Abstract
This paper analyzes the effect of several antecedent variables such as the holistic vision of the organization, competence management, lifelong learning and technical infrastructure of information technology in knowledge transfer and their impact on innovation performance. The working hypotheses are tested in a survey of 222 companies in the biotechnology and telecommunications industries where knowledge transfer plays a mediating role. Structural equation models provide results with a practical application for managers in the study companies because knowledge transfer requires an emphasis on creating a holistic view in the organization, competence management, promotion of continuous learning and improvement of the technical infrastructure of information technology. The study also shows that companies which disseminate knowledge appropriately obtain better results in innovation.

Key words: Knowledge transfer, knowledge-intensive industries, holistic view of the organization, continuous learning, skills management, innovative performance, technical infrastructure of information technology.

JEL codes: M10.

1. Introduction
Companies are increasingly interested in developing innovative assets that can compete in the markets, but to do so, they need to know what practices to imple-
ment to develop such highly valued assets (Dooley & Sullivan, 2007). In contexts where knowledge is an essential asset, firms increase their dependency on external information sources to promote innovation and improve performance (Morgan & Berthon, 2008), developing their absorptive capacity (Kostopoulos et al. 2011). Business exposure to external knowledge promotes the level of learning necessary for managing and generating value (Fosfuri & Tribo, 2008).

McEvily, Eisenhardt & Prescott (2004) claim that the ability to innovate effectively is a core change in companies. Knowledge-intensive businesses in particular usually show superior technological competences such as the ability to apply scientific and technical knowledge to develop and improve products and processes. Such businesses are more innovative and consequently show higher levels of firm performance.

According to the traditional view, innovation is the result of an interactive process of knowledge generation, dissemination and application (Tödtling, Lehner & Kaufmann, 2009) with innovation networks favouring such interactions. The ability to combine external and internal information inputs can increase business productivity (Cassiman & Veugelers, 2006).

This work has a twofold objective, firstly to understand the impact of knowledge transfer on the promotion of innovation performance and secondly, to understand the antecedent factors which have four variables (holistic business view, competency-based management, continuous learning and information technology infrastructure) affecting the promotion of knowledge transfer. The structure of the paper is as follows: Section 2 presents a literature review and formulates the research hypotheses. Section 3 includes all the methodological aspects of the study, explaining the data collection method and other research design issues. Section 4 shows the results of the testing of the hypotheses formulated in section 2. The work concludes with a Discussion section that explores the significance of the results, and finally, the conclusions.

2. Literature review

This section analyses the relationship between the theoretical constructs in the study, examining firstly antecedent variables with a positive effect on knowledge transfer, followed by the impact of knowledge transfer on innovative performance.

The holistic view is particularly important in business, in fact Senge (1990) considers systemic thinking to be the fifth discipline for organisational learning. The shared view assumes aptitudes for shaping shared visions of the future that encourage commitment. Team work involves mastery of discussion and dialogue, that is, the ability of the members of the group to set aside their presumptions and enter into genuine joint thinking which favours learning.

A systemic view of the organisation means taking into account all the agents in contact with the company. In this regard, the availability and effectiveness of systems
and resources for the ongoing, updated capture of significant information on providers, customers, suppliers, subcontractors, financial markets, legislation, etc. encourages this holistic view of the company as a whole.

This global business view codifies all necessary knowledge, taking into account the requirements of all the departments so that the subsequent dissemination and use of that knowledge is easier and achieves better results. Practices such as employee rotation and the generation of multidisciplinary teams encourage a more global view and a more efficient codification of knowledge. Therefore:

**H1:** There is a positive and significant relationship between holistic business view and knowledge transfer.

The creation of a competency-based management model involves, among other aspects, a cultural change as the company values its knowledge and attaches importance to learning from its own experience and to focusing on acquiring, storing and using knowledge to solve problems, anticipate the market, protect its intellectual assets and increase business intelligence and adaptability. Companies that introduce a competency-based management model administer the intellectual and intangible assets that represent individual competences (Cepeda & Vera, 2007). Furthermore, human resource management is aligned to business strategy, thereby increasing the firm’s ability to respond to new market demands.

Competency-based management enables programmes oriented to internal development of technological competences, so that a firm becomes aware of its innovation competences, especially in key technologies. It is possible to encourage the development of competences with the introduction of training programmes, multidisciplinary teams or by encouraging diversity of research lines (Dosi, Nelson & Winter, 2002).

In organisations that introduce a competency-based management system, the systems for remunerating and promoting human capital are associated with the development of new competences, ideas and knowledge (Chen & Huang, 2009). Task rotation or the introduction of benchmarking techniques can favour development of new competences thereby strengthening and encouraging learning capacity. Therefore:

**H2:** There is a positive and significant relationship between competency-based management and knowledge transfer.

An innovative culture that promotes R&D&i encourages creativity, innovation and continuous improvement. That sort of environment leads to improved products and organisational processes which in turn have a positive impact on the development of learning processes. One of the contextual factors affecting ability to learn is the existence of an organisational culture and structure that favours innovation. An organisation’s norms and values influence the individual and collective ability to
learn. A culture that favours, among others, dialogue, communication, openness to change and multiple perspectives, transparency, trust, risk, also enhances learning ability. This innovative culture is particularly necessary in knowledge-intensive industries because their complex, highly uncertain environments make the need to learn even more acute.

