FORMAL AND INFORMAL FACILITATORS OF LEARNING CAPABILITY: THE MODERATING EFFECT OF LEARNING CLIMATE

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Isabel Mª Prieto

Universidad de Valladolid
Spain
isabo@eco.uva.es

Elena Revilla

Instituto de Empresa
Spain
elena.revilla@ie.edu

Abstract
Organizations need to put in practice the most favourable conditions to facilitate learning capability. There are not clear answers about how these facilitators support and develop a learning capability. The different ways of thinking about learning in organizations distinguish two kinds of learning facilitators: formal and informal facilitators. In this paper, we suggest that organizations undertake both types of learning facilitators, but considering that informal facilitators may act as potential moderators of the effects of formal ones. We have focused on one comprehensive informal facilitator, the learning climate, and four formal facilitators: environmental scanning, strategic planning, performance measurement, and information technologies. The proposed hypotheses are tested through the analysis of surveys collected from Spanish Companies and using a structural equation model (SEM). Results show that learning climate may act as a strengthener moderator of the effects of scanning and IT on learning capability. Implications, limitations and future research are discussed.

Key words
Organizational Learning, Organizational Knowledge, Learning Capability, Learning Facilitators, Learning Climate

1. INTRODUCTION

The increasing need for learning in organizations is one of the latest concerns of current management literature. Not only is the capability to learn expected to create a major source of competitive advantage for organizations [78], but also learning itself is seen as a prerequisite for the survival of today's organizations. This is because organizations continuously need to change internally, as well as adapt to changes in their operational environment.

Organizations are said to learn when they facilitate the learning of all individuals within them [70] and the transfer of that learning between individuals and towards the organization [19]. This implies that learning in organizations takes place at different interacting levels and becomes a mean to develop a learning capability. In fact, for some authors [25, 26, 70, 78] the concept of organizational learning focuses on conditions and facilitators to develop and utilize a learning capability such that organizations will perform in improved ways, usually as a result of requirements to adapt and improve efficiency in times of change.

However, the understanding of the most favourable conditions to facilitate learning capability within organizations is far of being an easy job. Literature does not usually provide clear answers about how these facilitators support and develop a learning capability in practice. Moreover, the different ways of thinking about learning in organizations, each one characterized by a particular ontological view and by a range of contributions and problems [30], do not contribute to make things clearer. Numerous articles systematize these different perspectives to organizational learning literature [22, 30, 43] and most of them divide them differently. But there are two main perspectives that have been chiefly taken [31, 38, 86]: a technical-information perspective, concerned with the effective processing, interpretation, and response to information as essential frame for learning; and a social-interaction perspective, which is more concerned with the informal system or learning climate that induces the behaviors through which people learn at work.

Both views of learning are considered important and have been studied as legitimate ways to understand learning in organizations. Accordingly, organizations have a formal system through which tangible information is acquired, transmitted, and used. Together with it, they also have human participants who engage in day-to-day experiences at work within a more informal system for learning. However, there is a certain debate about the superiority of each perspective that remains inconclusive to this day. The debate seems to give relative superiority to the social-interaction perspective [31], which is often studied through successful informal facilitators of learning in organizations. On the contrary, empirical findings about the technical-information perspective are contradictory, and there are differences among researches regarding their value. In example, some researches support that modern information technologies are an effective mechanism for extensive knowledge sharing and thus learning in organizations [1, 39, 88]. On the other hand, more skeptic positions have begun to appear by considering that information technologies are not as critical as some literature suggests [16, 55, 71]. Moreover, formal facilitators are considered to have serious limitations as long as they are not as useful to convert information into knowledge, and they

may loose the essentially social nature of learning [6, 55]. This state of the question lead us to want know more about how formal facilitator influence on learning capacity. In order to do that, we suggest that limitations discussed about formal facilitators could be overcome in the presence of informal facilitators, which may well lead to success.

The point we make in this paper is that organizations undertake both types of learning facilitators, but considering that the formal facilitators of learning capability in organizations must be put it in its proper position in relation to the informal ones. In this sense, we suggest that the better or worse effectiveness of the formal frame that favour the development of learning capability in organizations depends on the informal frame under which it is used. In other words, we propose a conceptual model that analyzes the individual effect of formal facilitators and, with this, analyzes how informal facilitators of learning capability moderate the effect of formal facilitators. We have focused on one comprehensive informal facilitator, namely the learning climate [20, 65, 66, 81], and four formal facilitators [25, 26, 43]: environmental scanning, strategic planning, performance measurement, and information technologies.

To date, no one has studied informal facilitators as a potential moderator of the effects of formal facilitators of learning capability. Our research contributes to literature on organizational learning by trying to better understand the effect of formal facilitators on learning capability and, specially, by showing how these formal facilitators to facilitate learning may require the existence of a learning climate to become plenty effective.

In the body of this article we develop our arguments in greater detail. We first draw the theoretical underpinnings of the research model and hypotheses in our study. Next, we explain the research design and discuss the empirical results. Finally, we offer some concluding remarks including suggested directions for future research.

2. THEORETICAL FOUNDATIONS AND HYPOTHESES

2.1. Learning Capability in Organizations

To adjust to the changing environment and make appropriate strategic choices, organizations must become aware of ongoing environmental changes, make sense of them, and make the best strategic choices. This requires that knowledge existing in the organization to keep pace with changes in their environment, and this is possible thanks to learning. When environmental or even organizational conditions change, it produces a “knowledge gap” that requires learning processes to produce new knowledge of the environment. Thus, in a broad sense, organizational learning refers to the essential capability to fill the gap between past knowledge and knowledge required for acting in response to changing environmental conditions [91]. Learning results in a change of knowledge that takes place by adjusting cognition, action, or both [89].

In the present study we define organizational learning as the capability through which knowledge is continually developed in agreement with changing conditions. The focus of

organizational learning is on what is learn and how is learn [26]. On this matter, it is considered that all organizations uphold a stock of knowledge that needs to continually flow through learning processes to act in agreement with internal and external requirements [9, 10, 19, 24, 27, 73]. Knowledge stocks refer to all that is already known or needs to be known, which includes knowledge at the individual, group and organization levels (what is learnt). The learning flows are more concerned with the processes through which knowledge is generated, retained, transferred and used (how is learnt) [71]. Knowledge stocks are thus the content of learning flows [89] that, in turn, are necessary processes to ensure that sticky knowledge is transformed into fluid and actionable knowledge [17]. Learning capability comprises dynamically evolving knowledge that continually flow through learning to be renewed, integrated, and applied throughout the organization [10, 19, 62] to lead to more successful decisions with regard to internal adjustments and with regard to the environment [38].

Understanding learning capability by gathering together both knowledge stocks and learning flows highlights three main aspects. First, learning capability means having a high level of individual, group and/or organizational learning. To create a learning capability, managers must thus put in place and support both the generation of ideas by individuals and the progression of those ideas upwards and downwards through the groups and the organization. As a result, knowledge stocks exist at the individual, group and organizational levels.

Second, the interdependence between knowledge and learning implies the existence of constant changes that allows organizational activities to be maintained, improved or adapted according to internal and external stimuli. Managers need to supply conditions that facilitate their people to continuously investigate internal and external relationships and events, learn from past successes and failures, and used the shared knowledge of all of them to pursue a common goal, thus adapting to changing markets and creating the organization's own future [20].

Finally, the effectiveness of learning capability should not be assessed on the basis of the bulk of stocks of knowledge and learning flows, but on the basis of its utility to guide behaviors relative to the organization's relevant domain. It is not enough that learning generates new knowledge, but new knowledge needs to be relevant in the strategic context of the organization [19, 59, 89]. Hence managers must also invest effort in developing those conditions and mechanisms that allow learning capacity of organizational members to be aligned with organizational purposes, and thus contributes to organizational progress.

