Manufacturing strategy process and organizational knowledge: a cross-country analysis

Ely Laureano Paiva, Elena Revilla Gutierrez and Aleda V. Roth



Ely Laureano Paiva is based at Fundacao Getulio Vargas, Sao Paulo/SP, Brazil.
Elena Revilla Gutierrez is based at Instituto de Empresa, Madrid, Spain.
Aleda V. Roth is based at Clemson University, Clemson, South Carolina, USA.

Abstract

Purpose – *This paper aims to analyze manufacturing strategy process (MSP) from a knowledge-based view (KBV) of the firm. MSP considers the ways that manufacturing organizes its resources in order to create/strengthen manufacturing-related capabilities. In this context, managers often are under pressure to find quick answers in highly complex environments. By viewing MSP as a knowledge creation process, managers may choose a company's objectives based upon previous experiences and knowledge. MSP addresses the level of planning and decision making related to building competitive operations capabilities over the long term.*

Design/methodology/approach – *A survey research was used to make cross-country comparison. The constructs were empirically confirmed in both country samples, attesting to measurement invariance. The proposed model was tested in both samples and analyzed the differences between them.*

Findings – *The results suggest that knowledge is a key resource in MSP in both samples. Resource-based orientation presents higher levels of influence over MSP in Brazil. In the Spanish sample the influence of external knowledge in MSP and market performance is more relevant.*

Research limitations/implications – *One limitation of this study is that the Brazilian sample is located in a specific region and therefore some regional characteristics may be present. Another limitation was the use of a questionnaire in two different countries that was originally developed in a non-native language.*

Practical implications – *As a practical implication, manufacturing should seek to integrate the strategic process in order to be more responsive in dynamic environments.*

Originality/value – *The paper uses a cross-country sample for scale validation, which is rare in management research. Manufacturing strategy process was analyzed from a knowledge-based view, bringing new possibilities for academic studies. For managers, the paper highlights the importance of manufacturing developing a proactive role through knowledge integration in cross-functional activities during the strategic process.*

Keywords *Organizational knowledge, Manufacturing strategy, Surveys, Cross-country analysis, Manufacturing industries, Brazil, Spain*

Paper type *Research paper*

Introduction

Recent research indicates that the strategic view in operations has moved from a ''market-based'' to a ''knowledge-based view'' (KBV) of competition (Schroeder *et al.*, 2002). Thus, achieving low cost while maintaining high quality is no longer enough to guarantee success. Companies need to focus more on intangible assets and knowledge than on tangible assets, because most of the latter are either imitable or substitutable, which makes them unlikely sources of sustainable competitive advantage (Itami, 1987; Barney, 1991). This knowledge-based focus demands that functional areas, such as manufacturing, contribute to the ability to build new capabilities from organizational knowledge, i.e. bringing in or creating new knowledge. The capacity to gain new knowledge is a source of

Received April 2011
Revised September 2011
October 2011
October 2011
Accepted November 2011

sustainable competitive advantage (Kogut and Zander, 1992; Mohrman *et al.*, 2003; Hult *et al.*, 2006).

This paper aims to analyze manufacturing strategy process (MSP) from a KBV of the firm (Mohanty and Deshmukh, 1999; Grant, 2002). MSP considers the ways that manufacturing organizes its resources in order to create/strengthen manufacturing-related capabilities. In this context, managers often are under pressure for finding quick answers in highly complex environments. By viewing MSP as a knowledge creation process, managers may choose a company's objectives based upon previous experiences and knowledge. MSP addresses the level of planning and decision-making related to building competitive operations capabilities over the long term (Boyer *et al.*, 2005).

This study subjects to rigorous empirical scrutiny four constructs related to MSP and KBV based on Paiva *et al.* (2008) (internal knowledge, external knowledge, cross-functional orientation and resource-based orientation); evaluates the multi-item measurement scales related to each construct; and tests the proposed hypotheses pertaining to how each theoretically relates to performance. This study was firstly applied to Brazilian manufacturers and then replicate it using a Spanish sample, thereby exploring cross-cultural influences on performance. Replication studies are needed to advance OM research. In fact, several recent papers have called for more studies of this type (Singh, 2003; Frohlich and Dixon, 2006). Importantly, Roth *et al.* (2008) found that relatively few of the published multi-item measurement scales had sufficient reliability and validity.

This paper evaluates MSP from a KBV approach using a database from Brazilian and Spanish manufacturers. The Brazilian sample is designated as the ''baseline'' and the Spanish sample as the ''replicate.'' Both cover the same four industries. Importantly, each country has different environmental conditions for manufacturing. While manufacturers in Brazil and Spain face high levels of uncertainty, the contexts are quite different. In Brazil, foreign competitors and declining import taxes are making the competitive environment more complex. On the other hand, Spanish companies are spreading their markets into and beyond the European Union. Latin America, including Brazil, is one of the main Spanish targets in exports and investments (IBGE, 2003).

This study makes three main contributions to the manufacturing management literature and practice. First, the scales were validated by using a cross-cultural approach, which assesses measurement invariance. Second, MSP comparisons are made between the two countries and highlight how different country contexts affect the results. Finally, the results were expanded from the original, baseline study (Paiva *et al.*, 2008) by use of multi-group analysis and the inclusion of a performance variable.

This article presents the theoretical concepts relating MSP to organizational knowledge, discusses the research methodology, analyzes the empirical results and offers conclusions.

Background

Studies in strategic process have two main focuses. One is related to the formulation process and the other to the implementation stages. In the first case formulation process is considered as a continuous and intentional process of decision events (Pettigrew, 1997) or a formalized process with a previous definition of each step (Andrews, 1971).

On the other hand, the implementation is also a crucial aspect of the strategic process. Whittington (2003) stressed that studies in strategy several times present a lack related to the explicit links to strategy outcomes, i.e. the results related to the strategy implementation process. According to the same author (Whittington, 2006, p. 628), ''[. . .] strategy practice research embraces this concern: more effective strategy practitioners and more appropriate practices can contribute directly to organizational performance''. This article focuses preferentially in the first approach following an analysis based on the formulation process. Nevertheless, we also analyzed the results of the implementation process as a part of our proposed model.

Classic manufacturing strategy studies focus on the fit between business strategy and manufacturing strategy in order to reinforce competitiveness (Wheelwright, 1978; Giffi *et al.*, 1990; Gupta and Lonial, 1998). Other seminal articles on manufacturing strategy (Skinner, 1969; Wheelwright, 1978, 1984; Hill, 1995) follow a hierarchical view of MSP, linking corporate and business strategies to the competitive criteria (cost, quality, delivery and flexibility) and to product and process decisions. This hierarchical orientation reflects a view of MSP that is more structured regarding the external environment and the internal trade-offs. This orientation was clearly influenced by the traditional approach of strategic planning and has impacted some formulation tools proposed through the years, including Fine and Hax (1985), Platts and Gregory (1992), Slack (1994), and Menda and Dilts (1997).

Subsequent studies analyzed MSP from a less structured approach. This orientation considers the challenge for managers as being more complex than the dichotomy between ''weakness'' and ''strength'' (Cheng and Musaphir, 1996). Accordingly, MSP is considered as a sequence of decisions (and even consistencies) in the company's decision-making behaviors. Examples of studies with this orientation include Swamidass and Newell (1987), Anderson *et al.* (1991), Voss (1992), and Papke-Shields *et al.* (2002). Roth (1996b), Boyer and Lewis (2002), and Rosenzweig and Roth (2004) also questioned the need for trade-offs in MSP and proposed that competitive criteria should be cumulative.

A more dynamic view related to competence creation is another approach present in manufacturing strategy literature. See for example Cleveland *et al.* (1989), Vickery (1991), Vickery *et al.* (1993), and Miller and Roth (1994). Other studies following this approach also claim that the result of MSP is the capabilities creation from tangible and intangible resources (Zahra and Das, 1993; Hayes and Pisano, 1996; Tracey *et al.*, 1999; Schroeder *et al.*, 2002; Voss, 2005).