When an organisation encourages ongoing learning and the acquisition of new skills and knowledge by job rotation or job enrichment or introduces career plans that provide incentives for continuous learning, it also fosters the ability to develop an innovation culture and learning, team work and group problem-solving (Walter, Lechner & Kellermanns, 2007).

Ranft & Lord (2002:420) consider that knowledge transfer takes place with the acquisition and use of knowledge-based assets. Thus, an organisation oriented towards knowledge development and transfer provides its human capital with fast, unhindered access to the knowledge it needs. A variety of techniques such as dialogue and debate (distribution of written reports, presentation meetings, physical and electronic forums etc.) are available to enable this transfer. Internal benchmarking procedures can also be useful for sharing best practices between departments and employees. A learning orientation generates knowledge which is useful for generating and developing new ideas (Smith et al. 2008:665). Therefore:

H3: There is a positive and significant relationship between continuous learning and knowledge transfer.

There is a certain consensus in the ICT literature that the relationship between information technologies and business performance is not direct, as there are other mediating variables. Ravichandran & Lertwongsatien (2005) suggest studying the impact of information technologies on functional and operational performance measurements.

Lee and Choi (2003) claim that technology and its capabilities enable the creation of new knowledge, thereby contributing to knowledge management in different ways. Firstly, the technology infrastructure facilitates rapid collection, storage and exchange of knowledge. Secondly, it enables the integration of fragmented knowledge flows and thus eliminates communication barriers between departments in the organisation. Finally, it strengthens all the modes of knowledge creation.

Therefore, organisations need to consider programmes that stimulate and enable employees at all levels to share what they know with others and store organisational knowledge in repositories. Knowledge sharing seeks to transfer individual experiences and knowledge to generate organisational knowledge which the competition finds more difficult to imitate (Gururajan & Fink, 2010).

This paper considers that ICT facilitate knowledge transfer and therefore:

H4: There is a positive and significant relationship between ICT infrastructure and knowledge transfer.
Organisations that manage to achieve high levels of innovation are the consequence of certain management strategies and processes (Schilling & Kluge, 2009). Successful innovation management requires a well-defined strategy to align innovation projects with resources and objectives, promoting essential competences. In addition to promoting the generation of innovative ideas, organisational structure and control systems ensure efficient implementation.

According to Landry, Amara & Lamari (2002) innovation is closely linked to knowledge. Innovation is the result of a process whose success rests on knowledge interaction and exchange, with a great diversity of actors in interdependent situations. Similarly, Almeida, Phene & Grant (2003) point out that innovation diversity depends on the source of knowledge.

Fosfury & Tribo (2008) develop a model that relates absorptive capacity to innovation. An organisation’s ability to use external knowledge depends on its absorptive capacity. The development of new innovations is linked to its ability to transform and exploit external and internal knowledge.

The ability to innovate also requires the transformation and exploitation of existing knowledge (Jimenez and Sanz, 2011; Nonaka, 1994). Thus, organisational learning enables the development, acquisition, transformation and exploitation of new knowledge, thereby improving organisational innovation.

A firm’s ability to absorb new knowledge and merge it with existing knowledge is the key to success. Innovation hinges on the creation of knowledge and on creativity which is the result of exploring and exploiting knowledge within the firm’s boundaries and merging that knowledge with knowledge from the firm’s surrounding environment. Therefore:

\[ H5: \text{There is a positive and significant relationship between knowledge transfer and innovation performance.} \]

3. Methodology

This study tests the hypotheses in two knowledge-intensive industries, the biotechnology and telecommunications industries in Spain. Knowledge management is the key to such firms’ ability to compete; they need to introduce intangible assets onto the market in the form of patents, utility models, and suchlike and so they require a high degree of innovation and mechanisms to protect those innovations. Such characteristics make these industries ideal for the empirical study.

The chosen respondents for the email questionnaire were the managing directors of these firms whose holistic view enables them to provide reliable responses. After pre-testing the measurement instrument in 20 companies, 10 from the biotechnology industry and 10 from the telecommunications industry, the field work took place between February and July 2010. 222 valid questionnaires remained after eliminating 35 invalid ones representing a sampling error of 5.7 at the 95% confidence interval.
Previously validated measurement instruments operationalise the five theoretical constructs in the hypotheses. The scale from (Palacios & Garrigos, 2005) measures the holistic business view, competency-based management and continuous learning; the scale from (Byrd & Turner, 2000) measures ICT infrastructure; the scale from (Yi, 2009) measures knowledge transfer and finally, the scale from (Pla & Alegre, 2007) measures innovation performance.

Data analysis uses structural equations modelling software EQS 5.7b. This methodology enables representation of the latent concepts of observed variables and use of non-experimental data to study causal relations, when the relations are linear.

4. Results

The measurement scales meet all the sociometric properties required in social sciences. The measurements of absolute fit, incremental fit and parsimonious fit for the measurement models are statistically significant.

