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Design Management Capability and Product Innovation in SMEs

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Purpose

The aim of this paper is to present design management as a dynamic capability and to analyze its mediating role between organizational learning capability and product innovation performance in Small and Medium Enterprises (SMEs).

Design/methodology/approach

Structural equation modeling is used to test the research hypotheses based on data from the Italian and Spanish ceramic tile industries. The data are derived from the responses of 182 companies (50% of the target population) to a questionnaire addressed to Product Development Managers and Human Resource Managers.

Findings

The results suggest that organizational learning capability enhances product innovation through the mediation of design management capability. We find an interesting interplay between organizational learning, design management capability and product innovation that can be very useful to better understand how to improve innovation performance. This finding shows that design management, as a dynamic capability, emerges from learning and allows the firm to adapt to environmental changes.

Originality / value

Several works have studied dynamic capabilities but without specifying the nature of these capabilities. More recent empirically-based studies conceptualize and refer to specific dynamic capabilities. In this paper, we present design management as a dynamic capability. This study aims also to develop a better understanding of how organizational learning capability impacts on the product innovation performance of SMEs and how this relationship is mediated by design management capability.

Keywords

Organizational learning capability; product innovation; design management; dynamic capability; SMEs

Introduction

Design can be considered a key antecedent of firm performance (Hertenstein et al., 2005; Abecassis-Moedas and Mahmoud-Jouini, 2008). Furthermore, it has been found to be especially important for small and medium–sized enterprises (SMEs) since it can improve communication and product development, and can become a source of support for innovation (Brazier, 2004; Acklin, 2010). As Bruce and Bessant (2002) state, design is the result of a process that translates ideas and opportunities into a reality. As a consequence, an effective design management is required to achieve good design. Design management is considered by the literature (Gorb and Dumas, 1987; Dickson et al., 1995) to be the organizational and managerial practices and skills that allow a company to attain good and effective design.

In line with Ravasi and Stigliani (2012)'s recent literature revision on product design, we argue that efforts are required to clarify the concept of design management capability and its links with other organizational issues. Accordingly, we use the Resource-Based View (RBV) of the firm to conceptualize design management capability as a dynamic capability that is able to explain performance differences in a particular industry. The RBV posits that the endowment of unique and valuable resources allows some firms to outperform others and thus represents the main source of sustainable competitive advantage. This reasoning is useful for understanding the factors underlying performance differences among firms (Nelson, 1991; Zott, 2003). In current research, this explanation is being complemented by taking into account the role of dynamic capabilities in achieving competitive advantage sustainability: dynamic capabilities allow the firm to reconfigure its set of resources in order to adapt them to environmental changes (Teece, Pisano, and Shuen, 1997; Zott, 2003; Teece, 2007). Organizational learning plays an important role in resources reconfiguration (Zollo and Winter, 2002; Easterby-Smith and Prieto, 2008)

Dynamic capabilities have often been considered without specifying the nature of the capability (Teece et al, 1997, Teece, 2007). Recent empirically-based studies are conceptualizing and using specific dynamic capabilities dealing with distinct organizational processes such as acquisitions (Zollo & Singh, 2004), alliances (Kale, Dyer, & Singh, 2002), R&D (Yeoh & Roth, 1999), marketing (Morgan, Zhou, Vorhies, & Katsikeas, 2003), joint new product development (Ettlie & Pavlou, 2006), or major innovation (Colarelli O'Connor, 2008). Therefore, our study aims firstly at extending the range of specific dynamic capabilities considered in the literature by conceptualizing and implementing design management capability. Secondly, we use the dynamic capabilities framework to explain intra-industry differences in innovation performance in the context of ceramic tiles production in Italy and Spain. Finally, since dynamic capabilities arise from learning, we examine the role of Organizational Learning Capability (OLC) as an antecedent of design management capability and innovation performance.

In the succeeding sections, we review the design management capability concept and the relationships among design management capability, organizational learning capability and product innovation. We describe the methodology used to explore these relationships and present and discuss our results. We provide some implications and directions for further research.

Literature review and research hypothesis

Design Management

Design activity involves the creative visualization of concepts, plans, and ideas, which are represented in sketches, and provides instructions about how to create something that does not yet exist, or at least not in the particular form envisaged (Walsh, 1996; Bruce and Cooper, 1997). The act of designing requires a combination of logical and intuitive thought. Design is crucial to innovation and represents its creative aspect in which ideas are put into

material form. It is based on the coming together, the combination of technical capabilities and consumer demands (Walsh, 1996; p.514).

Product design is an essential aspect of product innovation (Roozenburg and Eekels, 1995; Perks et al., 2005). It is limited not just to usability and style, it also includes materials and vendor selection, prototyping, and so on (Utterback et al., 2006). In sum, product design is taken to be the process by which a product is developed while taking into account any function, use, manufacture and communication requirements (Ulrich and Eppinger, 1995; Walsh, 1996). This implies not only the creative effort, but also a whole series of technical, strategic and market aspects. These convergences and requirements entail a complexity within the process which needs certain management activities to support and sustain it. For this reason, there are scholars who are focusing in the design management function highlighting it as a capability (Jevnaker, 1998; Acklin, 2011; Ravasi and Stigliani, 2012).

Product development projects in small firms operate under severe resource constraints which do not apply to the projects conducted by large firms. As Acklin (2011; p.2) stated, many SMEs are still unaware of design as a strategic resource because of different types of barriers and problems. Limited human and financial resources, less formal or nonexistent product development and innovation processes (Fueglistaller, 2004), lack of access to design resources (Cox, 2005) or poor design understanding (Moultrie, Clarkson and Probert, 2007) make difficult the development and integration of a design management function in SMEs.