In this research, these theoretical approaches considers manufacturing strategy formulation as a process comprising both structured and unstructured strategy formulation (Adam and Swamidass, 1992). Accordingly, tacit knowledge, which is associated with the unstructured part of MSP, and explicit knowledge, which pertains to the structured part of MSP, are included in manufacturing strategy formulation. Consistent with KBV (Grant, 1996), existing knowledge in manufacturing (or ''manufacturing knowledge'') plays a central role in the manufacturing strategy formulation process. Next the text explores the linkages between competitiveness, manufacturing strategy and knowledge creation processes.

Knowledge creation and the process of manufacturing strategy formulation

The development of resource-based theoretic approaches, and especially those emphasizing the role of knowledge, has provided a broader basis upon which to build a theory of manufacturing strategy (Henriksen and Rolstadås, 2010) Currently, several articles also have highlighted the role of knowledge in OM. Hult *et al.* (2006) and Modi and Mabert (2007) analyzed the knowledge elements and their relations with supply chain performance. Knowledge also has studied in OM research in different topic such as technology adoption (Zhang and Dhaliwal, 2009), new production development (Richtnér and Åhlström, 2010; Kumar and Ganesh, 2011), supply chain decisions (Adamides and Pomonis, 2009; Craighead *et al.*, 2009; Li *et al.*, 2011) and HR related aspects (Siemsen *et al.*, 2007; Jung *et al.*, 2011). Roth (1996a, b) posits that knowledge is essential for building competitive capabilities. Also, Dyer and Nobeoka (2000) and Germain *et al.* (2001) explored the knowledge-sharing process in the supply chain. This topic has presented increasing relevance in OM research, using as example recent articles like Li *et al.* (2011), and special issues in OM leading journals (Anderson and Parker, 2010).

Moreover, some authors posit that the process of manufacturing strategy formulation may be analyzed under the KBV with knowledge being a critical resource for capability creation (Grant, 1996; Mohrman *et al.*, 2003; Henriksen and Rolstadås, 2010). Knowledge is an intangible strategic resource able to create value and achieve superior performance (Hult *et al.*, 2006).

The KBV of the firm is more a set of ideas, or streams of research, about the existence and nature of the firm that emphasize the role of knowledge. According to Grant (2002), these streams include the resource/capabilities analysis of the firm (Barney, 1986, 1991; Prahalad and Hamel, 1990; Grant, 1991), the ''epistemology'' (Polanyi, 1958; Maturana and Varela, 1980), and the organizational learning (Levitt and March, 1988; Huber, 1991). This study follows Grant's definition of KBV: ''a set of assumptions concerning the characteristics of knowledge and the circumstances of its creation and application'' (Grant, 1997, p. 451). The KBV considers a dynamic perspective of the competitive environment, where organizations are continuously changing.

This dynamic perspective provides an important contrast with traditional static perspective typified by traditional economic approaches, including Porter-based models. The KBV allows researchers to relax the assumption that firms compete with identical products, emphasizing the importance of industry or strategic groupings (Porter, 1980; Spencer, 1989) towards the notion of firms as being uniquely evolved (Penrose, 1959). At the foundations of the KBV is the differentiation between tacit and explicit knowledge. To Polanyi (1967), all explicit knowledge is rooted – i.e. necessarily depends on its application and understanding – in tacit knowledge. Explicit knowledge can be expressed in words and numbers and shared in the form of data, scientific formulae, specifications, manuals and plans. Tacit knowledge is difficult to articulate and to transfer. Its existence is based on individual (and group-shared) experiences. The difficulty in transferring tacit knowledge is a possible source of sustainable competitive advantage.

Based on the following premises regarding the nature of knowledge and its role within the firm, the concept of knowledge-creation process is a key aspect to understand. First, knowledge creation can be viewed as an adaptive behavior process that increases the potential of the company to innovate (Von Krogh *et al.*, 2001); and thus that it adapts to the changing environment. Some researchers have stated that solving problems creates knowledge (see Jaikumar and Bohn, 1986). Second, according with the view of competence creation in production and operation systems, and following Nonaka *et al.* (2000), MSP through knowledge creation facilitates problem recognition and definition, generates and applies knowledge to problem solving, and further generates new knowledge through these actions. Third, Peteraf (1993) argues that Andrews' approach to strategy formulation ''begins with an appraisal of organizational competencies and resources'' (p. 179). Thus, by analogy, MSP refines the manufacturer's understanding of its operating environment and improves its ability to react appropriately to future stimuli.

Along these lines, Paiva *et al.* (2008) propose that the manufacturing strategy formulation process is oriented to the creation of products/services that are valuable, rare and imperfectly imitable. The formulated strategy then results from a continuous process in which manufacturing organizational knowledge is used to create and sustain the company's competencies. External and internal perspectives comprise the approaches along the strategy formulation process (Andrews, 1971). The internal perspective emerges from the knowledge-based strategy approach, which encourages companies to continuously fit their internal capabilities to environmental changes (Teece *et al.*, 1997). The external perspective emphasizes the role of environmental factors for a firm that is determining its strategy (Venkatraman, 1989; Luo and Park, 2001). It focuses on market positions, allowing companies to see new forms of competitive advantage (Leonard-Barton, 1994). Every source of environmental change thus leads firms to realize that they do not possess adequate knowledge for effectively dealing with change. Both perspectives – internal and external – are present in knowledge management (Menon and Pfeffer, 2003). Accordingly, different environmental contexts necessitate addressing appropriate knowledge strategies to create and use knowledge.

A cross-functional approach is critical to the knowledge-creation process within firms (Brockman and Morgan, 2003). Cohen and Levinthal (1990) proposed that interaction between individuals who possess diverse and different knowledge enhances the organizational capability to innovate far beyond what an individual can achieve. The knowledge-base theory explains how knowledge integration becomes an important

capability that enables firms to access, share and exploit knowledge as well as create new knowledge. Cross-functional knowledge integration is the source of new ideas to achieve superior performance outcomes, owing to the synergies created within collaborative relationships (Grant, 1996; Teigland and Wasko, 2003). Cross-functional integration requires that members of different organizational units not only share knowledge but also understand its relationship to the specialized knowledge so as to engage in a collective problem-solving task. The ability to integrate knowledge requires a shared perspective of the problem, which permits existing knowledge to be combined and reformulated to produce new insights and solutions (Nonaka, 1994; Okhuysen and Eisenhardt, 2002). Bueno and Salmador (2003) claim that different categories of knowledge may emerge into the organization context and these different knowledge's are able to create a sustainable competitive advantage.

Frohlich and Westbrook (2001), Ward *et al.* (1994), Rosenzweig *et al.* (2003), and Hausman *et al.* (2002) reinforce the importance of a cross-functional approach for manufacturing. In each study, cross-functional decision making is found to be one of the central issues for knowledge creation (e.g. the process of cross-functional knowledge integration during the strategy formulation process). According to Paiva *et al.* (2008), the authors define cross-functional orientation as the ability of manufacturing to interact with other functional areas in order to improve a company's strategies and processes. Additionally, the authors claim that cross-functional orientation is a core aspect in MSP because it allows a cross-functional integration.

Ward *et al.* (1994), Rosenzweig *et al.* (2003) and Swink *et al.* (2005) empirically demonstrate the importance of manufacturing proactiveness in the strategic process to enhance competitiveness. According to these studies, manufacturing participation in the choices concerning products and services, strategic focus, and budgets and investments may be a key aspect to building a competitive advantage. Roth (1996a) identifies strategic agility as the company's ability to strategically change its competitive orientation following changes in the environment. Strategic agility is also related to the concept of capability lifecycle. According to Helfat and Peteraf (2003, p. 5), ''capability develops through search by the team for viable alternatives for capability development, combined with accumulation of experience over time.''

