Determinants of Organisational Learning in the generation of technological distinctive competencies

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Abstract: This paper presents an analysis of the influence of Organisational Learning (OL), as a process of knowledge creation, in the development of Technological Distinctive Competencies (TDCs). We also examine how the existence of certain organisational key variables in the OL process, not treated jointly from this perspective, positively affects OL and influences the generation of TDCs. The hypotheses proposed in this respect are tested on a sample of 140 Spanish industrial companies, applying a structural linear equation model according to the Partial Least Squares (PLS) approach. Our findings indicate that factors such as Entrepreneurial Orientation (EO) of the organisation, its Learning Orientation (LO) and Information Technology (IT) have a positive impact on OL; whereas, the technological distinctive competences are the result of the OL. On the other hand, the EO of the organisation and the IT play an important role in the creation process of TDCs.

Keywords: Organisational Learning (OL); knowledge creation; Entrepreneurial Orientation (EO); Learning Orientation (LO); Information Technology (IT); Technological Distinctive Competencies (TDCs); dynamic capability; Partial Least Squares (PLS).

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1 Introduction

Organisational Learning (OL) represents a source of heterogeneity and potentially sustainable competitive advantages because of companies' different capacities for learning and absorbing knowledge (Crossan and Nicolini, 2000; Easterby-Smith, 1997; Lei et al., 1999). The contributions from the Resource-Based View (RBV) approach and its extension, the Knowledge-Based View (KBV) approach, suggest that competitive advantage stems from the company's capabilities and abilities, with learning becoming a fundamental strategic aspect.

Innovation is the company's ability to transform and exploit technological knowledge (Zahra and George, 2002). The development of this knowledge is path-dependent (Prencipe, 1997) and, therefore, determined by the company's history and experience, in which OL plays a key role (Dutrénit, 2000). This explains the historic dependence of innovation on what has happened in the past and its irreversibility with respect to the technological path followed (Pavitt, 1987).

Technological Distinctive Competencies (TDCs) are the result of this collective learning process, including the ability to innovate to adapt to changes. This provides the organisation with the ability to generate new products and services more quickly than competitors (Lado et al., 1992). Through this approach, TDCs include both the expertise to develop and design new products, services and processes effectively and learning skills (Teece et al., 1994).

Hence, knowledge-based resources are particularly relevant to provide a sustainable competitive advantage and it becomes very interesting to analyse which factors influence the relationship between OL and the ability to introduce new products, processes or ideas in the organisation.

This research takes the current position concerning OL and the KBV as its reference framework. Although their theoretical frameworks are different, they share a series of similarities, which enable their integration into a global theory whose contemplation could imply the appearance of a new paradigm (Mahoney, 1995). Thus, using a dynamic model integrating OL and Knowledge Creation (OL-KC), we attempt to analyse how OL influences the process of creating TDCs. We will also examine how Entrepreneurial Orientation (EO), Learning Orientation (LO) and Information Technology (IT) contribute in a dynamic way to the success of such a process. These variables, which are antecedents of the OL-KC process, have not been jointly considered in the field of the theories used as a framework in this research. Moreover, we propose that EO and IT influence the development of knowledge-based resources such as TDCs, along with explaining how OL is a mediator that facilitates this relationship.

To achieve the proposed objectives, this paper has been organised as follows: To begin with, we describe the theoretical framework we have applied in this research, from which a series of hypotheses are derived describing our research model. Following this, we describe the sectors that are the objects of this study and the chosen sample of companies, along with the design of the questionnaire and the planning of the fieldwork. Next, we present our results and discuss them based on the analysis of data collected from 140 manufacturing firms. Finally, we present the conclusions, identify several limitations and provide guidelines for future research.

2 Research model and hypotheses

This research is focused on learning in organisations, a descriptive approach used to describe certain types of activity that take place in an organisation (Tsang, 1997). OL is understood to take place in organisations, in the sense of an activity or a process as indicated by Örtenblad (2001). Thus, we define OL as a dynamic process of knowledge creation generated at the heart of the organisation via its individuals and groups, directed at the generation and development of distinctive competencies that enable the organisation to improve its performance and results.

March (1991) proposes the existence of two types of basic activities for learning in the organisation: exploration or feedforward and exploitation or feedback. Exploration includes characteristics such as investigation, variation, risk, experimentation, flexibility, discovery and innovation. It consists in experimenting with new possibilities and its results are uncertain, takes a long time and are often negative. Exploitation is related to choice, efficiency, selection and execution. It consists in the improvement of existing competencies and technologies by using what has already been learnt, that is to say, by adaptation. Its results are predictable, quickly achieved and positive. OL constitutes a dynamic process of knowledge creation through levels which create a tension between the incremental or amplifying logic, implying exploration or new assimilation of learning (feedforward) and the reductive logic, involving, exploiting or using what has been learnt (feedback).

The 4I model of OL (Crossan and Berdrow, 2003; Crossan et al., 1999), used in this research to analyse OL as an OL-KC process, defines OL consisting of four related (sub) process:

1 intuition is a preconscious process taking place at the individual level
2 interpretation as a first type of transmission of elementary cognitive elements, acts as intermediary between individual and group levels
3 integration process or how and what is interpreted is inserted in the organisation, acts as a link between group and organisational levels and finally
4 institutionalisation process or how changes are consolidated, is exclusive for the organisational level.

This model has been operationalised using the Strategic Learning Assessment Map (SLAM) proposed Bontis et al. (2002). The SLAM matrix integrates the key dimensions of the OL literature. Firstly, an analysis perspective with multiple levels; secondly, a conceptual operative framework and thirdly, the integration of learning into stock and flow magnitudes: three learning stock constructs related to the learning that resides within a level (individual, group and organisation) and two learning flow constructs corresponding to its exploration and exploitation process (feedforward and feedback).

In the OL-KC model defined, the learning stocks are an intangible resource related to the knowledge stored in a particular agent (Hedlund and Nonaka, 1993), both in their technical dimension or know-how (capabilities, that is, preparation, knowledge and experience) and in its cognitive dimension (competencies, that is, ideas, values and mental models). The learning flow concept takes shape in the transfer and diffusion of knowledge within and throughout the limits of the organisation (Sanchez, 1997). Vera and Crossan (2004, pp.225–226) state that the feedforward flow moves from the individual and group to the organisation through the 4I learning process: intuiting-interpreting, interpreting-integrating, integrating-institutionalising and intuiting-institutionalising. At the same time, an analogous flow feeds back from the organisation to the individual and group, forming a new variation of processes: institutionalising-integrating, integrating-interpreting, interpreting-intuiting and institutionalising-intuiting. The definition of the SLAM constructs is set out in Table 1.

Table 1 Definition of SLAM constructs

II	Individual-level learning stocks	Individual competency, capability and motivation to learn the required tasks
GG	Group-level learning stocks	Group knowledge or knowledge incorporated into social interactions, a product of shared understanding
OO	Organisational-level learning stocks	Knowledge or skills internalised in non-human aspects of the organisation, including systems, structures, procedures and strategy
FF	Feedforward learning flows	Transfer of learning from the individual to the collective sphere
FB	Feedback learning flows	The use made of learning which has become institutionalised (learning which is embedded in the organisation, in its systems, structures, strategy, etc.)

Source: Adapted from Bontis et al. (2002).