How to organize the design function has evolved in response to the current competitive environment. Several studies show that firms with higher levels of internal resources are better able to exploit external resources (Belso-Martinez et al., 2011). Efficient management of the design function is a vital internal capability even if the function is outsourced. Outsourcing design is becoming an important option for firms (Utterback et al., 2006) and especially SMEs (Berends et al., 2011). Experienced designers can mitigate the lack

of internal firm design skills, and create solutions that no SME on its own could ever achieve. Designers can transfer and integrate knowledge about different socio-cultural contexts to propose new aesthetic solutions or new product meanings (Dell´Era and Verganti, 2009). Also, since small firms´ resources are limited, design expenses can be controlled by involving external designers on a project basis, as a variable cost (Bruce and Morris, 1994; Berends et al., 2011) and for small firms design in the context of product innovation can be extended over a long time frame of several months or even years. This may have an impact on process dynamics (Visser, 2009); the company will be more competitive if it has the capacity to perform this function better and faster. The current economic context makes clear the need for effective design management. We consider three ways to organize the design management function: (1) inside the company only, (2) outsourced only; or (3) a combination of in-house design and outsourced design (Bruce and Morris, 1994).

Definitions of design management vary between being very specific and quite broad. However, all emphasize the need for particular managerial activities or skills to optimize the design process. We follow the definition proposed by Gorb and Dumas (1987) and consider design management as a series of organizational and managerial activities or practices that are required to realize the design process.

In line with this definition, Dickson et al. (1995) suggest five design management skills and how they are managed by the CEOs of small, high growth firms. We revise their concept and adapt it to the dynamic capabilities literature by considering design management as a dynamic capability. Thus, design management is conceptualized as a high-order construct composed of five first-order factors. These factors are of similar importance and encompass many of the skills and activities underlined in the literature. (1) *Basic Skills* which involve managing the basic activities of the design process in order to design high quality, manufacturability, and low cost into products, and to ensure new products are designed and launched rapidly. (2) *Specialized Skills*, which refer to the ability to manage certain specialized

activities required for the product design process. (3) *Involving Others*, which means involving customers and suppliers in the design process in order to get new product ideas. (4) *Organizational Change*, which is the ability to manage change, both generally and in relation to moving towards concurrent design and cross-functional team management. (5) *Innovation Skills*, which is the ability to manage innovation through awareness of and knowledge about competing innovations and imitations as a source of radical new design ideas.

Organizational Learning Capability and Design Management Capability

The organizational learning literature includes attempts to analyze and determine whether and how learning is accomplished by organizations. The capacity to learn is considered a key indicator of an organization's effectiveness and potential to innovate and grow (Jerez-Gómez et al., 2005) and organizations and scholars increasingly are focusing on enhancing organizational learning capability and building learning organizations.

Anderson et al. (2001) emphasize that management learning in small firms is frequently informal and unplanned and occurs through a process of interaction within social and business networks. The evidence suggests that learning in small firms is often unintentional, incidental, or accidental, and that knowledge is generated mainly from trial an error decision making processes (Matlay, 2000). It shows also that learning processes are temporal and contextual (Zhang et al., 2006) and can occur through social relationships that are crucial to the innovation process (Pittaway and Rose, 2006). For example, investment decision-making can be understood as a learning process (Ekanem and Smallbone, 2007).

As dynamic capabilities enable firms to integrate, build, and reconfigure internal and external competencies in order to address rapidly changing environments ,we argue that different elements of Dickson et al.'s (1995) design management framework - basic skills, special abilities, participation of others, organizational change, and innovation skills - include

the notion of reconfiguring competence, and therefore could be considered a dynamic capability.

Dynamic capabilities are based on the creation of knowledge and may represent an important source of competitive advantage for the firm, since they allow the generation of unique organizational skills which are updated continuously (Teece et al., 1997).

Since dynamic capabilities arise from learning (Zollo and Winter, 2002; Easterby-Smith and Prieto, 2008), we suggest that organizational learning capability is a precursor to design management capability.

Design Management Capability and Product Innovation

Innovation requires two conditions to be fulfilled: novelty, and utility. In general, the requisite of novelty is verified when the innovation process puts into practice an invention, a scientific discovery or a new production or management technique. The requisite of utility is borne out through its use or commercial success. If the innovation involves new features, or significantly improved the service offered to customers, is a product innovation. The product innovation hardly depends of firm´s internal capabilities (Vega-Jurado et al., 2009), as is the ability to manage the design function. Product innovation differs from process innovations since it not requires using methods of equipment and / or new or significantly improved knowledge to provide the service. Also it differs from marketing innovations since it is not necessary to have a significant change in the functions or uses of the product (OECD, 2005).

Ho et al., (2011) hypothesized that strong design capabilities can promote successful technology commercialization, including new product commercialization frequency and speed, degree of innovation, and even number of patents.

Organizational Learning Capability and Product Innovation: A Case for Partial Mediation.

