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Information technology and learning: Their relationship and impact on organisational performance in small businesses ☆

Josefa Ruiz-Mercader, Angel Luis Meroño-Cerdan*, Ramón Sabater-Sánchez

Management and Finance Department, University of Murcia, Campus de Espinardo, 30100 Espinardo, Murcia ,Spain

Abstract

Information technology is seen as a key tool in knowledge management processes. Nevertheless, the presence of information technology neither guarantees knowledge creation, knowledge distribution nor knowledge use. In addition to information technology, a job environment and a culture that encourage sharing and continuous learning should also be created and maintained by management. This paper provides empirical evidence of the relationship between information technology and learning in small businesses as well as their impact on organisational performance. Furthermore, the level of sector knowledge-intensity is taken into consideration. Results show that individual learning along with individual and collaborative information technologies have a positive and significant impact on organisational learning. On the other hand, unlike individual and collaborative information technologies, individual and organisational learning have shown significant and positive effects on organisational performance. Therefore, information technology has a significant impact on outcomes only when in a proper context of learning is in place. Small businesses in sectors with high knowledge-intensity levels are more likely to use more frequently information technology tools and organisational learning practices.

Keywords: Information technology; Learning; Sector knowledge-intensity; Organisational performance; Small businesses

1. Introduction

Knowledge creation, both tacit and explicit, has become a key element in business administration. Both kinds of knowledge help management to adapt and anticipate environmental changes through the development of new products and/or services. Information technology allows companies to obtain, process, store and exchange information. Furthermore, in a knowledge management context, information technology can support transformation within and between tacit and explicit knowledge. Nevertheless, the presence of information technology neither guarantees knowledge creation, knowledge distribution nor knowledge use.

Some research has stated that many knowledge management systems have been unsuccessful (see Schultze & Boland, 2000), with Storey and Barnett (2000) reporting failure rates of over 80%. Information technology

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*Corresponding author. Tel.: +34 968 363791; fax: +34 968 367537.
E-mail addresses: peparuiz@um.es (J. Ruiz-Mercader), angelmer@um.es (A.L. Meroño-Cerdan), rsabater@um.es (R. Sabater-Sánchez).

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benefits are clear in well-structured job environments. If the flow of work, including people, tasks and tools, can be predefined, automation via information technology could be the best option. Fielder, Grover, and Teng (1994) argue that traditionally, the conservative approach for applying information technology was through the automation of existing processes within the boundaries of traditional functional structures, based on the assumption that the original process designs were satisfactory. Troubles arise when this fit cannot be made. That has been the case when implementing knowledge management scenarios. The best of information technology cannot be achieved without processes, rules and habits where sharing and collaboration play key roles.

In a knowledge management context, information technology benefits are highly influenced by the existence of an appropriate climate to share (Davenport, Long, & Beers, 1998) and a human orientation (Choi & Lee, 2003). In sum it depends on the employees' commitment to knowledge creation processes (Cross & Baird, 2000). Therefore, a culture in which learning features prominently is required. An internal environment that boosts the learning process activities (data collection, distribution, interpretation, action and reflection) and encourages the use of certain tools (metaphor, dialogue, interactive systems and information technology) should be promoted.

Despite the unexpected number of failures of knowledge management, there are some evidences of its positive influence on organisational performance. Some empirical work has been done (see Choi & Lee, 2003; Gold, Malhotra, & Segars, 2001; Lee & Choi, 2003) but there is still a lack of empirical evidence especially in small businesses.[1] Traditionally, knowledge management research has been addressed to large companies. Nevertheless, small businesses are likely to be knowledge generator. Their organic structure and culture may foster knowledge innovations. However, their structural features and resources scarcity may impede to obtain sustainable competitive advantage from these innovations (Levy, Loebbecke, & Powell, 2003). So, it can be expected that successful knowledge management initiatives could transform the small business innovation capacity into a sustainable higher performance.

Furthermore, researchers are starting to wonder if the level of sector knowledge-intensity could have an impact on managerial practices (Desnoyers & Lirette, 1999; Smith, 2002). Information technology as well as learning processes could be also affected by this variable.

The aim of this research is to provide empirical evidence of the relationship between information technology and learning as well as their impact on small businesses performance. To complete this aim: (1) the distinction between individual technology and collaborative technology is made; (2) a multilevel learning model is used; (3) the sector knowledge-intensity is considered; (4) the level of objectives achievement is introduced as a perceptual organisational performance measurement; and (5) an empirical study is accomplished.

2. Information technology and knowledge management

In this paper we focus on information technology which is different from information system. Essentially, information technology is a generic term for the convergence of computers, hardware, software, telecommunications, Internet, electronics and the resulting technologies. It can be measured through the inventory of applications that organisations have. Whereas, information system is a wider concept, which refers to how information flows are designed within organisations so as to meet organisations information needs (Gunasekaran, Love, Rahimi, & Miele, 2001).

