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Influence of Technological Assets on Organizational Performance through Absorptive Capacity, Organizational Innovation and Internal Labour Flexibility

Encarnación García-Sánchez ^{1,*} , Víctor J. García-Morales ²  and Rodrigo Martín-Rojas ²

¹ Department of Management, Faculty of Education, Economics and Technology, University of Granada, 51001 Ceuta, Spain

² Department of Management, Faculty of Economic and Business Sciences, University of Granada, 18071 Granada, Spain; victorj@ugr.es (V.J.G.-M.); rodrigomr@ugr.es (R.M.-R.)

* Correspondence: encags@ugr.es; Tel.: +34-958-244-268

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Abstract: Organizational innovation is increasingly mandatory for firms to overcome their competitors. Organizational innovation is especially relevant in today's dynamic and turbulent environments, where other internal variables—such as technological assets, employee training, coordination of new management capabilities, and new flexible human resources and more adaptable organizational designs—must be encouraged to create value and competitive advantage. The purpose of our research is to analyse whether technological assets influence absorptive capacity (potential and realized absorptive capacity) and how absorptive capacity influences internal labour flexibility, organizational innovation and performance. We achieve these goals by analysing the interrelations among internal labour flexibility, organizational innovation and performance, using the theory of resources and capabilities. A quantitative study was carried out with data gathered by personal interview using a structured questionnaire. Relationships proposed in the theoretical model were estimated through a structural equation model, using a sample of 160 European technology companies. The results show that support for technology and improvement of technological skills and technological distinctive competencies promote improvement in organizational performance through their positive influence on the processes of potential and realized absorption capacity. Potential absorptive capacity influences realized absorptive capacity, which impacts not only internal labour flexibility but also organizational innovation and organizational performance. Further, internal labour flexibility influences organizational performance through organizational innovation. This issue is of particular interest when considering the dynamic nature of turbulent technological environments in which the organization operates. Technological assets thus identify new sources of flexibility and organizational innovation based on deeper contextual knowledge and tools that aid knowledge capacity in the company.

Keywords: top management support; technological skills; technological distinctive competencies; absorptive capacity; internal labour flexibility; organizational innovation

1. Introduction

Organizations make strategic decisions in competitive global environments in which development of technology and technological processes is important to maintaining levels of competitiveness [1]. One of the most important strategic decisions facing management in today's globally competitive environment involves technology development [1]. The greater the firm's technology capabilities,

the more quickly the firm will acquire technology [2] and exploit other complementary assets important to providing firms with the high levels of internal variety needed to fundamentally reshape traditional business strategy [3].

Specifically, the company must have distinctive technological assets to face the dynamism of today's knowledgeable society [4]. Technology is thus a strategic mechanism that improves cooperation, communication, and exchange of information and knowledge through the presence and proper use of tools or assets that encourage knowledge and information to flow more rapidly and spread more easily throughout the organization. This study will analyse the importance of the technological assets indicated above to contribute to the literature on technological knowledge [5].

Technological assets increasingly encourage absorptive capacity in firms to enable organizations to achieve higher objectives by themselves through organizational learning processes [6,7]. In addition, the knowledge achieved by the company thanks to more developed absorptive capacity promotes efficient software products that support knowledge integration among people and processes within the company and enable more flexibility and better adaptation of its organizational structure, enhancing organizational innovation throughout the organization to increase organizational performance.

Bearing the importance of the topic and the problem companies currently face in mind, the research gaps we aim to fill are as follows: (i) Identify the impact of specific technological assets on potential and realized absorptive capacity [6], which enable the firm to increase the number of employees knowledgeable in both technology and fields of learning. (ii) Identify requirements in policies and strategies that help to promote potential and realized absorptive capacity as mechanisms for improving the organization's performance [2,8,9] and clarifying the relationship between these two concepts [10]. We thereby seek to demonstrate that acquiring more knowledge in the firm (from both external and internal sources) leads to better strategic and financial results, while also enhancing the internal acquisition, processing and dissemination of the knowledge acquired. (iii) Identify the internal mechanisms used by flexible companies to organize ideas in a collaborative environment, as well as priorities, and facilitating conflict resolution [11]; our paper aims to fill this gap by showing that a firm with greater flexibility and better-enabled communication will achieve more efficient decision-making processes. (iv) Determine how to take advantage of this flexibility within the company and to strengthen potential and realized absorptive capacity to obtain organizational innovation throughout the organization [9,12–16]. Such exploitation involves enabling organizational innovation throughout the firm by increasing flexible organizational design and the number of more knowledgeable individuals. This analysis advances knowledge on the previous research, which has not studied these relationships so directly [10,11]. (v) Deepen understanding of the indirect effect of core technological assets on organizational performance [5,7,17] through knowledge acquired and a flexible environment in which employees in the company and technology-based innovations throughout the organization can adapt easily to each other [16,18]. In tackling this last gap, we aim to shed light on the need of the firm's members to adapt to technology, especially to technological assets that will enable better performance through innovative types of flexibility in organizational design and more effective organizational learning processes.

We chose these from among various technological assets because they have been used in the literature and perform a significant role in accessing information and locating external knowledge sources that enable firms' knowledge [17,19]. It is necessary, however, to relate and analyse these technological assets from a theoretical and empirical perspective, and to analyse their influence on organizational performance through absorptive capacity, internal labour flexibility and organizational innovation:

- A. Top management support for technology (TMS) reflects the development of a work environment that supports knowledge management and information systems. TMS can, in turn, provide the appropriate funds and resources, encourage teams and help teams overcome problems, fostering cross-functional cooperation, knowledge and communication [20].

- B. Technological skills may be understood as one of the “dimensions that distinguishes and provides the knowledge set needed to enable a core capability” [21] (p. 113). This dimension of skills encompasses both firm-specific techniques and scientific understanding. It provides the basis for the firm’s competencies and sustainable competitive advantage in a particular business [22]. In applying this understanding to technological issues [21], our study stresses that technological skills constitute the entire technical system, a system that usually traces its roots to the firm’s first products.
- C. Technological Distinctive Competencies (TDCs) represent “the organization’s expertise in mobilizing various scientific and technical resources through a series of routines and procedures which allow new products and production processes to be developed and designed” [23] (p. 508).

Taking the technological assets selected into account, TDCs may be defined as assets that possess technology as shared value, belief and symbol, as well as the firm’s common base for adaptation, and that are supported by top managers [24,25].

The capacity to absorb external knowledge is becoming a key strategic factor supporting the search for collaborative learning and communication [26]. Our research focuses on absorptive capacity as core topic, since absorptive capacity allows firms to create value and achieve and sustain competitive advantage [27], based not only on the company’s internal knowledge but also on its external knowledge, thereby increasing the company’s worth. Cohen and Levinthal [28] (p. 128) define absorptive capacity as “the ability to recognize the value of new information, to assimilate it, and apply it to commercial ends”. In a 2002 study, Zahra and George [2] analyse and extend the initial concept to refer to absorptive capacity “as a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability” [2] (p. 186). Jimenez et al. [19] extend this study by adding exploitation of knowledge from outside the organization to create value.

This study deepens our understanding of the concept of absorptive capacity which, based on the previous definition, may be a dynamic capability composed of two subsets [2]: potential absorptive capacity and realized absorptive capacity. Potential absorptive capacity indicates the acquisition and assimilation of knowledge; realized absorptive capacity indicates the firm’s capacity to transform and exploit the knowledge assimilated by incorporating it into the firm’s operations [19].

As part of absorptive capacity, both concepts permit injection of new ideas into the organization, enabling it to become more flexible in organizational design; increasing its capacity to understand new ideas, primarily with technological assets as antecedents; and heightening its creativity and ability to spot new opportunities and results [20]. Absorptive capacities thus enable the organization to acquire external knowledge and to assimilate, transform and exploit it effectively, strongly affecting the firm’s capacity to innovate and to adapt to changes in its environment to become or remain competitive [19].

These changes occur because innovation, whether in the form of new ideas or new knowledge, is one of the main sources of competitive advantage, economic growth and employment in the organization. Innovation permits the organization to respond successfully to changes in the environment and the market in which the organization operates, and to develop competitive advantages that are sustainable over time [29]. Innovation has thus been defined as a new idea, method or device; the act of creating a new product, service or process that may improve organizational performance [30]. Recognizing the value of new and external information is essential to increasing knowledge throughout the company—essentially, organizational innovation.