Innovation involves the generation and implementation of new ideas, processes and products. Organizational learning processes involve the acquisition, dissemination and use of knowledge and therefore are strongly associated with product innovation performance (Lemon and Sahota, 2004). Following Chiva and Alegre (2009a), we propose that organizational learning capability consists of five dimensions: (1) *Experimentation* can be defined as the extent to which new ideas and suggestions are attended to and treated sympathetically (Nevis et al., 1995). (2) *Risk taking* can be understood as the tolerance of ambiguity, uncertainty, and errors. Hedberg (1981) emphasizes the importance of designing environments that assume risk taking and accept mistakes because such environments facilitate organizational learning. (3) We define *interaction with the external environment* as the extent of the relationships that a firm maintains in its immediate environment (Bapuji and Crossan, 2004; Chipika and Wilson, 2006). (4) *Dialogue* is defined as a sustained collective inquiry into the processes, assumptions, and certainties that compose everyday experience (Isaacs, 1993). The literature understands dialogue to be vitally important to organizational learning (Oswick et al., 2000). (5) *Participative decision making* refers to the level of influence that employees have in the decision-making process (Cotton et al., 1988). The literature considers participative decision making as one of the aspects that can facilitate learning (Bapuji and Crossan, 2004).

The literature shows a positive association between the dimensions of organizational learning capability and product innovation (Damanpour, 1991, Koc and Ceylan, 2006; Chipika and Wilson, 2006; Azagra-Caro et al., 2006) However, organizational learning capability could be not enough to achieve high levels of product innovation performance because the firm needs to have other organizational capabilities. We argue that design management capability is necessary for achieving better innovation performance through organizational learning capability. Given that design management, as a dynamic capability, emerges from learning (Zollo and Winter, 2002; Easterby-Smith and Prieto, 2008) we suggest that organizational

learning capability influences the firm design management capability, and the latter affects product innovation.

Therefore, we hypothesize:

Hypothesis: Design management capability acts as a mediating variable between organizational learning capability and product innovation.

Insert figure 1 about here

Methods

Data Collection

Our research hypothesis is tested on a single industry: ceramic tiles production in Italy and Spain. This a largely globalized industry: the biggest ceramic tiles producers are China, Spain, Italy, Brazil, and Turkey. Italy and Spain are ranked first and second for tile exports based on high quality and value added achieved through an emphasis on design, technology, and corporate image (Chamber of Commerce of Valencia, 2004). Italian and Spanish ceramic tile producers have several things in common. Most are SMEs with a maximum of 250 workers on average, and are generally geographically concentrated in industrial districts (Enright and Tenti, 1990). The Italian ceramic tile industrial district is located in Sassuolo (Northern Italy) and the Spanish district is in Castellón (Eastern Spain). Aggregate production on these two districts is similar.

Several studies have analyzed product innovation in the ceramic tile industry and find enamels and design to be the most important areas of product improvement (Meyer-Stamer et al. 2004; Hervas-Oliver et al. 2008; Hervas-Oliver et al. 2011). New enamels provide improved product characteristics such as non-slip properties or greater frost resistance. Novelty in design is focused on size and aesthetics.

Our focus on the ceramic tile industry reduces the range of extraneous variations in the data which could influence the constructs of interest. Analyzing a single sector has the

advantage that it avoids a problem common to inter-sectoral studies, of technological and economic diversity of products (Coombs et al., 1996; Santarelli and Piergiovanni, 1996). We acknowledge the disadvantages of this sampling in terms of limiting generalizability but believe that they are outweighed by the advantages offered by this approach.

The field work was conducted in June to November 2004. Items dealing with design management and innovation performance were addressed to those managers that were in charge of product development. Items dealing with organizational learning capability were addressed to Human Resource managers. Pre-testing was carried out on four technicians from ALICER, the Spanish Center for Innovation and Technology in Ceramic Industrial Design, to ensure comprehensibility of the questions in the context of the ceramic tile industry. The questionnaire used a 7-point Likert scale.

We received a total of 182 completed questionnaires, 101 from Spanish firms and 81 from Italian firms, which represents around 50% of the population under study for both the Italian and the Spanish subsamples (Chamber of Commerce of Valencia, 2004). The number of responses and the response rate can be considered satisfactory (Spector, 1992; Williams et al. 2004). To check for non-response bias, sales turnover and number of employees in respondent and non-respondent firms were compared. The comparison did not reveal any significant differences.

Measures

Organizational learning capability. We operationalized organizational learning capability as the mean of the fourteen items proposed by Chiva and Alegre (2009a). These items were applied using a 7-point Likert scale (see appendix).

Design management capability. We used Dickson et al.'s (1995) measurement scale conceiving their construct as a dynamic capability. The scale was applied as a 7-point Likert scale (see appendix). We operationalized design management capability as a second-order factor.

Product innovation performance was measured using the scale provided in the OECD's (2005) Oslo Manual for the assessment of the economic objectives of innovation. This scale was proposed by the OECD in order to achieve greater homogeneity and comparability among innovation studies. We asked the innovation performance in compared with competitors with regard to the following items (see appendix). We operationalized product innovation performance as a first-order factor.

Results

Psychometric Properties

The psychometric properties of the measurement scales were assessed in accordance with accepted practice (Gerbing and Anderson 1988; Tippins and Sohi 2003), including content validity, reliability, discriminant validity, convergent validity, and scale dimensionality. Table 1 presents the factor correlations, means, and standard deviations.

Content validity was established through a review of the literature and interviews with ceramic tile industry experts (four ALICER technicians). We computed the coefficient alpha and composite reliability indicator to assess scale reliability (Fornell and Larker 1981; Bou-Llusar et al. 2009). All scales achieved acceptable coefficient alphas and composite reliability indicators of at least 0.70 (Table 1).