2.2. Learning Capability Facilitators

Prescriptive literature on organizational learning gives many examples of the conditions that facilitate learning throughout the organization. These examples are often conditioned by two main perspectives dominating literature on organizational learning [31, 38, 86]: (1) a technical-information perspective, that supposes organizational learning to be a process of systematic information gathering and analysis to sense experiences of a 'knowable' external reality. This perspective tries to explain how organizations learn from experience and

know their environment to make more successful decisions about internal and external adjustments. Huber [43], Macdonald [56] and Dibella and Nevis [26] are some of the authors that have worked with this perspective; (2) a social-interaction perspective, to which learning focuses on experiences, insight development, and interpretations of organizational members at work. This perspective seeks to explain what kind of social context is the most suitable to organizational learning. Authors working with this perspective are Senge [78], Brown and Duguid [13], Nonaka [62] and von Krogh et al. [51].

According to each of these perspectives, learning capability embodies two frames for learning in organizations [60, 70, 86]: a first one embedded in the organization's formal system and a second one embedded in the culture and behavior of the organization's informal system. Examples of formal systems usually mentioned in literature are scanning systems [21, 22, 25, 26, 43, 58], information technologies [58, 86], strategy formulation [23, 58, 86], and various forms of after-action reviews and performance measurement [32, 33, 43]. In relation to the informal system, it is considered that some organizations informally create better conditions for learning than others. They make learning a value of the enterprise, they give people the freedom to learn at work [58], they allow idea time and support, they induce collaboration and trust [25, 26, 58], they comprise openness and risk taking, they simply have a better "learning climate".

Organizations need the formal substance of information and management systems, but this kind of facilitators has a potentially serious limitation: they are very useful to obtain process and make use of information, but they are not as useful to convert information into knowledge, especially tacit knowledge. Furthermore, when managing formal facilitators there is no reference to the personal but inter-subjective motives, interest, beliefs and feelings of people, and to relationships that mark organizations as communities defined by people's understanding of norms, values, and commitment to others. In their place, there are formal and impersonal relationships in the form of linkages, coordinating forces and feedback. So, to some extent, learning misses its essentially social nature. However, informal facilitators of learning capability and, specially, the existence of a learning climate, supply a meaningful context that influence behaviors and practices of people at work, which includes behaviors and practices when using formal facilitators.

Along with previous arguments, we argue that the idea that both formal and informal facilitators influence learning capability has intuitive appeal, but we consider a question of interest to analyze to what extent the effects of formal facilitators of learning capability may be reinforced by informal facilitators. While several scholars [86, 88] have pointed out that learning is the consequence of the collective existence of formal and informal facilitators, none of them have analyzed how these facilitators may reinforce each other as determinants of learning capability. That being so, we direct our attention to how formal facilitators will directly influence learning capability, but also to the way learning climate, considered as informal facilitator, will moderate the relationship between formal facilitators and learning capability.

According to the technical-information perspective of learning, we identify the aforementioned environmental scanning, strategic planning, performance measurement and

information technologies as formal facilitators that directly affect learning capability by facilitating effective information-seeking processes and decision-making processes in the organization –which eventually would provide an optimal fit between the organization and its environment-. However, we propose that their positive effects may be reinforced when they are used in the presence of a learning climate as informal frame where members of the organization, either individually or collectively, question and reflect on their own working processes. As it is shown in Figure 1, we thus try to validate the effects of scanning, strategic planning, performance measurement and information technologies as formal facilitators of learning capability and, specially, the effect of the learning climate as a moderator element for the formal facilitators.

Insert Figure 1 about here

2.2.1. Learning Climate

Literature on organizational climate suggests that the existence of certain characteristics of the work environment may facilitate and encourage learning processes in terms of knowledge generation and knowledge sharing, as well as knowledge application [44, 81]. The term "climate" is usually seen as more specific that "culture", involving an atmosphere for something such as safety [61], diversity [41] or, in our study, learning. A learning climate is a positive atmosphere that makes learning easy and natural. It is presumed to affect individual behavior and attitude, and it is necessary to encourage individuals to practice on-the-job learning. The learning climate provides the essential time and space to permit employees to reflect on their actions that, in turn, enable learning to occur (see, in example, Kolb, [50]). So, the organization provides space for learning that is facilitated, but not controlled.

Honey and Mumford [42] describe learning climate as one in which the behaviors and practices involved in continuous development are encouraged and opportunities for learning arise from work itself. For Popper and Lipshitz [70], the effectiveness of organizational learning is contingent on a context that promotes inquiry, openness, and trust. Van den Brink [88] also suggests that the proper climate for knowledge sharing is characterized by influencing the attitude of people to obtain an open-mindedness to deal with the unfamiliar, and the boldness to experiment and innovate. Together with it, an open and caring climate has also been discussed in the learning literature as important organizational attribute that encourage interaction among individuals and, as a result, learning and knowledge exchange. [23, 39].

This means that a learning climate must permit individuals to experiment at work [54, 70, 71] because they feel secure enough as to take risks and have no fear of receiving severe punishment if they fail [25, 70, 80]. Mistakes are seen as an opportunity for improvement and a chance to learn [25]. Furthermore, learning climate encourages and stimulates exchange of ideas, opinions, information and knowledge in the organization as it is characterized by trust and collaboration between employees [18, 37, 58, 59, 62].

Therefore, a learning climate settled by openness, innovativeness, and trust is particularly conducive to learning capability. Openness refers to the degree to which people can express their views, opinions and ideas. Stata [82] refers to openness as a will to put all the cards on the table, make our motives and feelings known, and invite others opinions and points of view. Innovativeness involves a blame-free context in which employees have the courage to experiment and try new ways of doing things. Change and creativity are encouraged, including risk-taking in areas where people have little or no experience. And trust generates a confidence in the reliability of others with respect to past, current and future behavior. It may lead to cooperative and consistent behaviors towards other persons over a period of time. It all shapes appropriate behaviors on people by which learning and knowledge exchange are encouraged.

In our proposals, we try to demonstrate that the presence of a learning climate strengthens the effect of environmental scanning, strategic planning, performance measurement and information technologies on learning capability.

2.2.2. Environmental scanning, its interaction with Learning Climate, and Learning Capability

Environmental scanning is the search process that ushers in information, internal and mostly external, about those events, relations and situations with a potential influence on the future of the organization [11, 85]. In essence, scanning is an essential method to provide an interface with environment and prevent ignorance about any sign of change [43] by providing information about threatens and, specially, opportunities. This resultant information, in turn, becomes the raw material for intuition, new ideas, and thus may provide the stimulation and direction of learning. An organization that does not value what is "out-there" and does not accept the importance of continuous vigilance thus limits the range and depth of its knowledge [25].