Transformation and exploitation of knowledge are also needed, however. They involve processes of change to generate a more flexible labour structure that enables the organization to expand and promote its capacity to work in a variety of areas, stimulating functions within the company to operate under different circumstances or scenarios [31].

Beltran Martin et al. (p. 1581) [13] argue that labour structure is defined by internal labour flexibility as “a multidimensional concept made up of the following components: (a) intrinsic flexibility; (b) skill malleability; (c) behavioural malleability; and (d) relational flexibility”. Internal labour flexibility refers to the flexibility demonstrated by the organization’s set of human resources at a

specific point in time. Internal labour flexibility is a strategic variable for pliable organizational design and innovation processes, as employees with a wide range of abilities and capacities combined in the right way permit the organization to improve its organizational innovation [23,32].

At the same time, this study analyses the influence of realized absorptive capacity and organizational innovation on organizational performance. In technology sectors, firms are characterized by their highly innovative character, which enables them to respond more rapidly to the changes in the environment and to find the new products and demands present in the market [33]. Organizations that develop both dynamic capabilities to respond to change and realized absorptive capacity foster innovative behaviour that enables them to take advantage of technological advances and improve their organizational performance [2]. Realized absorptive capacity permits the firm to transform and use the new knowledge, incorporating it into the production process along with the organization's existing knowledge, thus encouraging organizational innovation. The greater the use of innovative products, the greater the firm's competitive advantage, the more positive the repercussions for organizational performance, and the more difficult it will be for competitors to respond efficiently [8].

In sum, this paper will demonstrate, first, the influence of technological assets on potential and realized absorptive capacity; and second, the influence of these absorptive capacities on internal labour flexibility, organizational innovation and organizational performance.

The evidence suggests that this article increases understanding of the concept of absorptive capacity, divided into potential and realized absorptive capacity, and of the relationships between them. Due to the limited literature on technology management as it relates to these topics in European technology firms, the article attempts to synthesize the technological antecedents and organizational consequences of these two absorptive capacities for design. The technological antecedents of the paper are thus combined under a new construct name, "technological assets". Finally, another original contribution of this study is to strengthen the literature associating absorptive capacity with organizational performance through flexible organizational design and organizational innovation.

To achieve the objectives presented above, the investigation is structured as follows: Section 2 establishes a foundation of prior research from which to propose a series of hypotheses. Section 3 presents the data and the research methodology used in the empirical analysis. Section 4 shows the results obtained. Finally, Section 5 discusses the results, implications of the research, study limitations and lines for future research.

2. Theoretical Background

Our research focuses on the tools available to the organization that permit it to develop an ability to achieve competitive advantage based on technological skills, internal labour flexibility and absorptive capacity. We thus, include the theoretical framework of resources and capabilities [34] and the theory of dynamic capabilities [22,35].

We must consider two fundamental aspects of the theory of resources and capabilities: first, the fact that resources are distributed heterogeneously among the different firms; and, second, the continuity of these resources over time. Organizations possess a set of resources and capabilities that have more or less value and that permit them to obtain sustainable competitive advantage. The worth of the resources and capabilities must therefore be valuable, rare, imperfectly imitable and non-substitutable [34].

Although the theory of resources and capabilities has valuable explanatory power, various studies have criticized its static vision, arguing the need to complement it with the perspective of dynamic capabilities [21,22,35]. This perspective argues that organizations are conscious that the conditions surrounding them are inherent in changing and turbulent environments in which competition is very strong. Factors change with increasing rapidity; technological advances cause more rapid organizational innovations, etc. Under such circumstances, it is difficult for organizations to maintain the competitive advantage previously achieved unless they adapt to changes. The theory of dynamic

capabilities is thus based on the fact that only firms that can develop dynamic capabilities are able to generate sustainable competitive advantage [22].

Following this theoretical framework and the definition of technological skills analysed, a dynamic capability can be assimilated and integrated to enable configuration of internal competencies and promote the organizational change required by the demands of the environment.

As to internal labour flexibility, when the environment changes and uncertainty increases, top managers develop and stimulate employees to adopt more flexible work roles [13]. It follows that an organization's achievement of internal flexible labour fit is a sign that it has developed a dynamic capability that permits it to adapt to the changes in the environment in which the firm operates. Internal labour flexibility may thus be considered a strategic, dynamic variable of the organization [32].

Finally, we find abundant literature that defines absorptive capacity as a basic foundation for development of dynamic capabilities and a key strategic support factor in the search for collaborative learning and communication [19]. Taking this and the foregoing definition by Zahra and George [2] into account, we argue that organizations need knowledge absorptive capacity to adapt to changes in the environment and to respond properly to existing uncertainty, hence the inclusion of knowledge as a dynamic capability for the organization.

3. Hypotheses

3.1. *The Influence of Technological Assets on Potential and Realized Absorptive Capacity*

As stated above, we chose to focus on these technological assets because they have been used in the literature and perform a significant role in accessing information and locating external knowledge sources that provide firms with knowledge [17,19,21,23,36,37]. The presence of these technological assets is important to accessing information and locating knowledge sources, as well as to knowledge assimilation and elimination of organizational barriers [36,37]. Together, these assets produce a mechanism capable of standardizing data and processes [38]. This level of integration makes it possible to gather and share achievable, appropriate and precise information, and such comprehensive information enables fast, effective decision-making. For example, in some industries, real-time information integration permits firms to find and access price and value information quickly to cope with rapid market fluctuations. Firms can thus collect, trawl through and circulate information concerning variations in customer needs, competitor tactics, etc. [38,39].

Technological assets facilitate simultaneous, structured access and the information needed at the right moment by different users (multiuser) as often as needed [7,40]. Such presence requires not only support from top management for the use of technology, but also workers' possession of technological abilities and development of TDCs to use tools that foster interaction among different users at all times, stimulating a knowledge-based culture [41–43]. Technological Distinctive Competencies foster creation of an organizational culture that seeks to identify opportunities and generate new ideas and knowledge. Knowledge can be created and acquired through exploration of the environment using technological media (e.g., Internet searches on the topic about which we wish to learn) or interaction with agents (e.g., workers, customers, members, and suppliers), technology systems or networks [44]. All of these information exchanges can lead to creation of virtual information groups within firms that share instant information. Such groups require commitment to the presence of technological assets to foster the collaborative focus that enables the groups to acquire new knowledge to create innovative products [45,46] or processes. For example, Fiat used an open approach to generate design ideas and obtain knowledge for its "Punto" model, inviting customers to select features for the car on its web-site. More than 3000 people took advantage of the opportunity and gave Fiat valuable design information, participating in this co-creation using Internet [45]. Likewise, Hallmark Inc. uses its Hallmark Knowledge Creation Community to acquire and assimilate ideas and knowledge for new products, such as its new greeting cards [46]. In sum, a wealth of technology-based tools, supported by management and by employees' technological skills and TDCs for effective use, permits firms to

increase information and obtain knowledge necessary to maintain their competitive advantage [44]. Having the right technological and personal systems in an organization with technological skills encourages different processes for knowledge acquisition and assimilation [47]. Consequently:

Hypothesis 1. *Technological assets are positively related to potential absorptive capacity.*

The presence of technological assets also plays a crucial role in realized absorptive capacity, due to their strategic capacity to support the knowledge and communication acquired externally or internally among groups and their stimulation of collaborative learning [26], ultimately processes to be exploited. Only after the information and knowledge needed from different sources are acquired, promoted by the different existing technological assets and shared (normal or virtually); should the firm process and assimilate the information to exploit this new, useful knowledge for the firm's activity. Firms can thus use technological assets to process information acquired to reveal new patterns and enhance their understanding [48].

As existing technological assets perform a strategic role in the process of knowledge transformation and exploitation, the right technological structure supported by top managers and workers with the right skills and developed technological competencies provides key support for knowledge exchange and exploitation [48]—realized absorptive capacity. For example, Intranet, Extranet, Virtual Private Networks and Ethernet are instruments that combine technology and services, enabling construction of a digital environment in which the knowledge acquired and assimilated is constantly renewed, rapidly disseminated and widely exploited throughout the organization [49,50].

