

# Analyzing an absorptive capacity: Unlearning context and Information System Capabilities as catalysts for innovativeness

Gabriel Cepeda-Carrión\*  
Juan Gabriel Cegarra-Navarro\*\*  
Daniel Jimenez-Jimenez\*\*\*

## Abstract:

This study examines the impact of a company's unlearning context and information system (IS) capabilities on the company's ability to challenge of basic beliefs and to implement processes that are explicitly or tacitly helpful in the reception of new ideas (absorptive capacity). We also examine the relationship between absorptive capacity and the existence and enhancement of innovativeness. These relationships are examined through an empirical investigation of 286 large Spanish companies. Our results show that absorptive capacity is an important dynamic determinant for developing a company's innovativeness. Moreover, this relationship is best explained with two related constructs. Firstly, the company's unlearning context plays a key role in managing the tension between potential absorptive capacity and realised absorptive capacity. Secondly, the results also shed light on a tangible means for managers to enhance their company's innovativeness through IS capabilities.

*Key words:* Unlearning context, information system capabilities, organizational innovativeness, absorptive capacity.

*JEL classification:* M10, M15, M19.

**Corresponding author:** Gabriel Cepeda-Carrión, Departamento de Administración de Empresas y Marketing. Universidad de Sevilla, Ramón y Cajal, 1. 41018 Sevilla (SPAIN). Email: gabi@us.es

\* Departamento de Administración de Empresas y Marketing. Universidad de Sevilla

\*\* Facultad de Ciencias de la Empresa. Universidad Politécnica de Cartagena

\*\*\* Departamento de Organización de Empresas y Finanzas. Universidad de Murcia

## 1. Introduction

The literature in the field of organizational learning reports that organizations that possess relevant prior knowledge are likely to have a better understanding of new technology that can generate new ideas and develop new products (Tsai, 2001). Many scholars have suggested that the ability to exploit external knowledge is a critical component of innovative capabilities (Cohen and Levinthal, 1990). A company's absorptive capacity is the enabling quality for converting knowledge into new products, services or processes to support innovation (Zahra and George, 2002; Newey and Zahra, 2009). In the present paper, we focus on the distinction between what Zahra and George (2002) refer to as 'potential absorptive capacity' and 'realised absorptive capacity'. While the term potential absorptive capacity is used to refer to the capacity to acquire and assimilate knowledge, the concept of realised absorptive capacity includes transformation and exploitation capabilities.

Although it seems intuitively clear that potential absorptive capacity provides support for realised absorptive capacity by supporting a broad range of potential responses (March, 1972), there is some ambiguity regarding the relationship between potential absorptive capacity and realised absorptive capacity (Zahra and George, 2002). Potential absorptive capacity and realised absorptive capacity are fundamentally different concepts that require very different strategies and structures and the resulting tensions between the two are difficult to reconcile (Newey and Zahra, 2009). While potential absorptive capacity requires change, flexibility and creativity, realised absorptive capacity requires order, control and stability. This means that potential absorptive capacity might also have a negative impact on realised absorptive capacity, which may well result in the under-utilization of relevant knowledge or the utilization of irrelevant knowledge, both of which are liable to lead to a degradation of innovation (Lyndon, 1989).

In this paper, we propose an unlearning context to manage an appropriate balance between potential absorptive capacity and realised absorptive capacity. At its heart, the unlearning context, attempts to reorientate organizational values, norms and/or behaviours by changing cognitive structures (Nystrom and Starbuck, 1984), mental models (Day and Nedungadi, 1994), dominant logics (Bettis and Prahalad, 1995), and core assumptions which guide behaviour (Shaw and Perkins, 1991) to attain a competitive advantage. Thus, the contribution of that context is related to its ability to prepare the ground for innovation processes. As Jantunen (2005) points out, in order to sustain innovativeness in a dynamic environment, the company must have the ability to renew its knowledge base. In consequence, companies should create an internal context where the newly generated knowledge can be valued and combined with existing knowledge in order to develop new products, services or processes. Therefore, the new, valuable knowledge for the firm can contribute to sustaining organizational innovativeness in the following years.

However, knowledge can have a relatively short half-life because of 'employee' turnover and the passage of time (Gold, Malhotra and Segars, 2001). It is crucial to count on a information

system (IS) capability to allow the company to store and recover the new knowledge for sustaining organizational innovativeness when necessary. IS capability is particularly important in this era of restructuring and reliance on temporary or contract workers. It is essential that important knowledge be recodified or recorded in databases, information systems, operating procedures and white papers (Gold et al., 2001). Consequently, IS capabilities positively enhance the ability of companies to innovate, which is a crucial strategic goal. All these dimensions are discussed in detail in the following section. The third section investigates the development of alternative models to explore how these dimensions contribute to innovation. Details of the survey, which was used to collect appropriate data with which to test the models is presented in the next section, whilst the results of testing the models are presented in the fifth section. This is followed by the discussion of those results.

## **2. Linking potential absorptive capacity with realised absorptive capacity through unlearning**

Nowadays, knowledge is considered to be a valuable resource for the survival of organizations. A consolidated theory of organizational learning has underlined the advantages of the creation of new knowledge in organizations. However, new knowledge frequently generates internal problems when it contradicts current knowledge, behaviours or organizational routines. In this context, the presence of an internal environment that fosters the replacement of old knowledge could be essential for organizations that wish to create new products or services that require new points of view and ideas. Unlearning can be understood as a context where employees can change their habits and routines and forget old knowledge, and substitute new habits and knowledge, as part of a major process or which might be described as learning.

In recent organizational learning literature, the term unlearning has been analyzed in two related streams (i.e. individual forgetting and organizational un/relearning). Regarding individual forgetting, it is often stated that forgetting takes place at an individual level, since organizations themselves cannot forget (e.g. Imai, Nonaka and Takeuchi, 1985; De Holan and Philips, 2004; Cegarra and Sánchez, 2008). Most authors refer to forgetting as challenging for individuals because of the loss of prior ways of seeing reality – the loss of fundamental assumptions – which until now had brought certainty and security (Akgün, Byrne, Lynn and Keskin, 2007). This process may be facilitated by ‘awareness’ in the individual that there is a new way, along with the desire to ‘relinquish old ideas’ (Becker, 2005).

With regards to organizational un/relearning, drawing upon a reading of Sinkula (2002) and Akgün et al. (2003), Akgün et al. (2007) propose that organizational unlearning, in essence, is operationalized as changes of routines in the organization. Therefore, unlearning at the organizational level is viewed as memory elimination in general and as changing beliefs, norms, values, procedures, and routines in particular (Nonaka, Toyoma and Byosiere, 2001). A sudden change in those routines forces individuals to reconsider their old basic attitudes toward customers, competitors and suppliers (Sinkula, 2002). In this study we have considered that

forgetting takes place at the individual level, and what happens at the organizational level is a relearning process as a consequence of the individual forgetting. As Cegarra and Sanchez (2008) point out, relearning is an adaptation process where the new information structures have to replace old structures, while individual unlearning is the art of forgetting.