Organizational-learning and organizational-knowledge literatures have recently developed the idea of the ''knowledge strategy.'' For example, Bierly and Chakrabarti (1996) define the knowledge strategy as the set of strategic choices that shape and direct the organization's learning processes and determine the firm's knowledge base. Through the knowledge strategy, it is possible to identify important strategic knowledge gaps as a basis to take decisions regarding the creation, development, and use of a firm's knowledge in alignment with the requirements of the business strategy (Argote *et al.*, 2003). Following this logic, it is reasonable that MSP involves the choice of a knowledge strategy that determines the reliance on new knowledge and competencies versus existing knowledge and competencies, as required by the problem-recognition and resolution processes.

Thus, manufacturing strategy should allow the firm to develop its competencies by exploring its internal resources (Coates and McDermott, 2002; Schroeder *et al.*, 2002). This premise is according to Wernerfelt's (1984, p. 173) assumption: ''What a firm wants is to create a situation where its own resource position directly or indirectly makes it more difficult for others to catch up.'' This competitive position is achieved when the company's resources are oriented to create products/services that are valuable, rare and imperfectly imitable (Barney, 1991). In other words, they create what Roth (1996a) calls in OM, ''economies of knowledge.''

To organize previous arguments, the first step in MSP is the development of manufacturing knowledge. This knowledge derives from two main sources: the external and the internal environment. Cross-functional integration enhances organizational knowledge, which is the core resource for internal competencies creation and sustainability. Cross-functionality reinforces firms' internal strengths and helps to overcome internal weaknesses. Finally, a resource-based orientation helps MSP to create product characteristics that are valuable for

customers and difficult to find (for the constructs of MSP proposed here and their theoretical domains see Table I).

Model development

Internal knowledge and external knowledge

KBV suggests that internal knowledge embodied within a firm's resources is an important source of competitive advantage (Barney, 1991). However, manufacturing often does not possess all the inputs required to exploit internal resources successfully, which depends on the manufacturer's ability to absorb what is going on in the business and to act proactively based on this information. Proactiveness is critical in environments where there is a continuous change in the existing knowledge base. Here manufacturing is compelled to develop a wide range of skills for identifying knowledge flows inside the firm (Schroeder *et al.*, 2002).

Knowledge related to the strategic process should evaluate how to explore and to integrate a company's internal resources from different functional areas or business units in order to adapt to the environment. Therefore, internal knowledge is the manufacturer's ability to identify and explore the company's internal resources. At the same time, organizational learning capacity relies on interactions between the organization and the external environment (Fugate *et al.*, 2009). Accordingly to the literature, external knowledge is the manufacturer's ability to identify and explore opportunities and threats in the marketplace. This type of knowledge enables manufacturers to analyze effectively the conditions from the external environment, and in turn to identify opportunities and threats. External knowledge is related to the ability that Roth and Miller (1992) called ''marketing acuity.''

Thus, knowledge leads to an adaptable organization, and its development involves a process of knowledge transfer between different organizational functions or units. Germain *et al.* (2001) showed that a knowledge-based ''world-class manufacturer'' presents a continuous information exchange between the company's functions, creating readily accessible knowledge. Therefore, the following hypothesis is proposed:

H1. Internal knowledge is positively related to external knowledge.

Cross-functional orientation

Cross-functionality is the level of manufacturing's proactive participation in a company's strategic process together with other functional areas (Ward *et al.*, 1994). Cross-functionality allows knowledge integration, which is one of the main sources of knowledge creation (Grant, 1996; Nonaka and Konno, 1998). Organizations should develop the ability to perceive and to understand environmental conditions; which entails building, sharing and

Table I Read: Paiva *et al.* (2008) Constructs and their theoretical domains

Construct	*Domain*	*Theoretical references*
External knowledge (EK)	Extent to which manufacturing knows the threats and opportunities in the marketplace	Cohen and Levinthal (1990); Leonard-Barton (1994); Roth (1996b); Grant (1997); Badri *et al.* (2000); Germain *et al.* (2001); Grant (2002)
Internal knowledge (IK)	Extent to which manufacturing knows how to explore the firm's internal resources	Nonaka (1994); Nonaka and Takeuchi (1995); Roth (1996b); Grant (1997); Dyer and Nobeoka (2000); Germain *et al.* (2001); Grant (2002)
Cross-functional orientation (CF)	Extent to which manufacturing participates in the strategic process	Skinner (1969); Hayes and Wheelwright (1985); Ward *et al.* (1994); Grant (1996); Narasimhan and Wang (2000); Ward and Duray (2000); Hausman *et al.* (2002); Malhotra and Sharma (2002)
Resource-based orientation (RBO)	Extent to which manufacturing creates inimitable value in products from existing internal resources	Wernerfelt (1984); Barney (1991); Collis and Montgomery (1995); Stewart (1997); Schroeder *et al.* (2002); Coates and McDermott (2002)

integrating organizational knowledge (Siemieniuch and Sinclair, 2004). When environmental conditions change, knowledge should be created in accordance with the new conditions. Thus, cross-functional activities are a central orientation for MSP from a KBV. Considering that several studies have stressed the importance of manufacturing managers in the strategic process (Hayes and Wheelwright, 1985; Ward *et al.*, 1994; Swink *et al.*, 2005; Hausman *et al.*, 2002; Rosenzweig *et al.*, 2003; Giffi *et al.*, 1990), cross-functionality improves company responsiveness. Accordingly, the authors hypothesize:

H2. Internal knowledge is positively and directly related to cross-functional

H3. External knowledge is positively and directly related to cross-functional orientation.

Resource-based orientation

Resource-based orientation is the manufacturer's ability to decide strategic issues based on the company's resources when seeking a sustainable competitive advantage. There is much consensus in manufacturing strategy supporting the notion that MSP is related to capability creation. This orientation supports the assertion that capability creation lies within concept uniqueness (Schroeder *et al.*, 2002). Therefore, a capability from a resource-based approach should be imperfectly imitated and not easily found (Barney, 1991).

Cross-functionality allows knowledge integration, which is one of the main sources of knowledge creation (Grant, 1996; Nonaka and Konno, 1998). Similar to the concept of cross-functionality, Brusoni and Prencipe (2002) claim that a loosely coupled network is an in-house capability for systems integration. Thus, cross-functional activities play a key role for MSP from a KBV perspective (Ward *et al.*, 1994). When the external environment is more dynamic, cross-functionality may improve manufacturer responsiveness. Thus, when manufacturers face dynamic environments, MSP should foster knowledge integration from different functional areas.

Since capability creation is a source of uniqueness, imperfect imitation and rareness (Schroeder *et al.*, 2002), a resource orientation is necessary for sustainable competitive advantage (Barney, 1991). Taking the above ideas collectively, the following hypotheses are proposed:

H4. Internal knowledge is positively and directly related to resource-based orientation.

H5. External knowledge is positively and directly related to resource-based orientation.

H6. Cross-functional orientation is positively and directly related to resource-based orientation.

H7. External knowledge is positively related to market performance.

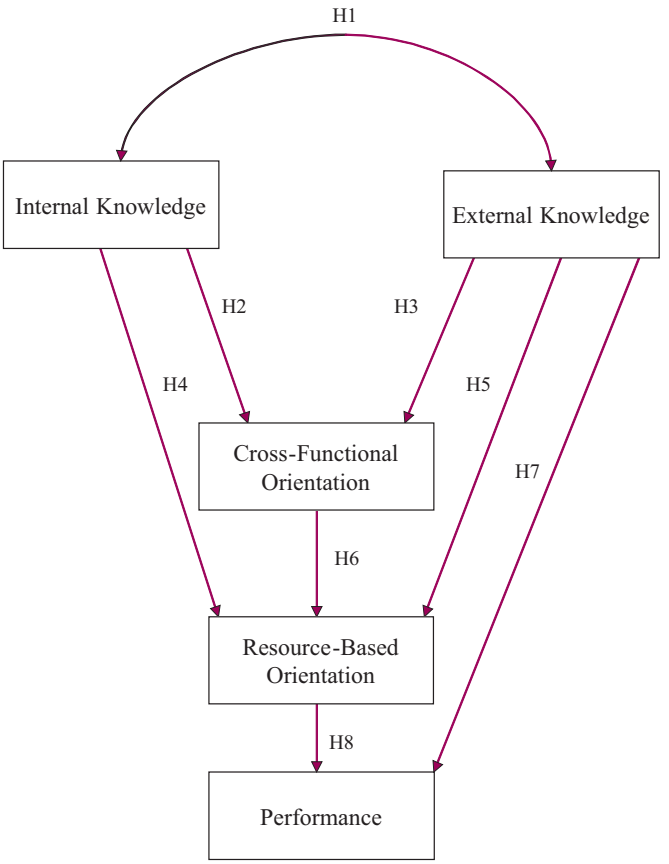
H8. Resource-based orientation is positively related to market performance.