Organizations that invest in technological assets to support exchange of knowledge among the members of the digital environment contribute not only to obtaining greater performance from the team, but also to developing the organization's realized absorptive capacity, since such organizations encourage transformation and exploitation of knowledge [2,51,52]. Individuals within the firm thus interact amongst themselves, enhancing solution of complex problems and developing new solutions, considering the diverse perspectives enabled by knowledge exploitation [53]. Moreover, technological assets provide a foundation that improves customer and firm knowledge and supports the organization in accessing, combining and exploiting knowledge [38,54]. For example, it systems enable handling of knowledge management (KM) artefacts by codification and dissemination tools and practices. One benefit of the codification approach is reuse of knowledge. Codification aims to transform organizational knowledge, making it accessible to members of the firm who need it. In this vein, "knowledge is codified using a people-to-documents approach: extracted from the person who developed it, made independent of that person, and reused for various purposes" [55] (p. 108). Since this interaction implies development of realized absorptive capacity, it follows that:

Hypothesis 2. *Technological assets are positively related to realized absorptive capacity.*

3.2. The Influence of Potential Absorptive Capacity on Realized Absorptive Capacity

Prior literature has tended to study the antecedents or consequences of absorptive capacity [6]. Few studies focus on the relationship between these two types of absorptive capacity [27] and their implications for adaptation to the company. It is necessary study the relationship between potential and realized absorptive capacity.

Although potential and realized absorptive capacities have different roles, their effect is not isolated, but complementary. These two subsets of absorptive capacity coexist and participate in improving firm performance [14]. They constitute a full process in which they complement each other [27]. Furthermore, firms cannot possibly exploit knowledge without first acquiring it [2]; that is, realized absorptive capacity cannot be developed properly without development of potential absorptive capacity [15]. Likewise, firms can acquire and assimilate knowledge but may not have the capability to transform and exploit this knowledge for profit generation. High potential

absorptive capacity does not necessarily imply enhanced performance [10]. Merely evaluating and acquiring knowledge from outside the organization does not guarantee that the firm will exploit this knowledge [19] to generate commercialize outputs [15]. Conversely, while firms focusing on transformation and exploitation (i.e., realized absorptive capacity) may achieve short-term profits through exploitation, they may fall into a competency trap [56] and be unable to respond to environmental changes [10].

If the process is performed correctly, the organization is more likely to have more knowledge; more means to develop realized absorptive capacity and more efficient processes for transformation and exploitation of this knowledge [57]. Firms must thus seek new knowledge externally or internally to acquire and assimilate it, and to integrate it into the firm's operational and strategic management; they must process and exploit the new knowledge [49]. It is strongly advisable to store and maintain newly-generated knowledge within the organization, facilitating its accessibility to the organizational members who exploit it. If this is not done, realized absorptive capacity and valuable knowledge will be lost [14,58]. The prior existence of virtual groups, which enable more effective collaboration due to use of social media, permits the organization to process and disseminate new knowledge, thereby increasing organizational response capacity and learning among the organization's members. Faster and easier access to more novel knowledge further encourages these capacities [59].

In sum, realized absorptive capacity involves transforming and exploiting the knowledge assimilated by incorporating it into the firm's operations. Based on these arguments, we propose the following hypothesis:

Hypothesis 3. *Potential absorptive capacity is positively related to realized absorptive capacity.*

3.3. *The Influence of Realized Absorptive Capacity on Internal Labour Flexibility and Organizational Innovation*

The use of technological assets develops both absorptive capacities in the firm (potential and realized). Once this knowledge has been exploited by each member, it must be learnt by the whole firm and shared with all employees to increase the firm's efficiency through development of abilities that encourage communication and mutual trust, and thus learning among colleagues and knowledge absorption, in turn encouraging a stable, committed relationship among work groups [10].

According to the theory of resources and capabilities, internal labour flexibility of workers is considered as a resource that gives the organization a valuable, non-imitable resource that becomes a strategic one [16,60]. Labour flexibility indicates the degree to which the firm's human resources possess abilities and knowledge that give rise to new strategies to face a competitive environment [60,61]. The worker will thus develop more flexible behaviour if he/she has previously acquired the knowledge and skills necessary for it [61]. Internal labour flexibility is stimulated if there is sufficient knowledge in the firm to undertake new projects, tasks and challenges [10]; that is, once absorptive capacity is developed, the firm can begin to propose new methods for enrichment of updated and flexible training [60].

One possibility for achieving absorptive capacity is to expand the uses of knowledge acquired. Employees who possess an extensive set of prior knowledge that permits them to develop a broad range of tasks are flexible employees [60]. Such greater knowledge enables the worker to be more versatile and polyvalent, increasing his/her capacity to work on different tasks, in a short time and in different functions or positions [16,35,60,62]. For instance, one way of fostering flexibility among one's employees in practice is to form multifunctional teams or to design positions based on projects, as these activities generate knowledge specific to the organization and difficult for the competition to imitate [10,63].

Moreover, because the worker's internal labour flexibility requires a continuous learning process, the firm should include training programmes in a long-term timeframe, such that the knowledge base is updated continuously and progressively over time [43]. Further, as knowledge is acquired (potential

absorptive capacity), it can be exploited (realized absorptive capacity). This process encourages adaptation of the company's workers (internal labour flexibility) and thus new trends for the firm. Employees should thus be involved in continuous experiential learning to avoid obsolescence of their knowledge. They will be more capable and flexible and better able to adapt easily to the organization's needs [64], particularly the technological needs inherent in today's work environment and society in general.

Workers' knowledge is encouraged by application of job rotation policies. Labour rotation improves employees' awareness of knowledge and skills in other functional areas of the organization and increases their ability to identify opportunities to transform and exploit new knowledge [10]. Labour rotation also permits development of organizational contacts that both helps to build the coalition necessary for successful exploitation of new knowledge [10] and influences labour flexibility positively. Such policies lead to higher involvement of employees, enabling the company to achieve better performance through innovative ways of working and thinking [60,65]. Transformation and exploitation of knowledge usually involve internal labour flexibility for the worker as a result of expansion of the functions he/she performs and his/her knowledge, strengthening the capability to perform work in diverse areas and stimulating firms' greater capability to operate in different circumstances or scenarios [66–70]. These changes stimulate workers to develop a greater spirit of willingness and participation, forms of flexibility in working hours, ubiquity, etc. [70]. Jansen et al. [10] indicates that potential absorptive capacity, which contains the elements of knowledge acquisition and assimilation, is enhanced by such coordination capabilities as cross-functional interfaces and job rotation, whereas realized absorptive capacity, which contains the elements of knowledge transformation and assimilation, is enhanced by socialization competencies [11].

In sum, recognizing the value of possessing a prior knowledge base that is solid and up to date enables workers to be flexible, versatile and responsible for their work position, qualities that encourage employees' involvement and motivation to improve how they perform their tasks. Thus:

Hypothesis 4. *Realized absorptive capacity is positively related to internal labour flexibility.*

According to the theory by Cohen and Levinthal [28], the ability to exploit external knowledge is critical in the process of obtaining innovation outcomes. Absorptive capacity is a core element for innovation in the company. Authors term the set of abilities related to recognizing the value of new information, assimilating it and applying it to commercial ends "absorptive capacity". Organizational ability thus enables knowledge to be converted into new products, services or processes supported by innovation throughout the organization [2,14,71].

While recognizing the value of exploiting new and external information is essential to increasing knowledge in the company, transformation and utilization of assimilated knowledge are crucial to enhancing the firm's innovation capacity [6,72]. The knowledge disseminated may be adapted to the company to serve as a strategic resource to obtain an innovation [2]. In addition, Fiol [73] argues that organizations' potential to generate innovation outcomes is dependent on the previous accumulation of knowledge they have absorbed. Organizational innovation is thus the result of the effort and investment that the organization makes to transform and apply the knowledge it has absorbed, as well as the knowledge of its workers.

Along similar lines, Zahra and George [2] discern that most empirical studies show significant relationships between a firm's absorptive capacity, innovative output and other outcomes related to creation and achievement of competitive advantages. Realized absorptive capacity is thus the primary source of performance improvements. Similarly, outcomes from knowledge absorptive processes contribute to configuring trustworthy and reliable products and processes that may result in higher performance [14]. These outcomes reflect the extraordinary efforts of the firm's realized absorptive capacity.