The discussion above provides an illustration that the distinction between learning and unlearning processes is not so clear (Tsang and Zabra, 2008). As shown in Figure 1, this division is more pedagogic than structural. On the one hand, the processes are neither independent nor autonomous, but are constantly interacting. People are able to create new knowledge by both processes, and some researchers even go further and argue that unlearning flourishes within communities of learning and communities of practice (e.g. Mitchell and Sackney, 2000; Wenger, 1998). From this perspective, unlearning can be understood as a necessary sub-process for learning, but not all types of learning. Sometimes employees acquire new knowledge that complements existing knowledge. In our opinion, unlearning is based on the premise that prior knowledge exists about a topic, idea, or concept and what we already know (explicitly and tacitly) and what we are trying to assimilate, interact and cross contaminate in non-linear and unpredictable ways. For example, while learning to use a new machine requires only new knowledge, what happens when an individual has been using a similar machine for some years and the company acquires a new one? The new machine may have the feeder on the left while the employee usually works on the right. In these circumstances, it would be a mistake to assume that whatever he/she knows is perfect; he/she may need to unlearn some habits and mindsets or he/she may need to take on other routines. Considering this, we argue that unlearning could be a necessary task in the acquisition of new knowledge that is not compatible with current knowledge in innovative organizations. These organizations are constantly seeking for ways to improve their methods and ideas in order to improve the lot of their customers. That is why these companies need a context where the oldest knowledge can be replaced (Rebernik and Sirec, 2007). As Sinkula et al. (1997) noted, as workers relearn they also unlearn and new knowledge replaces old, forgotten routines. Therefore, as workers continue, familiarity and confidence are gained with the new machine, old ways of doing things recede, prior expectations fade, discomfort is reduced, and forgetting takes place.

**Figure 1: The interaction between learning and unlearning processes**



When attempting to explain the unlearning process, the ‘unlearning context’ and its different sub-dimensions are frequently cited as antecedents to the elimination of old logic at the individual level and the creation of room for new approaches at the organizational level. Chell (1993), for instance, used two models (i.e. acceptance of reality and adjustment) to explain the process through which individuals progress during change. French and Delahaye (1996) suggest a model of individual change involving four phases of security, anxiety, discovery and integration, in a cyclical and ongoing process of change adoption. Within this model, it is assumed that at various stages within the process, individuals are able to show a level of self-awareness, and will also experience a level of anxiety during the change process, “caused by the loss of old familiar patterns and processes”. Lewin’s (1951) model of change involves three steps: a) unfreezing, which is suspending the current structure and involves disconfirmation of expectations, learning anxiety, and provision of psychological safety, b) transition, which is changing the mental structure and involves cognitive restructuring, semantic redefinition, and new standards of judgment; and c) refreezing, which is adapting the new mental structure and involves the creation of supportive social norms and making change congruent with personality. In the present paper, we have followed the suggestion of Cegarra and Sanchez (2008) that the unlearning context should be measured on three sub-dimensions, which clearly relate to Lewin’s three steps:

(a) *The examination of lens fitting*, which refers to an interruption of the employees’ habitual, comfortable state of being, and the creation of a framework that enables individuals in an organization to have access to new perceptions.

(b) *The framework for changing the individual habits*, which refers to the challenge of inhibiting wrong habits when an individual has not only understood the new idea, but is motivated to make the change, and

(c) *The framework for consolidating emergent understandings*, which refers to the organizational processes that can free employees up to apply their talents by implementing new

mental models based on adaptation to new knowledge structures.

The unlearning arguments outlined above seem to contradict absorptive capacity theory. In fact, absorptive capacity is the principle that assimilating new knowledge requires prior knowledge (Cohen and Levinthal, 1990). Similarly, absorptive capacity can be conceptualised as a set of organizational abilities to manage knowledge, assimilate it, and apply it to commercial ends. Kim (1998) understands absorptive capacity as skills relating to the ability to learn and solve problems that enable a firm to assimilate knowledge and create new knowledge. A possible explanation of the difference between these two views of the role of prior knowledge may relate to the advantages and disadvantages of this knowledge in innovative organizations. As noted above, unlearning plays a crucial role when newly acquired knowledge is incompatible with previous organizational knowledge. Innovative organizations, which frequently develop new products and services, have to confront extremely dynamic environments, strong competition and rapid advances in technology, and these require the intensive use and updating of knowledge (Day, 1994; Slater and Narver, 1995; Baker and Sinkula, 1999; Sinkula, 1994; Tippins and Sohi, 2003). A possible solution to this apparent dichotomy between unlearning and absorptive capacity may be found in an analysis of different absorptive capacity sub-dimensions.

Zahra and George (2002) have suggested four dimensions of absorptive capacity, each playing different but complementary roles in explaining how absorptive capacity can influence innovation performance. The first two dimensions (i.e. acquisition and assimilation) are in effect what Zahra and George (2002) label potential absorptive capacity (PACAP) and the other two dimensions (i.e. transformation and exploitation) constitute realised absorptive capacity (RACAP). Whereas PACAP implies personal internal processes such as reflection, intuition and interpretation, RACAP reflects the efficiency of leveraging externally absorbed knowledge. In other words, PACAP is considered a promising component in understanding and assimilating a new methodology (Purvis, Sambamurthy and Zmud, 2001). When members of an organization have significant specialist experience and expertise, it is easier for them to make use of new knowledge about this specialism (Balogun and Jenkins, 2003). Therefore, PACAP includes mental shortcuts about people, places, and things (stereotypes); how the world is and what is possible and not possible (mental models); and grooves and patterns of thinking about how things should be seen and what outcomes are likely (mindsets). In contrast with this, RACAP incorporates the combination of existing and newly acquired knowledge into operations.

Although, most studies in the area of absorptive capacity emphasise that RACAP is driven by PACAP (e.g. Zahra and George, 2002; Cohen and Levinthal, 1990), the existing literature has paid little attention to how RACAP is created and developed in the company. The few studies that have included organizational characteristics (e.g. Lane and Lubatkin, 1998; Gupta and Govindarajan, 2000) call for further research on the learning capacities of organizational units, organizational mechanisms to reduce the gap between what we are able to do (PACAP) and what we finally put into practice (RACAP). This gap can be seen when individuals are confronted with a substantial difference between what they see or hear and how they believe

the world to be (Purvis et al., 2001). The negative impacts of flawed mental models (in terms of emotional states of confusion, helplessness, and intense anxiety) on decision-making have been discussed by several authors (Toft and Reynolds, 1994; Reason, 1997; Chapman and Ferfolja, 2001). In this framework, what individuals have already learnt to absorb (PACAP) may be extremely difficult to unpack and undo, as a wide variety of factors, such as fear of the unknown, mental shortcuts, lack of awareness or organizational structures that channel information through managerial pathways, contribute to the resistance individuals offer to attempts to alter what they do and how they do it. As Tripsas and Gavetti (2000) highlight, experience significantly influences managerial cognition, which eventually determines a firm's ability to manage knowledge. Thus, a firm's PACAP is a path-dependent capability that is influenced by its prior knowledge and the past experiences of its members that are internalized as routines (Balogun and Jenkins, 2003). These routines represent a mix of structure and agency and discussions of the traps of routinization tend to overemphasize structural rigidity and ignore the capacity of organizational members to 'think outside the box' of their cognitive myopia (Howard-Grenville, 2005), which in turn causes RACAP and innovation to be undervalued (Lyndon, 1989). In order to develop RACAP, the ideas set out above could mean that companies, in order to innovate, have to eliminate old logics and routines that have not only become outdated (Barr, Stimpert and A., 1992), but also continue to surface unexpectedly and hinder the transformation of PACAP into RACAP.

