, with the exception of the size according to the level of technological intensity where the company operates (10%).

**Table 4.** Knowledge absorptive routines and the economic impact of incremental innovations.

Model II Summary						
Variable result	F	gl	Sig. (bilateral)	Durbin-Watson	R Square	Ajusted R Square
Economic impact of incremental innovation	45.044	12	0.000	1.925	8.5%	8.3%
		Beta (standardized)	T	Sig.	Collinearity Statistics	
				Tolerance		VIF
Constant			−0.158	0.875		
Age		−0.001	−0.031	0.975	0.348	2.874
Sector		−0.047	−1.377	0.168	0.113	8.819
Size		0.017	0.834	0.404	0.302	3.307
Age*Sector		0.031	0.881	0.379		
Size*Sector		0.055	1.908	0.056		
Acquisition	Cooperation	0.007	0.610	0.542	0.874	1.144
	Group	0.026	2.083	0.037	0.832	1.201
	Purchase (H <sub>1</sub> )	0.116	9.217	0.000	0.834	1.198
Assimilation		0.036	2.911	0.004	0.867	1.153
Transformation (H <sub>3</sub> )		0.171	14.428	0.000	0.936	1.068
Operations exploitation		0.016	1.339	0.181	0.868	1.152
Market exploitation		0.019	1.532	0.126	0.888	1.126

Note: \* Join effect of the variables.

In this case, the acquisition routines based on participation in group companies and, in particular, the purchase of technology in the markets allow for incremental innovations with a higher economic impact, as established in the H1 scenario. The same is observed in transformation routines (H3), which aim to improve the storage and retrieval of accumulated knowledge.

To conclude our analysis, the moderating effects proposed in scenarios H2, H4 and H5 are included in model III. In this case, there is a very significant increase in the explanatory capacity of the model, which let us recognize the need to establish coherent policies in the efforts made between the different phases of absorptive capacity. In general, the effects of the control variables are maintained, although there are some significant changes in the influence of individual absorptive routines. Thus, the cooperation formula becomes significant, while the learning formulas derived from relations with group companies cease to be so. However, the direct purchase of knowledge on the market remains a determining variable of the economic impact of incremental innovations as we predicted in hypothesis H1. Moreover, what is most relevant is the change of the transformation routines effect, whose influence now becomes very negative. These results challenge the initial ones supporting the H3.

As regards the test of the moderating effects, on the one hand, the results derived from the moderating effects of assimilation on the relationship between acquisition and the economic impact of incremental innovations (H2) and of exploitation on the relationship between transformation and the economic impact of incremental innovations (H4), make it possible not to reject either hypothesis, with the exception of the case of PACAP1, where the moderating effect is not significant. Furthermore, the joint effects of PACAP and RACAP allow us to appreciate that this transformation requires efforts to be complemented by routines for incorporating knowledge into operational processes (RACAP1) and market learning routines (RACAP2), since otherwise it will not be beneficial and the efforts made will result in high opportunity costs. According to the PACAP variable, the assimilation of knowledge makes sense when the company does not develop its acquisition processes through the purchase of technology in the markets. The less complex and specific nature of this knowledge, which can be traded in organized market structures, would explain this and highlight the under optimization in the distribution of resources.

**Table 5.** Absorptive routines, PACAP, RACAP and economic impact of incremental innovations.

Model III Summary						
Variable result	F	gl	Sig. (bilateral)	Durbin-Watson	R Square	Ajusted R Square
Economic impact of incremental innovation	95.909	23	0.000	1.938	23.8%	23.6%
	Beta (standardized)		T	Sig.	Collinearity Statistics	
					Tolerance	VIF
Constant			-1.294	0.196		
Age	0.000		0.019	0.985	0.348	2.875
Sector	-0.033		-1.071	0.284	0.113	8.834
Size	0.037		1.943	0.052	0.298	3.356
Age*Sector	0.018		0.582	0.561		
Size*Sector	0.049		1.863	0.062		
Acquisition	Cooperation	0.026	2.342	0.019	0.863	1.159
	Group	0.012	1.015	0.310	0.786	1.272
	Purchase	0.155	11.446	0.000	0.588	1.700
Assimilation	0.026		1.205	0.228	0.236	4.230
Transformation	-0.313		-10.412	0.000	0.120	8.367
Operations exploitation	0.010		0.658	0.511	0.460	2.172
Market exploitation	-0.059		-4.238	0.000	0.562	1.779
H <sub>2</sub>	PACAP1 (coop*assimilation)	-0.038	-1.552	0.121		
	PACAP2 (group*assimilation)	0.074	4.793	0.000		
	PACAP3 (buy*assimilation)	-0.033	-1.816	0.069		
H <sub>4</sub>	RACAP1 (trans*operations)	0.904	18.942	0.000		
	RACAP2 (trans*market)	0.206	8.871	0.000		
H <sub>5</sub>	PACAP1*RACAP1	0.840	7.899	0.000		
	PACAP1*RACAP2	-0.754	-9.377	0.000		
	PACAP2*RACAP1	-0.911	-10.834	0.000		
	PACAP2*RACAP2	1.621	31.394	0.000		
	PACAP3*RACAP1	-0.617	-10.353	0.000		
	PACAP3*RACAP2	-0.806	-14.799	0.000		

Note: \* Join effect of the variables.