Further, the more difficult it is to reproduce or imitate the firm's absorptive capacity and innovative capabilities, the greater and more innovative are the outcomes achieved—outcomes realized in achieving long-term competitive advantages [14,58]. Firms with strong absorptive capacity can acquire recently generated knowledge, combine it with existing knowledge, and use it to carry out innovative processes that enable the firm to achieve more intangible success. Thus:

Hypothesis 5. *Realized absorptive capacity is positively related to organizational innovation.*

3.4. The Influence of Internal Labour Flexibility on Organizational Innovation

One strategic element of innovation lies in the ability to develop and reconfigure firms' internal and external competencies and those of their workers to respond to continual changes in the environment [22].

From an internal point of view, an employee who increases his/her knowledge can conceive alternative methods for performing his/her work and even innovate in performing them. For instance, self-motivated employees will look for innovative ways to increase their effectiveness in the firm, such as databases, multimedia systems, simulation software, knowledge portals, workflow, intranets and forums [59], which lead the firm to achieve communication and innovative ways of working throughout the organization [4,40]—in other words, organizational innovation.

Flexible employees are trained and recycled according to need, anticipate future demands and perceive each event in the organization as an opportunity to innovate [16,60,74]. Workers who develop in such work environments will be more motivated to learn and inclined to participate in activities that involve a challenge or innovation, since they interpret them as a way to develop their knowledge of the tasks for which they are responsible [75]. Furthermore, the more flexible internal labour is, the more organizational innovations will be undertaken in the firm.

In this context, firms with strategies for internal labour flexibility can adjust more easily to changes in demand in their environment through reorganization of their work positions based on multi-functionality of tasks, teamwork and employee participation in the design and organization of their work. Through flexible design, employees improve their individual abilities and foster collaboration and coordination between the different areas and departments that make up the organization to become more innovative. Such policies create opportunities to adopt flexible organizational design of structures with multifunctional teams that require employees with multiple abilities and a wide range of knowledge [16].

Policies and strategies of internal labour flexibility can contribute to the firm's innovation capacity by obtaining more flexible commitments and development of employees in the competitive core environment [16]. Thus:

Hypothesis 6. *Internal labour flexibility is positively related to organizational innovation.*

3.5. The Influence of Realized Absorptive Capacity and Organizational Innovation on Organizational Performance

Absorptive capacity can promote financial performance and contribute to the achievement of competitive advantage [57]. Realized absorptive capacity plays a special role, since through it firms derive new insights and outcomes from the combination of existing and newly acquired knowledge [15].

The transformation and exploitation of knowledge incorporated and assimilated by potential absorptive capacity enable firms to renew and improve their knowledge, encouraging development of new practices, routines or competencies that improve development of the management system, production process or products, thereby improving organizational performance [15].

In technology-based firms, realized absorptive capacity is essential because it permits exploitation of the firm's current technological knowledge, both internal and external, and development of specific competencies. These competencies permit firms to respond to highly changeable environments and improve their organizational performance [22].

According to Martinez-Sanchez et al. [16], firms that lack the realized absorptive capacity to internalize knowledge created by others and modify it to fit their applications, processes and routines cannot benefit from knowledge acquisition to improve their new product market performance. Thus:

Hypothesis 7. *Realized absorptive capacity is positively related to organizational performance.*

Various authors have analysed the relationship between organizational innovation and performance. Abernathy and Utterback [76] show that adoption of innovations is stimulated by the pressure simultaneously to reduce costs and improve quality. Firms adopt innovations to ensure improved productivity and quality of the product or service provided. Camison [77] analyses how firms with more innovative behaviour follow and respond to their customers' needs and preferences, achieving better entrepreneurial results.

Similarly, new product and process outcomes from organizational innovation processes contribute to creating new initiatives that primarily reflect the firm's realized absorptive capacity [14,78], especially in the field of technology companies, where technological assets endure [7,17] and enable this capacity through connection and flexibility of employees who will seek new ways of working and achieve higher performance.

Organizational innovation is the core of long-term entrepreneurial success, as it permits enterprising firms to obtain profits by establishing a temporary monopoly. This is especially true in a globalized market, where technological assets are essential to organizational innovation that enables firms to achieve solid competitive positions [33]. Our paper attempts to determine whether adopting organizational innovations has a positive effect on performance due to technological assets, absorptive capacity and more flexible organizational designs that involve more knowledgeable employees. Thus:

Hypothesis 8. *Organizational innovation is positively related to organizational performance.*

4. Methodology

4.1. Sample and Procedure

This study uses high-tech manufacturing firms in the geographical area of the European Union (EU), and the Amadeus (2009) database. A structured questionnaire was developed to investigate these variables. The main informants were CEOs, due to their knowledge of the strategic variables examined in this investigation. Stratified random sampling by country was used to divide the population into strata [based on the 10 EU countries (Germany, United Kingdom, France, Italy, Spain, Poland, the Netherlands, Belgium, Austria and Denmark)]. Various statistical tests (e.g., *t*-test, confidence interval) indicated no significant differences between the firms chosen in the different countries. Table 1 reflects the means of the businesses in each country for different variables (e.g., number of employees, sales volume, annual investment in IT assets, and global budget allocated to R&D). All significance values for the *t*-test (>0.776, number of employees; >0.825, sales volume; >0.656, annual investment in IT assets; >0.431, global budget assigned to R&D) indicate no significant difference between the businesses by country—A low significance value for the *t*-test, typically less than 0.05, indicates a significant difference between the two group means—. The confidence interval for the mean also contains zero, indicating that the difference is not significant. In each stratum, a random sampling procedure was used. We collected 16 firms for each country (response rate of 17.7%, Table 1). Budgetary limitations and the need to obtain a minimum of responses to apply the statistical technique employed led us to establish the number of questionnaires per country.

Table 1. Technical details of the research.

Total	Austria	Belgium	Denmark	France	Germany	Italy	Poland	Spain	The Netherlands	United Kingdom	Total
Sample Size	125	105	118	96	72	84	87	75	70	68	900
% Response	12.80%	15.23%	13.55%	16.66%	22.22%	19.04%	18.39%	21.33%	22.85%	23.52%	17.77%
Methodology	Structured questionnaire										
Procedure	Stratified sample with proportional allocation										
Universe of Population	5441 firms										
Sample Size (% response)	160 (17.77%) firms										
Sampling Error	7.7%										
Confidence Level	95%, $p - q = 0.50$; $Z = 1.96$										
Comparison	Means										<i>t</i> -test 95% Conf. Int.
Mean No. Employees	125.37	128.66	122.31	126.53	127.46	136.18	123.93	128.37	123.68	138.07	>0.776 −112.580 118.271
Mean Sales volume	53.63	63.27	57.05	64.14	58.66	57.25	59.87	58.50	57.58	63.83	>0.825 −109.454 88.441
Mean Invest. It as.	3.98	4.37	4.46	5.06	5.04	5.04	5.68	5.41	5.15	5.33	>0.656 −10.088 6.675
Mean Budget R&D	1.15	1.36	1.73	1.43	1.83	1.71	2.05	1.91	1.30	1.66	>0.431 −2.790 1.270

Note: Resp., Respondents; Non-Resp., Non-Respondent; Sig., Significance Value; Volume sale, Sales Volume (millions of euros); Invest. It as., Annual investment in IT assets (hardware, software, etc.) (millions of euros); Budget R&D, Global budget allocated to R&D (millions of euros); 95% Conf. Int., 95% Confidence Interval of the Mean (Lower /Upper).