Considering the distinction between information technology and information system, information technology can be conceived as the infrastructure to knowledge management (Chou, 2003), or a knowledge platform (Tiwana, 2002). Some authors, as Choi and Lee (2003) and Gold et al. (2001), with a similar orientation see information technology as an enabler of knowledge management. The role of information technology is to extend human capacity of knowledge creation through the speed, memory extension and communication facilities of technology (Baroni & Araújo, 2001).

[1]Following the European Union concept for Small and Medium Size Enterprises (ENSR, 1997), in this research "small businesses" are defined as those with less than 250 employees.

Many of the technologies that support the management of knowledge have been around for a long time (Davenport & Prusak, 1998). An analysis of technological tools can be found in Tyndale (2002). A distinction is made between information technology based on tools borrowed from other disciplines that have entered into knowledge management field, and information technology based on tools that have been designed as knowledge management tools from their inception. After classifying tools in main knowledge phases, Tyndale concludes that new but also old tools can be used as knowledge management technologies. Baroni and Araújo (2001) also provide an information technology review for a knowledge management purpose, paying special attention to software applications.

For the aim of this paper and in order to connect information technology with learning in organisations a distinction is made. Individual technology related to business software featured by individual use is considered separately from collaborative technology, where people share data, information and/or knowledge.

Individual technology can be measured through the use of business software. At this empirical study, the business software considered includes manufacturing planning, inventory management, sales management, financing and accountant, personnel management, decision support systems, building and maintenance of websites, business processes simulation and software engineering tools. These applications match Fielder et al. (1994) explanation of information technology benefits. Individual technology is featured by the automation of well-defined work processes.

Collaborative technologies play a central function in knowledge management programs (Marwick, 2001; Alavi & Leidner, 1999; Skyrme, 1998). Inspired in Baroni and Araújo (2001) and Tyndale (2002), as in the case of individual technologies, a list of collaborative applications is considered, these are: newsgroups, shared databases, documents repositories, polls, workflow and shared agendas.

3. Learning in organisations

As a base for this research, learning in organisations is defined as the process that increases the actionable knowledge of the organisation and its members through interpretation, comprehension and assimilation of tacit and explicit information. The purpose is to generate knowledge that can be codified and institutionalised in norms of behaviour or organisational routines and work processes.

Nonaka (1991, 1994) and Nonaka and Takeuchi (1995) propose a four-level learning model (individual, group, organisation and inter-organisation) while Bontis, Crossan, and Hulland (2002), Crossan, Lane, and White (1999), and Martínez-León (2002), define a three-level model (inter-organisation level is not explicitly considered). Kim (1993) distinguishes between individual learning and organisational learning but he does not explicitly include group learning. Since our research used a sample with a high percentage of companies with less than 10 employees (72.2%), the two-level model proposed by Kim (1993) is the most appropriate for this study. Due to the firm size, in many cases it is quite difficult to build barriers between groups and the organisation since there could be no clear definition of groups rather people performing different tasks according to market and work requirements. Therefore, group learning is considered as a component of organisational learning.

Individual learning is the conscious or unconscious process where tacit and/or explicit knowledge is created by a person through intuition and interpretation of information (Bontis et al., 2002). As a result for this learning level, individual skills and behaviours will be modified (Fiol & Lyles, 1985; Garvin, 1993). According to Bontis et al. (2002), intuition depends on the individual's tacit knowledge and expertise, while interpretation requires not only competence and capability but also motivation and direction or focus. For these authors, individual learning is enhanced by the nexus between what individuals can do (capability), what they want to do (motivation), and what they need to do (focus). Table 1 shows the indicators used to measure individual learning as well as an explanation of how these indicators are related to this learning level.

The processes where knowledge is generated by socialisation, externalisation and combination, as defined by Nonaka and Takeuchi (1995), are considered "organisational learning". At this level, a shared understanding is translated into the organisation products, systems, structures, procedures and strategy (Bontis et al., 2002). Table 2 exhibits the organisational learning indicators used in this research.