With respect to H5, market-oriented operating routines become important when the source of technological knowledge comes from the group companies (PACAP2\*RACAP2). This relationship would support the need to improve knowledge further away from the market. With the rest of the sources, the exploitation routines that allow a closer approach to the market are counterproductive (PACAP1\*RACAP2 and PACAP3\*RACAP2).

For this type of incremental innovation, the efforts made in RACAP do not translate into a greater impact, except when the previous processes of accumulation have been carried out through intra-group relationships (PACAP2), which require the development of market learning routines (RACAP2). When complex and specific knowledge is acquired through cooperation agreements (PACAP1) requires knowledge assimilation systems, but also storage and easy recovery (RACAP1). In the other cases, RACAP does not allow the economic impact of incremental innovations to be improved; on the contrary, it assumes costs that do not lead to more competitive incremental innovations. Based on these results, we conclude that the Hypothesis 3 should not be rejected, since although not always in the expected direction, a significant moderating effect is observed. Future research will include further analysis on these intriguing results.

## 5. Discussion and Conclusions

The relationship between continuous improvement strategies and innovation has been established in previous articles [39,114]. By highlighting incremental and radical innovation as interrelated, mutually enabling and overlapping strategies in space and time, the development and cultivation of both would enable organizations to jointly retain some of the benefits of bureaucracy and lawlessness [15], encouraging renewal while limiting the high risk of engaging only in disruptive innovation. Combining the strategic management literature on incremental versus radical innovation and its relationship with the capacity to absorb external knowledge, our study also allows us to extract implications from a practical perspective.

### 5.1. Theoretical Contribution

The effect of the absorptive capacity of external knowledge and innovative performance has been widely studied in the literature [13,25]. This starting situation has guided the design of our analysis model, so that we have presented a proposal for a multidimensional measurement of the construct potential absorptive capacity (PACAP) and carried out absorptive capacity (RACAP), as well as a detailed analysis of each of its routines or phases; likewise, the individual and joint effects they have on the number of results related to the incremental innovation of companies in the Spanish manufacturing sector have been discussed. Measuring the economic impact of innovation is a complex task [115]. The purpose of the variable "impact of incremental innovation on turnover" is to determine the direct impact that the activities of this innovation have on organizational performance, which could not be achieved by taking account of the economic figures considered independently.

The consideration of both individual and joint effects and their evolution as effects are incorporated into successive study models constitute the main contributions of the work from both an academic and practical point of view. In addition, the study of the moderating role of PACAP in the functioning of potential absorption is a departure from the traditional consideration of a sequential development of the phases of absorption capacity [29]. Underlying the figures and results presented is the need to guide organizations on how to transform "great ideas" into useful and, therefore, market-recognized products and services.

### 5.2. Practical Contribution

According to previous papers [116], the results show that relationships are different considering the diverse sources of knowledge. It is important to highlight the confirmation of a greater positive effect of the purchase of technology in the markets, as a source of external knowledge with respect to obtaining incremental innovations with greater economic impact. The same applies to assimilation and transformation routines, if they are studied independently. Our results are consistent with previous studies, considering that this knowledge is closer to market desires [7] and at a lower cost than other sources [10], which contributes to the commercial success of new products and, consequently, to the profitability of incremental innovation [12,18]. In addition, the results also support the use of cooperation as a source of knowledge, in line with recent work supporting the positive relationship between more tacit knowledge and incremental innovation [67]. Knowledge that is more complex will make it possible to enrich the process of incremental innovation in such a way that the product or service resulting from this process is valued by the market as truly "novel" [117].

On the other hand, the exploitation dimension does not present the positive effect expected according to the majority current literature [45], perhaps because less complex external knowledge as a source requires less need to modify the routines for its incorporation into new processes or products. Moreover, the increased importance of transparent technological knowledge purchased on the markets, limit the need to acquire additional market information.

In the study of joint effects, the analysis of the relationships related to potential or actual absorption not only allows us to understand the functioning of the routines that make up each typology

(PACAP-RACAP). This analysis also proposes the study of the possible moderating role that the capacity played in the relationship between the potential capacity and the analyzed result, as well as the nuance that the incorporation of these joint relationships has on the results of the previously analyzed individual dimensions.

The study of these joint relationships allows us to design not only the most recommendable combinations of tools and routines between the different phases, but also those to avoid, which represents a notable contribution to the academic literature.

