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Why Open-mindedness Needs Time to Explore and Exploit Knowledge

Juan Gabriel Cegarra-Navarro and Gabriel Cepeda-Carrión

ABSTRACT. It is clear from the literature that in situations where organizations and their members face changing environments, it is necessary that mechanisms (learning) exist to capture the new knowledge which enables the firms to address those changes. This article examines the relative importance and significance of the existence of an 'open-mindedness context' to the existence and nature of 'organizational learning'. We include time as a variable in the analysis and focus on the need to unlearn at a moment (T) in order to learn more efficiently at a moment after (T+1). These relationships are examined through an empirical investigation of 107 Spanish small to medium-sized enterprises (SMEs) within the telecommunications industry. The results indicate that the effects of exploration and exploitation of knowledge at moment T+1 is conditioned by the existence of an 'open-mindedness culture' at moment T. **KEY WORDS** exploiting knowledge; exploring knowledge; open-mindedness; time

Introduction

Since the publication of March's (1991) pioneering article, the terms 'exploration' and 'exploitation' have emerged as the twin concepts underpinning organizational adaptation research. March (1991) described two aspect of organizational learning: a) exploration of (i.e. creating) new knowledge, skills

and processes; and b) exploitation of (i.e. using) existing knowledge, skills and processes. Although it seems intuitively clear that a firm needs both elements to explore new possibilities to ensure profits for tomorrow and exploit old certainties for profits for today, there is some ambiguity regarding the relationship between exploration and exploitation (March and Simon, 1958). As competition intensifies and the pace of change accelerates, it is likely that aspects of exploratory and exploitative processes (e.g. routines and procedures) will change over time, requiring the modification of some of the contents of organizational learning (Levinthal and March, 1993). In this regard, a value closely associated with a learning organization is open-mindedness (Sinkula et al., 1997). Open-mindedness is an organizational value that measures receptivity to new and possibly different ideas. While familiar approaches to problems and their solutions may have proven successful in the past, open-minded contexts are more likely to question long-held practices and beliefs (Sinkula et al., 1997) and encourage the sharing of strategic information among decision-makers (Day, 1994). Open-mindedness engenders a willingness to question current thinking and practice, to be receptive to emerging possibilities, to share ideas and to consider differing perspectives.

While the conceptual distinction between exploration and exploitation and their implications for strategy and structure have been intensively studied (He and Wong, 2004), there has been surprisingly little empirical investigation of the effects between the open-mindedness context and the learning process over time. Time has traditionally been considered in the management literature as a constant rather than a variable, a belief Blueborn (2000) ascribes to people in general. Further, as Blueborn notes, the belief that time is a constant is deeply institutionalized, which suggests that most people, most of the time, do not even consider the possibility that time may vary. This suggests one should speak of 'times' rather than 'time' (Purser et al., 2005). We assume in our study that 'times' are sequential, first to create an open-mindedness context and then to explore and exploit knowledge. To do so we propose the construction and analysis of three structural models. Whereas in the first model, open-mindedness is oriented to the exploration process, and the 'exploration process' is analysed in the creation of 'exploitation activities' as a prior step, in the second model 'exploitation' is considered as a prior step. In the last model, 'exploration and exploitation' are considered to be undertaken in parallel.

Conceptual Framework

Time

Models in current organizational theory rest on a theoretical understanding of time whose guiding concept is permanent identity. However, the identity con-

cept appears to be problematic in general, and for complex entities such as organizations, the issue of identity is more complex than for generic things. The focus on identity leads to a linear conception of temporality. The effect is to consider the organization existing 'in' time, although its identity evolves and changes 'through' time (Gioia et al., 2000). The outcome is omitting time as a variable in management research. However, another set of authors focuses on time as a variable to be taken into account. For Gist and Mitchell (1992), an individual's level of self-efficacy can be expected to change over time as new information and skills are acquired through direct experience of the task, performance feedback and other factors. Crossan et al. (2005) focus on three aspects of time:

- a) Time as a trigger for change – as Gersick's (1991) work shows, groups with very different characteristics change their behaviour when approaching the middle of the span of time they have to perform a task;
- b) Time acts as a co-ordination mechanism for change – time creates a shared calendar for change and, thus, serves to schedule activities and to maximize their synchronization (Hedberg et al., 1976);
- c) Time as a resource for change – time provides organizational members with the temporal space they need to reflect on and conceive of that change (Tyre et al., 1996), e.g. planning aims to enable co-ordination. It does so not by establishing deadlines on a case-by-case basis but by dictating the pace of the organization through the explication of its major change cycles (Eisenhardt and Brown, 1998).

Causal time is seen as one-dimensional, structured in terms of past (t_0), present (t_1) and future (t_2) (Adam, 1990). In this 'from-to' causal structure, whatever arises in the future has its origin in the past (Tulku, 1994), which means that organizational members who are always responding to a series of real-time instants are forced to think and act immediately (McKenna, 1997), and demands for instant responses frequently means relying on learned routines, established customer relations and unconscious cognitive biases (Purser et al., 1992). Therefore, when the rate of change itself is steadily accelerating, it becomes highly problematic as to whether or not the knowledge needed to manage change can be accessed in a timely manner. Our focus is the relationship between casual time and knowledge. In the learning process, knowledge is a process that happens over time, and takes time to learn and unlearn (Purser et al., 2005).

For the purposes of this article, we suggest that the implementation of an open-mindedness context is variable and distant in time by the fact that many of the behaviours and habits designed to foster a learning culture often require time (Lei et al., 1999). Changing a learning culture presents a similar problem. The values that define and shape a culture are generally deeply embedded, and are exceedingly difficult to change in the short term (Lei et al., 1999). Therefore, a decision to re-orientate exploration and exploitation processes takes an extended

period to produce significant results. This suggests that an open-mindedness context at a certain point affects the organizational learning afterwards by changing the ways individuals interact or come to interpret things. Only in this way, by creating a fostering context to change (t_0), can new cycles of exploration and exploitation receive updated knowledge at the later moment (t_1). In the following paragraphs, we examine these concepts in greater detail and postulate relationships between them.

Learning terms

Relevant literature pays great attention to the modifications to the knowledge stored in a firm (Huber, 1991), particularly in situations where the firm encounters unusual events for which it has no answer, thus initiating search processes and eventually leading to a new solution (e.g. Cyert and March, 1963). Organizational learning constitutes an idiosyncratic and complex capability, which is difficult to imitate, replicate and transfer (Argyris and Schön, 1978). This capacity allows organizations to solve new problems or to solve old problems in new ways (Miner and Anderson, 1999). As has been described by many investigators, such as March (1991) and Volberda and Lewin (2003), there are two types of learning; namely, exploration and exploitation of knowledge.

Knowledge exploration starts with search, variation, risk-taking, experimentation and innovation, and is the stage in which novel practices are introduced. Small to medium-sized enterprises (SMEs) can encourage the exploration of knowledge by implementing formal or informal meetings, or creating external communities of practice where customers and sellers interact and work together for the achievement of a particular objective (Dewhurst and Cegarra, 2004). Such knowledge can be internalized by sellers and customers who materialize it in the form of relational trust, common language and confidence (Selnes and Sallis, 2003). At this stage, knowledge is individual rather than collective (Cohen, 1991), and tacit rather than explicit (Nonaka, 1994). This tacit knowledge eventually becomes consolidated, often through 'trial and error', and becomes explicit so that it can be stored in the organizational memory (Selnes and Sallis, 2003) and then exploited by the members of the organization.

Exploitation of knowledge is the process of effective allocation of resources into valuable and competitive business platforms based on existing knowledge (March, 1991; Holmqvist, 2004). While knowledge exploration retains the knowledge within the organization, knowledge exploitation releases the knowledge into the external environment. Sub-activities involved in an instance of knowledge exploitation include targeting the output, producing the output by interpreting and applying existing knowledge for the target, and transferring the output by packaging and delivering projections that have been produced for customers in the environment (Holsapple and Singh, 2001).