Therefore, although a learning process may promote acquisition, diffusion, transformation and exploitation of knowledge, and contribute to both potential and realized absorptive capacity, an unlearning context is necessary for the proper use of newly acquired knowledge, in order that it should be applied, and not rejected or ignored. The unlearning context is not only a mechanism for forgetting old knowledge, but is also the way companies are able to develop and make room for new knowledge (e.g. Huber, 1991; Bogenrieder, 2002; Nystrom and Starbuck, 1984; Day and Nedungadi, 1994; Bettis and Prahalad, 1995). In the examination of lens fitting and the framework for changing the individual habits, all the old logics and mental shortcuts are identified and reshaped with new understandings. The framework for consolidating emergent understandings may take relearning into the organization more generally, breaking barriers of group inertia and peer group pressure to build new critical norms and a critical mass capable of exerting force on the whole system to change its prescribed routines. As a consequence, an unlearning context, especially for innovative activities, plays a mediating role between new knowledge and previous, obsolete knowledge. Reduction of competition between the old and the new knowledge is helpful for employees who have used the old knowledge in the past for the current operations. Through a reflective process, organizations can renew knowledge and generate organizational routines and behaviours that ensure a competitive advantage. This consideration allows us to frame the first hypothesis of the present work:

*Hypothesis 1: The impact of potential absorptive capacity on realised absorptive capacity is positively mediated through the unlearning context.*

### **3. Linking realised absorptive capacity with organizational innovativeness through IS capability**

Innovation is increasingly considered to be one of the key drivers of long-term success of a company in today's competitive markets (Baden-Fuller, 1995; Bruni and Verona, 2009; García-Morales, Lloréns-Montes and Verdú-Jover, 2008; Tzokas and Saren, 1997; Utterback, 2001; Baker and Sinkula, 2002; Darroch and McNaughton, 2002; Lyon and Ferrier, 2002). The reason for this is that companies with the capacity to innovate will be able to respond to environmental challenges faster and better than non-innovative companies (Brown and Eisenhard, 1995; Miles and Snow, 1978). Similarly, organizational innovativeness involves being supportive of and permeable to innovation in terms of developing new products or processes, opening new markets, or simply developing a new strategic direction (Wang and Ahmed, 2004). Most studies consider that realised absorptive capacity injects new ideas into the organization, increases the capacity to understand new ideas and strengthens creativity and the ability to spot new opportunities (e.g. Chesbrough, 2003; Gray, 2006; Powell, 1998; García-Morales et al., 2008).

As noted above, unlearning is a prerequisite for the creation of new knowledge when prior outdated knowledge exists, but the benefit of new knowledge (e.g. new experiences, client complaints and market trends) also depends on the amount of knowledge that has been accumulated and learned when the company implements change through the RACAP. Thus, realised absorptive capacity can be identified as the catalyst in the exploitation of knowledge, enhancing the company's ability to innovate, and RACAP facilitates the development of a company's innovation capacity through the application of knowledge acquired from internal and external sources.

However, new knowledge should persist in the organization and be accessible for those organizational members involved in later innovation activities. Otherwise, realised absorptive capacity, and its resulting valuable knowledge, may be lost. As noted by Haveman and Khaire (2004), increasing competition, continuous change and mergers in industry have created the risk of losing valuable knowledge, due to the turnover of employees and the passage of time. In an attempt to avoid this problem, technological capability and its outputs (e.g. databases, files, protocols, etc), are frequently cited as one way to preserve and use valuable knowledge (Gold et al., 2001). This is crucial because companies with superior knowledge-processing practices are likely to sustain innovativeness and thus be better positioned in long-term competition (Jantunen, 2005). The interest in this capability is motivated by two main advantages for the company. Firstly, through technologies, knowledge is transferable whoever creates it, and can be bought or sold (Cowan and Foray, 1997). Secondly, technology facilitates knowledge diffusion. The absorptive capacity for new technologies is enhanced when external information is added to knowledge already within the organization. Therefore, the ability to use information systems effectively enables quick and cheap diffusion of knowledge within a network (Becker, 2001).



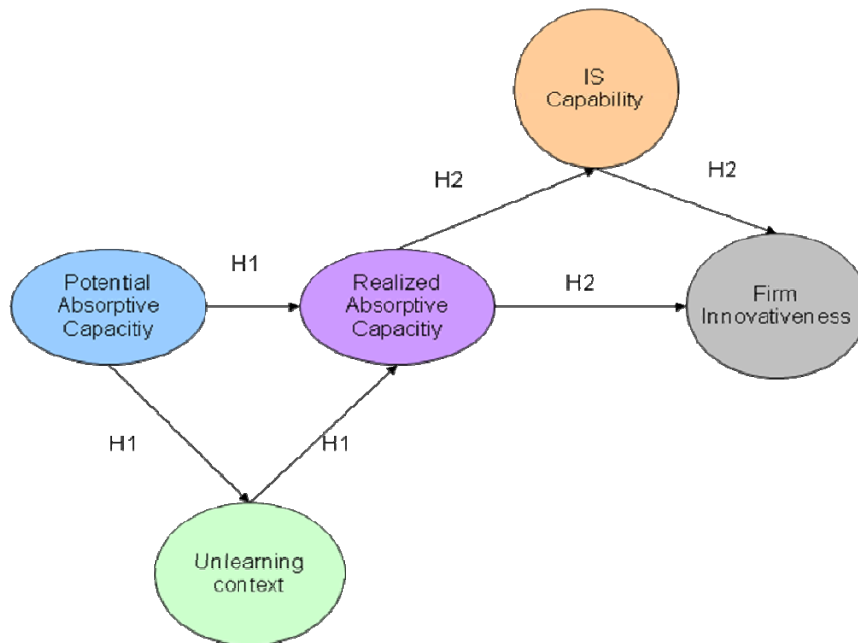
The relationship between the use of information systems and innovation has been analyzed in two related streams (Swan, Newell, Scarbrough and Hislop, 1999), namely the cognitive model and the community model. While the community model portrays the management of knowledge as socially constructed through interaction within communities (Scarbrough, Swan and Preston, 1999), the cognitive model provides a perspective where valuable knowledge is conceived as being captured and codified from individuals, packaged and transmitted and processed through the use of IS and, hence, disseminated and used by other individuals in other contexts. Nonaka and Takeuchi (1995), among others, support the cognitive model, and suggest that a prior step to codifying knowledge involves the use of a learning process to articulate, describe and explain information. In the present study, we take up this idea, and argue that IS capability can be seen as a 'secondary' step of absorptive capacity, where RACAP can be seen as a process for applying new knowledge, and IS capability can be understood as a way of classifying and preserving what has already been learned and successfully applied (Sorensen and Lundh-Snis, 2001). Through the use of information systems, individuals can consider the advantages and disadvantages of many alternative solutions (e.g. increased flexibility, better control over processes, and time saving), which in turn facilitates the easy transcription of relevant information, and enables the users to type and file knowledge in new products, services or processes to support innovation.

The above considerations lead us to argue that, for a given organization, the development of its innovation capabilities depends on the efficient search and integration of existing knowledge. While the pre-existing knowledge base guides future knowledge development, other factors, such as methods of integrating new knowledge with prior knowledge, a firm's ability to assimilate new knowledge and the difference between new knowledge and that incumbent in the organization, are also important determinants in building a company's capability (Liyanaage and Barnard, 2003). This dynamic approach focuses on the continuous reconfiguration of the company's knowledge-based assets, and emphasises that absorptive capacity depends on both knowledge processes and knowledge stocks (Jantunen, 2005). Thus, it suggests a relationship between the firm's absorptive capacity and its innovativeness (Jantunen, 2005), and between the existence of IS capability and the development of innovative ability. From this perspective, the task of IS capability is to codify and preserve knowledge and therefore may be a source of inertia in the innovation process. IS capability may constrain the learning paths of an organization (Becker, 2001). For example, guided by previous knowledge investments, managers may think developing strategic initiatives that leverage the current technologies and the current knowledge would be faster and easier than changing the technology and pursuing the acquisition and assimilation of new knowledge. In consequence, IS capability acts as a mediator in the relationship between absorptive capacity and organizational innovativeness, since it allows the codification and storage of the new knowledge created. Therefore, we propose the hypothesis:

*Hypothesis 2: The impact of realised absorptive capacity on organizational innovativeness is positively mediated through IS capability.*

Figure 2 shows the sequential model which illustrates the proposed hypotheses.