Insert Table 1 about here

Discriminant validity was assessed through confirmatory factor analysis by comparing the χ^2 differences between a constrained confirmatory factor model and an interfactor correlation set at 1 (indicating they are the same construct) and an unconstrained model with an interfactor correlation set free. All χ^2 differences were significant, providing evidence of discriminant validity (Anderson and Gerbing 1988; Gatignon et al. 2002; Tippins and Sohi 2003). Confirmatory factor analysis was used also to establish convergent validity by confirming that all scale items loaded significantly on their construct factors (Anderson and

Gerbing 1988). Convergent validity was also confirmed by comparing the χ^2 differences between a constrained confirmatory factor model with an interfactor correlation set at 0 (indicating no relationship between the two constructs) and an unconstrained model with an interfactor correlation set free. All χ^2 differences were significant, providing evidence of convergent validity (Gatignon et al. 2002).

We checked the dimensionality of the constructs through the loadings of the measurement items on first-order factors, and the loadings of the first-order factors on second-order factors. All loadings were above 0.40 and significant at $p<0.001$. No cross-loadings emerged.

Before testing our hypotheses, we assessed the extent of common method variance by conducting a Harman's single-factor test (Podsakoff and Organ 1986; Podsakoff et al. 2003; Bou-Llusar et al., 2009). Common method variance is a problem that can arise when the dependent and independent variables are collected from a single informant. In our study, we used two different key informants to minimize this problem.

Test of the Research Hypotheses

We tested for the presence of a mediating effect by performing competing model analysis. The first model (direct effect) examines the direct relationship between organizational learning capability and product innovation performance. Table 2 shows the results of the competing model analyses. The χ^2 statistic for each model is significant, and the other relevant indices suggest a good overall fit (Tippins and Sohi, 2003).

Insert Table 2 about here

First, the direct effect model was tested and found to be satisfactory. There is evidence of a positive link between organizational learning capability and product innovation performance. Second, the inclusion of design management capability in the analysis helps to

explain this positive link: design management capability acts as a mediating variable that boosts the positive effect (Grewal and Slotegraaf, 2007). The mediating effect of design management capability on the relationship between organizational learning capability and product innovation performance is demonstrated by the following sequence, suggested by Tippins and Sohi (2003): (1) the partial mediation model explains more of the variance of the dependent variable than the direct model (R^2=0,591 vs. R^2=0,329); (2) there is a positive relationship between organizational learning capability and dynamic capability in design management; (3) there is a positive relationship between dynamic capability in design management and product innovation performance; and (4) the significant relationship between organizational learning capability and product innovation performance indicated in the direct effect model is lower and non-significant in the partial mediation model. Statements (1)–(4) provide compelling evidence of a clear mediating effect of dynamic capability in design management on the relationship between organizational learning capability and product innovation performance. Thus, the partial mediation model represents a significant contribution to our understanding of the positive influence—supported by the theory and previous empirical research—of organizational learning capability on innovation performance. The positive impact of implementing organizational learning capability practice on innovation performance is mediated by the firm's design management capability. These results provide support for our research hypothesis.

Discussion

This study highlights that design management is a dynamic capability, which is connecting organizational learning with product innovation performance. Our research model examines the effects of organizational learning capability and design management capability on SME´s product innovation suggesting that the first one enhances product innovation performance, and this relationship is mediated by the capability of design management. An analysis of the

direct and indirect effects shows that the indirect effect prevails when both types of capabilities are taken into account providing strong support for our research model. Thus, organizational learning capability can enhance sustained competitive advantages in SME product innovation performance, but does so *indirectly* through its interaction with design management capability. Therefore, sustained competitive advantage in product innovation in the ceramic tile industry requires firm strategies that focus on organizational learning capability. However, special attention must be paid to design management capability, because the impact of organizational learning capability on product innovation performance is mediated by the firm's design management capability.

Since innovation is an important outcome of firm processes and has been shown to be critical to firm performance (Darroch, 2005), this research provides a more complete examination of the effects of organizational learning on innovation and offers an explanation to intra-industry differences in firm performance (Nelson, 1991; Easterby-Smith and Prieto, 2008). Given that performance varies among ceramic tiles producers, in this study we investigate this asymmetry within the context of organizational learning, design management and their link with product innovation. Results suggest that competitive advantage in innovation in the ceramic tiles industry requires firm strategies focusing on organizational learning and design management. This finding represents a contribution to the strategic management stream that seeks to explain differences in firm performance within a particular industry. Furthermore, this study supports the new trends in the RBV research that seeks to identify a particular industry's critical specific assets and to improve our understanding of the entire process of creating competitive advantage by considering the role of dynamic capabilities.

This study extends both, the literature of design management and the literature of dynamic capabilities. In the first one, recent studies are claiming the necessity to clarify the concept of design management capability and its links with other organizational issues (Ravasi

and Stigliani, 2012). We highlight the link of design management with organizational learning and product innovation performance. And in the second one, in the dynamic capabilities literature, scholars conceptualize different concepts such as absorptive capacity (Wang and Ahmed, 2007), ambidexterity (Fernandez-Mesa, Iborra and Safon, In Press.) or marketing (Morgan et al. 2003) as kinds of dynamic capabilities. We aggregate design management to the bundle of dynamic capabilities, which help the company to be aligned with the environment. In addition, in this study we re-conceptualize Dickson et al. (1995) as a measure of this dynamic capability.

Contribution to the literature on organizational learning capability is done by providing evidence of the importance of certain organizational practices that catalyze its effects on organizations. Organizational learning might be considered as an important determinant of product innovation performance. However our findings could explain why some firms might manifest low product innovation performance while their firm shows high organizational learning capability: the design management link would be missing.

Implications for Practitioners and Policy Makers

Our results have important implications for decision-making in relation to organizational learning and design management, particularly in the context of SMEs' product innovation. Those SMEs, which want to achieve better innovation performance, should be aware of the interplay between organizational learning capability and design management capability if they want to be successful.