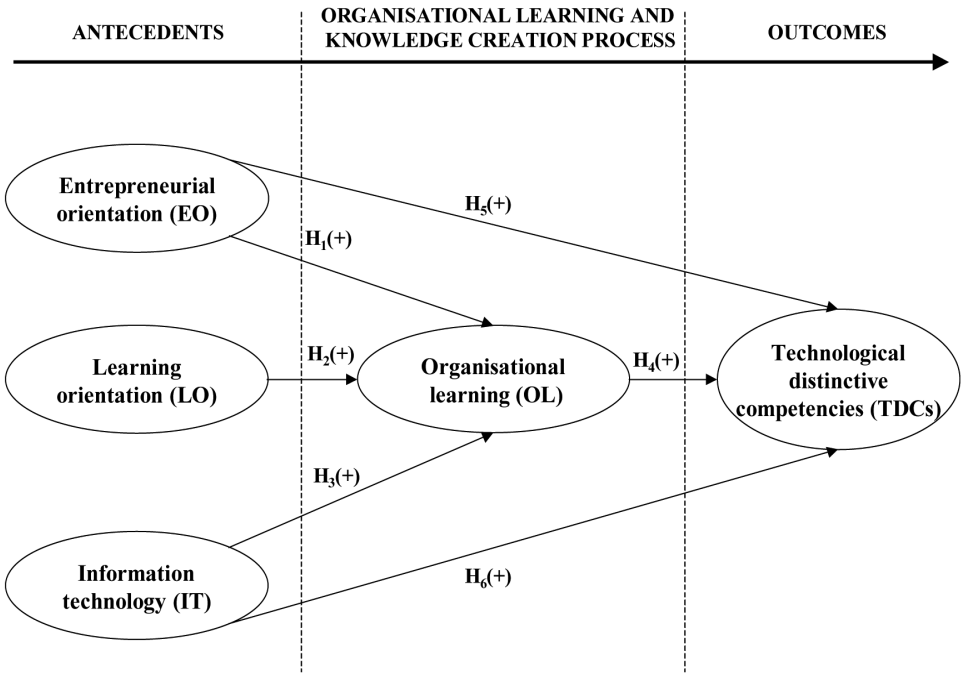
Using this perspective of OL as a system of stocks and flows via levels (i.e. individual, group and organisation), the conceptual model we propose is reproduced in Figure 1. The model starts by considering the OL-KC process as a capability of the company to generate new knowledge at the level of the individual or small groups, to disseminate it throughout the organisation and to incorporate it in products and services (Nonaka and Takeuchi, 1995). To do this, it is structured into three large sections.

Firstly, the organisational variables antecedent to the OL-KC process appear. To begin with, organisational EO, given its relevance in fostering OL and the development of new knowledge (Dess et al., 2003), allows knowledge stocks and flows to become TDCs. Then, we have LO, which influences the company's tendency to create and use knowledge (Sinkula et al., 1997). Next, we examine the relevance of IT on transfer and transformation processes and, in all, on the transformation of resources and capabilities in competencies (Andreu and Ciborra, 1996).

Secondly, a relationship is established between the OL-KC process and the process of constructing TDCs, as a result of collective learning in the organisation (Prahalad and Hamel, 1990), which is an aspect seldom addressed in empirical research (Lei et al., 1996). This is in addition to the mediating role of these competencies on the influence of OL and Perceived Business Performance (PERF).

Thirdly, we analyse the influence of EO and IT on the development of the resources that integrate the concept of TDCs, which include technology, product, process, knowledge, experience and organisation (Guan and Ma, 2003). Moreover, we consider the mediator role of OL in the analysis of the relevance of EO and IT in obtaining the previous knowledge-based resources.

Figure 1 Empirical model with hypothesised relationships



2.1 EO as a determinant of OL

The definition adopted in this study is EO denominated as entrepreneurial behaviour (Covin and Slevin, 1991; Entrialgo et al., 2000, 2001; Knight, 1997; Lumpink and Dess, 1996, 2001), which several authors name "entrepreneurship as an activity in the firm-level" (Zahra et al., 1999), "entrepreneurial posture" (Covin, 1991) or "internal corporate entrepreneurship" (Jones and Butler, 1992). All these terms gather together the firms' strategic orientation, which is related to methods, practices and decision-making styles that managers use to act entrepreneurially (Lumpkin and Dess, 1996). It consists in three dimensions (Covin and Slevin, 1989): innovativeness, proactiveness and risk-taking.

Innovativeness refers to the pursuit of creative or novel solutions or challenges, including the development or enhancement of products and services, as well as new administrative techniques and technologies for performing organisational functions (e.g. production, marketing, sales and distribution) (Knight, 1997, p.214). In this study, proactiveness is the opposite of reactiveness and is associated with aggressive posturing relative to competitors (Knight, 1997, p.214). This way, it is similar to "competitive aggressiveness" (Lumpkin and Dess, 1996, p.147), defined as how firms relate to competitors, that is, how they respond to trends and demands that already exist in the marketplace. Risk-taking is defined as the willingness to commit large amounts of resources to projects where results are unknown and the cost of failure may be high (Miller and Friesen, 1978, p.923).

EO may be an important measure of how organisations exploit knowledge-based resources to discover and exploit new opportunities (Wiklund and Shepherd, 2003). Zahra et al. (1999) suggest a model in which the influence of EO on OL provides a mechanism to create new knowledge that lays the foundation to build new competencies or revitalise the existing ones. Liu et al. (2002) show that EO is positively related to OL, the former being a cultural antecedent of the latter. On the other hand, Slater and Narver (1995) consider that EO provides a cultural foundation for OL, which, in turn, enables an organisation to achieve a high level of performance and better customer value. Therefore, according to the reasons set out, we propose that:

H1: Entrepreneurial Orientation has a positive effect on Organisational Learning as a knowledge creation process.

2.2 LO as a determinant of OL

LO is defined as an antecedent to the OL-KC, which synthesises the critical components of learning organisations, a prescriptive approach concerns with the question "How should an organisation learn?" (Tsang, 1997). In our study, following Sinkula et al. (1997), we consider LO as a group of organisational values which influences on the firm's tendency to create and use knowledge. Sinkula et al. (1997) and Baker and Sinkula (1999) state that one of these values is the commitment to learning, which is closely related to management commitment to support a culture fostering LO as one of its main values (Garvin, 1993; McGill et al., 1992; Stata, 1989). Another value is the open-mindedness, related to mental models that dominate the firm (Day, 1994; Porac and Thomas, 1990, Senge, 1990; Sinkula, 1994) and to unlearning as a driving force to organisational change. Shared vision (Senge, 1990) is different from

commitment to learning and open-mindedness which influences the direction of learning, whereas the previous components determine its intensity. Building a shared vision is the shared ideal that agglutinates individual energies of organisational members and guides them in a common direction, generating a tension that leads to learning.

Authors such as DiBella et al. (1996a,b), DiBella and Nevis (1998) and Nevis et al. (1995) define LO as a group of values and attitudes determining where learning will take place and the nature of what is learnt. LO determines how organisations acquire, share and use knowledge and it affects the spiral process and knowledge conversion (Kim, 1998). Based on the previous contributions, we propose that:

H2: Learning Orientation has a positive effect on Organisational Learning as a Knowledge Creation process.

2.3 IT as a determinant of OL

The definition of IT for knowledge management is not only broad but also somewhat difficult to specify (Davenport and Prusak, 1998). For the purpose of our research, and following Gold et al. (2001), we use the concept of IT infrastructure defined as the shared IT capabilities that enable the flow of knowledge in an organisation to be supported. In this category, we include a set of technological resources, both hardware and software applications, which support different utilisation characteristics of knowledge (Grant, 1996) and learning activities (Leonard-Barton, 1995). Examples of these are business intelligence, technologies for collaborating and distributing knowledge, knowledge discovery, localisation and use, knowledge generation and storage and support hardware for these technologies.

The existence of IT has been essential for the Knowledge Management movement (Davenport and Prusak, 1998). IT is involved in various knowledge management processes, which include knowledge creation (Alavi and Leidner, 2001; Pawlowsky et al., 2001; Teece, 1998). A great variety of procedures, tools and activities may act as a support to the knowledge generation/creation process (Nonaka et al., 2001).

IT contributes to sustainable competitive advantage through its interaction with other resources. Recent literature suggests that OL is a process that plays an important role in enhancing a firm's capabilities and competitive advantage (Grant, 1996; Lei et al., 1996) and which may benefit from the judicious application of IT. It has also been argued that for firms to be successful they must complement IT with OL (Tippins and Sohi, 2003). In accordance with our presentation so far, we therefore propose the following hypothesis:

H3: Information Technology has a positive effect on Organisational Learning as a Knowledge Creation process.

2.4 OL as a determinant of TDCs

TDCs are an appropriate concept for describing and studying the process of technological innovation, with the latter being a flow magnitude which serves to describe the process of generating technological knowledge (Nieto, 2004). In effect, companies innovate using a process of continuous learning through which they generate new technological knowledge (Nonaka and Takeuchi, 1995). Converting an activity of the organisation into a routine is the principal way of storing the organisation's specific operational knowledge

(Nelson and Winter, 1982). In accordance with this, TDCs represent the organisation's expertise in mobilising various scientific and technical resources through a series of routines and procedures, which allow new products and/or production processes to be developed and designed. This signifies a certain technological dominance, which may mean command of a competitive advantage.