We used several methods to analyse the possibility of non-response bias. First, we compared the characteristics of businesses where the CEOs returned the survey to the characteristics of businesses of the entire population for the characteristics for which data were available. These include return on assets, return on equity, return on sales and number of employees. No significant differences were found. Second, the survey respondents were divided in two groups based on response date. The hypothesis was that those who responded only after the second call might have more in common with those who did not respond at all than with those who responded early. The test showed no significant differences between early and late responders on the measures used in this research. The chi-square and *t*-tests showed no significant differences [79]. To reduce possible desirability bias and to increase the response rate, we offered the participants the option of receiving the results of the investigation once it was completed, assuring anonymity and using the data at aggregate level only. The possibility of common method bias was analysed and reduced by: (i) designing anonymity in the questionnaire; (ii) using contrasting items from other research; (iii) communicating study goals; (iv) randomizing order of presentation of the survey items across the subjects [80]; (v) using Harman's one-factor test (the one-factor model obtained using principal components analysis yielded eight factors with eigenvalues greater than 1.0, which accounted for 63% of the total variance; the first factor did not account for the majority of the variance, indicating that a significant amount of method variance was not present) [81,82]; (vi) using confirmatory factor analysis (CFA) as a more sophisticated method to test for common method bias (in this study, the fit was worse for the one-dimensional model than for the measurement model, suggesting that common method bias was not a serious problem); and (vii) adding a first-order factor with all measures as indicators to the researcher's theoretical model (in the model, indicator loadings before and after adding the common latent factor were compared and no differences greater than 0.200 were found, indicating that common method bias was not a major threat) [80].

4.2. Measures

Technological assets: This investigation used the arithmetical mean of three previously used scales to measure TMS (four items used by [83,84]; $\alpha = 0.805$, composite reliability = 0.84, AVE = 0.57), technological skill (four items used by [83,84]; $\alpha = 0.853$, composite reliability = 0.88, AVE = 0.64) and TDCs (six items used by [6]; $\alpha = 0.854$, composite reliability = 0.92, AVE = 0.66). This three-variable scale of technological assets had adequate validity and reliability ($\alpha = 0.833$) (Appendix A). **Potential and Realized Absorptive Capacity:** Six items were used to measure potential absorptive capacity (acquisition and assimilation of knowledge); the six items to measure realized absorptive capacity (transformation and exploitation knowledge) were drawn from [19]. Confirmatory Factor Analysis validated the scales of realized absorptive capacity ($\chi^2_{29} = 27.42$, NFI = 0.91, NNFI = 0.99, GFI = 0.98, CFI = 0.94; $\alpha = 0.806$) and potential absorptive capacity ($\chi^2_{25} = 11.20$, NFI = 0.96, NNFI = 0.95, GFI = 0.99, CFI = 0.97; $\alpha = 0.738$). In this last scale, Item 5 was eliminated (Appendix A). **Internal Labour Flexibility:** Based on [13], a seven-item Likert-type seven-point scale was used to measure internal labour flexibility: intrinsic flexibility, skill malleability, behavioural malleability and relational flexibility ($\chi^2_{14} = 54.04$; NFI = 0.98; NNFI = 0.96; GFI = 0.97; CFI = 0.90; $\alpha = 0.819$).

Organizational Innovation: The investigation adapted the five items of the scale from [85] and used by different researchers [5,17,43,85,86], performing CFA to validate the scale ($\chi^2_2 = 11.38$, NFI = 0.94, NNFI = 0.94, GFI = 0.99, CFI = 0.58, $\alpha = 0.773$). In this last scale, Item 5 was eliminated (Appendix A).

Organizational Performance: A 6-item scale to evaluate performance relative to main competitors, developed by [87], was used. When possible, objective measures were also included to calculate the correlation between objective and subjective data (it was high and significant). If there is high correlation between both measures, the literature establishes that one may use either measurement. The data obtained showed that the CEOs were more open to offering general views than precise quantitative data. CFA was used to validate the scale ($\chi^2_9 = 36.57$, NFI = 0.91, NNFI = 0.90, GFI = 0.97, CFI = 0.93, $\alpha = 0.816$) (Appendix A).

A seven-point Likert scale (1 “totally disagree,” 7 “totally agree”) was used to measure technological assets, potential and realized absorptive capacity, and organizational innovation. A seven-point Likert scale (1 “Very few employees,” 7 “Most of the employees”) asking the CEOs to indicate the extent to which employees in their firm possessed different capabilities and skills was used to measure internal labour flexibility. Finally, a seven-point Likert scale (1 “Much worse than my competitors,” 7 “Much better than my competitors”) was used to ask about the organization’s performance as compared to that of its most direct competitors. The country to which the firm belongs was used as control variable to analyse whether this variable influences the results.

4.3. Model and Analysis

Figure 1 presents the proposed theoretical model with one exogenous latent variable [technological asset (ξ_1)], and several endogenous latent variables [potential absorptive capacity (η_1) as first-degree and realized absorptive capacity (η_2), internal labour flexibility (η_3), organizational innovation (η_4) and organizational performance (η_5) as second-degree]. Country is used as a control variable. The theoretical model was analysed with the Lisrel 8.70 programme.

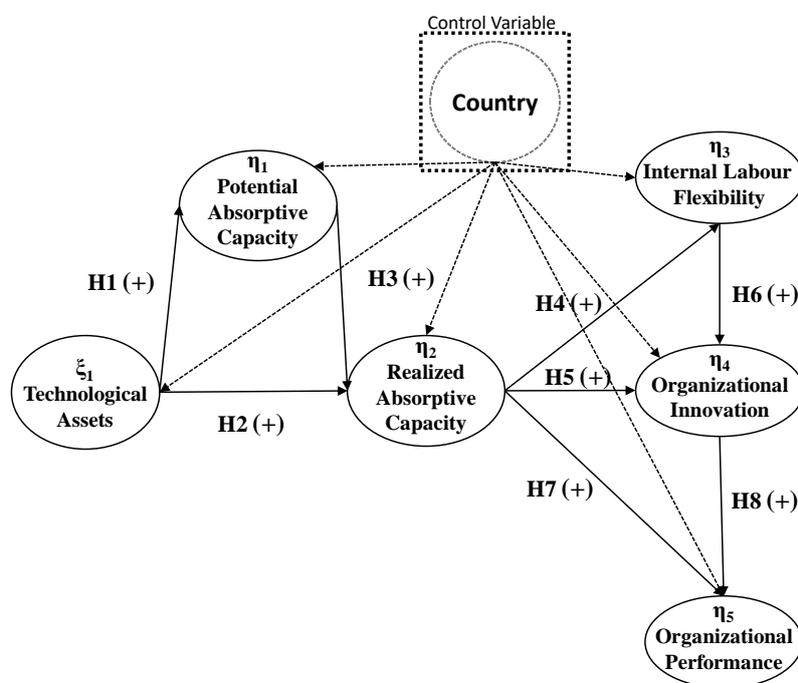


Figure 1. Hypothesized Model.

5. Results

Table 2 presents the inter-factor correlations matrix, means and standard deviations for the measures. The two-step approach designed by [88] was applied. First, a measurement model was estimated.

All indexes fit the model very well (Table 3). Satisfactory levels of reliability were also reached in the constructs (composite reliabilities between 0.88 and 0.95, average variance extracted coefficients between 0.62 and 0.87), as were convergent validity [each loading (λ) was significantly related to its underlying factor (t -values > 13.31) and average variance extracted > 0.50] and discriminant validity among all constructs (chi-square difference tests on the factor correlations showed that discriminant validity was achieved; the confidence interval for the correlation between each pair of critical dimensions did not produce a value of 1, also indicating discriminant validity; and, finally, discriminant validity was established between each pair of latent variables by constraining the

estimated correlation parameter between them to 1.0 and then using a chi-square difference test on the values obtained for the constrained and unconstrained models. Significant differences in chi-square show that the constructs are not perfectly correlated) [88].

Table 2. Means, standard deviations and correlations.

Variables	Mean	S.D.	1	2	3	4	5	6	7
1.-Technology Assets	5.055	1.111	1.000						
2.-Pot. Absorptive Capacity	5.045	1.371	0.282 ***	1.000					
3.-Real Absorptive Capacity	5.254	1.277	0.270 ***	0.478 ***	1.000				
4.-Int. Labour Flexibility	4.999	1.153	0.443 ***	0.218 **	0.224 **	1.000			
5.-Organizational Innovation	4.850	1.343	0.485 ***	0.244 **	0.254 **	0.363 ***	1.000		
6.-Organizational Performance	4.727	1.142	0.404 ***	0.144 †	0.301 ***	0.215 **	0.341 ***	1.000	
7.-Country	5.5	2.881	0.115	0.095	0.077	0.005	0.134 †	0.155 *	1.000

Notes: † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed).