Although managers recognize the importance of organizational learning, their implications for and demands on the rest of the organization are often ignored in the process towards its success. In this paper we suggest to put into practice an effective design management when managers have chosen to achieve better product innovation performance. Given that good design does not emerge by chance or by simply investing in design but rather

as the result of a managed process (Chiva and Alegre, 2009b), managers should do the effort of improving is way to manage it in order to increase innovation. An initial management action could be to enhance the design management dimensions – basic, specialized and innovation design skills, involving others and organizational change- so that design and innovation processes could be more fruitful. Furthermore, we underline the importance of measuring the effects of organizational learning by analyzing their product innovation performance.

Innovation is a key concept for organizations today, as it represents the essence of their competitive advantage. Policy makers should try to increase innovation performance in SMEs through different actions given that these kinds of firms represent a big part of our economy. To know that organizational learning and design management helps to increase innovation performance could be useful for them in order to decide future actions.

Limitations

This study has some limitations and its results come with some caveats. First, the data were gathered at one point in time, so we cannot conclusively demonstrate causality or rule out reverse causality. Second, the study's target population was narrowly defined to include a fairly homogeneous set of firms. Although a restrictive sampling approach increases confidence that the findings are the result of the hypothesized relationships, it may limit the generalization of our research results.

Future Research

The results of this study suggest directions for future research. The mediating effect of design management capability should be taken into account in research on organizational learning and product innovation. This dynamic capability constitutes an important step between operational organizational practices and performance. The relationship between organizational learning capability and design management capability should be analyzed

further from a longitudinal perspective. Future research could focus also on young innovative companies (Azagra-Caro et al., 2011) and distinguish between radical and incremental product innovation, which would require taking account of both adaptive and generative learning (Khilji, Mroczkowski, and Bernstein, 2006; Chiva, Grandío, and Alegre, 2010).

REFERENCES

Abecassis-Moedas, C. and Ben Mahmoud-Jouini, S. (2008). "Absorptive Capacity and Source-Recipient Knowledge Complementarily in Designing New Products: An Empirically Derived Framework". Journal of Product Innovation Management, Vol. 25, pp. 473–90.

Acklin, C. (2011). "Design Management Absorption Model – A Framework to Describe the Absorption Process of Design Knowledge by SMEs with Little or No Prior Design Experience". 1st Cambridge Academic Design Management Conference, 7-8 September.

Acklin, C. (2010). "Design-Driven Innovation Process Model". *Design Management Journal*, Vol. 5 No. 1, pp. 50-60.

Anderson, J.C. and Gerbing, D.W. (1988). "Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach", *Psychological bulletin,* Vol. 103, No. 3 pp. 411-23.

Anderson, V., Boocock, G. and Graham, S. (2001). "An Investigation into the Learning Needs of Managers in Internationalizing Small and Medium-sized Enterprises", *Journal of Small Business and Enterprise Development,* Vol. 8 No. 3, pp. 215–32.

Azagra-Caro, J.M., Archontakis, F., Gutiérrez-Gracia, A. and Fernández de Lucio, I. (2006). "Faculty support for the objectives of university industry relations versus degree of R&D cooperation: the importance of regional absorptive capacity". *Research Policy,* Vol. 35 No. 1, pp. 37–55.

Azagra-Caro, J.M., Mas-Verdú, F., Martínez-Gómez, V. (2011). "Forget R&D - pay my coach: young innovative companies and their relations with universities". Working paper Nº 2011/07 of INGENIO (CSIC-UPV), Valencia, 18 December.

Bapuji, H. and Crossan, M. (2004). "From questions to answers: Reviewing organizational learning research". *Management Learning,* Vol. *35* No. 4, pp. 397-417.

Belso-Martinez, J., Molina-Morales, F. and Mas-Verdu, F. (2011). "Clustering and internal resources: moderation and mediation effects" *Journal of Knowledge Management,* Vol. 15, No. 5, pp. 738.

Berends, H., Reymen, I., Stultiëns, R. G. L. and Peutz, M. (2011). "External designers in product design processes of small manufacturing firms". *Design Studies*, Vol. 32 No. 1, pp. 86-108.

Bou-Llusar, J., Escrig-Tena, A., Roca-Puig, V. and Beltrán-Martin, I. (2009). "An empirical assessment of the EFQM Excellence Model: Evaluation as a TQM framework relative to the MBNQA Model", *Journal of Operations Management,* Vol. 27 No. 1, pp. 1.

Brazier, S. (2004), "Walking Backward into Design: Support for the SME", *Design Management Review, V*ol. 15 No. 4, pp. 61.

Bruce, M. and Bessant (2002). "Managing design as a process". In: Design in Business: Strategic Innovation through design, Bruce, M and Bessant J. (eds). Essex: *Prentice Hall*, pp. 36-58.

Bruce, M. and Cooper, R. (1997). "Marketing and Design Management". *International Thomson*, London.

Bruce, M. and Morris, B. (1994). "Managing external design professionals in the product development process". *Technovation,* Vol. 14, pp. 585-99.

Chamber of Commerce of Valencia (2004). "Informe de la nueva economía global y su incidencia en los sectores tradicionales de la Comunidad Valenciana". *Valencia: Chamber of Commerce of Valencia*.

Chipika, S. and Wilson, G. (2006). "Enabling technological learning among light engineering SMEs in Zimbabwe through networking". *Technovation,* Vol. 26, No. 8 pp. 969–79.