According to Bessant et al. (1996), there is a broad acceptance that technological innovation is a complex learning process, whereby companies acquire and develop distinctive technological competencies. Some authors, such as Chaston et al. (1999), maintain that OL is a path for achieving competitive advantage and helping organisations to become more innovative and improve their performance. Distinctive competencies are developed through the OL process and with this process, together with its outcome forms a 'meta-learning' system. This system is the capability of continuous learning, which is particularly necessary in complex and turbulent environments to develop dynamic distinctive competencies (Lei et al., 1996).

For Leonard-Barton (1992b), distinctive competencies may become institutionalised over a long period of time and thus form a part of the company's knowledge creation system. Authors such as Fiol (1991), Hamel (1991), Prahalad and Hamel (1990), Reed and DeFillippi (1990) suggest that distinctive competencies are based on the organisation's collective learning. Andreu and Ciborra (1996) share this idea and mention that an OL process occurs during the development of core competencies of the organisation.

Lynn et al. (1999) found a positive relationship between learning and the successful development of new products in organisations of high-technology sectors. Helfat and Raubitscheck (2000) provided a conceptual model for generating new products, which explains how organisations can be successful by creating and using knowledge and organisational competencies via a learning system. All the above arguments lead us to the following working hypothesis:

H4: Organisational Learning as a Knowledge Creation process has a positive effect on the development of Technological Distinctive Competencies.

2.5 EO and its key role in developing TDCs

According to Lumpkin and Dess (1996), a firm's EO may be a source of competitive advantage and strategic renewal. This is why it has been proposed to be renamed as strategic entrepreneurship (Hitt et al., 2002), given its role in the firm's strategic renewal that allows companies to adapt and respond to changes in their new markets (Zahra et al., 1999).

Other authors, such as Floyd and Wooldridge (1999), state that EO is a mediator between inertia and learning in the competencies' development process. These competencies provide the basis for the firm's current competitive situation. Nevertheless, they are not easy to be changed, as they are based on values, and managers avoid actions threatening accepted values and norms. This double paradox, turning core competencies into core rigidities (Leonard-Barton, 1992b), explains why EO, through its strategic renewal, allows organisations to overcome the inertia in the competencies' development process.

EO takes shape as a new competencies' creation process, which is based on three basic elements: identification of an opportunity and generation of a new idea,

transformation of the new idea into a tangible result or initiative and development of the new competence (Floyd and Wooldridge, 1999, p.131). This process is contemplated by Alvarez and Busenitz (2001, p.756) by introducing two entrepreneurial concepts:

1 entrepreneurial recognition, defined as the recognition of opportunities and opportunity-seeking behaviour as a resource and

2 the process of combining and organising resources as a resource.

With this, organisations develop the knowledge necessary to use as a continuous source of innovations, to obtain a higher performance to that of their competitors (Kazanjian et al., 2001).

Moreover, Hult et al. (2004) recently demonstrated that EO plays a key role in the development and maintenance of innovation. This occurs because EO provides managers with the necessary encouragement to devise new products and processes. These arguments set out lead us to propose that:

H5: Entrepreneurial Orientation has a positive effect on the development of Technological Distinctive Competencies.

2.6 IT and its significance in the development of TDCs

Andreu and Ciborra (1996) propose an OL model whereby information technologies considered as a resource may participate in the fundamental process of transforming resources into capabilities:

1 sharing work practices and facilitating communication within groups and between individuals

2 facilitating reflection, experimentation and training in routines and work practices and

3 giving support to and making the process of disseminating capabilities possible.

IT also has a role to play in the process of converting capabilities into distinctive competencies, endowing them with the attributes of strategic assets, that is to say, rare, valuable, difficult to imitate and imperfectly substitutable.

TDCs are a form of technological knowledge that may be defined as a unique combination of knowledge and skills, which allow a series of profitable innovations to be generated (Chiesa and Barbeschi, 1994). Thus, IT plays an active role in the dissemination of knowledge and the relevant know-how for distinctive competencies throughout the organisation. In a similar manner, Lado and Zhang (1998) have examined the different paths whereby expert systems may be a potential source of sustainable competitive advantage, with one of these being their role in fostering the accumulation, updating and the use of distinctive competencies. Subsequently, Zhang and Lado (2001), from a Dynamic Capability Perspective, also showed the influence of IS on the development of the types of distinctive competencies at the operational level and their repercussions in the company achieving an advantageous position with respect to its competitors. Bearing in mind these considerations, we propose the following hypothesis:

H6: Information Technology has a positive influence on the development of Technological Distinctive Competencies.

3 Methodology

3.1 Sample selection

The population is made up of innovative manufacturing firms, given that the theoretical framework adopted is centred on the Knowledge-Based View. This perspective assumes as a premise that the environment can be considered as 'hypercompetitive', characterised by a high change and discontinuity index, which requires a flexible and rapid response from organisations (Hanssen-Bauer and Snow, 1996).

To determine the population to be studied, industrial sectors in which technological competencies are central were initially chosen (Bettis and Hitt, 1995; Henderson and Clark, 1990; Tushman and Anderson, 1986), since their innovation is based on an intense level of own research, as is the case of the so-called science-based sectors in Pavitt's (1984) well-known taxonomy. This classification was completed with information from the survey by the Spanish National Institute of Statistics (INE, 2000) of innovative sectors concerning Technological Innovation in Companies, which has become an important measurement of technological change in Spain. As a result, the following sectors were identified: food and drinks, cardboard and paper, the chemicals sector, rubber and plastic materials, non-metallic minerals, metallurgy and manufacturing of metal products, machinery and mechanical equipment, electrical, electronic and optical material and equipment and manufacturing of transport material.

The region of Andalusia in Spain was chosen as the geographical area for this research study, using the information contained in the Dun and Bradstreet, 2001 database, which includes 50,000 biggest companies operating in Spain. This information was completed with the list of companies forming the Andalusia Innovation Network promoted by the General Directorate for Industry, Energy and Mines (DGIEM) and managed by the Andalusian Institute of Technology (IAT). Combining these databases gave a population universe comprising 492 companies.

In relation to the sample unit, the questionnaire had to be answered by a single person from each company who had to be the R&D director or the operations director. If these positions did not exist, it could be answered by a member of the senior management team whose cognitive maps represent, in any case, the essential aspects of all members in the organisation (Lyles and Schwenk, 1992).

3.2 Measures

For the measurement instruments to be used, special attention was paid to translating the original versions of the scales to capture their linguistic nuances. As we have used scales that have already been validated, our efforts in this section are focused on making the relevant adjustments to the setting and language in which we are working. All of the variables were Likert 1–7 measurement scales from 1 = 'strongly disagree' to 7 = 'strongly agree', except for the case of LO where items are scored on a 5-point scale (1 = 'strongly disagree' and 5 = 'strongly agree'), and TDCs, where the range of responses is from 1 = 'much worse' to 5 = 'much better', attempting in this way to respect the psychometric properties originally used to design these scales.

We measured EO with Knight's (1997) scale, which is known as ENTRESCALE. According to ENTRESCALE, EO consists of eight items which are divided into two critical dimensions, entrepreneurial orientation and pioneering behaviour or

proactiveness. Nevertheless, we carried out a confirmatory factorial analysis (χ^2 = 20, p = 0.116, GFI = 0.945, RMSEA = 0.053, CFI = 0.952) and analysed the correlations between dimensions. We found three factors, being the correlations between these dimensions higher than 0.5. Therefore, the three dimensions co-varied. These can be found in Covin and Slevin's (1989) scale: innovativeness (EO_IN), proactiveness (EO_PR) and risk-taking (EO_RT). This modification has its precedents, mainly due to the existing broad debate on the dimensionality of EO (Knight, 1997; Lumpkin and Dess, 2001). Hence, unlike Kreiser et al. (2002), we state that the three dimensions cannot vary in an independent way, all of them being necessary for an EO to exist.

LO was measured with the scale used by Sinkula et al.'s (1997) empirical research. According to these authors, LO comprises 11 items grouped into three dimensions, which reflect the organisation's commitment to learning (LO_CL), shared vision (LO_SV) and open-mindedness (LO_OM).