**Figure 2: Model and hypotheses**



#### 4. Method

The population used in this study consists of Spanish organizations with more than 100 employees. Like other studies on the topic, this study was designed to cover a wide range of industries, but excluding the agricultural and construction sectors. 2,160 companies were identified from the SABI<sup>1</sup> (Sistema de Análisis de Balances Ibéricos) database and invited to participate. The information was collected via a postal survey addressed to the R&D and/or innovation executive. The individual addressed was expected to have a broad overview of the innovative issues studied in this paper. The information collection period lasted for approximately three months, from January to April 2008. The unit of analysis for this study was the company, on the assumption that aspects relating to organizational innovativeness, absorptive capacity, IS capability, and unlearning context affect the entire organization. 286 questionnaires were returned, yielding a response rate of 13.24 percent. This is within the 10 to 20 percent range which is the average response rate for surveys involving senior management (Menon, Bharadwaj and Howell, 1996). Responding companies were compared with those that did not respond in terms of size and performance. No significant differences were found

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<sup>1</sup> This database contains financial information for 520,000 companies (480,000 from Spain and 40,000 from Portugal), and includes public and private, Spanish and Portuguese companies, with up to 10 years of data. It is updated daily.

between those two groups, suggesting no response bias.

The questionnaire was designed based on the review of the literature described in Section 2. We modelled 'PACAP', 'unlearning context' and 'RACAP' as formative second-order constructs. We measured 'PACAP' and 'RACAP' by two first-order factors or dimensions: acquisition and assimilation; and transformation and exploitation respectively. We assessed the 'unlearning context' using three first-order factors or dimensions: 'consolidation of emergent understandings', 'the examination of lens fitting', and 'the framework for changing individual habits'. A question that arises when taking a multidimensional approach (i.e. using second-order measures) is whether these constructs (potential absorptive capacity, unlearning context and realised absorptive capacity) should be modelled as consisting of reflective or formative indicators. Indeed, understanding the underlying essence of the construct, whether it is reflective (i.e., changes in the underlying construct cause changes in the indicators) or formative (i.e., indicators impact or cause the underlying construct), is an essential first step in modelling its structure (MacKenzie, Podsakoff and Jarvis, 2005). Therefore, the choice depends primarily on whether the first-order factors or dimensions are viewed as indicators or causes of the second-order factors (Chin, 1998). We chose to view the structure as formative for our three second-order constructs. In this way, an increase in the level of each dimension does not imply an increase in the level of the other dimensions. The dimensions are not necessarily correlated, and consequently traditional reliability and validity assessment have been dismissed as inappropriate and illogical for a formative second-order factor, with reference to its dimensions (Bollen, 1989).

#### **4.1. Measures**

This study mainly used existing scales taken from the literature. The questionnaire items are given in full in the Appendix. The questionnaire constructs comprised:

a) Potential and realised absorptive capacity (PACAP and RACAP). To examine potential and realised absorptive capacity, we sought to measure the dimensions that have been defined (Zahra and George, 2002). Items were measured using a 7-point Likert scale from the study by Jansen *et al.* (2005). PACAP consists of two dimensions: acquisition and assimilation of new external knowledge. Six items assessed the intensity and direction of efforts expended in knowledge acquisition. In addition, four items measured assimilation and gauged the extent to which firms were able to analyze and understand new external knowledge. Ultimately, after a data cleansing process, 5 and 3 items formed the acquisition and assimilation scales respectively. RACAP includes the transformation and exploitation of new external knowledge. Six items initially measured transformation and assessed the extent to which firms were able to facilitate recognition of the opportunities and consequences of new external knowledge for existing operations, structures, and strategies (Zahra and George, 2002). Six items tapped into the extent to which firms were able to exploit new external knowledge. The scale gauged the ability of companies to incorporate new external knowledge into their operations. The final cleansed scale consists of 3 items for both the transformation and exploitation dimensions.

b) Unlearning context. As described above, three-dimension form the unlearning context: 'consolidation of emergent understandings', 'the examination of lens fitting', and 'the framework for changing individual habits'. The measures relating to 'consolidating the emergent understandings' consisted of 6 items taken from a scale designed by Cegarra and Sanchez (2008) and adapted from Akgun et al. (2007). These items describe the way management faced up to change, actively introduced it into the company through projects, collaborated with other members of the organization, and recognised the value of new information or taking risks. To measure the 'examination of lens fitting' 5 items were used. These items recognise the support of policies, rules, reporting, structures and decision-making protocols that encourage the identification of problems, mistakes and new ways of doing things. The final cleansed scale consists of 4 items. Finally, we measured 'the framework for changing individual habits' using 7 items. This scale focuses on employees' self-awareness or their own mistakes, ways of thinking and wrong behaviour that guide everyday attitudes.

c) IS capability. The measures of IS capability are based on the measures of infrastructure capabilities (i.e. technology) used by Gold et al. (2001). The initial scale comprises 7 items, but after the cleansing 3 items were used.

d) Firm innovativeness. Firm innovativeness has been measured in a variety of ways in previous research. In this study we measure how supportive and permeable to innovation the company is in terms of developing new products or processes. In this paper, we measured innovativeness using a scale of 5 items taken from previous studies (Hurley and Hult, 1998; Hult, Hurley and Knight, 2004). Three items make up the cleansed scale.

Because the use of a single survey for data collection created the potential for common-method bias, we took a number of steps to minimize bias (Podsakoff, MacKenzie, Lee and Podsakoff, 2003). Procedural remedies are recommended when including formative constructs. First, we contacted 31 marketing managers from companies that had responded to the questionnaire, by phone, in order to analyze the correlation between their answers and the data obtained in the first survey. No significant differences were found. Second, we used the procedural remedies of protecting respondent anonymity and reducing apprehension by assuring subjects that there were no right or wrong answers, improving scale items with the input of an expert panel, and randomizing question order.

#### **4.2. Data analysis**

The hypotheses were tested simultaneously using partial least squares (PLS), a structural equation modelling technique employing a principal component-based estimation approach (Chin, 1998). PLS was selected because of the characteristics of our model and sample. Our model uses formative indicators and our data is non-normal. Other techniques of structural equation modelling (e.g. the covariance-based model performed by LISREL or AMOS) cannot be applied in these circumstances (Diamantopoulos and Winklhofer, 2001). For hypothesis testing, we used the bootstrapping procedure recommended by Chin (1998).

This study uses PLS-Graph software version 03.00 Build 1058 (Chin, 2003). Using PLS involves following a two-stage approach (Barclay, Higgins and Thompson, 1995). The first step

requires the assessment of the measurement model. This allows the relationships between the observable variables and theoretical concepts to be specified. This analysis is performed in relation to the attributes of individual item reliability, construct reliability, average variance extracted (AVE), and discriminant validity of the indicators of latent variables. In the second step, the structural model is evaluated. The objective of this is to test the extent to which the causal relationships specified by the proposed model are consistent with the available data.

To analyze the relationships between the different constructs and their indicators, we have adopted the latent model perspective, in which the latent variable is understood to be the cause of the indicators and, therefore, we refer to reflective indicators for first-order constructs or dimensions. Two constructs in the model are operationalized as reflective, while three constructs; 'potential absorptive capacity', 'realised absorptive capacity' and 'unlearning context', are modelled as second-order formative constructs.

With regard to the measurement model, we began by assessing the individual item reliability (Table 1). The indicators exceed the accepted threshold of 0.707 for each factor loading (Carmines and Zeller, 1979).