The most unexpected results are related to the absorption capacity traditionally associated with incremental innovations [13]. The absorptive capacity should consider the combination of routines to be developed between the transformation and exploitation dimensions, as well as the sources of knowledge used. In other words, investing in RACAP would be counterproductive unless we are completing knowledge that comes from group companies with an exploitation that provides valuable information that customers need and want, overcoming certain organizational inertia. On the other hand, when working with the most complex and/or distant external knowledge from our organizational memory, it is necessary to carry out an adequate assimilation of it by trained personnel, equipped with the appropriate and motivated tools and, subsequently, to be properly stored and made available to the worker for its application to the operative process.

### 5.3. Limitation and Future Recommendation

The limitations of this study are mainly related to some aspects of its methodological design. Although it is a database widely used by researchers in their studies on innovation, the lack of some more internal development variables in the dimensions of absorption capacity has not made it possible to refute certain theoretical aspects. For this reason, we propose that the study should be replicated with primary information that allows us to delve into the behavior of the company and with companies from other contexts (geographical and industrial) as priority lines of research.

For the future, we can apply new measures in the assimilation and transformation dimensions. On the assimilation dimension, we can incorporate different measures related to human resource routines that encourage assimilation, for example, using communities of practice. In addition, the existence of other mechanisms that allow a distinction between technological and social systems in the area of knowledge transformation routines would enrich the present research. We can also use other facilitators to access integration and distribution. In addition, incorporating other sources of knowledge that can also have a significant impact on incremental innovations such as cooperation with customers or suppliers [18].

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Appendix A

Table A1. Correlation matrix.

		1	2	3	4	5	6	7	8	9	10	11
1. Size	Pearson Correlation	1										
	Sig. (bilateral)											
	N	9612										
2. Age	Pearson Correlation	-0.111 **	1									
	Sig. (bilateral)	0.000										
	N	9612	9612									
3. Sector	Pearson Correlation	0.084 **	-0.016	1								
	Sig. (bilateral)	0.000	0.120									
	N	9612	9612	9612								
4. Cooperation	Pearson Correlation	0.061 **	-0.019	0.006	1							
	Sig. (bilateral)	0.000	0.115	0.599								
	N	9612	9612	9612	9612							
5. Group	Pearson Correlation	0.101 **	-0.022 *	0.016	0.030 **	1						
	Sig. (bilateral)	0.000	0.030	0.100	0.010							
	N	9612	9612	9612	9612	9612						
6. Buy	Pearson Correlation	0.126 **	-0.031 **	0.014	0.071 **	0.098 **	1					
	Sig. (bilateral)	0.000	0.003	0.147	0.000	0.000						
	N	9612	9612	9612	9612	9612	9612					
7. Assimilation	Pearson Correlation	0.120 **	-0.032 **	-0.025 **	0.153 **	0.098 **	0.210 **	1				
	Sig. (bilateral)	0.000	0.002	0.004	0.000	0.000	0.000					
	N	9612	9612	9612	9612	9612	9612	9612				
8. Transformation	Pearson Correlation	0.170 **	-0.040 **	0.031 **	0.046 **	0.632 **	0.196 **	0.141 **	1			
	Sig. (bilateral)	0.000	0.000	0.001	0.000	0.000	0.000	0.000				
	N	9612	9612	9612	9612	9612	9612	9612	9612			
9. Exploitation operations	Pearson Correlation	0.103 **	-0.074 **	-0.076 **	0.158 **	0.107 **	0.118 **	0.276 **	0.129 **	1		
	Sig. (bilateral)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
	N	9612	9612	9612	9612	9612	9612	9612	9612	9612		
10. Exploitation market	Pearson Correlation	0.157 **	-0.017	0.048 **	0.033 **	0.068 **	0.324 **	0.056 **	0.121 **	0.000	1	
	Sig. (bilateral)	0.000	0.101	0.000	0.003	0.000	0.000	0.000	0.000	1000		
	N	9612	9612	9612	9612	9612	9612	9612	9612	9612	9612	
11. Economic impact of incremental innovation	Pearson Correlation	0.278 **	-0.063 **	0.020	0.044 **	0.094 **	0.174 **	0.105 **	0.212 **	0.082 **	0.084 **	1
	Sig. (bilateral)	0.000	0.000	0.054	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	9612	9612	9612	9612	9612	9612	9612	9612	9612	9612	9612

Note: \*\*. Correlation is significant at 0.01 level (2 tales). \*. Correlation is significant at 0.05 level (two tails).