Our notion of scanning draws upon Drucker's [28] idea of actively searching for opportunity sources for new ideas and chances to innovate. This idea relates to learning that is derived from deliberately monitoring the market, social, economic, regulatory and technological environments. Organizations that fail or poorly direct their efforts in this regard may suffer from market myopia. In response, organizations must increase their scanning capacity by using multiple information sources and techniques, such us the regular contact with customers, providers' reports, studies about competitors, regular contacts with experts and research centers, printed material, and any other way to get relevant environmental information [7]. Many organizations use SWOT (strengths, weaknesses, opportunities and threads) analysis or one of its more sophisticated derivatives to help to identify areas where good opportunities exist. It is even important to appoint "scanning specialists" to be responsible of doing it [25]. Because scanning is not simply to borrow from or adapt what others are doing, but a way of sensing developing problems or opportunities and acting of them before the problem is full-blown or the opportunity has closed, scanning is an essential activity to stimulate learning capability in organizations [25, 43]. Therefore, we may hypothesize the following:

Hypotheses 1: *Environmental scanning is a facilitator of learning capability in organizations, positively influencing knowledge stocks and learning flows.*

The direct effect of scanning on learning capability is expected to be more pronounced when organizational climate is favorable to learning. Organizations may differ widely in their active versus passive approach towards scanning [21], but it should be constant and ongoing in order to maintain a preparative stance as environmental influences arise. Managers and other decision-makers within an organization must not spend their entire time monitoring the environment, so it is often a function that is set up as a distinct unit. However, in the presence of a learning climate every organizational member may become a "scanning practitioner" that keeps a watching eye on those external events that are likely to impact the organization. In other words, learning climate results in more active environmental scanning, making of it a comprehensive activity where anyone may detect, interpret and inform about external forces with the potential to have a critical impact on the organization. This may lead to perceive trends and events that otherwise be unpredictable or uncontrollable, and thus helps the ultimate goal of environmental scanning: promote the organization to learn about its external environment in order to increase its responsiveness and adaptability. So, we may hypothesize the following:

Hypotheses 2: *The positive effects of environmental scanning on learning capability are strengthened in the presence of a learning climate.*

2.2.3. Strategic planning, its interaction with Learning Climate, and Learning Capability

Strategic planning is the process aimed to design the future path of the organization in accordance with environmental characteristics. Strategic planning is thus an organizational response to changes or potential changes in the environment. This involves the implication of managers and staff in the formulation and analysis of alternatives of action, their implications and selection of the alternative to which the organization is committed [5]. It is thus essential to take major decisions, and configure resources, products, processes and systems according to the needs of the organization. When doing this, strategic planning creates future learning parameters by bringing awareness of knowledge needed for the accomplishment of strategic aspirations. The difference between what the organization must know to execute its strategy and what it already knows shows learning needs [14, 91]. Thus, strategic planning is a fundamental facilitator of learning capability since it is necessary to determine where, how and when learning occurs [5, 36, 74, 91]. Lack of information about these issues hinders learning capacity to be aligned with organizational purposes, and thus does not contribute to organizational progress.

Strategic planning offers time for collective action and reflection regarding environment and future goals. The process can be more or less collective, more or less collective and more or less formalized but, in the last resort, is critical to articulate a shared vision of the strategic priorities, and the specific objectives and courses of action required for the coordination of learning processes [12, 81]. In other words, strategic planning must say organizational members which knowledge is relevant in the strategic context of the organization and which one is not, and thus point what are the learning processes required to

achieve it. Planning sessions thus favors the emergence of a collective identity, and also transmit explicit knowledge about expectations, new roles [14] and other critical assumptions. As a result, organizational members have a common perception of what they want and what they need to learn to get it [22, 52, 78]. According to previous arguments, we may hypothesize the following:

Hypotheses 3: *Strategic planning is a facilitator learning capability in organizations, positively influencing knowledge stocks and learning flows.*

We think that this positive relationship would be strengthened in those situations where a learning climate exits within the organization. Strategic planning is a way of prospective thinking to anticipate future actions that consist on recognizing and establishing performance and capability potentials. This results in a better understanding of the business systems, which is considered to improve learning in organizations [36, 74]. However, the extent to which strategic planning contributes to learning seems to vary widely. As argued by Schäffer and Willauer [74], a formalized strategic planning process may discourage learning. However, in the presence of a learning climate, strategic planning efforts should imply the involvement of staff. As a result, the organization may meet individual's ideas, initiatives and needs, and individuals can know new goals, understand the philosophy of the new management, and how it all affect roles and performance. At the same time, informal learning may occur as individuals discuss the new goals, the new roles and meet the people with whom they will be working. Moreover, if individuals know their fate is in their own hands, their learning matters. Hence, we further hypothesize the following:

Hypotheses 4: *The positive effects of strategic planning on learning capability are strengthened in the presence of a learning climate.*

2.2.4. Performance Measurement, its interaction with Learning Climate, and Learning Capability

Performance measurement refers to the general measurement practices that are customary in their function, company or even industry [26]. As part of feedback systems, performance measures provide information that help managers know about how well the organization meets its goals and about the efficiency of its actions. Such a feedback is critical to decide whether the organization is on course or if corrections are needed. In this sense, performance measurement is part of any adaptative learning system [25, 26].

Generally, performance measures involve information that provides an understanding of cause-effect linkages between operations and strategy and goals, and between various aspects of the value chain [15, 47, 90]. The perspectives that are relevant to profit orientated companies most often include financial, customers, internal processes and innovation. Information provided by these measures may help to test the organization's beliefs about what creates success and failure. In fact, performance measures provide a shared awareness of the difference between the organization's desired performance and actual performance. This performance gap stimulates organizational members to engage in problem-solving activities in order to reduce the gap [29] and, if we consider that performance gaps result from

knowledge gaps, performance measurement opens the door to learning by providing awareness that new knowledge is needed or that something needs to be unlearned. Lack of information about these gaps hinders problems existing in the organization and reduces the opportunities for learning and, specially, for learning that contributes to organizational progress.

At the same time, performance measurement provides a growing awareness of achieving higher performance or a way of being more effective than envisioned before [23]. Accordingly, the management of such performance measurement procedures is a platform for learning in the organization [15, 26, 49, 88]. So, we can hypothesize that:

Hypotheses 5: *Performance Measurement is a facilitator of learning capability in organizations, positively influencing knowledge stocks and learning flows.*

The positive effect of performance measurement on learning capability is expected to be reinforced in the presence of a learning climate. Performance measurement provides information of the organization's progress or retreat in its field. In a learning climate, this is not accomplished in a routine way, but as an instrument to fuel enthusiasm when things go right, and curiosity about areas of improvement when things go wrong. A learning climate induces people to interpret metrics not only to justify the investments done, but also to discern new possibilities and shifting direction. A learning climate prevents the conforming interpretation of measurement reports. On the contrary, they are considered as new opportunities for inquiry and reflection and thus strengths the possibilities for learning. Moreover, a learning climate may prevent the effects of the negative emotions that individuals experience when they discern past failures. Negative emotions may generate a tendency towards avoidance or inaction. However, when a learning climate exits, individuals may be motivated by the learning opportunity that failures provide, even when they experience negative emotions. They will not blame each other, but will collaborate when analyzing causes of mistakes and when searching solutions. We thus propose the following hypothesis:

Hypotheses 6: *The positive effects of performance measurement on learning capability are strengthened in the presence of a learning climate.*

2.2.5. Information Technologies, its interaction with Learning Climate, and Learning Capability

Information technologies are the advanced infrastructure that enhances the volume of data, information and knowledge that can be processed throughout the organization. The advantages of modern information technologies as a major issue for learning and knowledge in organizations have been widely recognized in literature [1, 23, 39, 72, 87, 88]. They are accepted as a real pipeline to codify, organize and disseminate information and knowledge, thereby removing barriers of time and location [1, 37, 39, 52, 76]. They create an interconnected environment that is a medium to vertically and horizontally integrate efforts within organizations, and in this way to shorten the length of the transformation cycles [8].