Concerning the quality of the measurement model for the full sample, the constructs display satisfactory levels of reliability with composite reliability ranging from 0.85 to 0.99 (holistic business view=0.89; competency-based management=0.87; continuous learning=0.84; ICT infrastructure=0.82; knowledge transfer=0.88; innovation performance=0.92), following Fornell and Larcker’s (1981) formula.

Convergent validity refers to the degree of convergence for the same variable between different methods, and is assessed by looking at the significance of the factor loadings and the shared variance. The amount of variance a construct shares or captures should be greater than the amount of measurement error (shared variance > 0.50). All the multi-item constructs analyzed meet this criterion, and each loading (λ) is significantly related to its underlying factor (t-values greater than 4.5), thereby supporting the existence of convergent validity.

The fit indexes for the complete model are (Table 2):

<table>
<thead>
<tr>
<th>Scale</th>
<th>d.f.</th>
<th>Chi²</th>
<th>P</th>
<th>BB NNFI</th>
<th>RCFI</th>
<th>GFI</th>
<th>RMR</th>
<th>NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holistic business view</td>
<td>9</td>
<td>10.77</td>
<td>0.29</td>
<td>0.95</td>
<td>0.99</td>
<td>0.94</td>
<td>0.03</td>
<td>1.21</td>
</tr>
<tr>
<td>Competency based management:</td>
<td>14</td>
<td>26.02</td>
<td>0.02</td>
<td>0.92</td>
<td>0.97</td>
<td>0.91</td>
<td>0.04</td>
<td>1.86</td>
</tr>
<tr>
<td>Continuous learning</td>
<td>2</td>
<td>2.73</td>
<td>0.25</td>
<td>0.98</td>
<td>0.99</td>
<td>0.97</td>
<td>0.02</td>
<td>1.37</td>
</tr>
<tr>
<td>ICT infrastructure</td>
<td>2</td>
<td>1.79</td>
<td>0.40</td>
<td>0.94</td>
<td>1</td>
<td>0.98</td>
<td>0.04</td>
<td>0.89</td>
</tr>
<tr>
<td>Knowledge Transfer</td>
<td>5</td>
<td>2.12</td>
<td>0.83</td>
<td>0.98</td>
<td>1</td>
<td>0.98</td>
<td>0.02</td>
<td>0.46</td>
</tr>
<tr>
<td>Innovation performance</td>
<td>9</td>
<td>7.59</td>
<td>0.57</td>
<td>0.97</td>
<td>1</td>
<td>0.97</td>
<td>0.02</td>
<td>0.84</td>
</tr>
</tbody>
</table>
As regards verification of the causal relationships, Figure 1 shows the coefficients for the structural equations. Associated to this coefficient is the t-value that represents the significance of the coefficient. The fact that t-values exceed 1.96 for all the hypotheses indicates that the relationships are significant.

Table 2. Global fit indexes

<table>
<thead>
<tr>
<th>f.d.</th>
<th>Chi²</th>
<th>p</th>
<th>BB</th>
<th>NNFI</th>
<th>RCFI</th>
<th>GFI</th>
<th>RMR</th>
<th>NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>39.145</td>
<td>0.061</td>
<td>0.946</td>
<td>0.992</td>
<td>0.877</td>
<td>0.022</td>
<td>1.45</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Hypothesis testing for the complete model
5. Discussion of the results and conclusions

The results show that knowledge transfer acts as a mediating variable between a holistic view, competency-based management, continuous learning and ICT infrastructure and innovation performance. This finding confirms that innovations are the result of continuous learning which involves the ability to assimilate knowledge from external and internal sources. These results reveal that in knowledge-intensive firms, innovations are the result of knowledge management practices that provide assets in the form of new patents, utility models, and suchlike and by protecting its innovations a firm can obtain sustainable competitive advantages.

Analysis of the structural equations coefficients in the different hypotheses suggests that of the four antecedent variables to knowledge transfer, the one with the greatest impact is a holistic view (0.85) and the one with the least impact is ICT infrastructure (0.61). A global vision of the organisation enables the design of systems that transfer the explicit knowledge that each department requires.

Although H4 is fulfilled, the coefficient in the equation is lower than in the first three hypotheses as ICT are a vehicle for knowledge transfer by knowledge intranets, collaborative tools, and so on, but they are still just another knowledge management practice. However, the other antecedent variables (holistic view, competency-based management, promotion of continuous learning) are principles that aid knowledge management and can lead to a set of practices and techniques that aid knowledge transfer.

At a pragmatic level, managers who want to obtain higher levels of innovation performance should promote employee rotation and the creation of multidisciplinary teams in order to develop a holistic business view (which, as this paper shows, has a positive impact on innovation performance), with knowledge transfer acting as a mediator variable. Benchmarking techniques can also help managers to promote the development of new competences among their employees. Implementing a system of competency-based management should redefine the classical functions of human resources, in order to base remuneration and promotion systems on employees' competences.

Competency-based management can also combine with a culture that fosters continuous learning so that managers who introduce job enrichment practices and who introduce new career plans to promote continuous learning will help their employees to accumulate the essential competences for a firm to develop new innovations.

References


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