**Table 1: Factor Loadings of reflective constructs**

	<i>INNOVATIVENESS</i>	<i>TRANSFORM</i>	<i>EXPLOITATION</i>	<i>IS CAPAC.</i>	<i>ADQUISITION</i>	<i>ASSIMILATION</i>	<i>UNDERSTANDINGS</i>	<i>LENS</i>	<i>INDIV. HABITS</i>
<i>P6_1</i>	<b>0.87</b>	0.42	0.47	0.35	0.42	0.39	0.51	0.39	0.42
<i>P6_2</i>	<b>0.88</b>	0.40	0.46	0.32	0.46	0.39	0.51	0.36	0.39
<i>P6_3</i>	<b>0.88</b>	0.38	0.34	0.39	0.32	0.31	0.46	0.29	0.35
<i>P5_1</i>	0.41	<b>0.88</b>	0.70	0.35	0.44	0.55	0.44	0.33	0.43
<i>P5_2</i>	0.31	<b>0.85</b>	0.70	0.40	0.40	0.34	0.36	0.38	0.39
<i>P5_3</i>	0.36	<b>0.76</b>	0.60	0.44	0.37	0.38	0.46	0.39	0.40
<i>P5_6</i>	0.34	<b>0.70</b>	0.59	0.31	0.35	0.31	0.31	0.16	0.30
<i>P5_7</i>	0.33	0.52	<b>0.78</b>	0.27	0.34	0.25	0.29	0.21	0.33
<i>P5_10</i>	0.44	0.70	<b>0.78</b>	0.36	0.47	0.39	0.38	0.34	0.48
<i>P5_12</i>	0.39	0.63	<b>0.80</b>	0.35	0.36	0.37	0.38	0.27	0.41
<i>P14_1</i>	0.36	0.45	0.43	<b>0.90</b>	0.40	0.44	0.47	0.37	0.44
<i>P14_2</i>	0.36	0.48	0.46	<b>0.91</b>	0.41	0.45	0.52	0.39	0.48
<i>P14_3</i>	0.28	0.33	0.37	<b>0.83</b>	0.34	0.26	0.38	0.28	0.36
<i>P4_1</i>	0.29	0.38	0.39	0.35	<b>0.71</b>	0.36	0.47	0.24	0.44
<i>P4_2</i>	0.25	0.31	0.36	0.23	<b>0.78</b>	0.29	0.33	0.32	0.36
<i>P4_3</i>	0.29	0.28	0.33	0.18	<b>0.77</b>	0.24	0.30	0.17	0.29
<i>P4_5</i>	0.32	0.27	0.27	0.19	<b>0.76</b>	0.23	0.22	0.18	0.26
<i>P4_6</i>	0.34	0.35	0.39	0.31	<b>0.70</b>	0.33	0.37	0.30	0.37
<i>P4_8</i>	0.29	0.38	0.31	0.32	0.34	<b>0.72</b>	0.37	0.31	0.32
<i>P4_9</i>	0.39	0.53	0.47	0.44	0.46	<b>0.95</b>	0.47	0.45	0.46
<i>P4_10</i>	0.41	0.52	0.44	0.44	0.45	<b>0.92</b>	0.47	0.48	0.50
<i>P1_1</i>	0.51	0.43	0.42	0.41	0.40	0.37	<b>0.83</b>	0.38	0.49
<i>P1_2</i>	0.47	0.39	0.32	0.33	0.41	0.40	<b>0.71</b>	0.41	0.34
<i>P1_3</i>	0.56	0.30	0.31	0.28	0.34	0.26	<b>0.74</b>	0.23	0.37
<i>P1_4</i>	0.49	0.43	0.42	0.49	0.44	0.41	<b>0.83</b>	0.46	0.53
<i>P1_5</i>	0.48	0.41	0.41	0.44	0.47	0.39	<b>0.84</b>	0.43	0.55
<i>P1_6</i>	0.43	0.45	0.49	0.47	0.53	0.48	<b>0.80</b>	0.47	0.68
<i>P2_1</i>	0.35	0.38	0.35	0.33	0.38	0.32	0.42	<b>0.70</b>	0.41
<i>P2_3</i>	0.20	0.21	0.17	0.15	0.20	0.30	0.27	<b>0.75</b>	0.26
<i>P2_4</i>	0.28	0.31	0.28	0.30	0.31	0.33	0.39	<b>0.70</b>	0.37
<i>P2_5</i>	0.37	0.33	0.32	0.35	0.38	0.40	0.44	<b>0.84</b>	0.50
<i>P3_1</i>	0.38	0.43	0.44	0.47	0.42	0.41	0.54	0.48	<b>0.78</b>
<i>P3_2</i>	0.34	0.45	0.46	0.39	0.42	0.36	0.49	0.44	<b>0.76</b>
<i>P3_3</i>	0.24	0.39	0.37	0.39	0.34	0.34	0.40	0.36	<b>0.71</b>
<i>P3_4</i>	0.33	0.39	0.42	0.37	0.46	0.37	0.52	0.41	<b>0.76</b>
<i>P3_5</i>	0.28	0.33	0.37	0.24	0.37	0.29	0.39	0.37	<b>0.75</b>
<i>P3_6</i>	0.33	0.31	0.37	0.26	0.35	0.31	0.44	0.37	<b>0.75</b>
<i>P3_7</i>	0.30	0.33	0.41	0.33	0.46	0.34	0.47	0.40	<b>0.78</b>

From an examination of the results shown in Table 2, we can state that all of the constructs are reliable. They have values for both Cronbach's alpha coefficient and for a composite reliability greater than the value of 0.7 required in the early stages of research, and the stricter value of 0.8 required for basic research (Nunnally, 1978). The AVE should be greater than 0.5, meaning that 50% or more variance of the indicators should be accounted for (Fornell and Larcker, 1981). All constructs of our model exceed this condition (Table 2). For discriminant validity, we have compared the square root of the AVE (i.e., the diagonals in Table 2) with the correlations among constructs (i.e., the non-diagonal elements in Table 2). On average, each construct relates more strongly to its own measures than to others.

**Table 2: Descriptive Statistics and Correlation Matrix**

	Mean <sup>a</sup>	SD	CA	CR	AVE	1	1a	1b	2	2a	2b	2c	3	3a	3b	4	5
1. Potential Absorptive Capacity	4.45	1.44	n.a.	n.a.	n.a.	<b>n.a.</b>											
1a. Acquisition <sup>b</sup>	4.36	1.51	0.80	0.86	0.56	n.a.	<b>0.75</b>										
1b. Assimilation <sup>b</sup>	4.61	1.33	0.92	0.95	0.86	n.a.	0.47	<b>0.93</b>									
2. Unlearning Context	4.85	1.26	n.a.	n.a.	n.a.	0.70	0.62	0.58	<b>n.a.</b>								
2a. Consolidation of emergent u... <sup>b</sup>	5.17	1.27	0.89	0.92	0.65	0.62	0.55	0.50	n.a.	<b>0.81</b>							
2b. The examination of lens fitting <sup>b</sup>	4.84	1.23	0.83	0.88	0.66	0.52	0.43	0.48	n.a.	0.52	<b>0.81</b>						
2c. The framework for changing i... <sup>b</sup>	4.58	1.27	0.94	0.95	0.72	0.62	0.57	0.48	n.a.	0.55	0.65	<b>0.85</b>					
3. Realized Absorptive Capacity	4.53	1.30	n.a.	n.a.	n.a.	0.65	0.58	0.52	0.62	0.55	0.43	0.58	<b>n.a.</b>				
3a. Transformation <sup>b</sup>	4.68	1.33	0.82	0.88	0.65	0.76	0.64	0.66	0.69	0.62	0.53	0.60	n.a.	<b>0.80</b>			
3b. Exploitation <sup>b</sup>	4.34	1.26	0.71	0.83	0.62	0.73	0.67	0.58	0.71	0.61	0.51	0.67	n.a.	0.74	<b>0.79</b>		
4. IS Capability	5.21	1.32	0.82	0.92	0.78	0.53	0.45	0.45	0.58	0.54	0.41	0.51	0.53	0.58	0.57	<b>0.88</b>	
5. Firm Innovativeness	4.78	1.33	0.80	0.91	0.77	0.64	0.56	0.53	0.67	0.64	0.54	0.53	0.62	0.65	0.69	0.53	<b>0.87</b>

Notes:

<sup>a</sup> Mean = the average score for all of the items included in this measure; S.D. = Standard Deviation; CA = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; n.a. = not applicable. <sup>b</sup> They represent the dimensions of each second-order construct. The bold numbers on the diagonal are the square root of the Average Variance Extracted. Off-diagonal elements are correlations among constructs.