Chiva, R., and Alegre, J. (2009a). "Organizational learning capability and job satisfaction: An empirical assessment in the ceramic tile industry". *British Journal of Management*, Vol. 20 No. 3, pp. 323-40.

Chiva, R. and Alegre, J. (2009b), "Investment in Design and Firm Performance: The Mediating Role of Design Management". *Journal of Product Innovation Management*, Vol. 26 No. 4, pp. 424–40.

Chiva, R., Grandío, A. and Alegre, J. (2010). "Adaptive and generative learning: Implications from complexity theories". *International Journal of Management Reviews*, Vol. 12 No. 2, pp. 114-29.

Colarelli O'Connor, G. (2008). "Major Innovation as a Dynamic Capability: A Systems Approach". *The Journal of Product Innovation Management*, Vol. 25 No. 4, pp. 313-25.

Coombs, R., Narandren, P. and Richards, A. (1996). "A literature-based innovation output indicator", *Research Policy*, Vol. 25, pp. 403-13.

Cotton, J. L., Vollrath, D. A., Froggatt, K. L., Lengnick-Hall, M. L. and Jennings, K. R. (1988). "Employee participation: Diverse forms and different outcomes". *Academy of Management Review,* Vol. 13 No. 1, pp. 8-22.

Cox, G. (2005). "Cox Review of Creativity in Business: Building on the UK´s Strenghts". London: Design Council.

Damanpour F. (1991). "Organizational innovation: a meta-analysis of effects of determinants and moderators". *Academy of Management Journal*. Vol. 34, pp. 555-90.

Darroch, J. (2005). "Knowledge management, innovation and firm performance". *Journal of Knowledge Management, Vol.* 9 No. 3, pp. 101-15.

Dell'Era, C. and Verganti, R. (2009). "Design-driven laboratories: organization and strategy of laboratories specialized in the development of radical design-driven innovations". *R&D Management*, Vol. 39, pp. 1-20.

Dickson, P., Schneider, W., Lawrence, P. and Hytry, R. (1995). "Managing design in small high growth companies". *Journal of Product Innovation Management*, Vol. 12 No.5, pp. 406-15.

Easterby-Smith, M. and Prieto, I.M. (2008). "Dynamic capabilities and Knowledge Management: An integrative framework". *British Journal of Management*, Vol. 19, pp. 235-49.

Ekanem, I. and Smallbone, D. (2007). "Learning in Small Manufacturing Firms: The Case of Investment Decision-making Behavior". *International Small Business Journal,* Vol. 25 No. 2, pp. 107-29.

Enright, M.J. and Tenti, P. (1990). "How the diamond works: The Italian ceramic tile industry". *Harvard Business Review*, Vol. 68, pp. 90-91.

Ettlie, J.E. and Pavlou, P.A. (2006). "Technology-based new product development partnerships". *Decision Sciences*, Vol. 37 No. 2, pp. 117-47.

Fernández-Mesa, A., Iborra, M. and Safón, V. (In Press). "CEO-TMT interaction: Does tenure and age affect ambidexterity dynamism?". *European Journal of International Management*.

Fornell, C. and Larcker, D. (1981). "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research*, Vol. 18, pp. 39-50.

Fueglistaller, U. (2004). "Charakteristik und Entwicklung von Klein – und Mittelunternehmen" (KMU). St.Gallen: KMU Verlag HSG.

Gatignon, H., Tushman, M.L., Smith, W. and Anderson, P. (2002). "A structural approach to assessing innovation: Construct development of innovation locus, type, and characteristics", *Management Science, V*ol. 48 No. 9, pp. 1103-22.

Gerbing, D.W. and Anderson, J.C. (1988). "An Updated Paradigm for Scale Development Incorporating Uni", *Journal of Marketing Research,* Vol. 25, No. 2, pp. 186-92.

Gorb, P. and Dumas, A. (1987). "Silent design", *Design studies*, Vol. 8 No. 3, pp. 150-56.

Grewal, Rajdeep and Rebecca J. Slotegraaf (2007), "Embeddedness of Organizational Capabilities," *Decision Sciences*, Vol. 38, pp. 451-88.

Hedberg, B. (1981). How organizations learn and unlearn? *in P.C. nystrom and W.H. starbuck (eds.) handbook of organizational design.*

Hervas-Oliver, J. L., Albors-Garrigos, J. and Damau, J. L. (2008). "External ties and the reduction of knowledge asymmetries among clusters within global value chains: Case of the ceramic tile district of Castellon". *European Planning Studies, 16*(4), 507-20.

Hervas-Oliver, J.L.; Jackson, I. and Tomlinson, P.R. (2011). "May the ovens never grow cold: regional resilience and industrial policy in the North Staffordshire ceramic industrial district – with lessons from Sassuolo and Castellon". *Policy Studies*, Vol.32, No.4, pp.377-95.

Hertenstein, J.H., Blatt M.B. anb Veryzer, R.W. (2005). "The impact of industrial design effectiveness on corporate financial performance". *Journal of Product Innovation Management*, Vol. 22, pp. 3-21.

Ho, Y., Fang, H. and Lin, J. (2011). "Technological and design capabilities: is ambidexterity possible?", *Management Decision, V*ol. 49, No. 2, pp. 208-25.

Isaacs, W. (1993). “Dialogue, collective thinking, and organizational learning”. *Organizational Dynamics,* Vol. 2 No. 22, pp. 24-39.

Jerez-Gómez, P., Céspedes-Lorente, J. and Valle-Cabrera, R. (2005). “Organizational Learning and compensation strategies: evidence from the Spanish chemical industry”, *Human Resource Management*, Vol. 44 No. 3, pp. 279-99.