Table 3. Measurement model results.

Variables	Items	λ^*	R^2	C.R.	AVE	Correlation Confidence Interval	Goodness of Fit Statistics
Technological Assets (T)	TECHN1	0.98 *** (54.97)	0.96	0.953	0.873		$\chi^2_{420} = 603.30$ $(p > 0.01)$ GFI = 0.94 AGFI = 0.93 NNFI = 0.96 IFI = 0.97 NCP = 183.30 CFI = 0.97 RMSEA = 0.05
	TECHN2	0.87 *** (31.68)	0.75				
	TECHN3	0.95 *** (45.21)	0.90				
Potential Absorptive Capacity (PAC)	PACAP1	0.82 *** (25.37)	0.68	0.888	0.620		
	PACAP2	0.92 *** (36.00)	0.85				
	PACAP3	0.89 *** (29.14)	0.79				
	PACAP4	0.63 *** (14.18)	0.51				
	PACAP6	0.63 *** (13.31)	0.52				
Realized Absorptive Capacity (RAC)	RACAP1	0.65 *** (14.92)	0.50	0.939	0.722		
	RACAP2	0.90 *** (32.63)	0.82				
	RACAP3	0.87 *** (32.55)	0.76				
	RACAP4	0.94 *** (36.40)	0.88				
	RACAP5	0.84 *** (26.85)	0.71				
	RACAP6	0.87 *** (29.45)	0.76				
Internal Labour Flexibility (ILF)	FLEXIB1	0.73 *** (18.80)	0.54	0.943	0.703		
	FLEXIB2	0.76 *** (20.04)	0.57				
	FLEXIB3	0.84 *** (27.70)	0.71				
	FLEXIB4	0.96 *** (40.71)	0.92				
	FLEXIB5	0.87 *** (32.10)	0.76				
	FLEXIB6	0.89 *** (32.70)	0.79				
	FLEXIB7	0.80 *** (22.71)	0.64				
Organizational Innovation (OI)	INNOVA1	0.83 *** (23.44)	0.67	0.903	0.701		
	INNOVA2	0.84 *** (24.80)	0.71				
	INNOVA3	0.81 *** (24.50)	0.66				
	INNOVA4	0.87 *** (28.18)	0.75				
Organizational Performance (OP)	PERFOR1	0.80 *** (25.12)	0.65	0.941	0.730		
	PERFOR2	0.83 *** (24.73)	0.69				
	PERFOR3	0.83 *** (28.49)	0.69				
	PERFOR4	0.99 *** (57.01)	0.99				
	PERFOR5	0.78 *** (20.26)	0.61				
	PERFOR6	0.88 *** (31.10)	0.77				

Notes: λ^* , Standardized Structural Coefficient (t -students are shown in parentheses); R^2 , Reliability; C.R., Composite Reliability; AVE, Average Variance Extracted; *** $p < 0.001$ (two-tailed).

Second, we used a structural model (Figure 2) with the correlation matrix and asymptotic covariance matrix as input to estimate direct, indirect and total effects. Significant relationships were found among the constructs, and overall fit was good (Table 4). Technological assets are related to and influence both potential absorptive capacity ($\gamma_{11} = 0.72, p < 0.001$) and realized absorptive capacity ($\gamma_{21} = 0.76, p < 0.001$), as predicted in Hypotheses 1 and 2. We also show an indirect effect (Table 4) of technological assets on realized absorptive capacity ($0.17, p < 0.01$) through potential absorptive capacity (0.72×0.24). Potential absorptive capacity affects realized absorptive capacity ($\beta_{21} = 0.24, p < 0.01$), supporting Hypothesis 3. The effect of technological assets on realized absorptive capacity is

larger than that of technological assets on potential absorptive capacity. Globally, the model provides a good explanation of both potential absorptive capacity ($R^2 = 0.52$) and realized absorptive capacity ($R^2 = 0.93$).

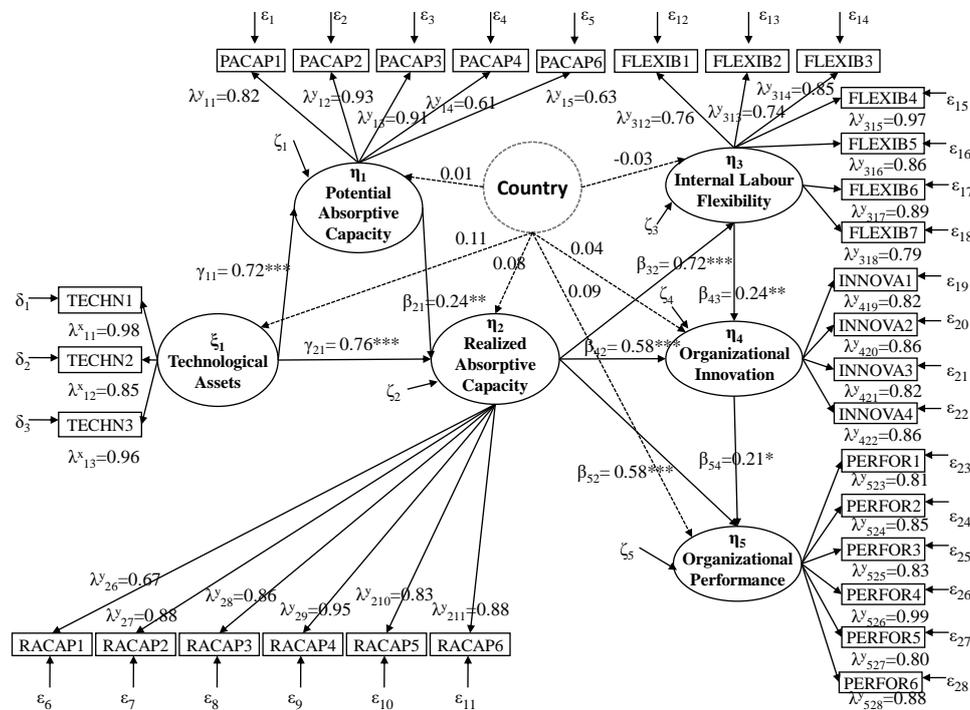


Figure 2. Results of Structural Equation Model.

Internal labour flexibility is influenced by realized absorptive capacity ($\beta_{32} = 0.72, p < 0.001$), supporting Hypothesis 4. Similarly, organizational innovation is influenced directly by both realized absorptive capacity ($\beta_{42} = 0.58, p < 0.001$) and internal labour flexibility ($\beta_{43} = 0.24, p < 0.01$). Realized absorptive capacity also affects organizational innovation indirectly ($0.17, p < 0.01$) through internal labour flexibility (0.72×0.24). The global effect is $0.75 (p < 0.001)$. Hypotheses 5 and 6 are thus supported. Realized absorptive capacity has a larger effect on organizational innovation than does internal labour flexibility. Globally, the model provides a good explanation of both internal labour flexibility ($R^2 = 0.51$) and organizational innovation ($R^2 = 0.62$).

Finally, organizational performance is influenced directly by realized absorptive capacity ($\beta_{52} = 0.58, p < 0.001$) and organizational innovation ($\beta_{54} = 0.21, p < 0.05$). We find an indirect influence of realized absorptive capacity on organizational performance ($0.16, p < 0.05$) through organizational innovation (0.58×0.21) and internal labour flexibility ($0.72 \times 0.24 \times 0.21$). The global effect of realized absorptive capacity on organizational performance is $0.74 (p < 0.001)$. Hypotheses 7 and 8 are thus supported. The effect of realized absorptive capacity on organizational performance is larger than the effect of organizational innovation on organizational performance. Globally, organizational performance is explained well by the model ($R^2 = 0.61$). Other indirect relationships can be seen in Table 4. The results thus show that differences among countries (in terms of culture, institutions, economic environment, etc.) affect some of the strategic variables analysed in this research.