## References

1. Varadarajan, R. Fortune at the bottom of the innovation pyramid: The strategic logic of incremental innovations. *Bus. Horiz.* **2009**, *52*, 21–29. [[CrossRef](#)]
2. OECD. *Manual de Oslo: Directrices Para La Recogida e Interpretación de Información Relativa a Innovación*, 3rd ed.; Dirección General de Universidades e Investigación: Madrid, Spain, 2005.
3. Marín-García, J.A.; Pardo del Val, M.; Bonavía Martín, T. La mejora continua como innovación incremental: El caso de una empresa industrial española. *Econ. Ind.* **2008**, *368*, 155–169.
4. Lu, T.-T.; Chen, J. Incremental or radical? A study of organizational innovation: An artificial world approach. *Expert Syst. Appl.* **2010**, *37*, 8193–8200. [[CrossRef](#)]
5. Ahuja, G.; Lampert, C. Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. *Strat. Manag. J.* **2001**, *22*, 521–543. [[CrossRef](#)]
6. Baumol, W.J. *Education for Innovation: Entrepreneurial Breakthroughs vs. Corporate Incremental Improvements*; National Bureau of Economic Research: Cambridge, MA, USA, 2004; p. 10578.
7. Sheng, M.L.; Chien, I. Rethinking organizational learning orientation on radical and incremental innovation in high-tech firms. *J. Bus. Res.* **2016**, *69*, 2302–2308. [[CrossRef](#)]
8. Forés, B.; Camisón, C. Does incremental and radical innovation performance depend on different types of knowledge accumulation capabilities and organizational size? *J. Bus. Res.* **2016**, *69*, 831–848. [[CrossRef](#)]
9. Globerman, S.; Lybecker, K.M. The benefits of incremental innovation: Focus on pharmaceutical industry. In *The Benefits of Incremental Innovation: Focus on the Pharmaceutical Industry*; Globerman, S., Lybecker, K.M., Eds.; Fraser Institute: Vancouver, BC, Canada, 2014.
10. Beck, M.; Lopes-Bento, C.; Schenker-Wicki, A. Radical or incremental: Where does R&D policy hit? *Res. Policy* **2016**, *45*, 869–883.
11. Leifer, R.; McDermott, C.M.; O'Connor, G.C.; Peters, L.S.; Rice, M.P.; Veryzer, R. *Radical Innovation: How Mature Companies Can Outsmart Upstarts*; Harvard Business Press: Boston, MA, USA, 2000.
12. Banbury, C.M.; Mitchell, W. The effect of introducing important incremental innovations on market share and business survival. *Strat. Manag. J.* **1995**, *16*, 161–182. [[CrossRef](#)]
13. Chen, Y.-S.; Chang, C.-H.; Lin, Y.-H. The Determinants of Green Radical and Incremental Innovation Performance: Green Shared Vision, Green Absorptive Capacity, and Green Organizational Ambidexterity. *Sustainability* **2014**, *6*, 7787–7806. [[CrossRef](#)]
14. Guisado-González, M.; Vila-Alonso, M.; Guisado-Tato, M. Radical innovation, incremental innovation and training: Analysis of complementarity. *Technol. Soc.* **2016**, *44*, 48–54. [[CrossRef](#)]
15. Farjoun, M. Beyond dualism: Stability and change as a duality. *Acad. Manag. Rev.* **2010**, *35*, 202–225.
16. Pisano, G.P. In defense of routine innovation. *Innovation & Entrepreneurship. Harvard Business Review*. 20 June 2014. Available online: <https://hbr.org/2014/06/in-defense-of-routine-innovation> (accessed on 20 May 2018).
17. Henderson, R. Underinvestment and incompetence as responses to radical innovation: Evidence from the Photolithographic Alignment Equipment Industry. *Rand J. Econ.* **1993**, *24*, 248–270. [[CrossRef](#)]
18. Sánchez-González, G.; Herrera, L. Effects of customer cooperation on knowledge generation activities and innovation results of firms. *BRQ Bus. Res. Q.* **2014**, *17*, 292–302. [[CrossRef](#)]
19. Chapman, R.L.; Hyland, P.W. Continuous improvement strategies across selected Australian manufacturing sectors. *Benchmarking Qual. Manag. Technol.* **1997**, *4*, 175–188. [[CrossRef](#)]
20. Terziowski, M.; Sohal, A.S. The adoption of continuous improvement and innovation strategies in Australian manufacturing firms. *Technovation* **2000**, *20*, 539–550. [[CrossRef](#)]
21. Carpinetti, L.C.R.; Martins, R.A. Continuous improvement strategies and production competitive criteria: Some findings in Brazilian industries. *Total Qual. Manag.* **2001**, *12*, 281–291. [[CrossRef](#)]
22. Treacy, M. Innovation as a last resort. *Harv. Bus. Rev.* **2004**, *82*, 29–30.
23. Corso, M.; Muffatto, M.; Verganti, R. Reusability and multi-project policies: A comparison of approaches in the automotive, motorcycle and earthmoving machinery industries. *Robot Comput. Integr. Manuf. J.* **1999**, *15*, 155–165. [[CrossRef](#)]
24. Enkel, E.; Heil, S. Preparing for distant collaboration: Antecedents to potential absorptive capacity in cross-industry innovation. *Technovation* **2014**, *34*, 242–260. [[CrossRef](#)]