According to Van den Brink [88], an effective technological system demands a combination of three related dimensions. One dimension is to have information and explicit knowledge components online, indexed and mapped, with east access and accurate retrieval for all users. Another dimension is to improve coordination and communication between people, teams or groups by transferring knowledge from those who posses it to those who need or can use it. The third dimension is to offer pointers to people with special expertise or knowledge documents. Which of them is more important depends on the organization's circumstances, but the final objective must be connecting people with other people or with explicit knowledge and information, which contributes to support and reinforce learning capability in organizations. Hence, we further hypothesize the following:

Hypotheses 7: *Information technologies are a facilitator of learning capability in organizations, positively influencing knowledge stocks and learning flows.*

Recognition of the role of information technologies in enabling learning capability has not blinded researchers about its potential limitations. In example, information technologies per se may be commoditized through imitation and acquisition. At the same time, they may become easily obsolete or even turn into overly formal and rigid systems. However, these limitations of information technologies may be evaded by how information technologies are deployed and used within organizations. Specially, the way people interact with information technologies when they use them is considered essential for the success of information technologies [40, 55, 84]. In fact, information technologies solve the problem of managing data, information and explicit knowledge, but the interpretation of information and explicit knowledge remains a distinctly human activity [55]. Therefore, even when knowledge is partly explicit, the use of information technologies will be more effective when is supported by other elements. A learning climate is expected to exert an influence on the formation of subjective norms regarding the use of information technologies. In a learning climate, individuals feel free to experiment and modify their use of information technologies. They are also expected to be willing to keep ongoing electronic relationships with others with regard to the provision and reception of information, knowledge and ideas. Within a learning climate, the use of information technologies is also likely to be well adapted to fit individual's circumstances. So, the use of information technology as facilitator of learning capability is reinforced if it arises alongside the existence of a learning climate. We thus finally hypothesize the following:

Hypotheses 8: *The positive effects of information technologies on learning capability are strengthened in the presence of a learning climate.*

3. RESEARCH METHODOLOGY

3.1. Data Collection and Sample Characteristics

The sample for this study consisted of Spanish Companies listed within the database *Dun and Bradstreet* (50.000 Main Spanish Companies, 2000). Chosen firms were those that

reported between 50 and 2.500 employees. Sampled firms fit into activities –from industry and service- facing dynamic and competitive environments, covering a wide enough range so as not to restrain the scope of analysis. Sample selection was guided by two factors. First, we have tried to target companies where issues of knowledge and learning are generally recognized as relevant and general. Second, we use a diverse sample to increase the generalizability of results.

The questionnaire was prepared on the basis of a thorough literature review. Prior to the survey administration, the questionnaire was validated through a pre-test that was carried out through several personal interviews with senior managers. These interviews allowed us to clarify our survey items and rectify any potential deficiency. Minor adjustments were made on the basis of specific suggestions. Next, the questionnaire was delivered by means of postal survey. It was addressed to the General Manager of the company or a reasonable substitute such as the Human Resource Manager (mainly for large companies), who have been identified as key respondents based on two criteria [9, 35]: (a) possession of adequate knowledge about the company and (b) adequate level of involvement with regard of the issues being investigated.

To asses the degree to which common method bias might present a problem, we subjected all scale items for similar constructs to a factorial analysis with a varimax rotation (see, for example, Seibert et al. [77] and Tippins et al. [87]). Results indicated that most items loaded cleanly on the factors representing the expected constructs. Thus, we found no general factor that would have emerged due to common method variance. Moreover, items loading unexpected constructs were rare and eliminated from further analysis. This way, we have applied a scale item trimming [69] to avoid any factor that would have emerged due to common method variance.

Table 1 summarizes the respondent characteristics in terms of industry type and total number of employees. Of the total 1064 that were administered, 111 surveys were finally returned, representing a 10.52% response rate. Most of final respondents belonged to services activity (83, 21%). Firm size was quite well distributed, with the exception of companies ranging between 100 and 250 employees, which represent a major group, and companies with less than 50 employees, which represent a marginal group.

Insert Table 1 about here

3.2. Measures Description

The measurement of the analysis variables has been built on a multiple-items method, which enhances confidence about the accuracy and consistency of the assessment. Each item was based on a five point Likert scale and all of them are perceptual variables. Appendix displays items used to measure the analysis variables.

Measurement of Formal Variables: Environmental Scanning, Strategic Planning, Performance Measurement and Information Technologies. Each of the four variables

included as formal facilitators of learning capability has been measured as a single construct. Most of the language for the items is well grounded in the literature. The operationalization of *environmental scanning* includes six items, which are mainly rooted in Sinkula et al. [80] and Barringer and Bluedorn [4]. The items mainly assess scanning activities associated with the specific market and industry of the firm (e.g. customers and competitors) rather than scanning activities in general (e.g. political and legal elements). Brews and Hunt [12], amongst others, influenced the crafting of the six items used for *strategic planning*. These items aim to assess how organizational members perceive the strategic plan of the organization. The specific wordings of the four items included for *performance measurement* included evaluation systems such as traditional accountability systems, customer satisfaction, quality evaluation, including as well the criteria to evaluate non-financial contents considered as a basis to undertake actions linked to long-term competition. They all were deduced from the theoretical proposals of Kaplan and Norton [47], the empirical insights about performance measures of Schmenner and Vollmann [75], and also from expert reports. *Information technologies* were operationalized by using six items mainly relative to computer hardware and software that are mostly based on Gold et al. [39] and Chuang [16].

Measurement of Informal Variable: Learning Climate. As pointed earlier, informal facilitators for learning capability are evaluated using a single variable: the *learning climate.* With this aim, we have used twelve specific items, which are also rooted in prior research [39, 44, 53, 70]. We have tried to select a range of items wide enough for assessing the learning climate through the behaviors and values linked to openness, innovativeness and trust, as frequently appointed by literature.

Measurement of the Outcome Variable: Learning Capability. As we have previously mentioned, and following Bontis [9] and Sanchez [73], an organization's learning capability encompasses two distinct but related phenomena: knowledge stocks and learning flows. We have thus modeled the *learning capability* in organizations as a latent multidimensional construct in which both knowledge stocks and learning flows are treated as first-order indicators of the second-order construct: learning capability.

In particular, we have considered that knowledge stocks in organizations exist at the individual, group and organizational levels [19, 63]. Obviously, organizations learn through their individual members, which develop knowledge through their personal experiences [63]. Some individual knowledge may be applied directly to perform the assigned task, but much of it is shared with other individuals in a group before that knowledge becomes a basis for taking action [62]. This way, individuals inside groups develop knowledge in common in order to perform tasks in a coordinated fashion. Similarly, groups in an organization interact, communicate their knowledge to other groups and acquire other knowledge required to put their own knowledge into action. As a result, individuals and groups play an important role in the integration of some knowledge in the organization in such a way that knowledge is embedded in the organization's systems, routines and values [64]. Accordingly, we have initially included 15 items as measures of k*nowledge stocks*: five items pertaining to individual stocks, five items for group stocks and five items for organizational stocks of knowledge. Most of the measures were adopted from relevant literature, especially Bontis [9].

Learning flows are also an essential element of learning capability. Specially, it is considered that the link of learning flows to knowledge stocks is reflected in the tension between the flows of exploration and the flows of exploitation of knowledge [9, 19, 57]. Exploration flows take place when individual members generate new knowledge, and groups and the organization progressively integrates it. Exploitation flows encompasses processes that take and transmit embedded organizational knowledge that has been learnt from the past down to groups and individual members. Accordingly, *learning flows* have been measured by using 10 items, five of them pertaining to exploration flows and five items to exploitation flows. Again, items were mainly based in Bontis [9].

4. ANALYSIS AND RESULTS

Data analysis has been conducted by Structural Equation Modeling (SEM), using LISREL 8, maximum likelihood program [45, 46]. SEM is a valid method to explain all paths of inter-related dependence relationships between a set of unobserved constructs, each measured by one or more observed indicators. SEM allows the researcher to decompose relations among variables and to test the causal models that involve both observable (manifest) and unobservable (latent) variables. LISREL (Linear Structural RELations) is one of the most relevant approaches that make it possible to encompass unobservable variables. Simply described, the LISREL model is a regression methodology for empirical variables that has many advantages. Probably the most important one is its high information content, because it allows the researcher to simultaneously evaluate both the measurement and causal (i.e. structural) components of a system. It also has a greater capacity to detect moderation effects than does other techniques [83]. Other advantages are, for instance, that LISREL can easily handle latent variables, measurement errors in variables, simultaneity and interdependence. Maximum likelihood estimates has a precision in achieving optimal prediction that PLS does not has [34], and it appears to be robust against departures from normality by the indicants (product indicators are not normally distributed) [46].