Jevnaker, B.H. (1998). “Building up organizational capabilities in design”. In M. Bruce & B. H. Jevnaker (Eds.), Management of design alliances. Sustaining competitive advantage. Chichester: John Wiley & Sons.

Kale, P., Dyer, J.H. and Singh, H. (2002). “Alliance capability, stock market response, and long-term alliance success: The role of the alliance function”. *Strategic Management Journal*, Vol. 23, pp. 747-67.

Khilji, S.E., Mroczkowski, T. and Bernstein, B. (2006). “From invention to innovation: Toward developing an integrated innovation model for biotech firms”. *Journal of Product Innovation Management*, Vol. 23, pp. 528-40.

Koc, T. and Ceylan, C. (2006). “Factors impacting the innovative capacity in large-scale companies”. *Technovatio,* Vol. 27 No. 3, pp. 105–14.

Lemon, M. and Sahota, P.S. (2004). “Organizational culture as a knowledge repository for increased innovative capacity”, *Technovation, V*ol. 24, No. 6, pp. 483-98.

Matlay, H. (2000). “Organizational Learning in Small Learning Organizations: An Empirical Overview”, *Education + Training,* Vol. 42 No. (4/5), pp. 202–10.

Meyer-Stamer, J., Maggi, C. and Seibel, S. (2004). “Upgrading the tile industry of Italy, Spain, and Brazil: Insights from cluster and value chain analysis”. *In Local Enterprises in the Global Economy, Ed. Schmitz, H., Edward Elgar.*

Morgan, N.A., Zhou, S., Vorhies, D.W. and Katsikeas, C.S. (2003). “Experiential and informational knowledge, architectural marketing capabilities, and the adaptive performance of export ventures: A cross-national study”. *Decision Sciences*, Vol. 34 No. 2, pp. 287-21.

Moultrie, J., Clarkson, P.J., and Probert, D. (2007). “Development of a Design Audit Tool for SMEs”. *Journal of Product Innovation Management,* Vol. 24 No. 4, pp. 335-68.

Nelson, R. R. (1991). “Why do firms differ, and how does it matter?” *Strategic Management Journal,* Vol. 12 No. 2, pp. 61-74.

Nevis, E. C., DiBella, A. J. y Gould, J. M. (1995). “Understanding organizations as learning systems”. *Sloan Management Review*, Vol. 36 No. 2, pp. 73-134.

OECD (2005). The measurement of scientific and technological activities. Proposed guidelines for collecting and interpreting technological data. Paris: OECD.

Oswick, C., Keenoy, T., Grant, D. and Marshak, B. (2000). Discourse, organization and epistemology. *Organization,* Vol. 7 No. 3, pp. 511-12.

Perks, H., Cooper, R. and Jones, C. (2005) “Characterizing the Role of Design in New Product Development: an empirical taxonomy”. *Journal of Product Innovation Management*, Vol. 22, pp. 111-27.

Pittaway, L. and Rose, M. (2006). “Learning and Relationships in Small Firms: Introduction to the Special Issue”, *International Small Business Journal,* Vol. 24 No. 3, pp. 227–31.

Podasakoff, P.M., MacKenzie, S.B., Lee, J. and Podsakoff, N.P. (2003). “Common method biases in behavioral research: A critical review of the literature and recommended remedies”, *Journal of Applied Psychology,* Vol. 88, No. 5, pp. 879-903.

Podsakoff, P.M. and Organ, D.W. (1986). “Self-Reports in Organizational Research: Problems and Prospects”, *Journal of Management, V*ol. 12, No. 4, pp. 531-44.

Ravasi, D. and Stigliani, I. (2012). “Product Design: a Review and Research Agenda for Management Studies”, International Journal of Management Reviews, in press (DOI: 10.1111/j.1468-2370.2012.00330.x).

Roozenburg, N.F.M., & Eekels, J. (1995). “Product Design, Fundamentals and Methods”, *Wiley*, Chichester, UK.

Santarelli, E. and Piergiovanni, R. (1996). “Analysing literature-based output indicators: the Italian experience”. *Research Policy*, Vol. 25, pp. 689-711.

Spector, P.E. (1992). “Summated rating scale construction: an introduction”. *Sage University*. California.

Teece, D.J. (2007). “Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance”. *Strategic Management Journal*, Vol. 28, pp. 1319-50.

Teece, D.J., Pisano, G. and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, Vol. 18, pp. 509-33.

Tippins M.J., and Sohi, R.S. (2003). IT competency and firm performance: is organizational learning a missing link? *Strategic Management Journal*, Vol. 24, pp. 745-61.

Ulrich, Karl T. and Steven D. Eppinger (1995), *Product Design and Development*, (New York, NY: McGraw Hill).

Utterback, J., Vedin, B.-A., Alvarez, E., Ekman, S., Sanderson, S. W., Tether, B. and Verganti, R. (2006). *Design-inspired innovation*. Singapore: World Scientific Publishing

Vega-Jurado, J., Gutierrez-Gracia, A. and Fernandez-de-Lucio, I. (2009). “Does external knowledge sourcing matter for innovation? Evidence from the Spanish manufacturing industry”. *Industrial and Corporate Change*, Vol. 18 No. 4, pp. 637-70.

Visser, W. (2009). “Design: one, but in different forms”. *Design Studies*, Vol. 30, pp. 187-223.

Walsh, V. (1996). “Design, innovation and the boundaries of the firm”. *Research Policy*, Vol. 25, pp. 509-29.