The evaluation of formative dimensions of three high-order constructs, 'potential absorptive capacity', 'realised absorptive capacity' and 'unlearning context', is different from that of the reflective dimensions. The appropriate procedure for formative dimensions is an examination of the weights (Mathieson, Peacock and Chin, 2001), which is a canonical correlation analysis and provides information about how each indicator contributes to the respective construct (see Table 3). Weights do not need to exceed any particular benchmark because a census of indicators is required for a formative specification (Diamantopoulos and Winklhofer, 2001). The concern with formative dimensions is potential multicollinearity with overlapping dimensions, which could produce unstable estimates (Mathieson et al., 2001). Results of a colinearity test show the variance inflation factor (VIF) scores of each second-order construct for all dimensions are far below the commonly accepted cut-off of 10. In addition, we confirmed the validity of the formative dimensions using the procedures suggested by Fornell and Larcker (1981) and McKenzie, Podsakoff and Jarvis (2005).

**Table 3: Weights of formative constructs**

High order constructs and their dimensions	weights	t de Student
Potential Absorptive Capacity		
Acquisition	0.66	12.82
Assimilation	0.44	8.92
Unlearning Context		
Consolidation of emergent understandings	0.45	5.68
The examination of lens fitting	0.21	3.23
The framework for changing individual habits	0.49	6.15
Realized Absorptive Capacity		
Transformation	0.48	4.14
Exploitation	0.56	4.91

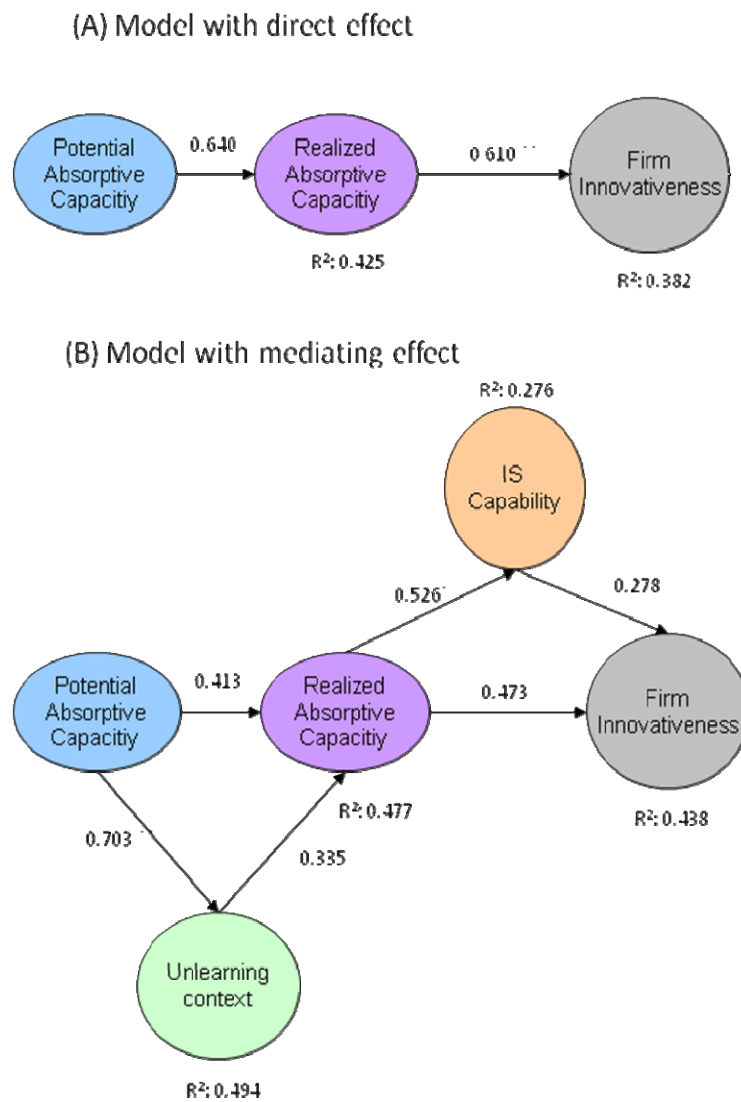
### 4.3. Results

The structural model resulting from the PLS analysis is summarised in Figure 3, where the explained variance of endogenous variables ( $R^2$ ) and the standardised path coefficients ( $\beta$ ) are shown. As can be seen, all the hypothesized relationships are significant, and therefore, the hypotheses are supported. Since PLS makes no distributional assumptions in its parameter



estimation, traditional parameter-based techniques for significance testing and modelling were used (Chin, 1998). One consequence of the comparison between covariance structure analysis modelling approaches and PLS is that no proper overall goodness-of-fit measures exist for models using the latter (Hulland, 1999). The structural model is evaluated by examining the  $R^2$  values and the size of the structural path coefficients.

**Figure 3: Estimated casual relationships in the structural model**



\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$  (based on  $t_{(499)}$ , two-tailed test)

The stability of the estimates is examined by using the  $t$ -statistics obtained from a bootstrap test with 500 resamples. Table 4 sets out the model statistics, the path coefficients and the  $t$  values observed with the level of significance achieved from the bootstrap test.

**Table 4: Model statistics**

Hypotheses	Path coefficients	T values	R <sup>2</sup>	ΔR <sup>2</sup>	F <sup>2</sup>
Potential absorptive capacity → Realized absorptive capacity (only direct effect)	0.649 <sup>***</sup>	5.77	0.42		
Potential absorptive capacity → Realized absorptive capacity (mediated by unlearning context)	0.413 <sup>***</sup>	4.13	0.47	+0.05	0.1
Realized absorptive capacity → Firm Innovativeness (only direct effect)	0.610 <sup>***</sup>	8.39	0.38		
Realized absorptive capacity → Firm Innovativeness (mediated by IS capacity)	0.473 <sup>***</sup>	6.69	0.43	+0.05	0.09

\*\*\*p < .001, \*\*p < .01, \*p < .05, ns = not significant (based on a Student t (499) distribution with two tails). t(.001,499)=3.310124157, t(.01,499)=2.585711627, t(.05,499)=1.964726835.

Adopting the approach used by Tippins and Sohi (2003), we checked for the presence of mediating effects by comparing the direct effect between variables and the competing links where the mediated variable is inserted, in which two substantive links are estimated and evaluated for significant differences. Table 4 shows the results of the two competing links.

The first link (direct effect) examined the direct relationship between PACAP and RACAP, while the second link (partial mediation) examined the same relationship with the unlearning context acting as a mediator. The results of this partial mediation link support our hypothesis. Firstly, the partial mediation model explains more variance in RACAP than the direct effect model (0.48 vs. 0.42). Secondly, positive relationships exist between PACAP and the unlearning context ( $\beta = 0.703$ ,  $p < 0.001$ ) and between the unlearning context and RACAP ( $\beta = 0.335$ ,  $p < 0.001$ ) (see Figure 2). Thirdly, the significant relationship between PACAP and RACAP in the direct effect model ( $\beta = 0.649$ ,  $p < 0.001$ ) diminishes in the partial mediation model ( $\beta = 0.413$ ,  $p < 0.001$ ). Together, these three points provide evidence that there is a discernible mediating effect on the unlearning context and that the partial mediation model represents a significant improvement over the direct effect model. The partial mediation model explained a substantial amount of the variance of the realised absorptive capacity ( $R^2 = 0.48$ ). We also estimate the ratio  $F^2$  suggested by Chin (1998), to provide the level of significance of the improvement. When  $F^2$  is greater than 0.02, the improvement is significant. In our case  $F^2$  was 0.1.