The IT scale is composed of 12 items, developed from the study by Gold et al. (2001), which load onto a single dimension. General aspects of an organisation's IT infrastructure, included in Tippins and Sohi's (2003) category of technical objects, are measured by this scale. Thus, it contains:

1 hardware as a support for the different technologies

2 the technological dimensions with respect to obtaining knowledge about competitors and environment or business intelligence systems

3 collaboration technologies and knowledge distribution, localisation and its use and

4 knowledge generation and storage technologies with reference to customers, project partners, employees and suppliers.

All the scales used to measure OL dimensions have their origin in the research developed by Bontis et al. (2002), which is defined with 50 items distributed in five dimensions (SLAM variables): individual (OL_II), group (OL_GG) and organisational (OL_OO) learning stocks; feedforward (OL_FF) and feedback (OL_FB) learning flows.

The TDCs' scale comes from the work performed by Camisón (1999, 2001). Constructed using the self-classification of the executives of the company with respect to its competitors, it comprises 27 items loading onto a single factor. These items study aspects such as the capability for technological differentiation of the product (on the basis of product and process innovations or else via knowledge protection using patents), the capability of remaining at the technological frontier of business, expertise in the management of technology and innovation, skill in the development of an innovation culture, management recognition of organisational strengths in this area, the dedication of human and financial resources to R&D and the efficient management of knowledge and internal competencies.

To assist in the preparation of the questionnaire, we validated the content through a series of interviews with experts on its different sections. Their suggestions and contributions were incorporated into a second version of the questionnaire. Subsequently, we submitted the questionnaire to a pretest using 14 companies, one for each of the sectors being studied. The final questionnaire was made up of 108 items.

3.2 Planning of the field work

The process of preparing and transmission of the questionnaire followed the questions set out by Dillman (1978) and Tomaskovic-Devey et al. (1994). A contact, sending and follow-up questionnaire methodology was adopted (Cycyota and Harrison, 2002). We telephoned the indicated person in each company, assuring them of the importance of taking part in the study and also of its usefulness, committing ourselves to sending them the results of the research if so required. They were also assured that the information would be dealt with confidentially, globally and anonymously. Finally, we highlighted the importance of the suggestions that the interviewees wished to propose to us and our gratitude for their participation.

All these aspects were emphasised in the introductory letter, which was subsequently sent, along with the questionnaire and a prepaid envelope for returning it on completion. To make responding easy, the questionnaire was designed in an electronic format enabling multiple mailings with a consequent cost saving.

The questionnaire was sent to the 492 companies forming the population with a total of 152 questionnaires being returned, of which 140 were considered useable and 12 eliminated because they were not adequate for performing the necessary statistical analysis. This represents a reply rate of 28.45%. To ensure the correct sample distribution, care was taken to achieve that it was proportional to the population of each stratum by sector and size. The profiles of the sample in terms of industry type, total sales revenue and number of total employees are given in Appendix.

4 Data analyses and results

4.1 PLS modelling

The chosen method for analysing data is the analysis of structural equations using the Partial Least Squares (PLS) technique. This methodology, which uses the Ordinary Least Squares (OLS) algorithm, is designed to reflect the theoretical and empirical qualities of social sciences and behaviour where there are usually situations with insufficiently supported theories and little information available (Wold, 1979). This study uses PLS-Graph software version 03.00 Build 1058 (Chin, 2003).

Using PLS involves following a two-stage or step 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. This analysis is performed in relation to the reliability attributes of individual item reliability, construct reliability, Average Variance Extracted (AVE) and the discriminant validity of the indicators as measures of the latent variables. In the second step, the structural model is evaluated. Its objective is to confirm to what extent the causal relationships specified by the proposed model are consistent with the available data.

To analyse the relationship 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 consider the effect of reflective indicators. The IT and TDCs constructs present a first-order factorial structure in which the set of items come together in a single principal factor. However, the other constructs in the model (EO, LO and OL) are operationalised using a molecular approximation

whereby the second-order factors are the causes of their first-order components or factors (Chin and Gopal, 1995), as it necessary to apply the approximation in two steps, also known as a hierarchical component model (Lohmöller, 1989, pp.128–133).

4.2 Measurements reliability and validity

With regard to the measurement model, we began assessing the individual item reliability. The first-order components for the second-order constructs (Table 2) exceed the accepted threshold of 0.707 (Carmines and Zeller, 1979), except for the EO_RT factor. However, many researchers believe that this rule of thumb should not be so inflexible (Barclay et al., 1995; Chin, 1998) and it was therefore decided not to eliminate it. In our study, six individual items of first-order measures had loadings with their respective constructs being lower than the accepted threshold and were excluded. This last result was not included in this work due to page limitations.

Table 2 Individual reliability, Composite reliability and average variance extracted for the first-order constructs, second-order constructs and dimensions

Factor order	*Construct/dimension and indicator*	*Loading*	*composite reliability*	*AVE*
2º	Entrepreneurial Orientation (EO)		0.800	0.573
1º	Innovativeness (EO_IN)	0.816	0.845	0.646
	Proactiveness (EO_PR)	0.766	0.733	0.587
	Risk Taking (EO_RT)	0.684	0.891	0.732
2º	Learning Orientation (LO)		0.879	0.707
1º	Commitment to Learning (LO_CL)	0.841	0.929	0.765
	Shared Vision (LO_SV)	0.884	0.815	0.674
	Open-Mindedness (LO_OM)	0.795	0.842	0.728
1º	Information Technology (IT)		0.944	0.586
2º	Organisational Learning (OL)		0.954	0.808
1º	Individual- Level Learning Stocks (OL_II)	0.873	0.932	0.604
	Group-Level Learning Stocks (OL_GG)	0.854	0.946	0.639
	Organisational-Level Learning Stocks (OL_OO)	0.928	0.948	0.699
	Feedforward Learning Flows (OL_FF)	0.919	0.939	0.607
	Feedback Learning Flows (OL_FB)	0.916	0.916	0.579
1º	Technological Distinctive Competencies (TDCs)		0.980	0.652

In relation to the construct reliability (Table 2), we can state that all of the constructs are reliable as they present values for composite reliability (ρ_c) greater than the value of 0.7 required in the early stages of research and the stricter value of 0.8 for basic research (Nunnally, 1978).

AVE should be greater than 0.5 meaning that 50% or more variance of the indicators should be accounted for (Fornell and Larcker, 1981). All constructs of our model exceed the threshold set by these authors (Table 2).

For discriminant validity, we compared the square root of the AVE (i.e. the diagonals in Table 3) with the correlations among constructs (i.e. the off-diagonal elements in Table 3). On average, each construct relates more strongly to its own measures than to others.

Table 3 Averages, typical deviations and correlations of the constructs

Constructs	*Mean*	*SD*	*EO*	*LO*	*IT*	*OL*	*TDCs*
EO	4.308	0.062	*0.757*				
LO	3.638	0.139	0.355	*0.841*			
IT	4.693	0.160	0.475	0.548	*0.766*		
OL	4.935	0.152	0.468	0.768	0.695	*0.899*	
TDCs	3.145	0.040	0.574	0.547	0.718	0.657	*0.807*

[a]Diagonal elements (italic figures) are the square root of the variance shared between the constructs and their measures. Off-diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal.

[b]All of the correlations are significant for $p < 0.01$.

4.3 Hypotheses test results

The structural model resulting from the PLS analysis is summarised in Table 4. This table sets out the explained variance by model (R^2), the standardised path coefficients (β), or direct effects and the *t*-values observed with the level of significance achieved from the bootstrap test with 500 resamples. In addition, the indirect and total effects are listed.

Table 4 Direct, indirect and total effects and explained variances for the endogenous variables

Effects on endogenous variables	*Path coefficients (β) t-value (bootstrap)*	*Indirect effects*	*Total effects*	*Variance explained*
Effects on OL				*0.707*
H1: EO	0.112^{*} (1.973)	–	0.112	0.053
H2: LO	0.538^{***} (8.000)	–	0.538	0.413
H3: IT	0.347^{***} (6.451)	–	0.347	0.241
Effects on TDCs				*0.613*
H4: OL	0.236^{**} (2.691)	–	0.236	0.149
H5: EO	0.259^{***} (4.174)	0.026	0.285	0.155
H6: IT	0.431^{***} (5.283)	0.082	0.513	0.309

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$ (based on a Student $t_{(499)}$ distribution with two-tailed).