25. Leal-Rodríguez, A.L.; Ariza-Montes, J.A.; Roldan, J.L.; Leal-Millán, A.G. Absorptive capacity, innovation and cultural barriers: A conditional mediation model. *J. Bus. Res.* **2014**, *67*, 763–768. [CrossRef]
26. Avalos-Quispe, G.A.; Hernández-Simón, L.M. Open Innovation in SMEs: Potential and Realized Absorptive Capacity for Interorganizational Learning in Dyad Collaborations with Academia. *J. Open Innov. Technol. Mark. Complex.* **2019**, *5*, 72. [CrossRef]
27. Tushman, M.L.; O'Reilly, C.A., III. The ambidextrous organization: Managing evolutionary and revolutionary change. *Calif. Manag. Rev.* **1996**, *38*, 1–23.
28. Zahra, S.A.; George, G. Absorptive capacity: A review, reconceptualization, and extension. *Acad. Manag. Rev.* **2002**, *27*, 185–203. [CrossRef]
29. Jansen, J.J.P.; Van Den Bosch, F.A.J.; Volberda, H.W. Managing potential and realized absorptive capacity: How do organizational antecedents matter? *Acad. Manag. J.* **2005**, *48*, 999–1015. [CrossRef]
30. Derbyshire, J. The impact of ambidexterity on enterprise performance: Evidence from 15 countries and 14 sectors. *Technovation* **2014**, *34*, 574–581. [CrossRef]
31. Chang, Y.-Y.; Hughes, M.; Hotho, S. Internal and external antecedents of SMEs' innovation ambidexterity outcomes. *Manag. Decis.* **2011**, *49*, 1658–1676. [CrossRef]
32. Sorte, W.F., Jr. Standardisation for incremental innovation: A case study in the Brazilian automobile industry. *Int. J. Lean Enterp. Res.* **2014**, *1*, 81–93.
33. Laursen, K.; Salter, A.J. Open for Innovation: The role of openness in explaining innovative performance among U.K. manufacturing firms. *Strat. Manag. J.* **2006**, *27*, 131–150. [CrossRef]
34. Lin, B.W.; Wu, C.H. How does knowledge depth moderate the performance of internal and external knowledge sourcing strategies? *Technovation* **2010**, *30*, 582–589. [CrossRef]
35. Kanter, R.M. Innovation: The classic traps. *Harv. Bus. Rev.* **2006**, *84*, 73–83.
36. Brockman, B.K.; Morgan, R.M. The moderating effect of organizational cohesiveness in knowledge use and new product development. *J. Acad. Mark. Sci.* **2006**, *34*, 295–307. [CrossRef]
37. Toner, P. *Workforce Skills and Innovation: An Overview of Major Themes in the Literature*; OECD Publishing: Paris, France, 2011; Available online: <https://www.oecd.org/innovation/inno/46970941.pdf> (accessed on 15 September 2018).
38. Rosenberg, N. *Exploring the Black Box: Technology and Economics*; Cambridge University Press: Cambridge, UK, 1994.
39. Medne, A.; Lapina, I. Sustainability and Continuous Improvement of Organization: Review of Process-Oriented Performance Indicators. *J. Open Innov. Technol. Mark. Complex.* **2019**, *5*, 49. [CrossRef]
40. Kim, J.; Choi, S.O. A Comparative Analysis of Corporate R&D Capability and Innovation: Focused on the Korean Manufacturing Industry. *J. Open Innov. Technol. Mark. Complex.* **2020**, *6*, 100.
41. Jeong, H.; Shin, K.; Kim, E.; Kim, S. Does Open Innovation Enhance a Large Firm's Financial Sustainability? A Case of the Korean Food Industry. *J. Open Innov. Technol. Mark. Complex.* **2020**, *6*, 101. [CrossRef]
42. Zollo, M.; Winter, S. Deliberate learning and the evolution of dynamic capabilities. *Organ. Sci.* **2002**, *13*, 339–351. [CrossRef]
43. Fang, E. Customer participation and the trade-off between new product innovativeness and speed to market. *J. Mark.* **2008**, *72*, 90–104. [CrossRef]
44. Cepeda-Carrión, G.; Cegarra-Navarro, J.G.; Jiménez-Jiménez, D. The Effect of absorptive capacity on innovativeness: Context and information systems capability as catalysts. *Br. J. Manag.* **2012**, *23*, 110–129. [CrossRef]
45. Benner, M.J.; Tushman, M.L. Exploitation, exploration, and process management: The productivity dilemma revisited. *Acad. Manag. Rev.* **2003**, *28*, 238–256. [CrossRef]
46. Schildt, H.; Keil, T.; Maula, M. The temporal effects of relative and firm-level absorptive capacity on interorganizational learning. *Strat. Manag. J.* **2012**, *33*, 1154–1173. [CrossRef]
47. Minbaeva, D.; Pedersen, T.; Bjorkman, I.; Fey, C.F.; Park, H.J. MNC knowledge transfer, subsidiary absorptive capacity, and HRM. *J. Int. Bus. Stud.* **2003**, *34*, 586–599. [CrossRef]
48. Volberda, H.W.; Foss, N.J.; Lyles, M.A. Absorbing the concept of absorptive capacity: How to realize its potential in the organization field. *Organ. Sci.* **2010**, *21*, 931–951. [CrossRef]
49. Kianto, A.; Sáenz, J.; Aramburu, N. Knowledge-based human resource management practices, intellectual capital and innovation. *J. Bus. Res.* **2017**, *81*, 11–20. [CrossRef]
50. Caloghirou, Y.; Kastelli, I.; Tscanikas, A. Internal capabilities and external knowledge sources: Complements or substitutes for innovative performance? *Technovation* **2004**, *24*, 29–39. [CrossRef]