Table 1
Individual learning indicators

	Indicators	Relationship with learning
What individuals can do?	Polyvalence (Scott & Cockrill, 1997)	Performing different tasks and/or positions will allow individuals to share tacit and explicit knowledge with other employees of different backgrounds thereby increasing their information, experience, and technical and social skills.
	Creativity (Dibella & Nevis, 1998)	It supplies new concepts and work routines to improve the current job context or when unforeseen events happen.
What individuals want to do?	Courage and determination	When employees choose to deal with and resolve problems not only their tacit but also explicit knowledge will increase.
	Openness values (Davenport, Long, & Beers, 1998)	Lack of openness values is an inhibitor of individual learning since employees may hide errors and difficulties. This causes a work environment where employees feel sharing information will reduce their power in the organization.
	Resistance to change (Benoit & Mackenzie, 1994)	When people resist to change and they fight to keep doing things as they have always been done they are rejecting the incorporation of new knowledge.
What individuals need to do?	Definition of goals	When management clearly establishes goals, individuals are more able to optimise their efforts in the process of achieving their targets because they can better assess the value of certain information and knowledge.
	Autonomy and control (Spencer, 1996)	Empowering employees to make decisions and take action in their jobs when facing unforeseen events has a positive effect on learning and in the integration of new knowledge.
	Acceptance of failure (Krogh, 1998)	Individual learning is also enhanced if there is an acceptance of failure by management when employees are encouraged to identify and resolve problems.
	Reward system (Krogh, 1998)	An incentive reward system fosters the most individual learning.

4. Research model and hypotheses

Fig. 1 shows the proposed model and hypotheses for this research. As it can be seen from Fig. 1, sector knowledge-intensity and organisational performance are introduced along with individual technology, collaborative technology, individual learning and organisational learning.

Regarding sector knowledge-intensity, there is no standard classification for it. R&D investment data as well as other non R&D innovation expenditures such as training, market research related to new product development, design, patents, licenses, and capital investment (Smith, 2002) have been used as indicators of sector knowledge-intensity. Some researches are focused on analysing if sector knowledge-intensity has an impact on various managerial aspects (see Desnoyers & Lirette, 1999; Smith, 2002). From our point of view, learning and information technology use are related to sector knowledge-intensity. According to Alavi and Leidner (1999), knowledge management systems are not solely appropriate for consulting and professional service firms. A broad range of organisations from a variety of industries can benefit from these systems. However, it can be expected that sector knowledge-intensity may influence the final results. Recent statistics

Table 2
Organizational learning indicators

Indicators	Relationship with learning
Project-based and teamwork structures (Nevis, DiBella, & Gould, 1995; Leonard-Barton & Sensiper, 1998)	Under the following conditions, individuals will have a higher predisposition to share their knowledge and information: different professional specializations, implementation of employees' suggestions, team reward systems, trust, dialogue, evident mutual respect and desire to help each other, and high levels of decentralization.
Communication skills and systems (Cohen & Levinthal, 1990)	To achieve effective organizational learning, the majority of the employees should have developed communication skills in order to transmit tacit knowledge. Furthermore, management should build communication systems such as: (1) procedure manuals or data bases in order to boost organizational memory; (2) processes to communicate between departments what they have learned from errors and developments; (3) systematic and regular procedures to collect internal and external information; (4) meetings or presentations to distribute relevant information; and (5) even facilitate social activities.
Experimentation (Slocum, McGill, & Lei, 1994; Fahey & Prusak, 1998; Dibella & Nevis, 1998)	Experimentation implies testing new techniques and methods in specific units or areas before its general implementation in order to create new knowledge or validate existing knowledge.
Training (Lundy & Cowling, 1996)	Training helps to institutionalise expertise, skills and knowledge mainly if it is: (1) continuous; (2) adapted to the specific requirements of the company; and (3) focused not only on technical but also social skills.

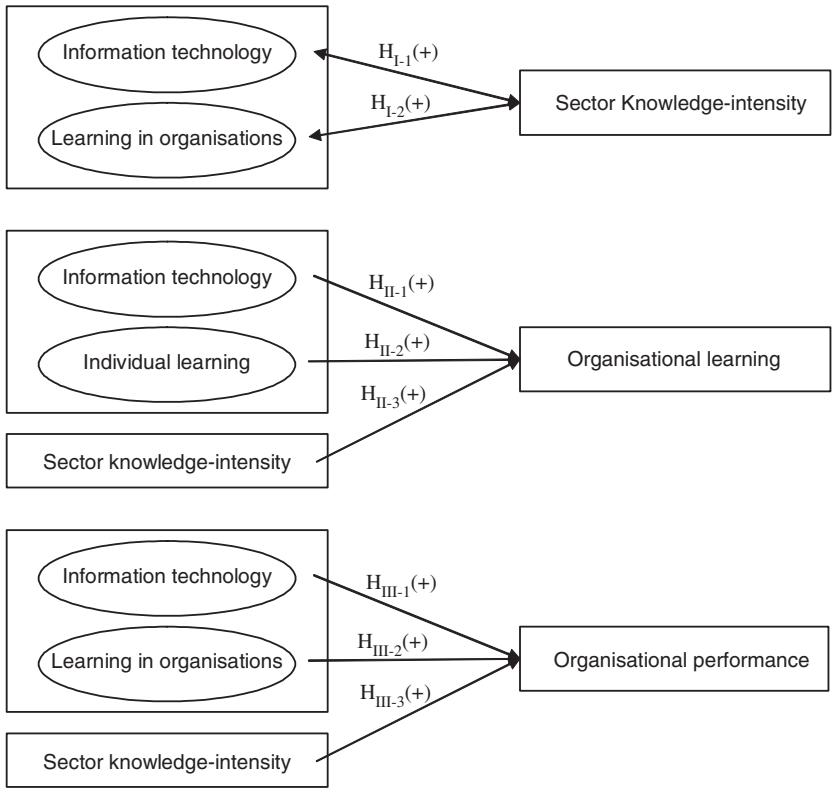

Fig. 1. Research model and hypotheses.