$t_{(0,001,499)} = 3.310124157$, $t_{(0,01,499)} = 2.585711627$ and $t_{(0,05,499)} = 1.964726835$.

In relation to the antecedent variables in the model, the relationships established in hypotheses H_1–H_3 have been demonstrated. They represent how EO ($\beta = 0.112$, $p < 0.05$), LO ($\beta = 0.538$, $p < 0.001$) and IT ($\beta = 0.347$, $p < 0.001$) are linked to OL (considered as a knowledge creation process), although in the first case the standardised regression coefficient shows a low significance.

Effects on TDCs are all verified. On the one hand, H4 has been accepted, which establishes the influence of OL ($\beta = 0.236$, $p < 0.001$). On the other hand, H5 and H6 have also been confirmed, establishing a link between EO and IT and TDCs ($\beta = 0.259$, $p < 0.001$; $\beta = 0.431$, $p < 0.001$). Moreover, we have also found an indirect effect of these antecedent variables on TDCs (0.026, 0.082), which is mediated by OL. Therefore, the total effects of EO and IT on TDCs have a value of 0.285 and 0.513, which exceeds the level established by Falk and Miller (1992).

With reference to the explained variance (R^2) of the endogenous variables (Table 3), the research model has shown a correct predictive power. The endogenous variables have achieved R^2 values that are never less than 0.613, with the OL variable having a maximum explained variance of 70.7%.

5 Discussion

LO is the construct which shows the highest predictive power on OL contributing 41.3% to its explained variance. This finding supports the results of several authors who have measured OL based on orientations that must exist for it to occur (Hult and Ferrell, 1997) or according to the critical components of learning organisations (Jerez-Gómez et al., 2004).

We can find an explanation to this result if we take into account the fact that LO stimulates the organisation's willingness to create and use knowledge. Such values represent attributes of learning organisations, this being a type of organisation in which learning is somehow important (Easterby-Smith, 1997). Hence, commitment to learning is a key aspect of knowledge-creation organisations, where management commitment is a point of departure for the existence of all the company members' commitment to learn. To create knowledge, organisations must support commitment among their employees by formulating and proposing an organisational intention (Nonaka and Takeuchi, 1995).

Open-mindedness is related to Senge's (1990) reflections about the learning discipline named 'mental models'. The questioning of outlines or assumptions modelling the acts of the members of the organisation will allow new ideas and points of view, both internal and external, to enter. This enables the constant updating, widening and improvement of individual knowledge (Leonard-Barton, 1992a; Senge, 1990; Sinkula, 1994; Slocum et al., 1994).

With regard to shared vision, this concept is similar to one of the measurements proposed by Nonaka and Takeuchi (1995, pp.252–254) which can be adopted to establish an organisational knowledge-creation programme in a company. Knowledge vision, defined as the field or sector providing the corporate members with a mental map of the world they live in, makes the tasks they carry out everyday have a meaning and defines what type of knowledge they must search for and create.

We must also emphasise the explanatory power due to IT (24.1%), as a result of its presence and support via numerous technological tools in the knowledge generation/creation process. As Alavi and Leidner indicate (2001), an important research question arises related to the importance of IT: the definition of a space that provides the sharing of the knowledge created. According to Pawlowsky et al. (2001) the question of how knowledge is generated cannot be answered with simple learning tools. Therefore, such a result may support the fact that IT may complement and interact with other

intangible organisational resources, as is the case for LO and EO, given that the former, by themselves, do not guarantee that the OL-KC process occurs (Powell and Dent-Micallef, 1997; Smith et al., 1996).

With regard to EO, the proposed model can only explain 5.3% of the variance of OL. This finding supports the conclusions of Sadler-Smith et al. (2001). With this, we can see how EO induces OL in the creation of new knowledge which lays the foundations of building new competencies (Zahra et al., 1999). Hence, as Dess et al. (2003) state, LO should be considered as one of the most important consequences of EO, which allows the organisation to create new knowledge to update its skills and capabilities.

Similarly, it is observed that OL has a role in the development process of TDCs, as it explains 14.9% of its variance. This is in line with the findings of Dutrénit (2000) in affirming that companies construct their technological distinctive competencies through individual and collective learning processes. Taking this into account, OL allows the company to create new knowledge, which will be used to develop innovations by the company itself and its employees, as Forrester's (2000) empirical study shows. This is why they can be defined as a dynamic capability, given that they are a stable model of collective activity through which the organisation systematically pursues an improved effectiveness (Zollo and Winter, 2002).

On the other hand, EO has also a positive effect on TDCs and contributes 15.5% to the explained variance of this construct. This relationship, which was shown by Hult et al. (2004), means that EO embodies the qualities of proactiveness, aggressiveness and initiative that can propel managers into action on new ideas, novelty, experimentation and creative processes, which will result in new technological processes, products or ideas in the organisation (Lumpink and Dess, 1996). The mediating role of OL on the influence of EO on TDCs means the consideration of OL as a knowledge-based resource, which allows the company to create new knowledge by means of exploration and exploitation processes.

Nevertheless, the highest predictive power of the level of TDCs is due to IT, because this construct contributes 30.9% to the explained variance of the former. IT plays an active role in spreading the necessary knowledge to foster the accumulation, updating and utilisation of distinctive competencies. Their role in the distinctive competencies development process has been shown (Andreu and Ciborra, 1996; Ciborra and Andreu, 2002; Zhang and Lado, 2001), as it is the case for TDCs considered as transformational competencies (Lado and Wilson, 1994; Lado et al., 1992). Moreover, we must highlight the fact that OL plays a significant role in mediating the effects of IT on TDCs. An explanation of this result can be found, as Adams and Lamont (2003) posit, in the relevance of IT in the development of a learning capability which allows the company to identify, assimilate and apply external information to new processes or products, known as absorptive capacity (Cohen and Levinthal, 1990).

6 Conclusions

In this study, we have examined, using the literature on OL and the KBV as theoretical frameworks, the problem of the complexity of OL as a KC process and we have considered it as a latent multidimensional construct composed of stocks and flows variables. A measurement scale has been used which will strengthen the area of study in

which there are a number of limited empirical studies and in the development of which there has been a growing interest.

Secondly, we have proposed a theoretical model that, starting from the measurement of the OL-KC process, has demonstrated the relevance of LO, IT and EO (in this order) as enablers of this process. LO, the most important predictor, can be explained by the attributes of learning organisations, where learning is a fundamental process. IT allows the identification, acquisition and incorporation of data and information, along with a proper management of them. This way, they contribute to making tacit knowledge become explicit knowledge. However, IT does not guarantee that the OL-KC process occurs. Other resources, such as EO and LO occurring jointly and additionally, are necessary for IT to become a source of competitive advantage. On the other hand, the effects of EO on the OL–KC process result in a strategic renewal process, as it implies new knowledge creation, which lays the foundations to build competencies or revitalise the existing ones.

Thirdly, we have analysed the relationship between OL and TDCs. The technological dominance via which TDCs are expressed has a strong learning component, coming as it does from the learning process. As a consequence, we speak about a process of path-dependence learning.

Finally, the role of EO and IT on the generation of TDCs is demonstrated. EO means the search for and exploitation of opportunities that allow the company to introduce new products, processes or ideas. IT plays an active role in turning tacit knowledge into explicit knowledge and in the spreading of knowledge throughout the organisation. They may take part in the fundamental process consisting in transforming resources into capabilities and then into distinctive competencies. OL constitutes a high-order capability with a combinatorial character, so that it can generate other competencies, such as TDCs, by the combination of other strategic resources such as EO and IT.

6.1 Limitations and directions for future research

We would not like to finish without indicating that the results and conclusions of this study have some limitations. Firstly, there is the cross-sectional character of this research, particularly if we consider OL to be a construct of a dynamic character and TDCs to be essentially of a continuous nature attached to historic determining factors. A research line would be able to contemplate carrying out of a longitudinal study, taking measures at different moments of time, that permits us to ratify the relations established in the theoretical model proposed.

Secondly, the significance that the inter-organisational level may have for KC is not been considered. A future research line could bear in mind considering the outer knowledge coming from the stakeholders, which represent valuable sources of intelligence and new ideas.

Thirdly, the data employed are mainly the result of subjective perceptions of the managers who were interviewed. Although managers' subjective evaluations through multi-item measurement scales are in general consistent with objective measurements, perceptions may differ from the objective data. In this sense, it would be interesting to carry out future studies in this line, employing objective indicators obtained from case studies.