51. Arbussa, A.; Coenders, G. Innovation activities, use of appropriation instruments and absorptive capacity: Evidence from Spanish firms. *Res. Policy* **2007**, *36*, 1545–1558. [[CrossRef](#)]
52. Hohberger, J.; Almeida, P.; Parada, P. The direction of firm innovation: The contrasting roles of strategic alliances and individual scientific collaborations. *Res. Policy* **2015**, *44*, 1473–1487. [[CrossRef](#)]
53. Cohen, W.M.; Levinthal, D.A. Absorptive capacity: A new perspective on learning and innovation. *Adm. Sci. Q.* **1990**, *35*, 128–152. [[CrossRef](#)]
54. Wernerfelt, B. A resource-based view of the firm. *Strat. Manag. J.* **1984**, *5*, 171–180. [[CrossRef](#)]
55. Chiang, Y.-H.; Hung, K.-P. Exploring open search strategies and perceived innovation performance from the perspective of inter-organizational knowledge flows. *RD Manag.* **2010**, *40*, 292–299. [[CrossRef](#)]
56. Laursen, K.; Salter, A.J. The paradox of openness: Appropriability, external search and collaboration. *Res. Policy* **2014**, *43*, 867–878. [[CrossRef](#)]
57. Garcia Martinez, M.; Zouaghi, F.; Sánchez, M. Capturing value from alliance portfolio diversity: The mediating role of R&D human capital in high and low tech industries. *Technovation* **2017**, *59*, 55–67.
58. Capaldo, A. Network structure and innovation: The leveraging of a dual network as a distinctive relational capability. *Strat. Manag. J.* **2007**, *28*, 585–608. [[CrossRef](#)]
59. George, G.; Zahra, S.A.; Wheatley, K.K.; Khan, R. The effects of alliance portfolio characteristics and absorptive capacity on performance. A study of biotechnology firms. *J. High Technol. Manag. Res.* **2001**, *12*, 205–226. [[CrossRef](#)]
60. Nooteboom, B.; Van Haverbeke, W.; Duysters, G.; Gilsing, V.; van den Oord, A. Optimal cognitive distance and absorptive capacity. *Res. Policy* **2007**, *36*, 1016–1034. [[CrossRef](#)]
61. Jin, K.; Park, C.; Lee, J. What Determines Innovative Performance of International Joint Ventures? Assessing the Effects of Foreign Managerial Control. *Sustainability* **2020**, *12*, 8770. [[CrossRef](#)]
62. Soosay, C.; Hyland, P.; Ferrer, M. Supply chain collaboration: Capabilities for continuous innovation. *Supply Chain Manag.* **2008**, *13*, 160–169. [[CrossRef](#)]
63. Yeoh, P.; Roth, K. An empirical analysis of sustained advantage in the U.S. pharmaceutical industry: Impact of firm resources and capabilities. *Strat. Manag. J.* **1999**, *20*, 637–653. [[CrossRef](#)]
64. Matusik, S.F. An empirical investigation of firm public and private knowledge. *Strat. Manag. J.* **2002**, *23*, 457–467. [[CrossRef](#)]
65. García-Villaverde, P.M.; Elche, D.; Martínez-Pérez, Á. Understanding pioneering orientation in tourism clusters: Market dynamism and social capital. *Tour. Manag.* **2020**, *76*, 103966.
66. Zhou, K.Z.; Li, C.B. How knowledge affects radical innovation: Knowledge base, market knowledge acquisition, and internal knowledge sharing. *Strat. Manag. J.* **2012**, *33*, 1090–1102. [[CrossRef](#)]
67. Okuyama, R. Importance of tacit knowledge in incremental innovation. Implications from drug discovery cases. *J. Strat. Manag.* **2017**, *10*, 118–130. [[CrossRef](#)]
68. Tripsas, M.; Gavetti, G. Capabilities cognition and inertia: Evidence from digital imaging. *Strat. Manag. J.* **2000**, *21*, 1147–1161. [[CrossRef](#)]
69. Doran, J.; Ryan, G. Firms' skills as drivers of radical and incremental innovation. *Econ. Lett.* **2014**, *125*, 107–109. [[CrossRef](#)]
70. Rupiotta, C.; Backes-Gellner, U. Combining knowledge stock and knowledge flow to generate superior incremental innovation performance: Evidence from Swiss manufacturing. *J. Bus. Res.* **2019**, *94*, 209–222. [[CrossRef](#)]
71. Blumberg, M.; Pringle, G. The missing opportunity in organizational research: Some implications for a theory of work performance. *Acad. Manag. Rev.* **1982**, *7*, 560–569. [[CrossRef](#)]
72. Chang, Y.; Gong, Y.; Peng, M. Expatriate knowledge transfer, subsidiary absorptive capacity, and subsidiary performance. *Acad. Manag. J.* **2012**, *55*, 927–948. [[CrossRef](#)]
73. Agarwal, R.; Shah, S. Knowledge sources of entrepreneurship: Firm formation by academic, user and employee innovators. *Res. Policy* **2014**, *43*, 1109–1133. [[CrossRef](#)]
74. Stringer, R. How to manage radical innovation. *Calif. Manag. Rev.* **2000**, *42*, 70–88. [[CrossRef](#)]
75. Noblet, J.-P.; Simon, E.; Parent, R. Absorptive capacity: A proposed operationalization. *Knowl. Manag. Res. Pract.* **2011**, *9*, 367–377. [[CrossRef](#)]
76. Cross, R.; Baird, L. Technology is not enough: Improving performance by building organizational memory. *Sloan Manag. Rev.* **2000**, *41*, 69–78.