To develop a LISREL model, the linkages between latent constructs and their measurable indicators must be first specified by developing the structural model. But prior to testing all of the defined causal relationships, items for each dimensional scale are subjected to scale refinement based on an evaluation of measurement model fit. This analysis is conducted by using confirmatory factor analysis, which also let us to demonstrate the quality of the measurement in terms of psychometric properties, reliability and overall model fit. Given that structural equation modeling has no single statistical test of significance for the model fit, several indices were used to assess the fit of models.

4.1. Measurement Models Estimation

Table 2 summarizes the number of items and the results of the validity and reliability test for the analysis variables. Because multiple-item construct measures variables, and to verify that items tapped into their stipulated construct, a confirmatory factorial analysis (CFA) was employed to determine the validity of the constructs. Four separate confirmatory factor analysis were conducted by using LISREL 8: two corresponding to formal and informal

facilitators variables, and two more for each of the broad dimensions of the learning capability (knowledge stocks and learning flows). The paths were examined using t-statistics (for expected factor loadings), whereas paths that were not specified were evaluated using standardized residuals and modification indices. Based on these statistics and theoretical considerations we deleted items if appropriate [3]. Convergent validity was established by confirming that all scale items loaded significantly ($t > 1.96$, $p < 0.05$) on their hypothesized constructs factors [3]. Discriminant validity was assessed by comparing the χ^2 differences between a constrained CFA (where the interfactor correlation was set to 1, indicating they are the same construct) and an unconstrained model (where the interfactor correlation was free). All χ^2 differences were found to be significant, providing support for discriminant validity [3]. Overall, the fit of the models is good, with GFI, AGFI, RMR and CFI all within recommended values. The Cronbach's alpha values were obtained in order to assess the reliability of the measurement instruments. Since the Cronbach's alpha values of all indicators exceed the recommended value of 0.6 [64], the scales used in this study are reliable.

Insert Table 2 about here

To confirm the multidimensionality of the learning capability as a higher-order construct we ran a second-order CFA. Table 2 also shows the results for this second-order model for learning capability. The loadings of the measurement items on the first-order factors, and the loadings of the measurement items of he first-order factors (knowledge stocks and learning flows) on the second-order factor (learning capability) were all significant ($p \leq 0.05$). Further, the goodness of fit indices was also excellent. High correlation between stocks and flows is comprehensible by considering that both constructs are measures of a higher order construct: the learning capability. This second-order CFA was estimated by resuming in single factors the indicators of the knowledge stocks construct (individuals, group and organizational stocks) and the learning flows construct (exploration and exploitation) through principal components analysis (using SPSS 10.0 for Windows).

4.2. Structural Models Estimation

In order to test our hypothesis we have decided to estimate four separate models corresponding to environmental scanning, strategic planning, performance measurement and information technologies to better differentiate the effect of each of these variables and, due to the large number of variables, avoid problems of correlation. To each model, we have added the learning climate and their moderator effects (product terms between the learning climate and the corresponding formal variable). Models with product terms (moderator effects) have been estimated by using Ping´s Method. Ping [67] proposed a variation of Kenny and Judd [48] technique that considerably simplifies it.

First of all, and to simplify further analysis, we have converted indicators for the learning climate in a single factor by using principal components factors analysis (using SPSS Version 10.0). Next, the ultimate measurement parameters for the linear latent variables are estimated in a single measurement model. Table 3 displays results for this analysis together with the correlation coefficients between the ultimate variables. The measurement parameters

estimates are then used to calculate the loadings and error variances for the indicators of the term products (Table 4). Finally, the model with moderator effects variables is estimated by fixing the loading and the error variances for the product indicators [for a detailed description of the steps, the reader is referred to 67 and 68].

Insert Tables 3 and 4 about here

The use of product indicators in a structural model renders the model non-normal and, thus, chi-square estimates cannot be meaningfully interpreted. Significance of the structural moderated model requires estimated parameters are positive and significant and a good fit of the model. It is also required that the proposed moderated models (non-linear relationships) outperform the alternative models without moderating variables (only linear relationships). So, (a) we have first estimated four separated structural models that introduce the direct impact of each of the formal variables; (b) then we have added in each equation the direct effect of learning climate; and finally (c) we add the product term to estimate the moderated models that include the hypothesized moderating effects of learning climate. This procedure is based on the suggestions of Sharma et al. [79] to ascertain whether the presence and typology of moderator variables.

Results are reported in Table 5, and show the proposed moderated models statistically and the alternative models without moderating variable. As we can see in Models 1 to 3, the expectation of a direct impact of scanning ($p< 0.05$ and $p< 0.05$), strategic planning ($p< 0.05$ and $p< 0.05$), performance measurement ($p< 0.05$ and $p< 0.05$), upon the learning capability – in terms of knowledge stocks and learning flows- receives support in agreement to hypothesis 1, 2 and 3. However, Model 4 in Table 5 indicates that the potential direct effect of information technologies upon the learning capability is not significant at all, which is taken as no support to Hypotheses 4. Moreover, the negative sign of the direct effect of information technologies is interesting as alert about the pervasive outcomes of over investing on information technologies as the isolated enabler of the learning capability. As we can see in Models 5 to 8, the addition of the learning climate is also positive and very significant ($p< 0.05$).

Insert Table 5 about here

In relation to the moderating effects of the learning climate, we may first observe Model 9, where the product terms between scanning and the learning climate emerge as significant in sign and magnitude for both the stocks and flows ($p< 0.05$), providing support to Hypothesis 5. Results show that, at each stage, that R^2 increases, so the proposed moderated model outperforms alternative models. So, learning climate has a moderating effect on scanning as enabler of the learning capability in such a way that the learning climate reinforces the effect of scanning (given that the learning climate has both a direct and indirect impact, it may be considered a quasi moderator according to the typology of Sharma et al.,

[79]). For strategic planning, Model 10 shows that the product term for strategic planning is not significant, so Hypothesis 6 is not supported. Also Model 11 shows the lack of significance for the expected moderating effect of learning climate on performance measurement, so that Hypothesis 7 is neither supported. Finally, we can observe in Model 12 that the product term between the learning climate and information technologies is positive and significant for both stocks and flows ($p < 0.05$ and $p < 0.10$, respectively). Moreover, the proposed-moderated models statistically outperform the alternative models without moderating variable. These results provide support to Hypothesis 8. The moderating effect of learning climate (once more quasi moderator) upon information technologies is especially significant as far as the direct relationship between information technologies and the learning capability is not significant.

5. DISCUSSION

5.1. Contributions

This study agrees with literature discussing both the technical-information perspective and the social-interaction perspective as legitimate ways to understand learning in organizations. Nowadays, the state of the question seems to give certain superiority relative superiority to the social-interaction perspective. Additionally, there are differences among researches regarding the value of formal learning facilitators linked to the technical-information perspective. In order to elucidate the role of these learning facilitators, this study analyzes how the effect of formal facilitators of learning capability is strengthened in the presence of a learning climate. Accordingly, both formal and informal facilitators of learning capability are included in our research model, where we first analyze the direct effect of formal facilitators on learning capability and, later, we analyze the moderator effect of informal facilitators over the formal ones. In doing so, we synthesize informal facilitators in a single variable, the learning climate, while formal facilitators are studied through four individual variables: scanning, strategic planning, performance measurement and information technologies. Structural equation models indicate that, even when results may be interpreted cautiously, the moderating effects between these facets are a promising area for future research.

The main contribution of this research is the theory and findings on the moderator effect of learning climate in the relationship between the formal facilitators and learning capability in organizations. Findings allow us to accept the existence of a reinforcing moderating effect of learning climate on scanning and information technologies to influence the learning capability. On the other hand, strategic planning and performance measurement may be considered direct enablers of the learning capability influential enough to motivate a meaningful learning, but we do not find support to the moderating role of learning climate.