from the European Communities (2003) calculate that employment in high-tech and medium–high-tech manufacturing sectors accounts for 7.4% of the employment in 2002 in the European Union. Additionally, the percentage for the knowledge-intensive services reaches the 33.3% of the employment. Consequently, almost half of the employment is related with high and medium tech and knowledge intensive sectors in Europe. Small businesses in industries with high knowledge-intensity level might have a larger use of information technology tools as well as managerial practices that encourage learning due to the higher level of pressure to be more innovative. Therefore, the following proposition and hypotheses can be drawn (Fig. 1):

Proposition 1. *Information technology and learning in small businesses are related to sector knowledge-intensity.*

$H_{I\text{-}1}$. *Small businesses within more knowledge-intensity sectors have a larger use of information technology.*

$H_{I\text{-}2}$. *Small businesses within more knowledge-intensity sectors have a larger use of practices that encourage learning.*

Organisational learning has been defined as the shared understanding within the organisation which is translated into its products, systems, structures, procedures and strategy. Organisational stocks of knowledge will be increased if individuals share tacit and explicit information and knowledge as a result of socialisation, externalisation and combination processes as defined by Nonaka and Konno (1998).

Regarding the relationship between information technology and organisational learning, Robey, Boudreau, and Rose (2000) distinguish two streams of research: studies that apply organisational learning concepts to the process of implementing and using information technology in organisations; and studies concerned with the design of information technology applications to support organisational learning. The latter is more related to knowledge management than the former. Both streams have evolved independently from each other. However, they are conceptually close: organisational learning makes easier information technology adoption whereas information technology use improves organisational learning capabilities.

Information technology can improve organisational learning since it can be used as a tool to transform tacit knowledge into explicit knowledge (externalisation) as well as to convert explicit knowledge into more complex sets of explicit knowledge (combination). Information technology is a key instrument for the creation, codification, storage, communication, analysis, diffusion and systematisation of information and knowledge. Furthermore, "information technology is widely employed to connect people with reusable codified knowledge, and it facilitates conversations to create new knowledge" (Lee & Choi, 2003). With this orientation, Marwick (2001) reviews knowledge management technology using as a framework Nonaka's (1991, 1994), and Nonaka and Takeuchi (1995) model of organisational knowledge creation. Small businesses with higher use of individual and collaborative information technology will be able to obtain larger organisational learning levels.

Nevertheless, knowledge will not necessarily circulate freely firm-wide just because accurate information technology to support such circulation is available (Brown & Duguid, 1991). Vandenbosch and Ginzberg's (1997) work concerning one of the most popular groupware systems concludes that technology does not change information sharing and communication patterns. Chou (2003) finds information technology has a positive effect on organisational learning, and that this link is supported when the appropriate culture exists. Davenport and Prusak (1998) highlight that as enterprises interact with their environment they absorb information, turn it into knowledge and take actions based on it in combination with their experiences, values and internal rules. Enterprises that are committed to knowledge management foster a job environment and a culture that support continuous learning. Several authors have considered individual learning as the cornerstone for learning at organisational level (Crossan et al., 1999; Kim, 1993; Nonaka, 1994). Tacit and explicit knowledge acquired by individuals will help the creation of collective and shared knowledge within groups and the organisation.

Organisational learning level could vary according to sector knowledge-intensity. It could be expected that small businesses within higher knowledge-intensity industries will require better and more formalised processes for socialisation, externalisation and combination.

The subsequent proposition and hypotheses are introduced concerning the organisational learning and its relationship with information technology, individual learning, and sector knowledge-intensity (Fig. 1).