Fourthly, an effective OL also requires a high organisational absorptive capacity, which is investigated by its role in learning and innovation. In this manner, another work line could prove that the absorptive capacity can have both a positive impact on the creation knowledge and indirect effects through the interaction with IT.

Fifthly, the choice of a multisectorial sample, although it has enabled us to reach more global conclusions, could adversely affect the quality of the results obtained, especially because of the great heterogeneity of the sectors considered.

Finally, our research is carried out in a narrow geographical area, which makes generalisation of results to other contexts difficult.

References

Adams, G.L. and Lamont, B.T. (2003) 'Knowledge Management systems and developing sustainable competitive advantage', *Journal of Knowledge Management*, Vol. 7, No. 2, pp.142–154.

Alavi, M. and Leidner, D.E. (2001) 'Review: Knowledge Management and Knowledge Management systems: conceptual foundations and research issues', *MIS Quarterly*, Vol. 25, No. 1, pp.107–136.

Alvarez, S.A. and Busenitz, L.W. (2001) 'The entrepreneurship of resource-based theory', *Journal of Management*, Vol. 27, No. 6, pp.755–775.

Andreu, R. and Ciborra, C. (1996) 'Core capabilities and information technology: an organizational learning approach', in B. Moingeon and A. Edmondson (Eds). *Organizational Learning and Competitive Advantage*, London: Sage Publications, pp.121–138.

Baker, W.E. and Sinkula, J.M. (1999) 'The synergistic effect of market orientation and learning orientation on organizational performance', *Journal of the Academy of Marketing Science*, Vol. 27, No. 4, pp.411–427.

Barclay, D., Higgins, C. and Thompson, R. (1995) 'The Partial Least Squares (PLS) approach to causal modelling: personal computer adoption and use as illustration', *Technological Studies*, Special Issue on Research Methodology, Vol. 2, No. 2, pp.285–309.

Bessant, J., Caffyn, S. and Gilbert, J. (1996) 'Learning to manage innovation', *Technology Analysis and Strategic Management*, Vol. 8, No. 1, pp.59–70.

Bettis, R.A. and Hitt, M.A. (1995) 'The new competitive landscape', *Strategic Management Journal*, Summer Special Issue, Vol. 16, pp.7–20.

Bontis, N., Crossan, M.M. and Hulland, J. (2002) 'Managing an organizational learning system by aligning stocks and flows', *Journal of Management Studies*, Vol. 39, No. 4, pp.437–469.

Camisón, C. (1999) 'Sobre cómo medir las competencias distintivas: Un examen empírico de la fiabilidad y validez de los modelos multi-Ítem para la medición de los activos intangibles' ['On how to measure distinctive competencies: An empirical examination of the reliability and validity of the multi-item models in measuring intangible assets'], *First International Conference of The Iberoamerican Academy of Management*, Madrid.

Camisón, C. (2001) *La Competitividad de la Empresa Industrial de la Comunidad Valenciana: Análisis del Efecto del Atractivo del Entorno, los Distritos Industriales y las Estrategias Empresariales* [The Competitivity of the Industrial Companies of the Valencian Community: Analysis of the Effect of the Environment Attractiveness, the Industrial Areas and the Business Strategies], Tirant lo Blanch, Valencia.

Carley, K. (1992) 'Organizational learning and personnel turnover', *Organization Science*, Vol. 3, No. 1, pp.20-46.

Carmines, E.G. and Zeller, R.A. (1979) 'Reliability and validity assessment', *Sage University Paper Series on Quantitative Applications in the Social Sciences*, Beverly Hills, CA: Sage, pp.07–017.

Chaston, I., Badger, B. and Sadler-Smith, E. (1999) 'Organisational learning: research issues and applications in SME sector firms', *International Journal of Entrepreneurial Behaviour and Research*, Vol. 5, No. 4, pp.191–203.

Chiesa, V. and Barbeschi, M. (1994) 'Technology strategy in competence based competition', in G. Hamel and A. Heene (Eds). *Competence-Based Competition*, Chichester: John Wiley & Sons, pp.111–144.

Chin, W.W. (1998) 'The partial least squares approach to structural equation modelling', in G.A. Marcoulides (Ed). *Modern Methods for Business Research*, Mahwah, NJ: Lawrence Erlbaum Associates, pp.295–336.

Chin, W.W. (2003) *PLS-Graph* (Version 03.00, Build 1058) (Computer Software), University of Houston.

Chin, W.W. and Gopal, A. (1995) 'Adoption intention in GSS: relative importance of beliefs', *The Data Base for Advances in Information Systems*, Vol. 26, Nos. 2/3, pp.42–63.

Cohen, W.M. and Levinthal, D.A. (1990) 'Absorptive capacity: a new perspective on learning and innovation', *Administrative Science Quarterly*, Vol. 35, No. 1, pp.128–152.

Ciborra, C.U. and Andreu, R. (2002) 'Knowledge across boundaries: managing knowledge in distributed organizations', in C.W. Choo and N. Bontis (Eds). *The Strategic Management of Intellectual Capital and Organizational Knowledge*, New York: Oxford University Press, pp.575–586.

Covin, J.G. and Slevin, D.P. (1989) 'Strategic management of small firms in hostile and benign environments', *Strategic Management Journal*, Vol. 10, No. 1, pp.75–87.

Covin, J.G. (1991) 'Entrepreneurial versus conservative firms: a comparison of strategies and performance', *Journal of Management Studies*, Vol. 28, No. 5, pp.439–462.

Covin, J.G. and Slevin, D.P. (1991) 'A conceptual model of entrepreneurship as firm behaviour', *Entrepreneurship Theory and Practice*, Vol. 16, No. 1, pp.7–25.

Crossan, M.M. and Berdrow, I. (2003) 'Organizational learning and strategic renewal', *Strategic Management Journal*, Vol. 24, No. 11, pp.1087–1105.

Crossan, M.M., Lane, H.W. and White, R.E. (1999) 'An organizational learning framework: from intuition to institution', *Academy of Management Review*, Vol. 24, No. 3, pp.522–537.

Cycyota, C.S. and Harrison, D.A. (2002) 'Enhancing survey response rates at the executive level', *Journal of Management*, Vol. 28, No. 2, pp.151–176.

Davenport, T. and Prusak, H.L (1998) *Working Knowledge: How Organizations Manage What They Know*, Boston: Harvard Business School Press.

Day, G. (1994) 'Continuous learning about markets', *California Management Review*, Vol. 36, No. 4, pp.9–31.

Dess, G.G., Ireland, D., Zahra, S.A., Floyd, S.W., Janney, J.J. and Lane, P.J. (2003) 'Emerging issues in corporate entrepreneurship', *Journal of Management*, Vol. 29, No. 3, pp.351–378.

DiBella, A. and Nevis, E.C. (1998) *How Organizations Learn. An Integrated Strategy for Building Learning Capability*, California: Jossey-Bass Inc.

DiBella, A.J., Nevis, E.C. and Gould, J.M. (1996a) 'Understanding organizational learning capability', *Journal of Management Studies*, Vol. 33, No. 3, pp.361–379.

DiBella, A.J., Nevis, E.C. and Gould, J.M. (1996b) 'Organizational learning style as a core capability', in B. Moingeon and A. Edmondson (Eds). *Organizational Learning and Competitive Advantage*, London: Sage Publications, pp.38–55.

Dillman, D.A. (1978) *Mail and Telephone Surveys: The Total Design Method*, New York: Wiley & Sons Inc.

Dutrénit, G. (2000) *Learning and Knowledge Management in the Firm: From Knowledge Accumulation to Strategic Capabilities*, Northampton, MA: Edward Elgar Publishing.

Easterby-Smith, M. (1997) 'Disciplines of organizational learning: contributions and critiques', *Human Relations*, Vol. 50, No. 9, pp.1085–1113.

Easterby-Smith, M., Crossan, M.M. and Nicolini, D. (2000) 'Organizational learning: debates past, present and future, *Journal of Management Studies*, Vol. 37, No. 6, pp.783–796.

Entrialgo, M., Fernández, E. and Vázquez, C.J. (2000) 'Linking entrepreneurship and strategic management', *Technovation*, Vol. 20, No. 8, pp.427–436.