Country and cross-cultural issues

One important aspect of this study is a cross-country comparison of the hypothesized MSP model (depicted in Figure 1). Cross-country influences on manufacturing strategy in MSP are discussed in only a few articles, including Ward *et al.* (1994), Swamidass and Newell (1987), and Badri and Davis (2000), among others. These papers address business costs, labor availability, competitive hostility and government decisions. Because of global competition, companies located in different parts of the world are forced to compete with each other. Nevertheless, they frequently face different environmental conditions and distance factors (Ghoshal and Nohria, 1989). Badri and Davis (2000) claim that globally-competing companies attempt to reach the largest number of consumers possible. At the same time, companies from different countries or global regions have diverse levels of access to technology, resources and dissemination of new managerial practices.

In the global context, cross-cultural issues emerge when investigating samples from different countries. On one hand, some authors argue that industrialization processes and

Figure 1 Theoretical model of the manufacturing strategy process (MSP) from a knowledge-based view (KBV) perspective



Source: Adapted from Paiva *et al.* (2008)

technology dissemination lead to a convergence across nations, organizations and individuals. On the other hand, the national specificity argument claims that national differences arise from cultural, political, economic and judicial issues (Rungtusanatham *et al.*, 2005). Craig and Douglas (2000) mentioned that construct equivalence is critical when constructs and their measurements are developed in a specific country and socio-cultural context. Similarly, Mullen (1995, p. 2) stated that cross-national studies must evaluate ''[. . .] the equivalence of constructs, samples and measurement''. Studies like Cadogan *et al.* (1999) empirically found construct equivalence in cross-country samples using invariance analysis through confirmatory factor analysis (CFA).

In OM research, Rungtusanatham *et al.* (2008) identified differences related to measures understanding when they analyzed responses from different hierarchical levels. Similarly, Rungtusanatham *et al.* (2005) found that national specificity influences total quality management (TQM) adoption and TQM-theory understanding in different countries. The authors argued that cross-cultural studies must advance beyond the usual tests of validity and reliability and use additional statistical tests like MANOVA and regression analysis. Flynn and Flynn (2004) also identified different sequences in the sandcone-priority model in a sample composed by European, North American and Asian companies. Masakure *et al.* (2004) reported that industrialized countries usually present dynamic and sophisticated markets, and are characterized by complexity and high value-added products and services. Therefore, this study assesses whether MSP's constructs are influenced by country location, namely Spain and Brazil.

Both countries face high levels of uncertainty in the external environment. The Spanish economy's opening-up to the global market has generated an increasing dynamism in its national industry. Spanish companies usually compete in different environmental conditions as compared to Brazilian companies because: Spain is highly integrated to international markets, especially through the European Union (EU); and developed countries still have markets with higher levels of sophistication, characterized by complexity and high value-added products and services (Masakure *et al.*, 2004). Environmental uncertainty in Brazil is caused mainly by Mercosur and global instability. At the same time, uncertainty in Spain is a consequence of high integration in the EU and in the global markets, and of domestic market sophistication. These aspects are a constant cause of changes in the external environments. Therefore:

H9. Spanish and Brazilian manufacturers will have similar levels of internal knowledge, on average.

H10. Spanish and Brazilian companies will have similar levels of external knowledge, on average.

H11. Spanish and Brazilian companies have similar levels of cross-functional orientation, on average.

H12. Spanish and Brazilian companies have similar levels of resource-based orientation, on average.

Methods

The 12 hypotheses related to MSP from a KBV perspective were tested empirically. First the text will discuss the samples and then the measures. Importantly, the measures are invariant across cultures are presented.

Two country samples

The companies studied are located in Brazil and Spain. All companies sampled have more than 100 employees and belong to one of four industries: food, electronics, transport equipment and machine industries. The sample is comprised of 78 Brazilian companies that are located in the state of Rio Grande do Sul, and 130 Spanish companies. The sample distribution related to industry and company size is similar in both countries. Machinery and food industries presented the highest number of companies, and most companies in both Brazil and Spain have between 100 to 500 employees (Tables II and III).

Table II Industry sample distribution by country

	Country			
	Brazil		*Spain*	
Industry	*Number of respondents*	*%*	*Number of respondents*	*%*
Food	30	38.4	49	37.7
Electronics	12	15.4	19	14.6
Machines	23	29.5	39	30
Transport equipment	13	16.7	23	17.7
Total	78	100	130	100

Table III Company size distribution by country

	Country			
	Brazil		*Spain*	
Number of employees	*Number of companies*	*%*	*Number of companies*	*%*
100-499	58	74.3	110	84.9
500-1,000	13	16.7	12	9.6
More than 1,000	7	9	8	5.5

The data were collected through a self-administered questionnaire. The questionnaire was originally developed in Brazil (see Paiva *et al.*, 2008, for details), and it was later cross-translated and administered in Spain. Since the Brazilian study is the baseline and was reported in Paiva *et al.* (2008), we paraphrase its survey development first.

The initial step for the questionnaire construction was qualitative. Two Brazilian executives – one from the plastics industry and the other from the machine industry – evaluated the first version of the questionnaire. Additionally, the survey items were improved based on a pilot test with 19 companies from the machine manufacturing and plastics industries located in Brazil. Following the procedures outlined in Dillman (2007), each company received a telephone solicitation to participate in the study; and potential respondents were encouraged to participate by giving the research objectives. For those agreeing to participate, the authors sent a letter with more details related to the research along with the survey instrument. A follow-up telephone call was made after two weeks to the non-respondents. A second wave of surveys was administered by mail. A random sample was drawn from a target population, which comprised companies in the Brazilian Service Support for Enterprises (SEBRAE). The sample is composed only by food, electronics, machinery and transport equipment industries. A total of 314 questionnaires were sent by regular mail and yielded a response rate of 32.1 percent.

The Spanish research was a replication of the Brazilian study and used the same questionnaire translated into Spanish. The Spanish sample was randomly selected from the list of 5,000 large companies published by the Spanish business periodical *Actualidad Economica*. In Spain, 350 manufacturers were contacted by phone and 130 from this group agreed to the study and completed a survey (yielding a response rate equal to 37.14 percent). Those that agreed to participate in the study received the questionnaires by fax or e-mail (further details are presented in Tables II and III). The data collection in Spain was one year after the data collection in Brazil.

Although this study may be classified in some aspects as a classic replication, it proposes some advances regarding the original Brazilian study. Thus, it also presents characteristics of generalizability replication. According to Frohlich and Dixon (2006), replication studies should offer a substantial contribution when compared to the first study. This is also identifiable in this study because it extends the original results found by Paiva *et al.* (2008) and analyzes possible cross-cultural influences in the results. The main new aspects present in this study were the inclusion of a market performance variable in the path analysis and the cross-country analyses presented.

Using samples from two countries the multi-item measurement scales were investigated, tapping into each construct for validity and reliability for the whole sample and for split-country samples (refer to Table I for the constructs and Appendix 1 for the corresponding survey questions). Additionally, statistical tests of means were included in order to identify possible presence of cross-cultural influence over the results (Tables II and III give the descriptive statistics for each country sample).