Proposition 2. *Information technology, individual learning, and sector knowledge-intensity are related to organisational learning in small businesses.*

$H_{I\text{-}1}$. *Information technology has a positive effect on organisational learning in small businesses.*

$H_{II\text{-}2}$. *Individual learning has a positive effect on organisational learning in small businesses.*

$H_{II\text{-}3}$. *Sector knowledge-intensity has a positive effect on organisational learning in small businesses.*

Resource and capability-based theory posits that internal factors are the trigger for organisational competitive advantages. Nevertheless, these factors have to possess certain characteristics in order to be counted as resources and capabilities that supply sustainable competitive advantages (Amit & Schoemaker, 1993; Barney, 1991; Grant, 1991; Peteraf, 1993). Organisational knowledge is a resource resulting from various interactive learning processes. So learning is a dynamic and inimitable process that has the ability to integrate and build internal and external competencies to face environmental changes. Therefore, learning is a capability. In terms of knowledge transfer, there is a tacit dimension that becomes knowledge assets in a competitive advantage (Teece, 2000). Hamel and Prahalad (1994) feature it as a core capability developed through a collective learning process in the company.

Concerning the information technology's potential for creating sustainable competitive advantage, Johannessen, Olaisen, and Olsen (2001) observe a general optimism, in the society as a whole. Nevertheless, they detail challenges to the earlier optimism from the emerging empirical evidence which indicates a lack of support for the positive economic impact of information technology investments. This is denoted as the productivity paradox of information technology. Although some authors as Brynjolfsson (1993) give reasonably explanations, Johannessen et al. (2001) take a rather different approach. They argue that the mismanagement of information technology is found in both the lack of understanding of tacit knowledge, and the relationship between tacit knowledge and information technology. Therefore, it can be expected that investment on individual or traditional information technology have limited consequences on competitiveness, and consequently on organisational performance. In contrast, collaborative technology has the potential to affect value creation due to the management of tacit knowledge. Although, as it was exposed previously, in order to attain information technology's potential benefits other elements must be achieved. Therefore, information technology could be considered as a kind of enabler of knowledge management success.

As suggested by Hamel and Prahalad (1993), organisations should be able to translate learning processes into managerial competences in order to improve their performances. Bontis et al. (2002) find empirical support to the positive association between individual and organisational learning with business performance in large companies. The theoretical relationship between organisational performance and information technology, as well as the relationship between organisational performance and learning, in small size businesses, are empirically tested in this paper. Hence, the next proposition and hypotheses (Fig. 1) are formulated. The relationship between sector knowledge-intensity and organisational performance has been also introduced.

Proposition 3. *Information technology, learning, and sector knowledge-intensity are related to organisational performance in small businesses.*

$H_{III\text{-}1}$. *Information technology has a positive effect on organisational performance in small businesses.*

$H_{III\text{-}2}$. *Learning has a positive effect on organisational performance in small businesses.*

$H_{III\text{-}3}$. *Sector knowledge-intensity has a positive effect on organisational performance in small businesses.*

5. Methodology

5.1. Sample and data collection

The target population consists of small businesses in the Information Technology sector in the Region of Murcia (Spain), a total of 253 companies. One hundred and fifty one valid responses have been obtained, yielding an overall response rate of 59.9%. The study assumes an error of 5.1% for $p = q = 50$ and a

confidence level of 95.5%. A structured questionnaire consisting of close-ended questions has been developed. Face-to-face surveys with the CEOs were conducted in June 2001.

The Information Technology sector is appropriate for analysing information technology systems and learning in small businesses. Firstly, this sector is primarily comprised of businesses with less than 250 employees (99.6% in the Region of Murcia). Secondly, companies in this industry have to face high levels of environmental uncertainty, which demands product and service innovation in order to survive in a hostile environment. Thirdly, due to the nature of the performance work in this sector, individual and collaborative technologies play an important role.

5.2. Measures of variables

Information technology: Individual technology and collaborative technology are measured through two sub-scales. Nine and six items are introduced in the questionnaire for each of them, respectively. Using a dichotomous scale, CEOs have to assess the presence of each item in their firms. The ''individual technology index'' and the ''collaborative technology index'' are formulated as the sum of the values given to the items, in each category. The internal reliability Cronbach′s alpha test is weaker for individual technology (0.568) than for collaborative technology (0.722). The value for the individual technology index, 0.568, is below 0.60 which is the level considered by Nunnally (1978) as acceptable, but since it is extremely close it is still used.

Learning: Two sub-scales are developed, one for individual learning and one for organisational learning. The Individual learning index is obtained summing the values given by CEOs to 17 items. These items are generated to capture the theoretical aspects of employees′ polyvalence and creativity, courage and determination when facing problems, openness values, no resistance to change, goals definition level, autonomy level, failure acceptance and reward system. A seven-point Likert scale is used (for all the items, ''1'' is associated with the lowest individual learning level, while ''7'' refers to the highest level). The Cronbach′s alpha test over the individual learning index (0.722) indicates scale reliability. The same process is followed to calculate the organisational learning index, using 27 items on project-based and teamwork structures, communication skills and systems, experimentation and training. The Cronbach's alpha in this case is 0.889.