Open-mindedness

It is obvious that all knowledge generated via exploration and exploitation processes does not stay there permanently. The open-mindedness context has, at its heart, an attempt to re-orientate organizational values, norms and/or behaviours by changing cognitive structures (Nystrom and Starbuck, 1984), mental models (Day and Nedungandi, 1994), dominant logics (Bettis and Prahalad, 1995), and core assumptions that guide behaviour (Shaw and Perkins, 1991). If this is so, the contribution of that context has to do with the ability to prepare the ground for new learning to appear. According to Bogenrieder (2002), managers need to foster a context that opens the way for new habits, patterns, ways of doing and interpreting things to take place. With this aim, Sinkula et al. (1997) proposed that open-mindedness (i.e. a willingness to consider ideas and opinions that are new or different) is associated with this kind of context through which the management supports the proactive questions of existing organizational routines, assumptions and beliefs, potentially leading to being ignored, modified, deleted or replaced.

Now the question is whether open-mindedness at the moment (t_0) has a direct or indirect effect on exploration and exploitation of knowledge at a later moment (t_1). Does the simultaneous pursuit of exploration and exploitation activities add to or detract from each other's values?

Answering the question of continuity or parallelism may further depend on the level of analysis. As noted previously, exploration and exploitation are fundamentally different concepts that require very different strategies and structures, and the resulting tensions between the two are difficult to reconcile (He and Wong, 2004). While adapting for tomorrow requires change, flexibility and creativity, profits for today require order, control and stability (Volberda and Lewin, 2003). March (1991) provides several arguments in favour of his theorization that the two processes are fundamentally incompatible. First, exploration and exploitation compete for scarce organizational resources. In this regard, we would observe that since resources are scarce in SMEs, any resources devoted to exploration imply fewer resources left over for exploitation, and vice versa. Second, and assuming all else is equal, both types of actions are interactively self-reinforcing. In other words, the return of a particular item of knowledge is likely to depend on the other that the organization has at its disposal. Based on these concepts, exploration and exploitation processes are not autonomous, but they are continually interacting (Zollo and Winter, 2002). Through exploration, new ideas and actions flow from the customer to the vendor and from the vendor to the rest of the organization. As Harrington and Guimaraes (2005) note, knowledge exploration within the organization allows the acquisition, distribution, interpretation and storage of new knowledge that permits the organization to understand and censor new information systems as to their even-

tual use to the organization. At the same time, what has already been learned feeds back from the organization to the individual and customer levels, affecting how individuals act and think. These findings are consistent with Holmqvist's (2004) conceptualization that exploration within organizations may form a prerequisite for organizational exploitation, and illustrate what authors such as Boland et al. (1994) express when they suggest that exploiting knowledge supports knowledge exploration because it reduces uncertainty. It tells employees about their learning – what is working (do more of this) and what is not (do less of this). These aspects are studied in our investigation in the first two models of the work:

Model 1

Open-mindedness context (OM; t_0) → exploration of knowledge (ER; t_1) → exploitation of knowledge (ET; t_1)

Model 2

Open-mindedness context (OM; t_0) → exploitation of knowledge (ET; t_1) → exploration of knowledge (ER; t_1)

A parallel argument is made in Gupta et al. (2006) on the specialization of firms in exploration and exploitation and the matching of their search processes through co-operation. It is suggested that exploration and exploitation can effectively be balanced in systems of organizations when co-operating partners, A and B, possess complementary capabilities. In this regard, March (1991) suggests that maintaining an appropriate balance between exploration and exploitation is critical for firm survival and prosperity. Similarly, Levinthal and March (1993) argued, 'the basic problem confronting an organization is to engage in sufficient exploitation to ensure its current viability and, at the same time, to develop enough energy for exploration to ensure its future viability' (p. 105). The ability to manage an appropriate balance between exploration and exploitation has been labelled as 'ambidexterity' (Tushman and O'Reilly, 1996). A firm is regarded as ambidextrous if it has relatively equal emphasis on explorative and exploitive processes (He and Wong, 2004). Under this model, open-mindedness enables and encourages individuals to make their own judgement about how to divide their time between conflicting demands for alignment and adaptability. To validate this possibility, we propose the following model:

Model 3

Open-mindedness context (OM; t_0)  exploration of knowledge (ER; t_1)
exploitation of knowledge (ET; t_1)

Figure 1 provides a synopsis of all three models; while in the first model the open-mindedness culture is oriented to the exploration process, in the second

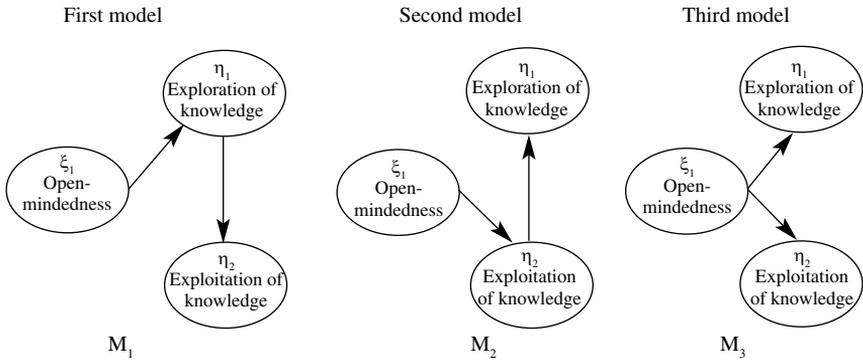


FIGURE 1
Open-mindedness context versus organizational learning

model, individuals that form part of the company exploit knowledge due to the existence of an open-mindedness context. Finally, in the third model, open-mindedness supports a simultaneous balance within the learning process.

Method

The Spanish economy has grown at an average annual rate of 3.6 per cent between 1996 and 2004. Today, the Spanish economy is the fifth largest in Europe, accounting for around 9 per cent of European Union output (OECD, 2005). The Spanish telecommunications industry was the subject of our data collection. The total market in Spain for ‘telecommunications’ (including set and mobile, and data communications with broadband Internet access as a key means of transmission), represents 18 per cent of the total European telecommunications market and nearly 4.7 per cent of the Spanish gross domestic product. SMEs that make up the Spanish telecommunications industry are highly motivated to introduce processes for learning and unlearning as they have to face up to a highly dynamic environment, strong competition and rapid advances in technology. In Spain, SMEs represent more than 99.8 per cent of all registered businesses, account for about 70 per cent of those participating in the workforce and generate approximately 65 per cent of the gross domestic product (Faces, 1999).

Data collection and measures

In order to test these models, we employed key informant methodology (Kumar et al., 1993) to collect survey data in the telecommunications industry in Spain during 2004 and 2005. The executives surveyed were identified as appropriate key respondents based on two criteria: a) possession of sufficient knowledge, and b) adequate level of involvement with regard to the issues under investigation (Campbell, 1955). To further ensure the validity of our data and ensure that we isolated the correct key informants, we included validation items in the research instrument. We used these items to again verify that the executives who responded were fully qualified to provide the information we requested.

The data were gathered in two phases and the first phase lasted over a month, from early May to June 2004. In total, 665 companies were solicited for participation in the study by telephone, and only 195 agreed. All companies were classified according to the European Union classification as SMEs. The second phase lasted for about two months, from early May to July 2005. In total, 130 companies (the companies that had completed the survey one year earlier) were contacted and 107 surveys were carried out, which gives a response rate of 16.09 per cent of the total (54.87% response rate from the companies who agreed). A comparison between the companies that answered and the companies that did not answer yielded no significant differences relevant to turnover, total assets or the number of employees, which suggests that non-response bias is not a problem (Armstrong and Overton, 1977).

Based on a discussion of the literature, a questionnaire consisting of 13 items (five measuring the range of learning exploration, four measuring the range of learning exploitation and four measuring the extent to which the open-mindedness context was achieved) was designed (see Appendix for questionnaire items).