Environmental scanning is corroborated as formal facilitator of learning capability in organizations. Scanning mainly supplies external information about external developments affecting the company. It allows organizational members to sense what happens around the firm and construct a shared interpretation that is used as a basis for organizational action.

Moreover, when surrounded by the existence of a learning climate, scanning doesn't arises as a routine or passive procedure, but as the provider of a stimuli for internal reflections on possible applications on improvements of existing products, processes and services. Learning climate relieves and motivates organizational members, influencing on behaviors by shaping perceptions of information. It thus helps individuals to discern what information to accept in order to learn and adapt, and what information to reject, as it do not fit with the dominant model of the environment and the organization's role therein.

Our results also show that strategic planning is a significant formal facilitator of learning capability, but we do not find support to the moderating effect of learning climate on this formal facilitator. As stated by Slater and Narver [81], strategic planning provides a motivated shared vision grounded in an understanding of the environment that guides the organization's competitive advantage efforts, and is communicated throughout the organization. The shared vision sets the broad outlines for strategy development as a result of the development of critical assumptions about the business and its environment. These assumptions are a powerful influence of behavior as they should emerge from a range of interpretations and shared discussion. Indeed, when strategy making is a relatively unstructured, bottom-up, emergent process guided by top management, it will gain adequate knowledge and commitment from key stakeholders and enables the organization to better learn and adapt. Therefore, strategic planning, when developed as an iterative participative process, may be considered by its own a very powerful enabler of the learning capability that motivates people towards meaningful learning.

Results also indicate that performance measurement systems significantly stimulate learning capability. Indeed, performance measurement provides meaningful feedback information about problems existing in the organization that guide performers to the correct response by enabling them to determine which behaviors are appropriate or inappropriate for successful performance. Performance measurement may thus help performers to identify learning opportunities by means of problem-solving activities, and enact corrective actions after or even before adverse processes have happened. However, we do not find support to the moderating effect of learning climate on performance measurement. This result may be due to the fact that performance measurement, by their own, may reinforce people's learning effort by positively influencing both their productivity and their satisfaction. Feedback information may enact individuals and, specially, managers to question their assumptions and reflect on whether the theory under which they were operating is still consistent with current evidence, observations and experience [47]. As stated by Wongrassanee et al. [90], the key factor is linked to the question of how to select adequate measures, i.e. measures that motivate al employees to learn from experience and achieve strategic outcomes. New performance measurement systems, most of them based on non-financial and financial measures, are generating a revolution, but provide specific frameworks in which a company can focus on pursuing continuous improvement and long-term performance.

Finally, our results come to confirm recent critics suggesting that there has been far too much reliance on information technologies as facilitators of learning capability [40, 55]. Even when surveys reveal that most organizations only implement some kind of technology to enable the learning capability, our results come to confirm recent critics suggesting that

there has been far too much reliance on information technologies as facilitators of learning capability [40, 55]. Indeed, we do not find empirical support to the positive direct effect of information technologies on learning capability. This comes to show that information technologies alone are unable to fully develop an understanding of complex situations and relationships characterized by emotional richness and deepness. It is when information technologies are reinforced by the presence of a learning climate when they have a positive effect on the learning capability. The learning climate can function as a positive force to exploit information technologies advantages and to neutralize its potential disadvantages. Considering information technologies as something that can be implemented by any organization, their value for learning capability lies in people who use them, in how they are used, and in the quality of the knowledge network –people talking to each other- that these technologies are able to support. From a managerial perspective, mangers need to understand that it is necessary to put information technology in its proper perspective as formal facilitator of learning in organizations.

In summary, we can thus argue that possessing a learning climate can enable the organization to capitalize on its scanning abilities, together with the potentials of information technology. On the contrary, strategic planning and performance measurement seems to facilitate learning capability even without a learning climate that strengthens them. Possessing a proper learning climate can thus function as a positive force that permeates openness, innovativeness and trust to facilitate the development of a truly global, learning community where information is given meaning through active social processes and creativity. Although much more need to be known about the role of learning climate in the tested relationships, our findings encourage us to persevere in the analysis of moderating effect in the future. Specially, we think current research claims for the theoretical and empirical consideration of an overall view that integrates formal and informal facilitators of learning capability, and evaluates their relationship.

5.2. Some limitations and future research directions

Findings reported in this paper should be interpreted within the limits it presents that, however, show the direction to future research.

As a first limitation it is necessary say that we have tried to define our constructs as precisely as possible by drawing on relevant literature and to closely link our measures to the theoretical underpinnings through a careful process of item generation and refinement. Evidently, this measurement effort represents an advance for knowledge management and learning assessment but, nonetheless, the measurement items used here can realistically be thought of as only proxies for an underlying and latent phenomenon that is neither fully nor easily measurable.

A second limitation concerns the fact that all data were collected from the same respondent using the same perceptual measurement technique. This is currently the standard in strategic research, but is known to suffer from certain drawbacks, including common method bias. We took several steps to minimize these problems, including separating items between dependent and independent variables into different sections of the survey instrument

and using different question formats for each set of variables. We have also checked for the presence of common method bias. But although our findings may help to explain certain relationships between variables, we are aware that replies from multiple respondents, together with the inclusion of some objective data, would have completely ruled out potential drawbacks.

We could also mention as a limitation the exclusion for analysis of learning that takes place at the inter-organizational level (external learning flows). In this sense, we have not forgot that research has often identified learning that take place between organizations as an essential constituent of the capability to learn in organizations, but it has not been considered in order to focus on the single organization as our central unit of analysis.

Finally, another issue needs to be acknowledged. We have made causal inferences arguments whereas we only have cross-sectional data. Longitudinal data would be suitable to support causal relationships and, what is more, to analyze the evolution of the learning capability as an antecedent of organizational competence.

To counterbalance limitations, there are several directions for extension of this research. First, the individuality of information technologies as facilitator of learning capability should be thoroughly analyzed. Our findings show a negative direct effect of information technology, so that they do not seem to be a positive influence upon learning capability without being in conjunction with social initiatives. It is then necessary to deeply analyze the conditions in which information technologies may enable/disable-learning capability.

Future research should also provide a more complete inventory of learning facilitators. In this sense, it is relevant to recognize the role of specific informal facilitators as well as to enlarge the range of formal facilitators. Even more, we also need to enlarge our analysis by studying the effects of learning capability on organizational performance. As long as this field of inquiry grows, it will become increasingly important to test the learning capability consequences on the organizational performance. Evidence about this question is fairly small, so that it represents one of the richest and most interesting subjects in relation to organizational learning research.