Entrialgo, M., Fernández, E. and Vázquez, C.J. (2001) 'The effect of the organizational context on SME's entrepreneurship: some Spanish evidence', *Small Business Economics*, Vol. 16, No. 3, pp.223–236.

Falk, R.F. and Miller, N.B. (1992) *A Primer for Soft Modelling*, Akron, OH: The University of Akron.

Fiol, C.M. (1991) 'Managing culture as a competitive resource: an identity-based view of sustainable competitive advantage', *Journal of Management*, Vol. 17, No. 1, pp.191–211.

Floyd, S.W. and Wooldridge, B. (1999) 'Knowledge creation and social networks in corporate entrepreneurship: the renewal of organizational capability', *Entrepreneurship Theory and Practice*, Vol. 23, No. 3, pp.123–143.

Fornell, C. and Larcker, D.F. (1981) 'Evaluating structural equation models with unobservable variables and measurement error', *Journal of Marketing Research*, Vol. 18, No. 1, pp.39–50.

Forrester, R.H. (2000) 'Capturing learning and applying knowledge: an investigation of the use of innovation teams in Japanese and American automotive firms', *Journal of Business Research*, Vol. 47, No. 1, pp. 35–45.

Garvin, D.A. (1993) 'Building a learning organization', *Harvard Business Review*, Vol. 74, No 4, pp.78–91.

Gold, A.H., Malhotra, A. and Segars, A.H. (2001) 'Knowledge management: an organizational capabilities perspective', *Journal of Management Information Systems*, Vol. 18, No. 1, pp.185–214.

Grant, R.M. (1996) 'Toward a knowledge-based theory of the firm', *Strategic Management Journal*, Winter Special Issue, Vol. 17, pp.109–122.

Guan, J. and Ma, N. (2003) 'Innovative capability and export performance of Chinese firms', *Technovation*, Vol. 23, No. 9, pp.737–747.

Hamel, G. (1991) 'Competition for competence and inter-partner learning within international strategic alliances', *Strategic Management Journal*, Vol. 12, No. 4, pp.83–103.

Hanssen-Bauer, J. and Snow, C.C. (1996) 'Responding to hypercompetition: the structure and processes of a regional learning network organization', *Organization Science*, Vol. 7, No. 4, pp.413–427.

Hedlund, G. and Nonaka, I. (1993) 'Models of knowledge management in the West and Japan', in P. Lorange, B. Chakravarthy, J. Roos and A. Van de Ven (Eds). *Implementing Strategic Processes: Change, Learning, and Cooperation*, Oxford: Basil Blackwell, pp.117–144.

Helfat, C.E. and Raubitscheck, R.S. (2000) 'Product sequencing: co-evolution of knowledge, capabilities and products', *Strategic Management Journal*, Vol. 21, Nos. 10/11, pp.961–979.

Henderson, R.M. and Clark, K.B. (1990) 'Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms', *Administrative Science Quarterly*, Vol. 35, No. 1, pp. 9–31.

Hitt, M.A., Ireland, R.D., Camp, S.M. and Sexton, D.L. (2002) 'Guest editors' introduction to the special issue strategic entrepreneurship: entrepreneurial strategies for wealth creation', *Strategic Management Journal*, Vol. 22, Nos. 6/7, pp.479–491.

Hult, G.T.M. and Ferrell, O.C. (1997) 'Global organizational learning capacity in purchasing: Construct and measurement', *Journal of Business Research*, Vol. 40, No. 2, pp.97–111.

Hult, G.T.M., Hurley, R.F. and Knight, G.A. (2004) 'Innovativeness: its antecedents and impact on business performance', *Industrial Marketing Management*, Vol. 33, No. 5, pp.429–438.

INE (2000) *Encuesta de Innovación Tecnológica en las Empresas [Survey on Technological Innovation in Spanish Firms] 1998*, Instituto Nacional de Estadística, Madrid.

Jerez-Gómez, P., Céspedes-Lorente, J. and Valle-Cabrera, R. (2004) 'Organizational learning capability: a proposal of measurement', *Journal of Business Research*, Vol. 58, No. 6, pp.715–725.

Jones, G.R. and Butler, J.E. (1992) 'Managing internal corporate entrepreneurship: an agency theory perspective', *Journal of Management*, Vol. 18, No. 4, pp.733–749.

Kazanjian, R.K., Drazin, R. and Glynn, M.A. (2001) 'Implementing strategies for corporate entrepreneurship: a knowledge-based perspective', in M.A. Hitt, R.D. Ireland, S.M. Camp and D.L. Sexton (Eds). *Strategic Entrepreneurship: Creating a New Mindset*, Oxford: Blackwell, pp.173–200.

Kim, L. (1998) 'Crisis construction and organizational learning: capability building in catching-up at Hyundai motor', *Organization Science*, Vol. 9, No. 4, pp.506–521.

Knight, G.A. (1997) 'Cross-cultural reliability and validity of a scale to measure firm entrepreneurial orientation', *Journal of Business Venturing*, Vol. 12, No. 3, pp.213–225.

Kreiser, P.M., Marino, L.D. and Weaver, K.M. (2002) 'Assessing the psychometric properties of the entrepreneurial orientation scale: a multi-country analysis', *Entrepreneurship Theory and Practice*, Vol. 6, No. 4, pp.71–94.

Lado, A.A., Boyd, N.G. and Wright, P. (1992) 'A competency-based model of sustainable competitive advantage: toward a conceptual integration', *Journal of Management*, Vol. 18, No. 1, pp.77–91.

Lado, A.A. and Wilson, M.C. (1994) 'Human resource systems and sustained competitive advantage: a competency-based perspective', *Academy of Management Review*, Vol. 19, No. 4, pp. 699–727.

Lado, A.A. and Zhang, M.J. (1998) 'Expert systems, knowledge development and utilization, and sustained competitive advantage: a resource-based model', *Journal of Management*, Vol. 24, No. 4, pp.489–509.

Lei, D., Slocum, J.W. and Pitts, R.A. (1999) 'Designing organizations for competitive advantage: the power of unlearning and learning', *Organizational Dynamics*, Vol. 27, No. 3, pp.24–38.

Lei, D., Hitt, M.A. and Bettis, R. (1996) 'Dynamic core competences through meta-learning and strategic context', *Journal of Management*, Vol. 22, No. 4, pp.549–569.

Leonard-Barton, D. (1992a) 'The factory as a learning laboratory', *Sloan Management Review*, Vol. 34, No. 1, pp.23–38.

Leonard-Barton, D. (1992b) 'Core capabilities and core rigidities: a paradox in managing new product development', *Strategic Management Journal*, Vol. 13, No. 8, pp.111–125.

Leonard-Barton, D. (1995) *Wellsprings of Knowledge*, Boston, MA: Harvard Business School Press.

Liu, S.S., Luo, X. and Shi, Y-Z. (2002) 'Integrating customer orientation, corporate entrepreneurship, and learning orientation in organizations-in-transition: an empirical study', *International Journal of Research in Marketing*, Vol. 19, No. 4, pp.367–382.

Lohmöller, J.B. (1989) *Latent Variables Path Modelling with Partial Least Squares*, Heidelberg: Physica-Verlag.

Lumpkin, G.T. and Dess, G.G. (1996) 'Clarifying the entrepreneurial orientation construct and linking it to performance', *Academy of Management Review*, Vol. 12, No. 1, pp.135–172.

Lumpkin, G.T. and Dess, G.G. (2001) 'Linking two dimensions of entrepreneurial orientation to firm performance: the moderating role of environment and industry life cycle', *Journal of Business Venturing*, Vol. 16, No. 5, pp.429–451.

Lyles, M.A. and Schwenk, C.R. (1992) 'Top management, strategy, and organizational knowledge structures', *Journal of Management Studies*, Vol. 29, No. 2, pp.155–174.

Lynn, G.S., Skov, R.V. and Abel, K.D. (1999) 'Practices that support team learning and their impact on speed to market and new product success', *Journal of Product Innovation Management*, Vol. 16, No. 5, pp.439–454.

Mahoney, J.T. (1995) 'The management of resources and the resource of management', *Journal of Business Research*, Vol. 33, No. 2, pp.91–101.

March, J.G. (1991) 'Exploration and exploitation in organizational learning', *Organization Science*, Vol. 2, No. 1, pp.71–87.