Likewise, we checked for the presence of the second mediating effect by comparing the relationship between RACAP and company innovativeness, and the competing link where IS capability is included. Table 4 also shows the results of these two competing links. The first link (direct effect) examined the direct relationship between RACAP and 'firm innovativeness', while the second link (partial mediation) examined the same relationship with IS capability acting as a mediator. The results of the partial mediation link support our hypothesis. Firstly, the partial mediation model explains more variance in innovation than the direct effect model (0.44 vs. 0.38). Secondly, positive relationships exist between RACAP and IS capability ( $\beta = 0.526$ ,  $p <$

0.001) and between IS capability and company innovativeness ( $\beta = 0.278$ ,  $p < 0.05$ ) (see Figure 2). Thirdly, the significant relationship between RACAP and innovativeness in the direct effect model ( $\beta = 0.610$ ,  $p < 0.001$ ) diminishes in the partial mediation model ( $\beta = 0.473$ ,  $p < 0.001$ ). Together, these three points provide evidence that there is a discernible mediating effect of IS capability and that the partial mediation model represents a significant improvement over the direct effect model. The partial mediation model explained a substantial amount of the variance of the innovation ( $R^2 = 0.44$ ). We also estimate the ratio  $F^2$  suggested by Chin (1998), to provide the level of significance of the improvement. When  $F^2$  is greater than 0.02, the improvement is significant. In our case  $F^2$  was 0.09.

Therefore, we can state that both hypotheses are supported. That is to say, the dependent variables (i.e. RACAP, firm innovativeness), are better explained in the presence of the mediator variables than when the mediators are not present.

Finally, we performed the Stone-Geisser test for predictive relevance to assess model fit in the PLS analysis (Geisser, 1975; Stone, 1974). When q-squared is greater than zero, the model has predictive relevance. In our model, q-squared was 0.25.

## 5. Discussion

The purposes of this study are to examine the relationship between absorptive capacity and company innovativeness and to identify potential contexts and capacities that can act as catalysts for these relationships. In pursuing those aims, we unpack the concept of absorptive capacity by capturing the processes behind the development of acquisition, assimilation, transformation and exploitation capacities and testing their impact on company innovativeness, in the context of unlearning and IS capability. As expected, and consistent with our model, organizational mechanisms associated with PACAP had a significant positive effect on RACAP. Therefore, if the PACAP-enhancing activities provide access to more knowledge, and a greater knowledge base enables the company to search for solutions more effectively, then these activities should improve the efficiency of RACAP for new innovation (Cohen and Levinthal, 1990).

Furthermore, the organizational mechanisms associated with the unlearning frameworks provide somewhat surprising results. Our data indicate that PACAP has an indirect effect on RACAP through the unlearning context. This confirms what authors such as Zahra and George (2002) suggested when they stressed that PACAP and RACAP are fundamentally different concepts that require very different strategies and structures, and that the resulting tensions between the two are difficult to reconcile. While PACAP requires change, flexibility and creativity, RACAP requires order, control and stability (Zahra and George, 2002). Current measures may pay too much attention to the ability to recognise and assimilate external knowledge (i.e. PACAP) while neglecting the role of the receiving unit's motivation to put knowledge to commercial use (i.e. RACAP). Therefore, managers need to be aware of the role of the unlearning context in closing the knowledge gap between PACAP and RACAP. Because old, outdated knowledge can impede adaptation to new configurations, senior managers need to

create a culture of continuous unlearning. Without care, organizations can fall into a 'competence trap' (Leonard-Barton, 1992), increasingly exploiting obsolete competences, or they can fall into a 'failure trap' (Levinthal and March, 1993), where a failure while exploring new opportunities may lead to more research and change, and so to failure again, which leads to more research and so on. Taking this into consideration, we argue that the company's unlearning context plays a key role in managing the tension between PACAP and RACAP. As organizational members pursue new learning, the unlearning context is instrumental in establishing new habits, patterns and ways of doing things and interpreting things as integral to employees' jobs.

Our results are consistent with the organizational innovation literature. As we proposed, RACAP has a positive effect on organizational innovativeness. That is, newly created knowledge allows companies to generate new ideas and innovation. These findings confirm the important role of the knowledge-creating process. RACAP fosters the utilization of recently created knowledge. This is essential for developing innovations. These results support the theoretical literature (Cohen and Levinthal, 1990; March, 1991; Kogut and Zander, 1992; Leonard-Barton and Sensiper, 1998; Hedlund, 1994; Nonaka and Takeuchi, 1995) and are consistent with previous empirical research (Hurley and Hult, 1998; Baker and Sinkula, 1999).

Finally, the analytical results of this study support the proposal that firms that invest in and improve information systems are more likely to adopt innovations. This is in broad agreement with the conclusions of authors such as Dibrell, Davis and Craig (2008) who assert that IS capability may be essential in translating knowledge into enhanced company performance (i.e. innovation). Furthermore, the results support the idea that RACAP has an indirect effect on company innovativeness mediated by information technology. These findings support the views of Hsiu-Fen and Gwo-Guang (2005), who drew attention to the fact that IS capability (knowledge infrastructure) enables employees to both use existing knowledge and create new knowledge, both of which are crucial for the adoption of innovation. For example, rather than engaging in an extensive search through an organization's information technology-based repository of knowledge (e.g. databases), employees turn first to friends and peers to learn where to find the relevant knowledge. Consequently, organizations can only take advantage of RACAP after technology systems or colleagues direct members of an organization to a specific location in a database for lessons or tools.

Therefore, managers need to be aware of the role of the unlearning context in closing the knowledge gap between PACAP and RACAP. Because old, outdated knowledge can impede adaptation to new configurations, senior managers need to create a culture of continuous unlearning. Without care, organizations can fall into a 'competence trap' increasingly exploiting obsolete competences, or they can fall into a 'failure trap', where a failure while exploring new opportunities may lead to more research and change, and so to failure again, which leads to more research and so on. Taking this into consideration, we argue that the company's unlearning context plays a key role in managing the tension between PACAP and RACAP. As

organizational members pursue new learning, the unlearning context is instrumental in establishing new habits, patterns and ways of doing things and interpreting things as integral to employees' jobs. We think that this is an important finding, as potential for any company to develop will depend substantially on its ability to maintain an appropriate balance between PACAP and RACAP, thus, companies may be trapped in a suboptimal stable equilibrium. As many overloaded managers are paring their sources, they may pay too much attention to the ability to recognise and assimilate external knowledge (i.e. PACAP) while neglecting the role of the receiving unit's motivation to put knowledge to commercial use (i.e. RACAP).

This article makes three contributions to the management literature. First, our results indicate that establishing an unlearning context, whereby an organization encourages individuals to make their own choices as to how they divide their time between PACAP and RACAP, is possible and relates positively to innovation. This finding is important in the ongoing debate surrounding the relationship between the exploration and exploitation of knowledge, and confirms what authors such as Eisenhardt and Martin (2000) and Newey and Zahra (2009) say when they argue that a company's ability to reconfigure the dynamic processes of exploration and exploitation of knowledge is a key source of its sustainable competitive advantage.

Second, this research provides evidence to test the theoretical model on the basis of empirical tests. Even though research in the innovation field theoretically indicates that absorptive capacity is a catalyst for organizational innovativeness (Cohen and Levinthal, 1990; Fosfuri and Tribó, 2008), the innovation literature lacks empirical evidence to support this assertion. The process we followed included an in-depth literature review and an empirical study of several industries. This method helps to fill the gap in empirical work in the innovation and absorptive capacity fields, in which measures of organizational knowledge are rare, and often rely on crude proxies.

Third, the results also shed light on a tangible means for managers to enhance their company's innovation capabilities through IT. Our findings indicate that both IS capability and RACAP contribute to company innovativeness. This could be interpreted as meaning that the lack of absorptive capacity that may exist in the early stages of IS development can gradually be enhanced through the use of RACAP (i.e. real options). Consequently, this sequential model presented in this paper provides practical steps for managers interested in organizational structures that support company innovativeness.