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Figure 1: Research model

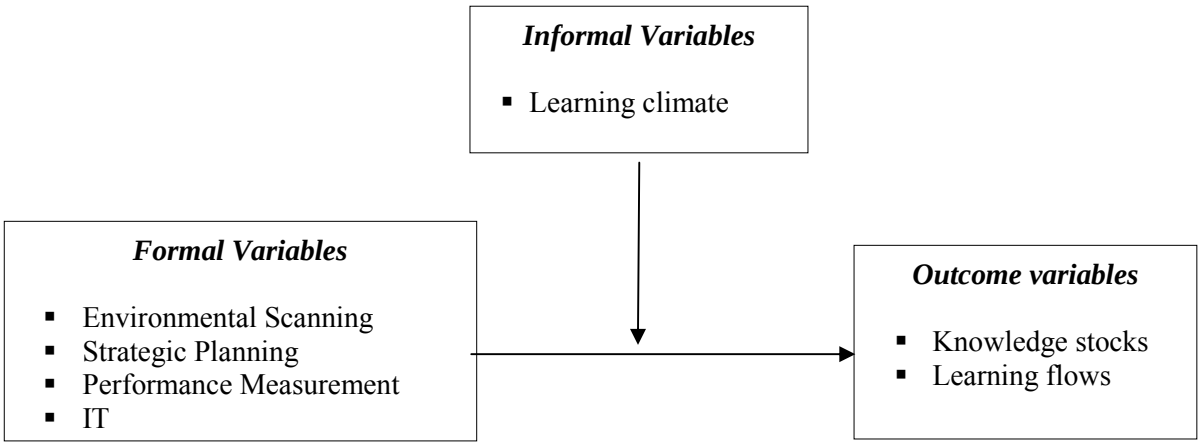

Table 1. Respondent characteristics

INDUSTRY TYPE	Nº Responses	% Response (respect to final sample)
Manufacturing (chemistry, petroleum and others)	15	13,39%
Mining	4	3,57%
Total industry activity	**19**	**16,96%**
Transport, communications and public services	5	4,46%
Services	59	52,67%
Financing and insurance	28	25%
Total service activity	**92**	**83,21%**
TOTAL	**111**	**100%**
NUMBER OF EMPLOYEES		
<50	8	7,2%
50 a ≤100	15	13,51%
100 a ≤ 250	45	40,54%
250 a ≤ 500	16	14,41%
500 a ≤ 1000	14	12,61%
≥1000	13	11,71%
TOTAL	**111**	**100%**

Table 2: Adjusted first order measurement models

Paths	Path coefficient	t-values	R^2	Cronbach α	Constructs correlation	Goodness of fit indices
Knowledge stocks						
V1←individual stock	0.670	7.124	0.450		$\phi_{I\text{-}G}$ = 0.597	
V2←individual stock	0.822	9.022	0.676	0.757	(6.897)	χ^2= 35.376
V3←individual stock	0.707	7.579	0.500			(P= 0.312)
V6←group stock	0.616	6.664	0.379		$\phi_{I\text{-}O}$ = 0.513	GFI = 0.940
V7←group stock	0.826	9.818	0.682		(4.785)	AGFI = 0.896
V8←group stock	0.711	8.015	0.506	0.782		RMR = 0.0510
V9←group stock	0.614	6.648	0.377		$\phi_{G\text{-}O}$ = 0.873	CFI = 0.990
V11←organizational stock	0.532	5.346	0.283		(12.725)	
V13←organizational stock	0.745	7.728	0.556	0.652		
V15←organizational stock	0.586	5.991	0.344			
Learning flows						
V16←exploration flows	0.662	7.060	0.438			χ^2= 21.391
V19←exploration flows	0.753	8.321	0.566	0.775		(P= 0.316)
V20←exploration flows	0.798	8.976	0.637			GFI = 0.952
V21←exploitation flows	0.607	6.199	0.369		ϕ = 0.867	AGFI = 0.909
V22←exploitation flows	0.641	6.613	0.410		(13.589)	RMR = 0.0472
V23←exploitation flows	0.549	5.504	0.302	0.714		CFI = 0.990
V24←exploitation flows	0.584	5.917	0.341			
V25←exploitation flows	0.530	5.278	0.281			
Formal Variables					$\phi_{SPLA\text{-}ESCA}$ = 0.643	
V32←strategic planning	0.845	9.583	0.715		(7.725)	
V33←strategic planning	0.827	9.340	0.684	0.819	$\phi_{SLAP\text{-}IT}$ = 0.414	
V26←scanning	0.725	7.812	0.525		(3.792)	χ^2= 34.888
V27←scanning	0.785	8.595	0.617	0.750	$\phi_{SPLA\text{-}MEAS}$ = 0.655	(P= 0.614)
V28←scanning	0.620	6.496	0.384		(7.828)	GFI = 0.948
V38←performance measurement	0.868	8.876	0.754		$\phi_{ESCA\text{-}IT}$ = 0.443	AGFI = 0.909
V39←performance measurement	0.683	7.048	0.466	0.740	(3.970)	RMR = 0.0553
V42←inform. technologies	0.692	6.689	0.478		$\phi_{ESCA\text{-}MEAS}$ = 0.616	CFI = 1.000
V44← inform. technologies	0.467	4.410	0.218		(6.711)	
V46← inform. technologies	0.705	6.819	0.497	0.632	$\phi_{MEAS\text{-}IT}$ = 0.374	
V47← inform. technologies	0.486	4.599	0.236		(3.248)	
Informal variables						
V49←learning climate	0.581	6.400	0.338			
V50←learning climate	0.572	6.270	0.327			χ^2= 19.192
V51←learning climate	0.446	4.700	0.199			(P= 0.509)
V52←learning climate	0.505	5.412	0.255	0.864		GFI = 0.960
V55←learning climate	0.825	10.256	0.681			AGFI = 0.928
V56← learning climate	0.876	11.242	0.767			RMR = 0.0373
V57←learning climate	0.748	8.886	0.560			CFI = 1.000
V59← learning climate	0.743	8.799	0.552			
Learning capability						
individiual stock←knowl. stock	0.461		0.213			χ^2= 2.752
group stock← knowl. stock	0.712		0.507		$\phi_{KS\text{-}LF}$ = 0.948	(P= 0.431)
organization stock← knowl. stock	0.859		0.738			GFI = 0.990
exploration←learning flows	0.888		0.789			AGFI = 0.952
exploitation←learning flows	0.748		0.559			RMR = 0.0169
knowl. stock←learning capabil.	0.951		0.904			CFI = 1.000
learning flows←learning capabil.	0.997		0.994			

Table 3: Measurement moderated model

Paths	Items	Standard loadings	Goodness of fit	Constructs correlation 1	2	3	4	5
1.Env. Scanning (SCANN)	V26-V27-V28	0.725-0.785-0.620		1.000				
2. Strategic Planning (SPLAN)	V32-V33	0.845-0.827	$\chi^2(67) = 42.694$ (P= 0.991)	0.643	1.000			
3. Performance measurement (MEAS)	V38-V39	0.868-0.683	GFI = 0.942 AGFI = 0.933	0.616	0.655	1.000		
4. Info. Technologies (IT)	V42-V44-V46-V47	0.692-0.467-0.705-0.486	RMR = 0.0549 CFI = 1.000	0.443	0.414	0.374	1.000	
5. Learning climate (CLIMA)	CLIMATE	0.922		0.667	0.713	0.640	0.479	1.000