The final measures relating to the existence of an 'open-mindedness culture' scale consisted of six items adapted from a scale designed by Baker and Sinkula (1999) to measure the construct of open-mindedness. These items describe the way management faced up to change, introduced it actively into the company through projects, collaborated with other members of the organization and recognized the value of new information or risk-taking.

The market orientation construct is highly relevant to generating knowledge in organizations (e.g. Kohli et al., 1993). Even though other possible dimensions of market knowledge can be discussed and conceptualized, the discussion of *intelligence generation* versus *knowledge exploration* is considered to be a fruitful starting point. While the former encourages individuals in the organization to track changing markets and share market intelligence with customers (Kohli et al., 1993), the latter places emphasis on the acquisition of knowledge about other external agents (e.g. universities, expert technicians, etc.). It is also more

related to encouraging exploration of knowledge through formal and informal meetings where external (e.g. customers) and internal agents (e.g. sellers) interact and work together for the achievement of a particular objective. In this study, the final measures relating to the existence of learning exploration consisted of six items adapted from a scale designed by Pérez López et al. (2004) to measure the construct of knowledge acquisition. Consistent with Pérez López et al. (2004), items that tapped the exploration of knowledge were interwoven with issues related to encouraging individuals in the organization to track changing markets and share market intelligence with external agents.

The existence of conditions necessary to support knowledge exploitation was measured using an adapted version of a scale also designed by Pérez López et al. (2004) to measure the constructs of 'knowledge interpretation'. This construct focuses on the implementation of information, having a sense of pride and ownership in one's work, and being aware of the critical issues that affect one's work. In line with Pérez López et al. (2004), items investigating the exploitation of knowledge were combined with issues related to support policies, rules and reporting structures that encourage the generation of new insights, taking actions that are experimental in nature, breaking out of traditional mindsets to see things in new and different ways, and developing the competencies for doing one's job. Four items make up this scale.

Data Analysis and Results

We used structural equation modelling (SEM) to test the proposed models and used EQS 6.1 to test the measurement and structural models. Using SEM involves following a two-stage approach (Barclay et al., 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 (constructs). For the second step, the structural model is evaluated. The objective of this is to confirm to what extent the causal relationships specified by the proposed model are consistent with the available data.

To analyse 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 speak of reflective indicators. All three constructs in the model are categorized as reflective.

With regards to the measurement model, the procedures included assessments of item and scale reliability, unidimensionality, and convergent and discriminant validity in order to validate measures. First, a series of exploratory factor analyses was conducted. A single factor was extracted for each multiple-item reflective scale in these analyses, using an eigenvalue of 1 as the cut-off point (which indicates that the measurement scales used in this study were unidimensional).

Next, overall measurement quality was assessed using confirmatory factor analyses (Anderson and Gerbing, 1988). Maximum likelihood was used in the estimation and re-specification of the confirmatory measurement model, and the sample covariance matrix was used as input.

After this deputation process, the resulting measurement model for the confirmatory factor analysis (CFA) model was found to fit the data reasonably well: $\chi^2_{(63)} = 85.63$, comparative fit index (CFI) = 0.95, incremental fit index (IFI) = 0.95, non-normed fit index (NNFI) = 0.94, and root-mean-square error of approximation (RMSEA) = 0.06. In addition, all items loaded significantly on their respective constructs (with the lowest *t*-value being 5.14), providing support for convergent validity. As a check for discriminant validity, the square root of the average variance extracted for each construct was greater than the latent factor correlations between pairs of constructs (see Table 1; Fornell and Larcker, 1981). Discriminant validity was also obtained using chi-square difference tests for all pairs of constructs (that is, correlations between all pairs of constructs were shown to be significantly below unity). The reliabilities of the multiple-item reflective measures are reported in Table 1, along with construct correlations and descriptive statistics for the scales. All reliability estimates – including coefficient alphas, average variance extracted for each construct and composite reliabilities – are well beyond the threshold levels suggested by Nunnally (1978) and Fornell and Larcker (1981). It is therefore concluded that the measures are unidimensional and have adequate reliability, discriminant validity and convergent validity.