77. Kale, P.; Singh, H. Building firm capabilities through learning: The role of the alliance learning process in alliance capability and firm-level alliance success. *Strat. Manag. J.* **2007**, *28*, 981–1000. [[CrossRef](#)]
78. Huang, J.-J. Organizational knowledge, learning and memory—a perspective of an immune system. *Knowl. Manag. Res. Pract.* **2013**, *11*, 230–240. [[CrossRef](#)]
79. Stein, E.W. Organizational memory: Review of concepts and recommendations for management. *Int. J. Inf. Manag.* **1995**, *15*, 17–32. [[CrossRef](#)]
80. Lauring, J.; Selmer, J. Diversity attitudes and group knowledge processing in multicultural organizations. *Eur. Manag. J.* **2013**, *31*, 124–136. [[CrossRef](#)]
81. Camisón, C.; Forés, B. Knowledge absorptive capacity: New insights for its conceptualization and measurement. *J. Bus. Res.* **2010**, *63*, 707–715. [[CrossRef](#)]
82. Tajudeen, F.P.; Jaafar, N.I.; Sulaiman, A. External Technology Acquisition and External Technology Exploitation: The Difference of Open Innovation Effects. *J. Open Innov. Technol. Mark. Complex.* **2019**, *5*, 97. [[CrossRef](#)]
83. Steward, G.; Osei-Beyson, K.-M. Exploration of factors that impact voluntary contribution to electronic knowledge repositories in organizational settings. *Knowl. Manag. Res. Pract.* **2013**, *11*, 288–312. [[CrossRef](#)]
84. Spithoven, A.; Clarysse, B.; Knockaert, M. Building absorptive capacity to organize inbound open innovation in traditional industries. *Technovation* **2011**, *31*, 10–21. [[CrossRef](#)]
85. Sharma, S.; Goyal, D.P.; Mittal, R.K. Data mining research for customer relationship management systems: A framework and analysis. *Int. J. Bus. Inf. Syst.* **2008**, *3*, 549–565. [[CrossRef](#)]
86. Huang, T.C.K.; Wu, L.; Chou, C.C. Investigating use continuance of data mining tools. *Int. J. Inf. Manag.* **2013**, *33*, 791–801. [[CrossRef](#)]
87. Tejero, A.; León, G. Plataformas cognitivas de inteligencia tecnológica como herramienta de apoyo a la inteligencia competitiva de las PYMEs de base tecnológica. *Econ. Ind.* **2017**, *406*, 123–136.
88. Wu, J. Cooperation with competitors and product innovation: Moderating effects of technological capability and alliances with universities. *Ind. Mark. Manag.* **2014**, *43*, 199–209. [[CrossRef](#)]
89. Menor, L.J.; Roth, A. New service development competence in retail banking: Construct development and measurement validation. *J. Oper. Manag.* **2007**, *25*, 825–846. [[CrossRef](#)]
90. Dibrell, C.; Davis, P.S.; Craig, J. Fueling innovation through information technology in SMEs. *J. Small Bus. Manag.* **2008**, *46*, 203–218. [[CrossRef](#)]
91. Lane, P.J.; Lubatkin, M. Relative absorptive capacity and interorganizational learning. *Strat. Manag. J.* **1998**, *19*, 461–477. [[CrossRef](#)]
92. Thomas, R.; Wood, E. Innovation in tourism: Re-conceptualising and measuring the absorptive capacity of the hotel sector. *Tour. Manag.* **2014**, *45*, 39–48. [[CrossRef](#)]
93. Robertson, P.L.; Casali, G.L.; Jacobson, D. Managing open incremental process innovation: Absorptive Capacity and distributed learning. *Res. Policy* **2012**, *41*, 822–832. [[CrossRef](#)]
94. Eisenhardt, K.; Martin, J. Dynamic capabilities: What are they? *Strat. Manag. J.* **2000**, *21*, 1105–1121. [[CrossRef](#)]
95. Sorensen, J.B.; Stuart, T.E. Aging, obsolescence, and organizational innovation. *Adm. Sci. Q.* **2000**, *45*, 81–112. [[CrossRef](#)]
96. Nieto, M.; Quevedo, P. Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort. *Technovation* **2005**, *25*, 1141–1157. [[CrossRef](#)]
97. Chang, W.; Park, J.E.; Chairy, S. How does CRM technology transform into organizational performance? A mediating role of marketing capability. *J. Bus. Res.* **2010**, *63*, 849–855. [[CrossRef](#)]
98. Tu, Q.; Vonderembse, M.A.; Ragu-Nathan, T.S.; Sharkey, T.W. Absorptive capacity: Enhancing the assimilation of time-based manufacturing practices. *J. Oper. Manag.* **2006**, *24*, 692–710. [[CrossRef](#)]
99. Patel, P.C.; Terjesen, S.; Li, D. Enhancing effects of manufacturing flexibility through operational absorptive capacity and operational ambidexterity. *J. Oper. Manag.* **2012**, *30*, 201–220. [[CrossRef](#)]
100. Wu, J.; Guo, B.; Yongjiang, S. Customer knowledge management and IT enabled business model innovation: A conceptual framework and a case study from China. *Eur. Manag. J.* **2013**, *31*, 359–372. [[CrossRef](#)]
101. Li, Y.; Cui, V.; Liu, H. Dyadic specific investments, absorptive capacity, and manufacturers' market knowledge acquisition: Evidence from manufacturer–distributor dyads. *J. Bus. Res.* **2017**, *78*, 323–331. [[CrossRef](#)]