Companies located in the state of Rio Grande do Sul compose the Brazilian sample. This is the southernmost state of Brazil and is strategically located for Mercosur. Recent Brazilian history (with clear trade barriers) was a probable cause of internal orientation in the Brazilian economy in the last decades (Franco, 1999). Brazil is the main economy in the custom union of Mercosur. At the same time, Mercosur has faced a series of challenges in recent years including Brazilian currency fluctuation, Argentinean economic crises, and trade barriers among its main members. Mercosur seeks to establish a role in South America similar to Europe's EU, but the problems faced by its members have created additional constraints to the initial proposal of regional integration.

Although the Spanish sample is equally distributed in the country, it is possible to identify some regional specialization, as is the case of the Valencian Community in the food industry and the Basque Country in the machine industry. The opening of the Spanish economy to the global market has generated an increasing dynamism in its national industry. Spanish exports reached five percent of the EU's total exports. In light of this progress, the

companies are led to introduce new technologies and managerial practices in order to adapt to international competitive patterns.

Results discussion

Measurement validity and reliability

A CFA analyzed construct validity and reliability. The constructs were originally developed and tested in Brazil (Paiva *et al.*, 2008). The only variable not considered in the original study, which was the baseline, related to performance. Another difference from the baseline study (Paiva *et al.*, 2008) is that this study models internal and external knowledge as the exogenous variables in order to stress knowledge's role as the first resource in MSP. According to Kline (1998, p. 16), exogenous variables are similar to the independent variables in a regression analysis and ''they are assumed to affect other variables in the model.''

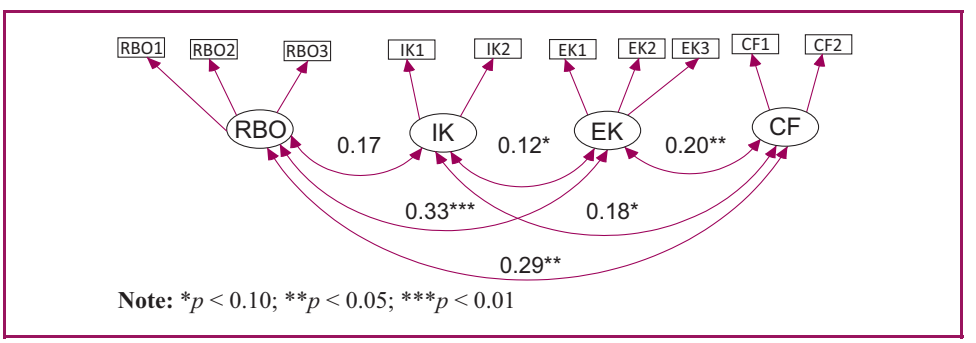
Our measurement analysis was based on the following dimensions: reliability, unidimensionality and convergent validity. First, measurement invariance was analyzed across the two independent samples (Brazil and Spain). Measurement invariance verifies the extent to which both samples have the same structure (Bollen and Long, 1993) (see Figure 2 for the structure). The structural invariance tests are presented in Table AI (Rungtusanatham *et al.*, 2008); however, IK1 are not equivalent across samples, and this is an area for future investigation. The path models were evaluated separately for each country.

Given structural invariance, pooled samples were used to evaluate the overall psychometric properties. Figure 1 presents the set of items analyzed for the measurement scales in the pooled sample. The CFA model for the pooled sample presents all the measures of goodness-of-fit at acceptable levels: Chi-square = 54.65; and GFI, AGFI, CFI and NFI indicate values above 0.90, as is recommended (Table IV).

Convergent validity can be assessed through the individual items loadings. The loadings varied from 0.41 to 0.91 and all were statistically significant ($p < 0.05$), confirming convergent validity. Additionally, the Cronbach's alpha coefficient of the scales with three items – external knowledge and resource-based orientation – presented satisfactory alpha values (0.79 and 0.76 respectively). The two-item constructs presented lower alpha values close to the minimum level of reliability that Malhotra (2006) considers acceptable for exploratory studies (0.60). Internal knowledge presented a coefficient alpha equal to 0.61; and cross-functional orientation, equal to 0.65. Table V presents the descriptive statistics for the pooled sample.

Common method variance (CMV) was analyzed through the Harman's single-factor technique (Podsakoff *et al.*, 2003). All the items were pooled in one single variable. The results showed that the single factor accounted for only 0.25 of the total variance, suggesting that CMV is not present in the data analyzed.

Figure 2 CFA for the strategic process in operations from a KBV



Note: *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table IV Standardized path loadings from CFA

Measurement	*Standardized loading*	t-*value*
Internal knowledge		
Manufacturing knows how to explore the company's internal resources, which leads to a competitive advantage	0.51	4.91
Manufacturing knows how to seek more integration with other functional areas of the company to reinforce internal resources	0.74	8.12
External knowledge		
Manufacturing clearly understands the primary opportunities to be explored in the marketplace	0.57	4.77
Manufacturing knows the performance of its main competitors	0.50	4.30
Manufacturing clearly understands the existing threats in the marketplace	0.41	3.78
Cross-functional orientation		
Decisions related to manufacturing, marketing and R&D strategies	0.45	4.12
Decisions related to the growth strategy of the business unit	0.50	5.76
Resource-based orientation		
Providing product characteristics that are valued by the customers	0.63	8.74
Seeking competitive resources the competitors do not have	0.91	9.95
Creating resources not easily imitable by the competitors	0.69	9.20

Notes: General statistics for goodness-of-fit for the CFA: χ^2=54.65, d.f. = 29, $p < 0.03$, RMR = 0.06, RMSEA = 0.06, GFI = 0.95, AGFI = 0.90, NFI = 0.91, IFI = 0.95, CFI = 0.95

Table V Pooled-data multi-item scale means, standard-deviations and Pearson bi-variate correlations

	Internal knowledge	*External knowledge*	*Cross-functional orientation*	*Resource-based orientation*	*Performance*
Mean	3.87	3.46	3.75	3.75	3.24
SD	0.61	0.84	0.93	0.89	0.82
Correlation					
Internal knowledge	1.00				
External knowledge	0.60**	1.00			
Cross-functional orientation	0.41**	0.21**	1.00		
Resource-based orientation	0.42**	0.45**	0.37**	1.00	
Performance	0.05	0.06	0.15*	0.11	1.00

From the analysis above, the measurement scale items presented in Table IV will be used in subsequent analyses from Paiva *et al.* (2008):

1. The internal knowledge construct includes the following items: ''manufacturing knows how to explore the company's internal resources (IK1), and manufacturing knows how to seek more integration with other functional groupings in the company in order to reinforce the internal resources (IK2)'' (p. 129).
2. The external knowledge construct refers to the following items: ''manufacturing clearly understands the primary opportunities to be explored in the market place (EK1), manufacturing clearly knows the performance of main competitors (EK2), and manufacturing clearly understands the existing threats in the marketplace (EK3)'' (p. 129).
3. The cross-functional orientation construct includes the following items: ''cross-functional activities are used to decide about manufacturing, marketing and R&D strategies (CF1); and cross-functional activities are used to decide about the business unit's growth strategy (CF2)'' (p. 129).

4. The resource-based orientation construct is related to the following items: ''manufacturing provides characteristics valued by the customers in products (RBO1); manufacturing seeks competitive resources, which the competitors do not have (RBO2); and manufacturing seeks to create resources not easily imitable by the competitors (RBO3)'' (p. 129).

It is worth noting that this study is a cross-cultural survey; and thus, there were potential barriers in the questionnaire adaptation and application. The barriers are the usual cultural aspects related to questionnaire translation from an original idiom (Portuguese) to a second idiom (Spanish). As the two languages have Latin roots many words and expressions are very similar, but sometimes they have different meanings. In order to avoid these translation issues in the questionnaire development and study replication, the authors used a reverse translation process. Therefore, a researcher translated the items to Spanish and a second person translated the items again to Portuguese. This version was then compared to the first Portuguese version.

Considering all these aspects and the CFA results, the questionnaire replication is at acceptable levels of reliability and validity.