Sector knowledge-intensity activity: Using the K-means cluster analysis, two significantly different groups of companies are found according to the ''percentage of sale of each product over the overall sales''. One group, 69 companies, is perfectly identified as Software businesses. Their main products are ''development of customised software and its modifications'', ''consulting'', ''telecommunication advanced services'', and ''training''. The other group, comprised of 82 companies, is identified as Hardware businesses whose sales are mainly focused on ''hardware and its maintenance''. Information from these two sub-sectors, Software and Hardware, is used in order to analyse the effect of the ''sector knowledge-intensity'' variable. The products and services of Software companies can fit in what Krajewski and Ritzman (2000) define as ''flexible flow'' (a wide range of products or services produced in small batches; different types of machines or employees with different sets of skills grouped to handle all products or services requiring a specific function to be performed, and various products or services moving from one process to another). On the other hand, Hardware companies fit into the ''intermediate flow'' category defined by the same authors (several products and services produced in relatively high volumes; equipments and employees tending to be organised following the process, and material and/or information grouped according to the existing routes). This was confirmed with our data. Significant differences between sub-sectors were found using the χ^2 Pearson test over ''product standardisation level'' and ''strategy'' variables. Given a list of products and services and using a seven-point Likert scale, CEOs have to indicate the level of standardisation for their products. 61.9% of Software companies produce customised products or services while this number decreases to 32.8% for Hardware companies ($p<.001$). Following Porter's (1980) orientations, a question to evaluate the strategy followed by the company (overall cost leadership, differentiation or focus) is also included in the survey. Results show that 73.9% of Software small businesses follow the differentiation strategy comparing with 50.0% of Hardware companies ($p<.001$). Therefore, the Software sub-sector can be considered as a higher knowledge-intensity sector than the Hardware sub-sector since they require superior level of R&D, training, market research related to new products development, design, patents and licenses and capital investment (Kim, 1993). A dummy variable is introduced, Software was coded as 1 and Hardware was coded as 0.

Organisational performance: The level of objectives achievement is used as a perceptual indicator of organisational performance. According to Dess and Robinson (1984) perceived measures of performance can be a reasonable substitute for objective performance measures. Furthermore, this kind of organisational performance has been already introduced in researches connected with information technology (Wang, 2003) as well as with learning in organisations (Bontis et al., 2002). Objectives achievement has been used in small businesses by several authors including Gadenne (1998) and Beal (2000). The main determinants of small businesses success and failure (cash flow, costs, market share, quality, introduction of new technology, employees′ satisfaction, customers′ satisfaction, and organisational reputation) are included to evaluate the level of objectives achievement.[2] Using a seven-point Likert scale, a weighted organisational performance index is developed. For each objective, CEOs have to indicate its "importance" and its "level of achievement". An index for each company is established as the sum of the products of these two questions for each objective. Internal reliability test illustrates a satisfactory Cronbach′s alpha (.83).

Control variables: Company age and size are included as control variables. These two variables are also used as control variables by Murphy, Trailer, and Hill (1996) in their study about measuring performance in entrepreneurship research and by Bontis et al. (2002), and Martínez-León (2002) when analysing learning in organisations. Company age refers to the number of years that the company is operating. Size is measured through the average number of employees in year 2000.

5.3. Statistical analysis

Hypotheses from Proposition 1 are tested through *t*-student tests over two independent samples (Software and Hardware). Hierarchical regression analysis is used to examine hypotheses of the rest of propositions. For Proposition 2, in its first model, organisational learning index is regressed only on control variables. In the second model, individual technology, collaborative technology, and individual learning indexes are added to the equation. The third model includes the effect of the sector knowledge-intensity on organisational learning. For Proposition 3, the same control variables are used for its first model. In its second one, the level of objectives achievement is regressed furthermore on individual technology collaborative technology, individual learning and organisational learning indexes. The third model embraces the effect of sector knowledge-intensity on organisational performance. Cases with missing or inappropriate data on key variables were removed, resulting in a final sample size of 149 companies. Tests are completed to check if the assumptions for the regression analyses are met.

6. Results

Table 3 includes the descriptive statistics and two-sided Pearson correlations. None of the correlation coefficients are large enough to expect substantial multicollinearity problems in estimating the regression equations.

The results obtained after testing our hypotheses are summarised in Fig. 2. The full set of results can be obtaining from the corresponding author.

With reference to Proposition 1, Hypotheses $H_{I\text{-}1}$ and $H_{I\text{-}2}$ postulate that the mean values of responses for the Software group should be higher than those for the Hardware group on each of the four dimensions (individual technology, collaborative technology, individual learning, and organisational learning). On each *t*-test, the *p*-values are equal or inferior to 0.05, with exception for individual learning. This indicates that the mean response values for Software are significantly higher that the mean response values for Hardware on individual technology, collaborative technology and organisational learning. Therefore, hypothesis $H_{I\text{-}1}$ is supported (small business within more knowledge-intensity sectors have a larger use of information technology) and hypothesis $H_{I\text{-}2}$ is partially supported (small businesses within more knowledge-intensity sectors have a larger use of organisational learning but no significant difference is found for individual learning).