TABLE 1
Descriptive statistics and correlation matrix

	Mean	SD	CA	CR	AVE	1	2	3	4
1. Open-mindedness culture	5.51	1.56	0.86	0.91	0.72	0.85			
2. Exploration of knowledge	5.29	1.39	0.81	0.87	0.56	0.30	0.75		
3. Exploitation of knowledge	5.47	1.62	0.80	0.87	0.63	0.38	0.18	0.79	

Mean = the average score for all of the items included in this measure; SD = Standard Deviation; CA = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted. The bold numbers on the diagonal are the square root of the Average Variance Extracted. Off-diagonal elements are correlations among constructs.

The structural models resulting from the SEM analysis are summarized in Table 2, where the standardized path coefficients (β) and the *t*-values associated are shown. As is observed, all paths presented in the three models are significant and have therefore been verified. We also reported the measures of fit for each model. As can be observed, the third model may be considered as the most

appropriate since it rates the best values for every measure of fit. This comparison among three models permits the conclusion that the third model fits better to the observable data than the other models shown.

TABLE 2
Models comparison

		First model	Second model	Third model
Open-mindedness → Exploration of knowledge (<i>t</i> -value)		0.271* (2.43)	–	0.263* (2.37)
Open-mindedness → Exploitation of knowledge (<i>t</i> -value)		–	0.356* (3.15)	0.356* (3.14)
Exploration of knowledge → Exploitation of knowledge (<i>t</i> -value)		0.209* (1.99)	–	–
Exploitation of knowledge → Exploration of knowledge (<i>t</i> -value)		–	0.202* (2.00)	–
Measures of fit	χ^2 (df, p)	93.57 (63, 0.00)	88.80 (63, 0.00)	86.76 (63, 0.00)
	CFI	0.902	0.935	0.940
	IFI	0.925	0.937	0.942
	NNFI	0.904	0.919	0.926
	RMSEA	0.068	0.062	0.060

* $p < 0.01$.

Discussion

In today’s organizational environment of increasingly rapid continuous change, the consequences of relying on learned routines become increasingly problematic. Our results support that open-mindedness at a moment (t_0) is a significant positive predictor of learning at moment (t_1). These findings highlight the significance of time, a factor often overlooked in organizational learning research. In the present study, time in open-mindedness is one factor that is important in determining the relative impact of outdated knowledge. It must be noted that organizations may attempt to update information on employee skills, expertise and knowledge through open-mindedness efforts, but employees may be reluctant to forget a complete personal profile for a variety of reasons. For example, open-mindedness may decrease an employee’s motivation because the performance appraisal criteria become unclear. Furthermore, the effect of open-mindedness is slow because it takes time for individuals to forget outdated knowledge. This is, in part, due to the liability of success. ‘The presumed correctness of past actions and interpretations is reinforced by repeated success,

and the ensuing complacency breeds rejection of information that conflicts with conventional wisdom' (Day, 1994: 24). In addition, individuals tend to overlook relevant events just outside their domain that threaten their reputation and careers (Starbuck, 1992). Consequently, managers should not expect instant results of open-mindedness with regard to organizational learning. In such situations, open-mindedness may be further 'consolidated' through time and the emergent understandings that are created by organizational members when they interact; or by exploitive processes (e.g. using organizational memory), which may offer a better way of delivering information (Schein, 1993).

In our examination of causal time in the field of organizational learning, we have questioned the existing models that relate to open-mindedness and organizational learning. In doing so, three models of knowledge management have been identified in this article.