Table 4: Loading and error variances of the product term indicators

Loadings	Error variances
$\lambda_{X1Z1} = \lambda_{X1}\lambda_{Z1}$	$Var(\delta_{X1\cdot Z1}) = \lambda^2_{X1}\, Var(X)Var(\delta_{Z1}) + \lambda^2_{z1}\, Var(Z)Var(\delta_{x1}) + Var(\delta_{x1})Var(\delta_{x1})$
$\lambda_{26CLI} = \lambda_{26}\lambda_{CLI} = 0{,}725 \cdot 0{,}922 = 0{,}66845$	$Var(\delta_{26CLI}) = 0{,}725^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}475 + 0{,}15 \cdot 0{,}475 = 0{,}55388$
$\lambda_{27CLI} = \lambda_{27}\lambda_{CLI} = 0{,}785 \cdot 0{,}922 = 0{,}72377$	$Var(\delta_{27CLI}) = 0{,}785^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}383 + 0{,}15 \cdot 0{,}383 = 0{,}43999$
$\lambda_{28CLI} = \lambda_{28}\lambda_{CLI} = 0{,}620 \cdot 0{,}922 = 0{,}57164$	$Var(\delta_{28CLI}) = 0{,}620^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}616 + 0{,}15 \cdot 0{,}616 = 0{,}67371$
$_{32CLI} = \lambda_{32}\lambda_{CLI} = 0{,}845 \cdot 0{,}922 = 0{,}77909$	$Var(\delta_{32CLI}) = 0{,}845^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}285 + 0{,}15 \cdot 0{,}285 = 0{,}39212$
$\lambda_{33CLI} = \lambda_{33}\lambda_{CLI} = 0{,}827 \cdot 0{,}922 = 0{,}762494$	$Var(\delta_{33CLI}) = 0{,}827^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}316 + 0{,}15 \cdot 0{,}316 = 0{,}418615$
$\lambda_{38CLI} = \lambda_{38}\lambda_{CLI} = 0{,}868 \cdot 0{,}922 = 0{,}800296$	$Var(\delta_{38CLI}) = 0{,}868^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}246 + 0{,}15 \cdot 0{,}246 = 0{,}359034$
$\lambda_{39CLI} = \lambda_{39}\lambda_{CLI} = 0{,}683 \cdot 0{,}922 = 0{,}629726$	$Var(\delta_{39CLI}) = 0{,}683^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}534 + 0{,}15 \cdot 0{,}534 = 0{,}604018$
$\lambda_{42CLI} = \lambda_{42}\lambda_{CLI} = 0{,}691 \cdot 0{,}922 = 0{,}637102$	$Var(\delta_{42CLI}) = 0{,}691^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}522 + 0{,}15 \cdot 0{,}522 = 0{,}59366$
$\lambda_{44CLI} = \lambda_{44}\lambda_{CLI} = 0{,}466 \cdot 0{,}922 = 0{,}429652$	$Var(\delta_{44CLI}) = 0{,}466^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}782 + 0{,}15 \cdot 0{,}782 = 0{,}81463$
$\lambda_{46CLI} = \lambda_{46}\lambda_{CLI} = 0{,}705 \cdot 0{,}922 = 0{,}649088$	$Var(\delta_{46CLI}) = 0{,}705^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}503 + 0{,}15 \cdot 0{,}503 = 0{,}577384$
$\lambda_{47CLI} = \lambda_{47}\lambda_{CLI} = 0{,}485 \cdot 0{,}922 = 0{,}44717$	$Var(\delta_{47CLI}) = 0{,}485^2 \cdot 1 \cdot 0{,}15 + 0{,}922^2 \cdot 1 \cdot 0{,}764 + 0{,}15 \cdot 0{,}764 = 0{,}80234$

Table 5. Analysis of structural models

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9		Model 10		Model 11		Model 12	
VARIABLES	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows	Stocks	Flows
Formal Variables																								
E. Scanning	0.621*	0.697*							0.183	0.177***							0.383*	0.272*						
Strategic Planning			0.778*	0.859*							0.188	0.244*							0.259**	0.290*				
Perf. Measurement					0.674*	0.688*							0.299*	0.192*							0.333*	0.181*		
Information Technologies							0.299	0.384							-0.095	-0.059							-0.023	-0.012
Informal variables																								
Learning Climate									0.656*	0.780*	0.694*	0.756*	0.587*	0.776*	0.824*	0.926*	0.674*	0.788*	0.706*	0.763*	0.595*	0.775*	0.863-*	0.952*
Interactions																								
E. Scanning x L.Climate																	0.285*	0.137*						
S. Planning x L. Climate																			0.129	0.076				
P. Measurement x L. Climate																					0.082	-0.025		
I. Technologies x L. Climate																							0.217*	0.14***
R^2	0.382	0.0.486	0.590	0.722	0.451	0.473	0.088	0.148	0.618	0.824	0.691	0.886	0.652	0.828	0.607	0.808	0.703	0.843	0.703	0.892	0.659	0.830	0.654	0.828
ΔR^2	-	-	-	-	-	-	-	-	0.236	0.0.338	0.101	0.164	0.201	0.355	0.519	0.660	0.085	0.019	0.012	0.006	0.007	0.002	0.047	0.020
GFI	0.896		0.840		0.898		0.898		0.900		0.885		0.899		0.894		0.813		0.860		0.879		0.814	
AGFI	0.879		0.814		0.870		0.885		0.878		0.857		0.866		0.876		0.780		0.825		0.842		0.790	
CFI	0.932		0.854		0.927		0.938		0.949		0.925		0.939		0.943		0.844		0.910		0.925		0.834	
NFI	0.859		0.802		0.870		0.831		0.879		0.873		0.885		0.848		0.772		0.849		0.856		0.719	

* Significant at 95% confidence level ** Significant at 92 % confidence level *** Significant at the 90% confidence level

Appendix: Construct Definition and Sample Survey Items

Section		Variable	Item	Description
LEARNING CAPABILITY IN ORGANIZATION	B	**LEARNING CAPABILITY IN THE ORGANIZATION**		
	Knowledge stocks	Individual-level knowledge stock	V1	Individuals knowledge and work qualification
			V2	Individuals competence for work performance
			V3	Individuals awareness of critical issues that affect their work
			V4	Individuals confidence on their personal competences
			V5	Individuals sense of responsibility about work
		Group-level knowledge stock	V6	Groups posses a shared knowledge about their work
			V7	Groups capability to make decisions concerning their work
			V8	Groups capability for effective conflict resolution
			V9	Groups coordination and organization of work
			V10	Groups ability to share successes and failures
		Organizational-level knowledge stock	V11	Organization have a strategy that positions well its future
			V12	Organizational structure allows to work effectively
			V13	Organizational management methods exist to work efficiently
			V14	Organization holds actualized documents, information and data bases
			V15	Organization's culture is properly distinctive
	Knowledge flows	Exploration flows	V16	Individual lessons learnt are actively shared within the group
			V17	Individual opinions and viewpoints are shared and considered within groups
			V18	Individuals put input into the organization's decisions
			V19	Organization adopts recommendations made by groups/ individuals
			V20	Organization do not "reinvent the wheel"
		Exploitation Flows	V21	Past policies and procedures aid individual work
			V22	Internal training and work training are essential in organization
			V23	Interdisciplinary training, work rotation and special assignations are usual
			V24	Group decisions are supported by individuals
			V25	Past experiences are an influence for organizational future behavior
FORMAL FACILITATOR VARIABLES				
		Environmental Scanning	V26	Environmental scanning is an essential activity within organization
			V27	Competitors monitoring is used as a scanning tool
			V28	Customers monitoring is used as a scanning tool
			V29	Future scenario conception is used as a scanning tool
			V30	Regular contacts with external institutions and other specialized information sources are used as a scanning tool
			V31	Specialized individuals or units are used as a scanning tool
		Strategic planning	V32	Courses of action exist to create shared strategic goals in the organization
			V33	Regularly processes for strategic reflection aim to define organizational goals
			V34	Strategic coherence and adherence is consistently promoted
			V35	Strategic goals and tactics are communicated to employees
			V36	Employees are commitment to organizational strategic issues
			V37	Organization an system which promotes overall strategic coherence
		Performance Measurement	V38	Performance measures are regularly used in the organization
			V39	Technical parameters and quality appraisal are used as performance metrics
			V40	The evaluation of customers' satisfaction is used as performance metric
			V41	Non-financial issues are used as performance metrics
		Information technologies	V42	Intranets are essential within the organization
			V43	Organization uses IT that allows collaboration
			V44	Support management software is essential in the organization
			V45	Organization uses IT that allows codification, retrieve and use of knowledge
			V46	Organization uses IT that allows the search of knowledge and information
			V47	Organizational work-stations are effectively computerized
INFORMAL FACILITATOR VARIABLES				
		Learning climate	V48	Creativity is encouraged within the organization
			V49	Most employees enjoy work autonomy
			V50	Employees are allowed to solve known problems in unfamiliar ways
			V51	Organization is committed with innovation
			V52	Managers are open to risky projects
			V53	Failures are tolerated within the organization
			V54	Organization is open to change and entrepreneurial activities
			V55	A warm and support climate is inspired in the organization
			V56	Employees are motivated to collaborate, help and trust each other
			V57	Integrity, equity and fairness are noticeable values within the organization
			V58	Employees realize that they are assisted personal and professionally
			V59	Managers trust on their employees skills and performance