Data analysis

Path model results

Hypothesized model in Figure 1 was testes by using the path analyses implemented with structural equation modeling software (Amos 6.0). The indicator variables were the item averages on each scale for each observation. First, model invariance was applied across the two country groups. Based on the tests used by Hausman *et al.* (2002), the models related to each sample did not present form invariance (see Appendix 1). Thus, two separate path analyses are presented, one for the Brazilian sample and the second for the Spanish sample. Table VI presents the general statistics for goodness-of-fit for each country's path analysis. All the fit indices are in acceptable levels for each country, indicating good fit. Table VII shows the direct, indirect and total effects in the path analysis model for each sample. Regarding the original model presented in Paiva *et al.* (2008), the model includes a market-performance variable. Table VII shows the direct and indirect effects for both countries separately.

The results show that the measurement scales presented a positive relation among themselves in both samples as expected; but some differences across the countries were

Table VI Path analyses results: regression weights and general statistics for goodness-of-fit

				Model fit							
	Predictor	*Brazil*	*Spain*	χ^2	*df*	p	*GFI*	*AGFI*	*RMSEA*	*TLI*	*CLI*
Sample 1 – Brazil				0.64	2	0.73	0.99	0.97	0.08	1.05	1.00
Sample 2 – Spain				1.24	2	0.54	0.99	0.97	0.06	1.05	1.00
Outcomes											
Performance	Resource-based orientation	0.26*	0.06								
	External knowledge	0.10	0.11								
Resource-based orientation	Internal knowledge	0.32**	0.12								
	External knowledge	0.14	0.37**								
	Cross-functional orientation	0.40***	0.17*								
Cross-functional orientation	Internal knowledge	0.44**	0.64***								
	External knowledge	0.22*	0.10								

Notes: Estimated from structural equation modeling; *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table VII Support for hypotheses by country: results from path model

Outcomes	*Predictor*	*Hypothesis*	*Predicted sign*	*Support*	*Significant level*
Performance	Resource-based orientation	8	+	Yes (Br)	0.10
				No (Sp)	NS
	External knowledge	7	+	No (Br)	NS
				No (Sp)	NS
Resource-based orientation	Internal knowledge	4	+	Yes (Br)	0.05
				No (Sp)	NS
	External knowledge	5	+	No (Br)	NS
				Yes (Sp)	0.05
	Cross-functional orientation	6	+	Yes (Br)	0.05
				Yes (Sp)	0.10
Cross-functional orientation	Internal knowledge	2	+	Yes (Br)	0.05
				Yes (Sp)	0.05
	External knowledge	3	+	Yes (Br)	0.10
				No (Sp)	NS

identified regarding the statistical significance (Table VIII). Internal knowledge is positively related to external knowledge, confirming *H1* [covariance = 0.45 (Brazil), $p < 0.001$ and covariance = 0.23 (Spain), $p < 0.001$]. Internal knowledge is positively related to cross-functional orientation, 0.44 and 0.64 respectively in Brazil and Spain ($p < 0.05$). *H2*, which indicates that external knowledge is related to cross-functional orientation, was only weakly supported in the Brazilian sample (0.22, $p < 0.10$). Cross-functional orientation was associated with resource-based orientation [0.40, $p < 0.01$ (Brazil) and 0.17, $p < 0.10$ (Spain)] confirming *H6*. *H4*, which states that internal knowledge contributes to the resource-based orientation relationship, was only confirmed in the Brazilian sample (0.32, $p < 0.05$). Interestingly, the converse was found for Spain regarding support for *H5* that external knowledge leads to resource-based orientation (0.37, $p < 0.50$). Thus, the manner in which internal knowledge and external knowledge act to create resources differs across countries.

Surprisingly external knowledge is not related to market performance in the two samples, thus *H7* was not supported. Finally, resource-based orientation is positively and directly related to market performance – supporting *H8* – only in Brazil (0.10, $p < 0.10$). Notably, empirical testing of the hypothesized model (Figure 1) indicates that MSP is clearly related to knowledge integration; but country differences exist.

All companies in both studies have more than 100 employees, characterizing medium and large-sized companies. Also, both samples present similar size distribution (see Table II). In Brazil, for medium and large companies, the use of resources in a strategic approach presents more operational slack than in Spain and could directly influence their market performance (*H8*). The Spanish companies garner resource-based orientation directly through external knowledge, perhaps indicating a strategic capability of more advanced manufacturers; whereas no such effects were observed for Brazil. This difference can also be related to market competitiveness. Arguably, more sophisticated markets require a higher level of market acuity or a clearer view of what is occurring in the market place, influencing resource focus and consequently performance.

The three hypotheses that were supported across countries (*H1*, *H2* and *H6*) suggest that knowledge is a critical aspect in the proposed model, and it is related to cross-functional integration and resource-based orientation. Therefore, a resource-based orientation leads to the creation of differentiated products and capabilities not easily imitated by competitors, which from theory are key factors for a sustainable competitive advantage (Barney, 1991). Cross-functionality plays a central role is this process because it allows different functional areas to exchange tacit and explicit knowledge, which indicates that manufacturing should seek integration with other areas like marketing, R&D and finance, among others, in order to make business decisions, exchange strategic information from the market, or exchange new products and services.

Table VIII Effects of exogenous and prior endogenous variables on model constructs

	Cross-functional orientation						*Resource-based orientation*						*Performance*					
	Direct		*Indirect*		*Total*		*Direct*		*Indirect*		*Total*		*Direct*		*Indirect*		*Total*	
Effect on	*Brazil*	*Spain*	*Brazil*	*Spain*	*Brazil*	*Spain*	*Brazil*	*Spain*	*Brazil*	*Spain*	*Brazil*	*Spain*	*Brazil*	*Spain*	*Brazil*	*Spain*	*Brazil*	*Spain*
Internal knowledge	0.44**	0.64***	0.00	0.00	0.44**	0.64***	0.32	0.23	0.17**	0.11**	0.49*	0.12	0.00	0.00	0.13**	0.00	0.13**	0.00
External knowledge	0.22*	0.11	0.00	0.00	0.22*	0.11	0.14	0.38**	0.09	−0.01	0.23	0.37**	0.10	0.11	−0.05	−0.02	0.05	0.09
Cross-functional orientation							0.40***	0.17*	0.00	0.00	0.40***	0.17*	0.00	0.00	0.01**	0.01	0.01**	0.01
Resource based orientation													0.26*	0.06	0.00	0.00	0.26*	0.06

Notes: *$p < 0.10$; **$p < 0.05$; ***$p < 0.001$

Cross-country results

Based on Rungtusanatham *et al.* (2005), additional statistical tests evaluated the presence of other aspects related to cross-cultural influence over the results, as identified in the proposed path model. This analysis was based on a nonparametric test because the samples' variances in the case of the internal knowledge scales were not the same. Considering that nonparametric tests do not require assumptions about the shape of the underlying distribution, the Mann-Whitney test was used for a cross-country analysis with the four constructs identified. An ANOVA test was used for the other multi-item scales with acceptable difference in their variances (external knowledge, cross-functional orientation and resource-based orientation). Only cross-functional orientation presented a statistically significant result ($df = 207$, $F = 6.31$, $p < 0.05$, refer to Table IX). Internal and external knowledge did not present any difference in our comparative analyses. In this sense, marketing acuity has similar levels despite the country's sample analyzed. Companies from both countries are seeking to be aware of their external environment, are exploring their internal resources and are creating unique characteristics in their products. Therefore, *H9*, *H10* and *H12* were confirmed.

In contrast, *H11* was not confirmed, which suggests that higher levels of cross-functional orientation are needed when increasing levels of market sophistication are present. Therefore, responsiveness would be present when companies develop a cross-functional orientation. This is a possible result of the opening to the global market, which has obligated the Spanish firms to adopt more advanced management systems and to seek modern technologies in order to adapt themselves to the process of market integration into the EU. Therefore, this empirical result suggests that the economic environment is a key driver for a high level of cross-functional orientation.