The research used several nested models with different assumptions about the relationships (Table 5). Model 1, which supports the theoretical model, is preferable to the others. When compared to Model 1, Model 2, for example, has a worse Root Mean Square Error of Approximation ($\Delta RMSEA = 0.007$), Non-Normed Fit Index ($\nabla NFI = 0.01$), Expected Cross-Validation Index ($ECVI = 0.40$), Akaike Information Criterion ($\Delta AIC = 63.86$) and Estimated Non-Centrality Parameter

($\Delta\text{NCP} = 64.87$), showing Model 1 to be preferable to Model 2 ($\Delta\chi^2 = 65.87$). The proposed theoretical model represents the preferred, most parsimonious and acceptable model.

Table 4. Structural model results (direct, indirect and total effects).

Effect From	To	Direct Effects	<i>t</i>	Indirect Effects	<i>t</i>	Total Effects	<i>t</i>
Technological Assets	→ Potential Absorptive Capacity	0.72 ***	13.14			0.72 ***	13.14
Technological Assets	→ Realized Absorptive Capacity	0.76 ***	8.66	0.17 **	3.21	0.93 ***	14.41
Technological Assets	→ Internal Labour Flexibility			0.67 ***	13.96	0.67 ***	13.96
Technological Assets	→ Organizational Innovation			0.70 ***	15.02	0.70 ***	15.02
Technological Assets	→ Organizational Performance			0.58 ***	15.50	0.58 ***	15.50
Potential Absorptive Capacity	→ Realized Absorptive Capacity	0.24 **	2.97			0.24 **	2.97
Potential Absorptive Capacity	→ Internal Labour Flexibility			0.17 **	2.94	0.17 **	2.94
Potential Absorptive Capacity	→ Organizational Innovation			0.18 **	2.97	0.18 **	2.97
Potential Absorptive Capacity	→ Organizational Performance			0.17 **	2.97	0.17 **	2.97
Realized Absorptive Capacity	→ Internal Labour Flexibility	0.72 ***	11.22			0.72 ***	11.22
Realized Absorptive Capacity	→ Organizational Innovation	0.58 ***	6.57	0.17 **	2.84	0.75 ***	11.82
Realized Absorptive Capacity	→ Organizational Performance	0.58 ***	6.09	0.16 *	2.12	0.74 ***	12.32
Internal Labour Flexibility	→ Organizational Innovation	0.24 **	2.81			0.24 **	2.81
Internal Labour Flexibility	→ Organizational Performance			0.05	1.61	0.05	1.61
Organizational Innovation	→ Organizational Performance	0.21 *	2.12			0.21 *	2.12
Country	→ Technological Assets	0.11 †	1.78			0.11 †	1.78
Country	→ Potential Absorptive Capacity	0.01	0.03	0.08 †	1.75	0.09	1.32
Country	→ Realized Absorptive Capacity	0.08	1.40	0.02 †	1.88	0.10 **	2.99
Country	→ Internal Labour Flexibility	−0.03	−0.46	0.07 **	2.99	0.04 †	1.78
Country	→ Organizational Innovation	0.04	0.73	0.13 **	3.04	0.17 **	2.80
Country	→ Organizational Performance	0.09	1.62	0.12 ***	3.44	0.21 ***	3.94
Goodness of Fit Statistics	$\chi^2_{452} = 698.76$ ($p > 0.01$) GFI = 0.94 AGFI = 0.93 ECVI = 5.35 AIC = 850.76 CAIC = 1160.48 NNFI = 0.95 IFI = 0.96 PGFI = 0.80 PNFI = 0.81 NCP = 246.76 CFI = 0.96 RMSEA = 0.059						

Notes: Standardized Structural Coefficients; † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5. Model statistics against theoretical model.

Model	Description	χ^2	$\Delta\chi^2$	RMSEA	NNFI	ECVI	AIC	NCP
1	Theoretical	698.76		0.059	0.95	5.35	850.76	246.76
2	Without Tech. Assets to Pot. Abs. Capacity	764.63	65.87	0.066	0.94	5.75	914.63	311.63
3	Without Tech. Assets to Real Abs. Capacity	740.71	41.95	0.063	0.94	5.60	890.71	287.71
4	Without Pot. Abs. Capacity to Real Abs. Capacity	704.31	5.34	0.059	0.89	5.37	854.31	251.31
5	Without Real Abs. Capacity to Int. Lab. Flexibility	763.72	64.96	0.066	0.94	5.75	913.72	310.72
6	Without Real Abs. Capacity to Org. Innovation	733.91	35.15	0.062	0.95	5.56	883.91	280.91
7	Without Int. Lab. Flexibility to Org. Innovation	705.89	7.13	0.059	0.95	5.38	855.89	252.89
8	Without Real Abs. Capacity to Org. Performance	722.20	23.44	0.061	0.95	5.49	872.20	269.20
9	Without Org. Innovation to Org. Performance	702.75	3.99	0.059	0.95	5.36	852.75	249.75

Notes: $n = 160$.

6. Conclusions and Future Research

6.1. Discussion

One of the most important strategic decisions facing management in today's globally competitive environment involves technology development [1]. Previous research has argued that knowledge and technology assets provide an innovative way to achieve better organizational performance [6,18,25,89–91].

To develop new ways of researching that advance this literature, our paper has analysed the strategic influence of three significant and extensively-studied [6,7,17,25,89,91–95] technological assets—TMS, technological skills and TDCs—on potential and realized absorptive capacity [2,8,9]. These assets constitute ongoing elements to enhance flexibility and innovation throughout the company and, in turn, to achieve excellent performance. Top managers should generate a culture of learning in the firm technologically, cultivating technological skills and distinctive capacities or competencies [21]. When all of these constructs are combined, they constitute intangible technological assets that enable companies to outdo competitors. Our paper also aimed to show how top managers, as a significant technological asset, promote a flexible framework that enables the firm to absorb and use knowledge from outside the firm and obtain greater innovation capacity to generate sustainable competitive advantages [21].

This research also analyses the inherent relationship between both types of absorptive capacity (potential and realized), since firms must be receptive to external knowledge—that is, to acquiring, analysing, interpreting and understanding external knowledge (potential absorptive capacity) [19], in order to transform this new knowledge and, in turn, exploit it (realized absorptive capacity) [2].

Our third goal has enabled us to apply the knowledge generated and to facilitate knowledge transfer at the right moment among the employees within the firm. We see that realized absorptive capacity to enhance internal labour flexibility and enable management of the firm's workforce to face constant change requires the participation of the entire organization [22]. The paper thus demonstrates that this compound absorptive capacity is an antecedent of internal labour flexibility, which has received little attention in prior research.

The study later observes that absorptive capacity also encourages new adaptable structures and ways of working that provide new processes and information throughout the company, thereby encouraging creation of organizational innovation.

Finally, the study demonstrates the indirect effect of core technological assets on organizational performance [5,7,17] through absorptive capacity, internal labour flexibility and organizational innovations [16,18]. After explaining our findings, we will discuss how the paper contributes to theory and practice.

6.1.1. Theoretical Implications

Based on a synthesis of the previous literature, we stress that technological assets are increasingly crucial to today's companies, as technological knowledge is essential to achieving high organizational performance more easily [25,90]. Our investigation thus extends the previous literature [89,91], with new implications for scholars:

It has deepened understanding of the concept of technological assets and of the literature on their relationship to absorptive capacity, since technological support from managers, improvement of technological skills and achievement of technological competencies may generate absorptive capacity, both potential and realized.

It has also extended the research on absorptive capacity: (i) It identifies the internal relationship between both types of absorptive capacity [10,19]. (ii) It relates absorptive capacity to strategic human resources management; the firm will foster workers' internal labour flexibility through initiatives and improvements in their area of management due to better adaptation capacity and application of the technological knowledge workers have acquired, processed and used, generating organizational benefits in economic and financial terms [96]. Absorptive capacity may encourage organizations'

sustainability through flexible internal structures that enhance the firm's adaptation to turbulent environments. (iii) It relates absorptive capacity to organizational innovation, since absorption of technological knowledge by all employees also enhances the search for new ways to achieve competitive advantages [6]. Absorptive capacity is highly likely to encourage innovation throughout the organization. (iv) It relates absorptive capacity to organizational performance, since the more technological learning employees acquire, the higher the performance they will achieve [27].