The first model recommends aligning open-mindedness efforts with the firm's explorative capacity. The fit statistics for this model were acceptable with $\chi^2_{(63)} = 93.57$; CFI = 0.90, IFI = 0.92 and RMSEA = 0.068. The interaction between open-mindedness and exploration was positive with a standardized coefficient of 0.271, $t = 2.43$ ($p < 0.01$). This reinforces the idea that exploratory behaviour alone may produce poor results in the acquisition of external knowledge. Companies may acquire external knowledge using only similar processes or contacts to what they have utilized previously. That is, rather than deciding ahead of time which process or partner must be used to acquire external knowledge and making this explicitly available to the exclusion of everything else, managers need to reassess long-held organizational routines, assumptions, and beliefs (Sinkula et al., 1997), allowing organizational members to call upon aspects of practice, latent in the periphery, as they are needed (Brown and Duguid, 1993). Otherwise, external information will rely on prior experience and inter-firm trust that has been created with familiar partners (Lavie and Rosenkopf, 2006). Note that this model also indicates that in order to exploit knowledge, organizations need to provide and support exploration of knowledge as a prior step. In this regard, we have found a significant effect of exploration on exploitation of knowledge with a standardized coefficient of 0.209, $t = 1.99$ ($p < 0.01$). This addresses the concerns expressed by authors such as Humphreys et al. (2005) when they assert that if employees are going to challenge their deepest-held meaning in a workplace context, the workplace context needs to change prior to this.

The second model recommends aligning open-mindedness efforts with the firm's exploitive capacity. The fit statistics for this model were also acceptable with $\chi^2_{(63)} = 88.80$; CFI = 0.93, IFI = 0.94 and RMSEA = 0.062. The interaction between open-mindedness and exploitation was positive with a standardized coefficient of 0.356, $t = 3.15$ ($p < 0.01$). From this view, the framework for open-mindedness is related to changing the implicit preconscious mode of thinking.

Through open-mindedness, individuals will be able to think outside their conventional boundaries and recall inappropriate attitudes and habits. In this model, we have also found a significant effect of exploitation on exploration of knowledge with a standardized coefficient of 0.209, $t = 1.99$ ($p < 0.01$). This finding corroborates the notions of Day (1994) that when personal value structures and behaviours change, this might result in a change in the organizational structures to one that is more oriented around end-user markets, which in turn results in a relation shift that favours the customers. As a result, because of their inherent flexibility, these firms are able to quickly reconfigure their architecture and re-allocate their resources to focus on emergent opportunities or threats (Slater and Narver, 1995).

Regarding the third model, open-mindedness was significantly related to both exploration and exploitation processes with standardized coefficients of 0.263 ($p < 0.01$) and 0.356 ($p < 0.01$) respectively. It is often stated in relevant literature that firms more often converge (exploit) rather than re-orient (explore) due to a variety of reasons such as organizational inertia (e.g. Hannan and Freeman, 1984; Milliken and Lant, 1991). Consequently, our results challenge these traditional views, as they suggest that an open-mindedness context is an important antecedent to encourage the alignment of knowledge exploitation and exploration within the organization. Organizations with the highest levels of open-mindedness appear able to simultaneously explore and exploit knowledge through time. Furthermore, a comparison among the three models permits the conclusion that the third model fits better to the observable data than the first two models shown (the fit statistics for the third model were $\chi^2_{(63)} = 86.76$; CFI = 0.94, IFI = 0.94 and RMSEA = 0.060). Therefore, we can infer that in most situations the appropriate knowledge approach will be neither of the first two models. An explanation for this could be that the first two models are affected by the advantages and disadvantages of the knowledge categories they concentrate on. On one hand, the first model (OM \rightarrow ER \rightarrow ET) renders knowledge easier to store (Hansen et al., 1999) and communicate (Grant, 1996) but exposes it to higher risk of external capture (Hall and Andriani, 2003). On the other hand, the second model (OM \rightarrow ET \rightarrow ER) makes knowledge safer from imitation (Spender, 1994) but more difficult to store (Ambrosini and Bowman, 2001), and susceptible to loss due to labour turnover (Boiral, 2002).