102. Kotabe, M.; Jiang, C.X.; Murray, J.Y. Managerial ties, knowledge acquisition, realized absorptive capacity and new product market performance of emerging multinational companies: A case of China. *J. World Bus.* **2011**, *46*, 166–176. [[CrossRef](#)]
103. McCarthy, I.P.; Gordon, B.R. Achieving contextual ambidexterity in R&D organizations: A management control system approach. *RD Manag.* **2011**, *41*, 240–258.
104. Cronbach, L.J.; Meehl, P.E. Construct validity in psychological test. *Psychol. Bull.* **1995**, *52*, 218–302.
105. Archibugi, D.; Filippetti, A.; Frenz, M. Economic crisis and innovation: Is destruction prevailing over accumulation? *Res. Policy* **2013**, *42*, 303–314. [[CrossRef](#)]
106. Hurmelinna-Laukkanen, P. Constituents and outcomes of absorptive capacity–appropriability regime changing the game. *Manag. Decis.* **2012**, *50*, 1178–1199. [[CrossRef](#)]
107. Echevarría, J. Sociedad abierta del conocimiento. *Argum. Razón Técnica* **2007**, *10*, 69–88.
108. Dollan, C.V. Factor analysis of variables with 2,3,4 and 7 response categories: A comparison of categorical variables estimators using simulated data. *Br. J. Math. Stat. Psychol.* **1994**, *47*, 309–326. [[CrossRef](#)]
109. Holgado-Tello, F.P.; Chacón-Moscoso, S.; Barbero-García, I.; Vila-Abad, E. Polychoric versus Pearson correlations in exploratory and confirmatory factor analysis of ordinal variables. *Qual. Quant.* **2010**, *44*, 153–166.
110. Herath, H.M.A.; Mahmood, R. Strategic orientations and SME performance: Moderating effect of absorptive capacity of the firm. *Asian Soc. Sci.* **2014**, *10*, 95–107.
111. Brettel, M.; Greve, G.I.; Flatten, T.C. Giving up linearity: Absorptive capacity and performance. *J. Manag. Issues* **2011**, *2*, 164–189.
112. Lin, C.; Wu, Y.J.; Chang, C.; Wang, W.; Lee, C.Y. The alliance innovation performance of R&D alliances—the absorptive capacity perspective. *Technovation* **2012**, *32*, 282–292.
113. Rothaermel, F.T.; Alexandre, M.T. Ambidexterity in technology sourcing: The moderating role of absorptive capacity. *Organ. Sci.* **2009**, *20*, 759–780. [[CrossRef](#)]
114. Bârsan Raluca, M.; Kifor, S. Continuous improvement challenges: Implementing PBL in one university in Romania. *Stud. Bus. Econ.* **2020**, *15*, 18–27.
115. Romero García de Paredes, M.J. El impacto Económico de la Innovación en las Empresas Andaluzas. Ph.D. Thesis, Universidad de Sevilla, Sevilla, Spain, 2012.
116. Wyszowska-Kuna, J. Internal and External Sources of Knowledge in Manufacturing and Service Enterprises A Comparative Analysis of European Union Countries. *Comp. Econ. Res.* **2020**, *23*, 21–39. [[CrossRef](#)]
117. Johannessen, J.A.; Olsen, B.; Lumpkin, G.T. Innovation as newness: What is new, how new, and new to whom? *Eur. J. Innov. Manag.* **2001**, *4*, 20–31. [[CrossRef](#)]

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