[2]Small business main determinants of success and failure are deeply analyzed in Gaskill, Auken, and Manning (1993) Gaskill et al. (1993), Lin (1998), Gadenne (1998) and Ruiz-Santos (2002).

Table 3
Descriptive statistics and two-sided pearson correlations [a]

	Mean	SD	1	2	3	4	5	6	7	8
1. Age	7.516	6.122	1							
2. Size	12.846	31.915	0.138*	1						
3. Sub-sector[b]	0.463	0.500	−.017	.180**	1					
4. Individual technology	4.557	1.783	0.099	0.283***	0.239***	(0.568)				
5. Collaborative technology	1.678	1.508	0.103	0.268***	0.360***	0.366***	(0.722)			
6. Individual learning	86.664	11.067	−0.271***	−0.101	0.000	−0.041	−0.076	(0.722)		
7. Organisational learning	96.812	31.492	0.071	0.225***	0.333***	0.315***	0.278***	0.210***	(0.889)	
8. Objectives achievement	34.453	7.056	0.181**	0.063	−0.090	0.078	−0.115	0.307***	0.252***	(0.825)

*$p<0.1$; **$p<0.05$; ***$p<0.01$. When appropriate Cronbach alpha estimates are listed on the diagonal.
[a] $n = 149$.
[b] Dichotomous variable: 0 = Hardware and 1 = Software.

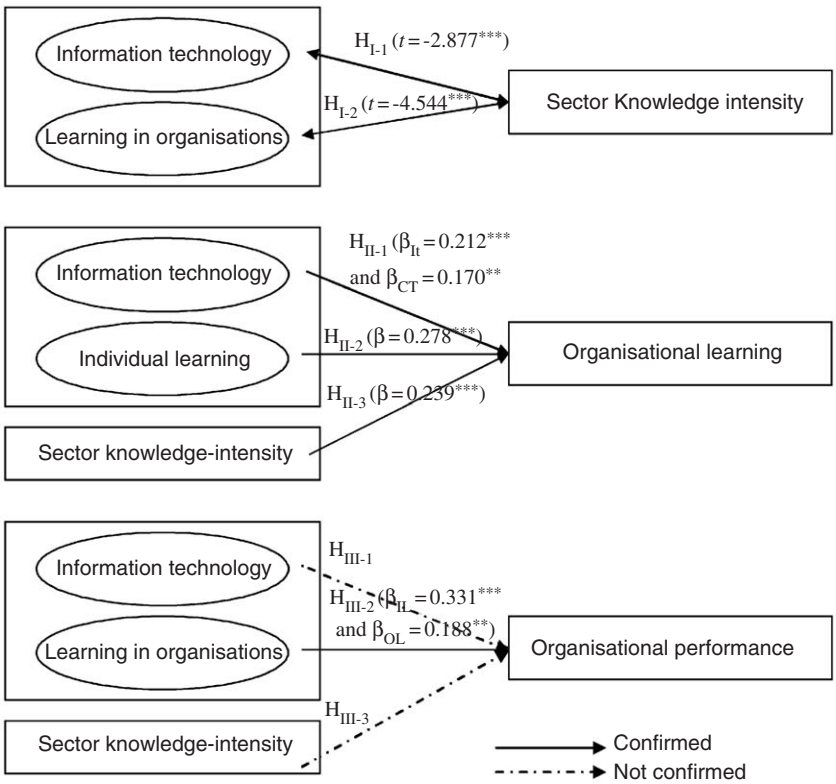

Fig. 2. Support to hypotheses. *$p<0.1$; **$p<0.05$; ***$p<0.01$.

Concerning Proposition 2, Model 1 examines the relationship between organisational learning and the two control variables. The company size variable shows a positive and significant relationship with organisational learning. Larger companies have a more formalised structure to create and keep their knowledge than smaller companies. Model 2 includes the two control variables along with information technology and individual learning indexes. Model 2 presents significant explanatory improvements over model 1. In model 2, individual technology, collaborative technology, and individual learning present a significant positive effect on organisational learning. These results provide support for hypothesis H_{II-1} as well as for hypothesis H_{II-2}. Considering the effect of the sector knowledge-intensity (Model 3 in Table 3), there is a significant

improvement over Model 2. Small businesses within the Software sector present higher levels of organisational learning, therefore $H_{II\text{-}3}$ is also supported (sector knowledge-intensity has a positive significant relationship with organisational learning in small businesses).