McGill, M.E., Slocum, J.W. and Lei, D. (1992) 'Management practices in learning organizations', *Organizational Dynamics*, Vol. 21, No. 1, pp.5–17.

Miller, D. and Friesen, P.H. (1978) 'Archetypes of strategy formulation', *Management Science*, Vol. 24, No. 9, pp.921–933.

Nelson, R.R. and Winter, S.G. (1982) *An Evolutionary Theory of Economic Change*, Cambridge, MA: Harvard University Press.

Nevis, E.C., DiBella, A.J. and Gould, J.M. (1995) 'Understanding organizations as learning systems', *Sloan Management Review*, Vol. 36, No. 2, pp.73–85.

Nieto, M. (2004) 'Basic propositions for the study of the technological innovation process in the firm', *European Journal of Innovation Management*, Vol. 7, No. 4, pp.314–324.

Nonaka, I. and Takeuchi, H. (1995) *The Knowledge-Creating Company*, New York: Oxford University Press.

Nonaka, I, Toyama and Byosière, R. (2001) 'A theory of organizational knowledge creation: understanding the dynamic process of creating knowledge', in M. Dierkes, A. Berthoin, J. Child and I. Nonaka (Eds). *Handbook of Organizational Learning and Knowledge*, NY: Oxford University Press, pp.491–517.

Nunnally, J. (1978) *Psychometric Theory*, NY: McGraw-Hill.

Örtenblad, A. (2001) 'On differences between organizational learning and learning organization', *The Learning Organization*, Vol. 8, No. 3, pp.125–133.

Pavitt, K. (1984) 'Sectoral patterns of technical change: towards a taxonomy and a theory', *Research Policy*, Vol. 13, No. 6. pp.343–373.

Pavitt, K. (1987) 'The objectives of technology policy', *Science and Public Policy*, Vol. 14, No. 4, pp.182–188.

Pawlowsky, P., Forslin, J. and Reinhardt, R. (2001) 'Practices and tools of organizational learning', in M. Dierkes, A. Berthoin, J. Child and I. Nonaka (Eds). *Handbook of Organizational Learning and Knowledge*, NY: Oxford University Press, pp.775–793.

Porac, J.F. and Thomas, H. (1990) 'Taxonomic mental models in competitor definition', *Academy of Management Review*, Vol. 15, No. 2, pp.224–240.

Powell, C.T. and Dent-Micallef, A. (1997) 'Information technology as competitive advantage: the role of human, business, and technology resources', *Strategic Management Journal*, Vol. 18, No. 5, pp.375–405.

Prahalad, C.K. and Hamel, G. (1990) 'The core competence of the corporation', *Harvard Business Review*, Vol. 68, No 3, pp.79–91.

Prencipe, A. (1997) 'The technological competencies and product's evolutionary dynamics a cause study from the aero-engine industry', *Research Policy*, Vol. 25, No. 8, pp.1261–1276.

Reed, R. and DeFillippi, R.J. (1990) 'Casual ambiguity, barriers to imitations and sustainable competitive advantage', *Academy of Management Review*, Vol. 15, No. 1, pp.88–102.

Sadler-Smith, E., Spicer, D.P. and Chaston, I. (2001) 'Learning orientations and growth in smaller firms', *Long Range Planning*, Vol. 34, No. 2, pp.139–158.

Sanchez, R. (1997) 'Managing articled knowledge in competence-based competition', in R. Sanchez and A. Heene (Eds). *Strategic Learning and Knowledge Management*, Chichester: John Wiley & Sons, pp.163–187.

Senge, P.M. (1990) *The Fifth Discipline*, NY: Currency Doubleday.

Sinkula, J.M. (1994) 'Market information processing and organizational learning', *Journal of Marketing*, Vol. 58, No. 1, pp.35–45.

Sinkula, J.M., Baker, W.E. and Noordewier, T. (1997) 'A framework for market-based organizational learning: linking values, knowledge, and behavior', *Journal of the Academy of Marketing Science*, Vol. 25, No. 4, pp.305–318.

Slater, S.F. and Narver, J.C. (1995) 'Market orientation and the learning organization', *Journal of Marketing*, Vol. 59, No. 3, pp.63–74.

Slocum, J.W., McGill, M. and Lei, D.T. (1994) 'The new learning strategy: anytime, anything, anywhere', *Organizational Dynamics*, Vol. 23, No. 2, pp.33–48.

Smith, K.A., Vasudevan, S.P. and Tanniru, M.R. (1996) 'Organizational learning and resource-based theory: an integrative model', *Journal of Organizational Change Management*, Vol. 9, No. 6, pp.41–53.

Stata, R. (1989) 'Organizational learning: the key to management innovation', *Sloan Management Review*, Vol. 30, No. 3, pp.63–74.

Teece, D.J. (1998) 'Capturing value from knowledge assets: the new economy, markets, and intangible assets', *California Management Review*, Vol. 40, No. 3, pp.55–79.

Teece, D.J., Rumelt, R.P., Dosi, G. and Winter, S. (1994) 'Understanding corporate coherence: theory and evidence', *Journal of Economic Behavior and Organization*, Vol. 23, No. 1, pp.1–30.

Tomaskovic-Devey, D., Leiter, J. and Thompson, S. (1994) 'Organizational survey nonresponse', *Administrative Science Quarterly*, Vol. 39, No. 3, pp.439–457.

Tippins, M.J. and Sohi, R.S. (2003) 'IT competency and firm performance: is organizational learning a missing link?', *Strategic Management Journal*, Vol. 24, No. 8, pp.745–761.

Tsang, E.W.K. (1997) 'Organizational learning and the learning organization: a dichotomy between descriptive and prescriptive research', *Human Relations*, Vol. 50, No. 1, pp.73–89.

Tushman, M. and Anderson, P. (1986) 'Technological discontinuities and organizational environments', *Administrative Science Quarterly*, Vol. 31, No. 3, pp.439–465.

Vera, D. and Crossan, M.M. (2004) 'Strategy leadership and organizational learning', *Academy of Management Review*, Vol. 29, No. 2, pp.222–240.

Wiklund, J. and Shepherd, D. (2003) 'Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized business', *Strategic Management Journal*, Vol. 24, No. 13, pp.1307–1314.

Wold, H. (1979) *Model Construction and Evaluation When Theoretical Knowledge is Scarce: An Example of the Use of Partial Least Squares*, Cahiers du Département D'Économétrie, Faculté des Sciences Économiques et Sociales, Université de Genève, Genève.

Zahra, S.A. and George, G. (2002) 'Absorptive capacity: a review, reconceptualization, and extension', *Academy of Management Review*, Vol. 27, No. 2, pp.185–203.

Zahra, S.A., Jennings, D.F. and Kuratko, D.F. (1999) 'The antecedents and consequences of firm-level entrepreneurship: the state of the field', *Entrepreneurship Theory and Practice*, Vol. 24, No. 2, pp.45–65.

Zahra, S.A., Nielsen, A.P. and Bogner, W.C. (1999) 'Corporate entrepreneurship, knowledge, and competence development', *Entrepreneurship Theory and Practice*, Vol. 23, No. 3, pp.169–189.

Zhang, M.J. and Lado, A.A. (2001) 'Information systems and competitive advantage: a competency-based view', *Technovation*, Vol. 21, No. 3, pp.147–156.

Zollo, M. and Winter, S.G. (2002) 'Deliberate learning and the evolution of dynamic capabilities', *Organization Science*, Vol. 13, No. 3, pp.339–351.

Appendix

Sample profile

		Number of firms	*%*
a	*Industry type*		
	Food and drinks	27	19.29
	Cardboard and paper	4	2.86
	Chemical sector	23	16.43
	Rubber and plastic materials	12	8.57
	Non-metallic minerals	17	12.14
	Metallurgy and manufacturing of metal products	11	7.86
	Machinery and mechanical equipment	9	6.43
	Electrical, electronic and optical material and equipment	18	12.86
	Manufacturing of transport material	19	13.57
	Total	140	100.00
b	*Total sales revenue (millions)*		
	Range		
	2M€–10M €	42	30.00
	More than 10M €–50M €	59	42.14
	More than 50M €	39	27.86
	Total	140	100.00
c	*Total number of employees*		
	Range		
	10 to < 50	42	30.00
	50 to < 250	59	42.14
	250 to < 500	24	17.14
	500 and above	15	10.71
	Total	140	100.00