Wang, C. L. and Ahmed, P. K. (2007). “Dynamic capabilities: A review and research agenda”. *International Journal of Management Reviews*, Vol. 9, No. 1, pp. 31–51.

Williams, L.J., Gavin, M.B. and Hartman, N.S. (2004). “Structural equation modeling methods in strategy research: Applications and issues”. In Ketchen, D.J. Jr and Bergh; D.D. (Eds.) *Research Methodology in Strategy and Management,* Vol. 1, pp. 303-46. Oxford: Elsevier.

Yeoh, P.L. and Roth, K. (1999). “An empirical analysis of sustained advantage in the U.S. pharmaceutical industry: impact of firm resources and capabilities”. *Strategic Management Journal*, Vol. 20, pp. 637-53.

Zhang, M., Macpherson, A. and Jones, O. (2006). “Conceptualizing the Learning Process in SMEs: Improving Innovation through External Orientation”, *International Small Business Journal,* Vol. 24 No. 3, pp. 299–323.

Zollo, M. and Singh, H. (2004). “Deliberate learning in corporate acquisitions: Post-acquisition strategies and integration capability in U.S. bank mergers”. *Strategic Management Journal,* Vol. 25, pp. 1233-53.

Zollo, M. and Winter, S.G. (2002). “Deliberate learning and the evolution of dynamic capabilities”. *Organization Science*, Vol. 13, pp. 339-51.

Zott, C. (2003). “Dynamic capabilities and the emergence of intra-industry differential firm performance: insights from a simulation study”. *Strategic Management Journal*, Vol. 24, pp. 97-125.

APPENDIX: Questionnaire

Assess the importance of the following items in your organization (Chiva and Alegre, 2009):

Not important **1** **2** **3** **4** **5** **6**	**Very important** **7**
EXPERIMENTATION	
V1. People here receive support and encouragement when presenting new ideas	1-2-3-4-5-6-7
V2. Initiative often receives a favorable response here, so people feel encouraged to generate new ideas	1-2-3-4-5-6-7
RISK TAKING	
V3. People are encouraged to take risks in this organization	1-2-3-4-5-6-7
V4. People here often venture into unknown territory.	1-2-3-4-5-6-7
INTERACTION WITH THE EXTERNAL ENVIRONMENT	
V5. It is part of the work of all staff to collect, bring back, and report information about what is going on outside the company.	1-2-3-4-5-6-7
V6. There are systems and procedures for receiving, collating and sharing information from outside the company.	1-2-3-4-5-6-7
V7. People are encouraged to interact with the environment: competitors, customers, technological institutes, universities, suppliers etc.	1-2-3-4-5-6-7
DIALOGUE	
V8. Employees are encouraged to communicate.	1-2-3-4-5-6-7
V9. There is a free and open communication within my work group	1-2-3-4-5-6-7
V10. Managers facilitate communication	1-2-3-4-5-6-7
V11. Cross-functional teamwork is a common practice here.	1-2-3-4-5-6-7
PARTICIPATIVE DECISION-MAKING	
V12. Managers in this organization frequently involve employees in important decisions	1-2-3-4-5-6-7
V13. Policies are significantly influenced by the employees' views	1-2-3-4-5-6-7
V14. People feel involved in main company decisions	1-2-3-4-5-6-7

Indicate whether each of these new product design issues is one your firm manages well or whether it is one your firm has trouble managing (Dickson et al., 1995).

Manages poorly **1** **2** **3** **4** **5** **6**	**Manages extremely well** **7**
BASIC SKILLS	
V15. Designing quality into products.	1-2-3-4-5-6-7
V16. Designing manufacturability into products.	1-2-3-4-5-6-7
V17. Designing low cost into products.	1-2-3-4-5-6-7
V18. Designing and launching new products faster.	1-2-3-4-5-6-7
SPECIALIZED SKILLS	
V19. Using the latest computer aided design tools effectively.	1-2-3-4-5-6-7
V20. Estimating the true cost of new products during the design process.	1-2-3-4-5-6-7
V21. Finding people with excellent design skills.	1-2-3-4-5-6-7
V22. Testing manufacturability of new products during the design process.	1-2-3-4-5-6-7
INVOLVING OTHERS	
V23. Involving customers in the design process.	1-2-3-4-5-6-7
V24. Involving suppliers in the design process.	1-2-3-4-5-6-7
V25. Getting new product ideas from customers.	1-2-3-4-5-6-7
ORGANIZATIONAL CHANGE	
V26. Changing traditional ways of doing things.	1-2-3-4-5-6-7
V27. Getting different functions in the firm to work together.	1-2-3-4-5-6-7
V28. Replacing sequential with concurrent design.	1-2-3-4-5-6-7
INNOVATION SKILLS	
V29. Finding new design ideas - not just me-too imitations.	1-2-3-4-5-6-7
V30. Quickly becoming aware of competitors' innovations and imitations.	1-2-3-4-5-6-7

Indicate the performance of your company compared to your competitors with regard to the following items (OECD, 2005):

Much worse			**At the same level**			**Much better**
1	**2**	**3**	**4**	**5**	**6**	**7**
V31. Replacement of products being phased out						1-2-3-4-5-6-7
V32. Extension of product range within main product field through new products						1-2-3-4-5-6-7
V33. Extension of product range outside main product field						1-2-3-4-5-6-7
V34. Development of environment-friendly products						1-2-3-4-5-6-7
V35. Market share evolution						1-2-3-4-5-6-7
V36. Opening of new markets abroad						1-2-3-4-5-6-7
V37. Opening of new domestic target groups						1-2-3-4-5-6-7