When testing Proposition 3, Model 1 reports that more mature small businesses in the Information Technology industry have higher objectives achievement levels. Results for hypotheses $H_{III\text{-}1}$ and $H_{III\text{-}2}$ are exhibited in Model 2. Collaborative technology had a negative effect on objectives achievement while individual technology has not significant impact on this organisational performance variable, therefore hypothesis $H_{III\text{-}1}$ is not supported. Hypothesis $H_{III\text{-}2}$ which posits that learning has a positive effect on organisational performance in small businesses is confirmed. There is a positive and significant relationship between individual learning and organisational learning and objectives achievement. Model 3 (Table 3) shows that sector knowledge-intensity has not significant effect on objectives achievement, so hypothesis $H_{III\text{-}3}$ is rejected.

7. Conclusions

Obtaining sustainable competitive advantages depends on organisational learning capabilities, which are essential in information technology implementation in non structured contexts. These kinds of contexts are typically those of knowledge management where tacit transmission plays a differentiation role. The aim of this paper is to provide empirical evidence of the relationship between information technology and learning in small businesses as well as their impact on organisational performance. Sector knowledge-intensity is also introduced in our theoretical model.

The nature of the work performed in small businesses within higher knowledge-intensity sectors (in our study, software companies) required higher level of use of information technology as well as larger implementation of practices that improved learning at the organisational level. However, individual learning is found as a key factor for small businesses regardless the level of knowledge-intensity of the sector. Learning at this level has a positive and significant effect on organisational learning. This means that when small businesses use accurately tools, such us polyvalence, openness values or high autonomy level, they will produce a synergetic effect since not only knowledge at the individual level will increase but also the knowledge captured in the systems and infrastructure of the organisation. Additionally, individual learning in small businesses has shown a high positive impact on organisational performance (even higher than the one produced by organisational learning). These results obtained for small businesses differ from the ones obtained by Bontis et al. (2002). These authors, using a sample built mainly by large companies, found organisational learning more closely related than either individual or group learning to organisational performance. Small businesses invest primarily in creating and developing individual learning being more difficult for them to focus on more expensive and complex practices like communication systems, experimentation or continuous and programmed training. Furthermore, in large businesses organisational learning required to be more formalised and planned by management due to its size. They have a bigger necessity to identify explicit processes through which individual learning is retained by the organisation. In small businesses, learning at this level can exist in a more informal way.

Organisational learning can be boosted through investing in information technology as well as encouraging individual learning. However, organisational performance can be improved through individual learning and organisational learning but not through information technology. So, information technology contributes to obtain better outcomes indirectly via organisational learning. Our results confirm that, as Popper and Lipshitz (2000) assert, to develop learning capacity within organisations a social-cultural climate for learning have to coexist with appropriate structures, systems and procedures. The high number of failures in installing knowledge management systems can be explained by a lack of attention to human and organisational aspects. Working systems take into account that people need to be connected (McDermott, 1999). A balance between systems and human-orientation is needed (Choi & Lee, 2003). So, information technology has bigger influence on outcomes in a proper context of learning.

This study has been able to incorporate an assessment of information technology as well as those learning practices small businesses incorporate. An easy to understand and to apply methodological tool has been

developed. Its implementation will underline where CEOs should focus on in order to facilitate the creation and transmission of knowledge in their companies.

8. Limitations and directions for future research

The conclusions may be limited to the kind of activity and to the size of the companies analysed (72.2% are micro-companies with less than 10 employees). Other sectors and a better distribution between micro-companies, small and medium size companies should be studied in order to generalise the conclusions obtained with this study.

The study is a cross-sectional study. Further longitudinal studies are needed to establish causal direction among the relationships investigated in this research. For example, in a longitudinal study, it may be possible to observe over time if certain information technology tools and learning practices that are associated with improvements of organisational performance at one point are also associated with improvements at a later point.

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Josefa Ruiz-Mercader is associate professor of management at the University of Murcia in Spain. She holds a Ph.D. in Business Administration and Economics (University of Murcia). Honorary Research Fellow of the Business School at the Manchester Metropolitan University, England. Her research interests include organisational learning, organisational culture, organisational flexibility and small businesses.

Angel Luis Meroño-Cerdán is associate professor of management at the University of Murcia in Spain. He holds a Master in Business and Foreign Trade including a three months training at USA-Spanish Chamber of Commerce in New York and a Ph.D. in Business Administration (University of Murcia, Spain). Teaching and researching are related to Information Systems, Knowledge Management and E-business.

Ramón Sabater-Sánchez is professor of management at the University of Murcia in Spain and chair of the Management and Finance Department. He holds a Ph.D. in Business Administration and Economics (Universidad Autónoma of Madrid). His research interests include strategic management, innovation and technology, alliances and knowledge management. He has been leading research projects for over 10 years.