The importance of knowledge integration is highly relevant when companies face global competition. Increasing levels of market sophistication may require continuous effort to integrate knowledge in order to compete with competitors from different regions. Other aspects related to cross-cultural specificities were not identified in the study. Moreover, our results suggest the need for a new mindset in manufacturing managers that will lead to proactive participation by manufacturing in the company's strategic process through cross-functional activities. It is important also that manufacturers are aware of how to integrate company resources in order to build growth strategies. Although conventional wisdom suggests that company location or industry may influence the whole MSP, the only aspect identified in this study was related to internal processes cross-functionality, which may in part be explained by the need for constant adaptation of internal processes to the changes in the marketplace in highly sophisticated markets.

Implications for researchers and practitioners

For managerial implications from this study, the level of cross-functional integration was higher in the Spanish sample (developed country) versus the Brazilian sample (emerging market). These country differences indicate the importance of understanding a country's competitiveness-evolution-cycle regarding levels of relative sophistication.

Table IX Nonparametric test statistics (Mann-Whitney U)

	Mean		*SD*			
	Spain	*Brazil*	*Spain*	*Brazil*	*Z*	*Signif.*
Internal knowledge	3.92	3.72	0.53	0.73	−1.43	0.15
External knowledge	3.42	3.52	0.84	0.85	−0.047	0.64
Cross-functional orientation	3.98	3.38	0.83	0.97	−4.50	0.00*
Resource-based orientation	3.78	3.72	0.90	0.89	−0.77	0.44

Notes: *Statistically significant

Therefore, the difference in cross-functional orientation suggests that different managerial practices are present in the samples. Future research may explore internal and external knowledge and increasing cross-functional integration as potential challenges for the big emerging countries (e.g. Brazil, Russia, India and China). The shift from a commodity-based economy to a more sophisticated economy requires a complete transformation in company processes. Manufacturing managers from emerging regions will have to see beyond the trivial aspects of production planning for exploring their resources with effectiveness. A relational view of management will be needed, integrating manufacturing to the whole company's strategic process.

Thus, exploiting internal resources, knowing market characteristics, and developing company's competencies are the current ordinary ''manufacturing tasks'' (using Skinner's expression), even with different environmental conditions. Our empirical findings confirm the current need for quick responses to the market. The proposed MSP model highlights the need for a company's internal conditions to integrate the existing knowledge embedded in the different functional areas beyond manufacturing. In this context, manufacturing plays a central role in the whole business strategic process; including investment decisions, new product development, and value creation in products and services.

Limitations of research/suggested future research

One limitation of this study is that the Brazilian sample is located in a specific region, and therefore some regional characteristics may be present. Another limitation was the application in a second country of a questionnaire originally developed in another language. The difference between sample sizes is also a possible source of bias in the results found.

Additionally, the data are based on responses from only one respondent in each company. The performance variable is also based on only one perceptual variable. Finally, the test of invariance analysis for the path analysis model showed a weaker influence of MSP on performance from a KBV perspective for the Spanish sample.

Further studies may explore this aspect in depth. Future studies also may develop other analyses linking environment and other managerial processes and practices beyond the manufacturing strategy process. Possibilities to expand these first analyses include other operations techniques (like lean production), other types of knowledge integration (concurrent engineering and project teams, among others) and small-sized companies. Also the KBV may be a rich approach for OM studies that focuses on technology adoption considering that this is a key aspect for highly competitive environments, such the current market conditions. Also KBV studies may expand the view of value creation in specific processes such as product development when this one involves different actors as, for example, focal company and suppliers.

Conclusions

This paper analyzed the role of organizational knowledge in MSP using a cross-country sample. The first contribution of this paper is related to the construct validation. In this way, constructs related to the manufacturing strategy process from a KBV were tested and validated in the pooled sample and in the split sample. In this sense, the results are very similar to the proposed model from the original baseline study (Paiva *et al.*, 2008). Slight differences regarding the statistic significance in the relationship between external knowledge and resource-based orientation were identified only in the Spanish sample, and may be explained by the inclusion of a new variable in the model and the exclusion of the variables related to information from the original study.

While the measures were validated in each country, the invariance tests showed that the scale relationships are not exactly the same in the model from each sample analyzed. Only *H1*, *H2* and *H6* were confirmed in both samples. *H3*, *H4* and *H8* were confirmed in the Brazilian sample and *H5* in the Spanish sample, indicating that the role manufacturing knowledge plays in competitiveness varies across countries. This is not surprising since

Spain is classified as a more advanced industrial nation, whereas Brazil is emerging. Surprisingly *H7* was not confirmed in both the samples. Possibly external knowledge is important for cross-functionality and resource-based orientation but influence market performance only indirectly.

It is worth mentioning that replication studies in OM areas are rare, however some advances related to the first study are identified. First, a variable related to market performance showed a positive relationship with the proposed model. Second, having a measurement scale tested in two competitive environments is important and relevant to advancing empirical science in OM, especially considering that properly validated OM scales are still scarce.

Substantive findings beyond scales validation also add to the study's contribution. Considering that Spanish manufacturers compete in a more sophisticated market than their Brazilian counterparts, cross-functional integration is likely to be associated with high value-added product creation. In addition the results suggest that resource-based orientation directly influences market performance in the Brazilian sample, while it is not identifiable in the Spanish sample.

Furthermore, the authors conjecture that the Brazilian companies present in the sample are more heterogeneous than the Spanish companies, especially when the resource-based orientation in their strategy is considered. In other words, Brazilian companies may have more slack resources than those in Spain, which fosters market performance. Country market-sophistication possibly leads to a more homogenous pattern of strategy formulation based on the company's resources. The results suggest that companies must orient their formulation processes based on their resources or they will not survive in more advanced markets.

The three hypotheses that were confirmed in both samples are related to knowledge. This finding highlights the key role of knowledge in the proposed model as related to cross-functional integration and resource-based orientation. In general, based on the results, external knowledge is more important (critical for competitiveness) in Spain than in Brazil. This aspect could be related to higher levels of competitiveness and dynamics in the Spanish environment. In Brazil, external knowledge is not taken into account (or is less so) for the resource-based orientation of MSP. According to that, the results suggest that external knowledge is not considered significantly determinant for market performance. The same does not occur in Spain, where the critical question for manufacturing is how to exploit external knowledge for value creation.

Comparing the constructs from the proposed model, only cross-functional orientation presented a statistically significant difference between Spanish and Brazilian samples. Therefore, other aspects related to cross-cultural specificities were not identified in the study.

References

Adam, E.E. and Swamidass, P.M. (1992), ''Assessing operations management from a strategic perspective'', in Voss, C.A. (Ed.), *Manufacturing Strategy – Process and Content*, Chapman Hall, London, pp. 373-400.

Adamides, E.D. and Pomonis, N. (2009), ''The co-evolution of product, production and supply chain decisions, and the emergence of manufacturing strategy'', *International Journal of Production Economics*, Vol. 121 No. 2, pp. 301-12.

Anderson, E.G. and Parker, G.G. (2010), ''Integrating information and knowledge work in outsourced, offshored, and other distributed business networks'', *Production and Operations Management*, Vol. 19 No. 3, p. 368.

Anderson, J.C., Schroeder, R.G. and Cleveland, G. (1991), ''The process of manufacturing strategy: some empirical observations and conclusions'', *International Journal of Operations Management*, Vol. 11 No. 3, pp. 86-110.

Andrews, K.R. (1971), *The Concept of Corporate Strategy*, McGraw-Hill/Irwin, New York, NY.

Argote, L., McEvily, B. and Reagans, R. (2003), ''Managing knowledge in organizations: an integrative framework and review of emerging themes'', *Management Science*, Vol. 49 No. 4, pp. 571-82.

Badri, M.A. and Davis, D. (2000), ''Operations strategy, environmental uncertainty and performance: a path analytic model of industries in developing countries'', *Omega*, Vol. 28 No. 2, pp. 155-73.

Barney, J. (1986), ''Strategic factors market: expectations, luck and business strategy'', *Management Science*, Vol. 32 No. 10, pp. 1232-41.