Finally, within strategic human resources management and organizational design, we find that firms with internal labour flexibility assign workers to better positions; as such firms are more skilled at matching knowledge, abilities and qualities to characteristics of the position, thus improving the organization's innovative capacity [32]. Consequently, the study shows a positive relationship between internal labour flexibility and organizational innovation, which enhances the firm's sustainability. New or different ways to innovate encourage the emergence, sustainability and improvement of competitive advantage [19].

In sum, this research deepens our understanding of absorptive capacity by analysing it from the perspective of both potential and realized absorptive capacity and exploring its direct and indirect effects to improve organizational performance. Our data suggest new hypotheses that show direct impact on organizational performance, while also considering previous research breakthroughs that advocate exploiting external knowledge effectively to improve organizational performance.

6.1.2. Practical Implications

In addition to the theoretical implications for scholars, this study has several new implications for managers, which advance the literature reviewed [5,15,17,18,25,40,60,65,97] and expands its practical implications for firms. The positive influence of managerial support for and improvement of technological skills and competencies on both potential and realized absorptive capacity encourages the dynamic and knowledgeable nature of the technological competitive environments, motivating managers to develop strategic policies that in turn motivate personnel to adopt technological assets [25,97] as a mechanism to promote learning policies such as distinguishing quality work practices, creating multidisciplinary groups that focus on use of information technologies and rotating work positions. Such practices permit employees to improve their technical distinctive competencies and skills to facilitate both absorptive capacities and exploitation of new knowledge assets [5,15,17].

Second, we advance previous research [18] by providing further theory and evidence that absorption of technological assets enables employees to be more proactive and to renew themselves to make the firm more competitive. Organizations that facilitate the process of acquiring, transferring and using knowledge by initiating policies of internal labour flexibility promote personnel who are motivated and prepared to assume new tasks, activities and functions, improving organizational performance.

It follows from this new implication that employees who possess more knowledge can be more polyvalent and attempt to improve their competencies continually. Such employees are usually more willing to show flexibility in their behaviour, for example, showing initiative at work that goes beyond the tasks assigned to them [60]. For example, such activities as enriching job positions, and promoting empowerment and autonomy practices in employees facilitate autonomy and responsibility, encouraging development of workers willing to learn and adapt to challenging situations to enable the firm's survival and sustainability in turbulent environments. Employees are more disposed to learning and improving their competencies, since they attribute great importance to these new competencies in their jobs. At the same time, enrichment of positions implies variety in performing operations and procedures, as well as in the knowledge and skills that employees must possess. Such variety makes it easier for the employee to have a wider range of possibilities for change and innovation [60], encouraging more sustainable design of the organization [98].

Increasing both absorptive capacities may lead organizations to employ additional mechanisms and processes to make internal labour more flexible—for example, shortening or sliding work time

to allow the worker to define the start and end time of the workday; reducing workweek hours or increasing use of part-time workdays; promoting flexible modalities for hiring women and young people; developing policies for helping, training and preparing new workers; and introducing so-called bankers' hours, especially at peak production times, for which workers are compensated with free days during periods of lower production [60]. These are ultimately policies that aim to increase the workers' motivation and satisfaction with their work, and the participation and integration of workers in the firm.

Third, these features of internal labour flexibility encourage organizational innovation by providing an inter-organizational context and implementing innovative policies oriented to suppliers and customers, whether by means of so-called customer service, commercialization platforms for suppliers, or platforms for receiving and sending of orders. All of the foregoing advances the previous literature on this topic [60,65], which asserts that these features enable design of organic structures that avoid excessive rigidity and promote decision-making processes and implementation of organizational innovation [60,65].

Fourth, some papers [25,40] assert that the dynamic and knowledgeable nature of current competitive environments motivates managers to develop innovative and strategic policies that in turn motivate personnel to adopt technological assets as a mechanism to promote learning policies. We extend this idea by studying specific practices—such as distinguishing quality work practices, creating virtual multidisciplinary information groups and rotating work positions—as a novel practice likely to enable employees to improve their technical competencies and skills to facilitate absorptive capacity and exploitation of new knowledge.

Finally, thanks to technological assets, organizations encourage development of collaborative work environments in which each employee can interact with other members of the organization anywhere any time. Organizations should invest in tools to design, modify, execute and control workflows with inter-hierarchical lines of communication between the organization's members to enable free flow of ideas for the different processes in the firm [97]. They can also invest in advanced search engines to capture and apply external knowledge [60], stimulate innovation and thus achieve higher organizational performance.

6.2. Limitations and Future Research

First, social desirability bias must be reduced in survey data based on self-reports [82]. The study used anonymity to reduce such bias in response to sensitive topics [81]. Second, common method variance was tested using Harman's one factor test and other method tests. This bias is not present in the study, but future research could use dependent and independent variables from different data sources to reduce the possibility of such bias [80,82].

Third, future longitudinal studies would enable detection of possible reciprocal processes between the variables. In this study, which uses cross-sectional data, theoretical arguments and temporal considerations in the measurement of the variables enabled assessment of the causal relationship between the variables. Fourth, future studies should incorporate both countries other than these ten OECD countries and more sectors. It would be interesting to perform similar studies with a larger number of cases in the sample. It is also necessary to analyse in greater depth how the differences among the countries (in terms of culture, institutions, economic environment, etc.) might affect the variables analysed.

Fifth, future studies should develop the methodological part of the analysis in greater depth by performing different tests, such as the Hausman test, to promote the robustness of the models that verify the relationships among the variables analysed.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix

Technological Assets

Top Management Support

1. Top management cultivates technology project champions.
2. Top management ensures adequate funding of technology research and development.
3. Top management restructures work processes to leverage technological opportunities in the organization.
4. Top management facilitates technology transfer throughout the organization.

Technological Skills

1. Are very superior to those of closest competitors in hardware and operating systems performance.
2. Are very superior to those of closest competitors in business applications software performance.
3. Are very superior to those of closest competitors in communications services efficiency.
4. Are very superior to those of closest competitors in the generation programming languages.

Technological Distinctive Competencies

1. Capability to obtain information about the status and progress of science and relevant technologies.
2. Capability to generate advanced technological processes.
3. Capability to assimilate new technologies and useful innovations.
4. Capability to attract and retain qualified scientific-technical staff.
5. Capability to master, generate or absorb basic and key technologies.
6. Effectiveness in setting up programs oriented to internal development of technological or technology absorption competencies, either from R&D centres or from suppliers and customers.

Potential Absorptive Capacity

1. There is close personal interaction between the two organizations.
2. The relation between the two organizations is characterized by mutual trust.
3. The relation between the two organizations is characterized by a high level of reciprocity.
4. Workers must communicate regularly with colleagues about work-related issues.
5. The main capabilities of the two organizations are very similar.
6. The organizational cultures of the two organizations are compatible.

Realized Absorptive Capacity

1. Interdepartmental meetings are organized to discuss the development and tendencies of the organization.
2. The important data are transmitted regularly to all units.
3. When something important occurs, all units are informed within a short time.
4. The organization has the capabilities or abilities necessary to ensure that knowledge flows within the organization and is shared among the different units.
5. There is a clear division of functions and responsibilities regarding use of information and knowledge obtained from outside.

6. Capabilities and abilities are needed to exploit the information and knowledge obtained from the outside.

Internal Labour Flexibility

1. If the need emerged, employees of this firm could easily be transferred to other jobs with responsibilities similar to those of their current jobs.
2. If the need emerged, employees of this firm could easily be transferred to more qualified jobs.
3. Employees in this firm attempt constantly to update their skills and abilities.
4. Employees in this firm are quick to learn new procedures and processes introduced in their job.
5. When employees detect problems in performing their jobs, they voluntarily try to identify the causes of these problems.
6. Employees in this department act efficiently in uncertain and ambiguous circumstances.
7. Employees in this department exchange ideas with people from different areas of the organization.

Organizational Innovation

The organization has significantly increased:

1. Spending on new products/services development activities.
2. The number of products/services added by the organization that are already on the market.
3. The number of new products/services that the organization introduced on the market for first time.
4. Emphasis on R&D, technological leadership and innovations.
5. The rate of new product introduction on the market.

Organizational Performance

1. Organizational performance measured by return on assets (ROA).
2. Organizational performance measured by return on equity (ROE).
3. Organizational performance measured by return on sales (ROS).
4. Organization's market share in its main products and markets.
5. Growth of sales in its main products and markets.

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