Conclusions

This study has examined, through an empirical study of 107 Spanish telecommunications SMEs, how open-mindedness affects the exploration and exploitation of knowledge over time. Our findings support the need for managers to become more aware of the need to consider time when they drive the conditions

and/or context in which knowledge can be explored and/or exploited. Because exploration and exploitation of knowledge create rules that may become inflexible during the learning process, time is required to break them. With this in mind, we argue that traditional concepts of managing and leading change based on causal-time assumptions need to yield to methods aimed at deepening participation or immersion in the immediacy of the temporal flow. Managers should consider incorporating open-mindedness and time in models of organizational learning as this provides a holistic presentation and adds realism to exploration and exploitation processes.

The need for such a concept of time in theories of organizational learning is necessary because, if open-mindedness is continuous and accelerating rapidly – and it is difficult to argue that it is not – the issue of casual time to manage open-mindedness becomes problematic. The causal-time framework analyses current situations in terms of the past conditions that gave rise to them. It results in knowledge that is bound to the inertia of past routines and the gravity of organizational identity, and thus proves counterproductive when the truths that held in the past mutate with ever increasing rapidity. Understood in this way, open-mindedness gives access to the dynamic of time, and knowledge attuned to this dynamic can serve as a more reliable guide to explore and exploit knowledge. Through open-mindedness, individuals take the initiative and are alert to opportunities beyond the confines of their own jobs (e.g. taking action in the broader interest of the organization or thinking about work processes). In addition, individuals can become sufficiently motivated and informed to act spontaneously, without seeking permission or support from their superiors. Therefore, the implication for management practice is that open-mindedness is a desirable context that business units must foster to stay ahead of the competition as it involves adaptation to new opportunities aligned with the overall strategy of the business, although the establishment of this context is not immediate.

The study is not without limitations. First, although the constructs have been defined as precisely as possible by drawing on relevant literature and being validated by practitioners, they can realistically only be thought of as proxies for an underlying latent phenomenon that is itself not fully measurable. Second, the model presented in this study was general and did not capture the possible moderating effects of environmental turbulence and uncertainty. Prior research has shown that the effect of cognitive factors on individual, group and organizational performance can vary substantially with environmental conditions. For instance, under turbulent conditions, open-mindedness efforts might produce more desirable results for organizational performance. Moreover, we are only able to provide a snapshot of ongoing processes over a short period of time (i.e. $t_0 \rightarrow t_1$).

Taking into account its limitations, this study points to the need for new avenues of research. First, we consider that the use of additional items might

help capture the rich construct to a greater extent. Second, the companies must also understand that open-mindedness is not about a one-time investment but it requires constant attention and investment over a substantial period of time, even after it begins to deliver results. Therefore, another possible research direction could examine the open-mindedness effects on organizational learning over the same period of time ($t_0 \rightarrow t_0$) or over a long period of time (e.g., $t_0 \rightarrow t_2$).

APPENDIX

Questionnaire items

Knowledge exploration: indicate the degree of agreement or disagreement (1 = high disagreement and 7 = high agreement) with respect to your organization.

ER1: Co-operation agreements with other companies, universities, technical colleges, etc. are fomented

ER2: The company is in touch with professionals and expert technicians

ER3: The organization encourages its employees to join formal or informal nets made up by people from outside the organization

ER4: The employees attend fairs and exhibitions regularly

ER5: Your employees frequently maintain work meetings with customers

Knowledge exploitation: indicate the degree of agreement or disagreement (1 = high disagreement and 7 = high agreement) with respect to your organization.

ET1: All the members of the organization share the same aim to which they feel committed

ET2: Employees share knowledge and experience by talking to each other

ET3: The company develops internal rotation programmes so as to facilitate the shift of the employees from one department or function to another

ET4: The company offers other opportunities to learn (visits to other parts of the organization, internal training programmes, etc.) so as to make individuals aware of other people's or departments' duties

Open-mindedness culture: indicate the degree of agreement or disagreement (1 = high disagreement and 7 = high agreement) with respect to your employees.

OM1: The company is prepared to change working practices

OM2: New and novel approaches are considered

OM3: Employees are prone to collaborate with members of the organization and to solve problems together

OM4: Employees take risks

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