## **6. Conclusions**

As competition intensifies and the pace of change accelerates, it is likely that aspects of PACAP and RACAP will change over time, requiring the modification of some of the content of organizational learning. Sethi, Smith and Park (2001), for instance, found that social cohesion among product development teams decreases the innovativeness of new products. In such situations, even though PACAP and RACAP potentially facilitate information sharing and joint sense-making, if those processes are not balanced appropriately, innovations are likely to suffer,

causing a reduction in the value of new products and services. The present study found that the unlearning context mediates the effects of PACAP on RACAP. Although this result needs further investigation, one conclusion that might be drawn is that managers need to foster an unlearning context to encourage the alignment of knowledge exploitation and exploration within the organization, in order to build effective innovations. As part of this assessment, the results emphasise the need for managers to have an explicit understanding of how their critical knowledge can be leveraged to renew their RACAP when needed. Perhaps management is over-investing in the development of PACAP and RACAP processes when they should be investing in mechanisms to facilitate the context of unlearning. Increased efforts to promote unlearning will greatly strengthen the link between PACAP and RACAP.

On the other hand, company innovativeness is not determined by RACAP alone, but is also influenced by changes in the technological structures and the organizational developments that facilitate technology implementation. The present study found that the effect of RACAP on company innovativeness is mediated through the presence of information system capability. From a practical point of view, this finding may help managers to decide what technological knowledge they should have to support their RACAP, to compare that technological knowledge with what they already have, and to make decisions about how to develop or acquire the appropriate technology and knowledge. As a result, managers need actively to manage the knowledge gap between the technology they need to have and the RACAP they actually have.

Future research will need to continue developing tools to support unlearning. Because knowledge entails scope and context and is enacted through the perspectives of multiple holders of knowledge in a firm and captured through language, the choice of the “holders of knowledge” who will identify what the firm must know is crucial (Cepeda and Vera, 2007). The present study has relied on the CEO or a member of the senior management team as a key holder of knowledge about the company and its capacity to learn or unlearn. Future research, might profitably sample multiple holders of knowledge within a company, and will be helpful in testing for inter-rater reliability and improving the internal validity of knowledge management studies. Furthermore, the present research was conducted within one national context to control for national culture effects across firms. Nonetheless, this design affects the external validity of the results. Since we have used a list of companies belonging to different sectors, it is probable that the results can be generalised to countries with similar characteristics. Some relevant features of the companies in this study need to be taken into consideration: (1) the companies are relatively large and old, (2) most of the personnel hold a university degree, and (3) the technological environment is changing continuously. Future studies could compare our results with those in other contexts.

Finally, the cross-sectional design does not allow us to observe the short- and long-term impact of absorptive capacity on the unlearning context, information system capability and organizational innovativeness. Although our model proposes sequenced relationships between absorptive capacities (PACAP and RACAP), the unlearning context and IS capability, we

measure all these constructs at one point in time. Also, our measures do not directly capture dynamic change in innovation, but only the positive association between RACAP, IS capability and organizational innovativeness at one point. This positive association is suggestive of how a change in one variable is related to change in the other variable. Given the dynamic nature of the processes and constructs implied in our model, and the possibility of feedback loops and circular relationships characteristic of such dynamic capabilities, our study would benefit from a more longitudinal approach in order to understand more fully the link between unlearning context, IS capability and absorptive capacities.

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### **Appendix 1. Questionnaire items**

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**Potential Absorptive Capacity** (1= high disagreement and 7= high agreement):

- 
- P4\_1: Our unit has frequent interactions with corporate headquarters to acquire new knowledge
- P4\_2: Employees of our unit regularly visit other branches
- P4\_3: We collect industry information through informal means (e.g. lunch with industry friends, talks with trade partners).
- P4\_4: Other divisions of our company are hardly visited (reversed).
- P4\_5: Our unit periodically organises special meeting with customers or third parties to acquire new knowledge.
- P4\_6: Employees regularly approach third parties such as accountants, consultants or tax consultants
- P4\_7: We are slow to recognise shifts in our market (e.g. competition, regulation, demography) (reversed).
- P4\_8: New opportunities to serve our clients are quickly understood
- P4\_9: We quickly analyze and interpret changing market demands
- (Source: Jansen et al., 2005)

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**Realised Absorptive Capacity** (1= high disagreement and 7= high agreement):

- 
- P5\_1: Our unit regularly considers the consequences of changing market demands in terms of new products and services
- P5\_2: Employees record and store newly acquired knowledge for future reference
- P5\_3: Our unit quickly recognises the usefulness of new external knowledge to existing knowledge
- P5\_4: Employees hardly share practical experiences (reverse)
- P5\_5: We laboriously grasp the opportunities for our unit from new external knowledge (reverse)
- P5\_6: Our unit periodically meets to discuss consequences of market trends an new product development
- P5\_7: Its clearly known how activities within our unit should be performed
- P5\_8: Client complaints fall on deaf ears in our unit (reverse)
- P5\_9: Client complaints fall on deaf ears in our unit (reverse)
- P5\_10: Our unit has a clear division of roles and responsibilities
- P5\_11: We constantly consider how to better exploit knowledge

P5\_12: Our unit has difficulty implementing new products and services (reverse)

P5\_13: Employees have a common language regarding our products and services

(Source: Jansen et al., 2005)

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**The consolidation of emergent understandings:** with respect to your organization indicate the degree of agreement or disagreement (1= high disagreement and 7= high agreement):

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P1\_1: Managers seem to be open to new ideas and new ways of doing things

P1\_2: Management has tried to initiate projects and introduce innovations

P1\_3: Managers recognise the value of new information, assimilate it and apply it

P1\_4: Managers adopt the suggestions of personnel in the form of new routines and processes

P1\_5: Managers are prone to collaborate with members of the organization and to solve problems together

P1\_6: Managers are concerned with the fact that the manner of answering before unforeseen circumstances will be known by all

(Source: Cegarra and Sánchez, 2008)

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**The examination of lens fitting:** with respect to your current position indicate the degree of agreement or disagreement (1= high disagreement and 7= high agreement):

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P2\_1: Employees are able to identify problems (new ways of doing things) easily

P2\_2: Employees are able to see mistakes from my colleagues

P2\_3: Employees are able to listen to my customers (e.g. complaints, suggestions)

P2\_4: Employees are able to share information with my boss easily

P2\_5: Employees try to reflect and learn from their own mistakes

(Source: Cegarra and Sánchez, 2008)

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**The framework for changing the individual habits:** with respect to your personal skills indicate the degree of agreement or disagreement (1= high disagreement and 7= high agreement):

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P3\_1: New situations have helped individuals identify their own mistakes

P3\_2: New situations have helped individuals recognise unwished attitudes

P3\_3: New situations have helped individuals identify improper behaviours

P3\_4: Individuals recognise forms of reasoning or arriving to solutions as inadequate

P3\_5: New situations have helped individuals change their behaviours

P3\_6: New situations have helped individuals change their attitudes

P3\_7: New situations have helped individuals change their thoughts

(Source: Cegarra and Sánchez, 2008)

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**IS capability:** (1= high disagreement and 7= high agreement):

P14\_1: There are rules for formatting or categorizing knowledge in my organization

P14\_2: There are specified keywords that need to be used for categorizing or searching for knowledge in my organization

P14\_3: There are common technologies available for everyone in my organization

P14\_4: There are technological barriers in my organization that prevent absorbing knowledge

P14\_5: There are technological barriers in my organization that prevent applying knowledge

P14\_6: Potential problems in technology are uncovered before the business is affected

P14\_7: Data is searched for errors/mistakes frequently

(Source: Gold et al., 2001)

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**Organizational innovativeness:** (1= high disagreement and 7= high agreement):

P6\_1. Accepted technical innovation

P6\_2. Management seeks innovation

P6\_3. Innovation is readily accepted in program/project management

P6\_4. People are penalised for new ideas that don't work (R)

P6\_5. Innovation is perceived as too risky and is resisted (R)

(Source: Hurley and Hult, 1998)

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