Barney, J. (1991), ''The resource-based model of the firm: origins, implications, and prospects'', *Journal of Management*, Vol. 17 No. 1, pp. 97-117.

Bierly, P. and Chakrabarti, A. (1996), ''Generic knowledge strategies in the US pharmaceutical industry'', *Strategic Management Journal*, Vol. 17, pp. 123-35.

Bollen, K.A. and Long, J.S. (1993), *Testing Structural Equation Models*, Sage Publications, Newbury Park, CA.

Boyer, K.K. and Lewis, M.W. (2002), ''Competitive priorities: investigating the need for trade-offs in operations strategy'', *Production and Operations Management*, Vol. 11 No. 1, pp. 9-20.

Boyer, K.K., Swink, M. and Rosenzweig, E.D. (2005), ''Operations strategy research in the POMS journal'', *Production and Operations Management*, Vol. 14 No. 4, pp. 442-9.

Brockman, B.K. and Morgan, R.M. (2003), ''The role of existing knowledge in new product innovativeness and performance'', *Decision Sciences*, Vol. 34 No. 2, pp. 385-420.

Brusoni, S. and Prencipe, A. (2002), ''Managing knowledge in loosely coupled networks: exploring the links between product and knowledge dynamism'', *Journal of Management Studies*, Vol. 38 No. 7, pp. 1019-35.

Bueno, E. and Salmador, M.P. (2003), ''Knowledge management in the emerging strategic business process'', *Journal of Knowledge Management*, Vol. 7 No. 3, pp. 5-17.

Cadogan, J.W., Diamantopoulos, A. and de Mortanges, C.P. (1999), ''A measure of export market orientation: scale development and cross-cultural validation'', *Journal of International Business Studies*, Vol. 30 No. 4, pp. 689-707.

Cheng, T.C. and Musaphir, H. (1996), ''Theory and practice of manufacturing strategy'', *International Journal of Production Research*, Vol. 34 No. 5, pp. 1243-59.

Cleveland, G., Schoereder, R.G. and Anderson, J.C. (1989), ''A theory of production competence'', *Decision Sciences*, Vol. 20 No. 4, pp. 655-68.

Coates, T.T. and McDermott, C.M. (2002), ''An exploratory analysis of new competencies: a resource-based view perspective'', *Journal of Operations Management*, Vol. 20 No. 5, pp. 435-50.

Cohen, W.M. and Levinthal, D.A. (1990), ''Absorptive capacity: a new perspective on learning and innovation'', *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 128-52.

Collis, D.J. and Montgomery, C.A. (1995), ''Competing on resources: strategy in the 1990s'', *Harvard Business Review*, Vol. 73 No. 4, pp. 118-28.

Craig, C.S. and Douglas, S.P. (2000), *International Marketing Research*, Wiley, Chichester.

Craighead, C.W., Hult, T.M. and Ketchen, D. (2009), ''The effects of innovation-cost strategy, knowledge, and action in the supply chain on firm performance'', *Journal of Operations Management*, Vol. 27 No. 5, pp. 405-21.

Dillman, D.A. (2007), *Mail and Internet Surveys*, John Wiley & Sons, New York, NY.

Dyer, J. and Nobeoka, K. (2000), ''Creating and managing a high-performance knowledge-sharing network: the Toyota case'', *Strategic Management Journal*, Vol. 21 No. 3, pp. 345-67.

Fine, C.H. and Hax, A.C. (1985), ''Manufacturing strategy: a methodology and an illustration'', *Interfaces*, Vol. 15 No. 6, pp. 28-46.

Flynn, B.B. and Flynn, E.J. (2004), ''An exploratory study of the nature of cumulative capabilities'', *Journal of Operations Management*, Vol. 22 No. 5, pp. 439-57.

Franco, G.H.B. (1999), *O Desafio Brasileiro: Ensaios sobre Desenvolvimento*, Editora 34, Globalização e Moeda, São Paulo.

Frohlich, M. and Dixon, J. (2006), ''Reflections on replication in OM research and this special issue'', *Journal of Operations Management*, Vol. 24 No. 6, pp. 865-7.

Frohlich, M.T. and Westbrook, R. (2001), ''Arcs of integration: an international study of supply chain strategies'', *Journal of Operations Management*, Vol. 19 No. 2, pp. 185-200.

Fugate, B.S., Stank, T.P. and Mentzer, J.T. (2009), ''Linking improved knowledge management to operational and organizational performance'', *Journal of Operations Management*, Vol. 27 No. 3, pp. 247-64.

Germain, R., Droge, C. and Christensen, W. (2001), ''The mediating role of operations knowledge in the relationship of context with performance'', *Journal of Operations Management*, Vol. 19 No. 4, pp. 453-69.

Ghoshal, S. and Nohria, N. (1989), ''Internal differentiation within multinational corporations'', *Strategic Management Journal*, Vol. 10 No. 4, pp. 323-37.

Giffi, C., Roth, A.V. and Seal, G. (1990), *Competing in World Class Manufacturing*, Irwin Professional Publishing, Chicago, IL.

Grant, R.M. (1991), ''The resource-based theory of competitive advantage: implication for strategy formulation'', *California Management Review*, Vol. 33 No. 3, pp. 114-35.

Grant, R.M. (1996), ''Prospering in dynamic-competitive environments: organizational capability as knowledge integration'', *Organization Science*, Vol. 7 No. 4, pp. 375-87.

Grant, R.M. (1997), ''The knowledge-based view of the firm: implications for management practice'', *Long Range Planning*, Vol. 30 No. 3, pp. 450-4.

Grant, R.M. (2002), ''The knowledge-based view of the firm'', in Choo, C.W. and Bontis, N. (Eds), *The Strategic Management of Intellectual Capital and Organizational Knowledge*, Oxford University Press, Oxford.

Gupta, Y.P. and Lonial, S.C. (1998), ''Exploring linkages between manufacturing strategy, business strategy, and organizational strategy'', *Production and Operations Management*, Vol. 7 No. 3, pp. 243-64.

Hausman, W.H., Montgomery, D.B. and Roth, A.V. (2002), ''Why should marketing and manufacturing work together? Some exploratory empirical results'', *Journal of Operations Management*, Vol. 20 No. 3, pp. 241-57.

Hayes, R.H. and Pisano, G.P. (1996), ''Manufacturing strategy: at the intersection of two paradigm shifts'', *Production and Operations Management*, Vol. 5 No. 1, pp. 25-41.

Hayes, R.H. and Wheelwright, R. (1985), ''Competing through manufacturing'', *Harvard Business Review*, Vol. 63 No. 1, pp. 99-110.

Helfat, C.E. and Peteraf, M.A. (2003), ''The dynamic resource-based view: capability cycles'', *Strategic Management Journal*, Vol. 24 No. 10, pp. 997-1010.

Henriksen, B. and Rolstadås, A. (2010), ''Knowledge and manufacturing strategy – how different manufacturing paradigms have different requirements to knowledge. Examples from the automotive industry'', *International Journal of Production Research*, Vol. 48 No. 8, pp. 2413-30.

Hill, T. (1995), *Manufacturing Strategy – Text and Cases*, Macmillian Business, London.

Huber, G.P. (1991), ''Organizational learning: the contributing processes and the literatures'', *Organization Science*, Vol. 2 No. 1, pp. 88-115.

Hult, G.T., Ketchen, D.J. Jr, Cavusgil, S.T. and Calantone, R.J. (2006), ''Knowledge as strategic resource in supply chain'', *Journal of Operations Management*, Vol. 24 No. 5, pp. 458-75.

Instituto Brasileiro de Geografia e Estatística (IBGE) (2003), available at: www.ibge.org.br

Itami, H. (1987), *Mobilizing Invisible Assets*, Harvard University Press, Cambridge, MA.

Jaikumar, R. and Bohn, R. (1986), ''The development of intelligent systems for industrial use: a conceptual framework'', *Research on Technological Innovation, Management and Policy*, Vol. 3, pp. 169-211.

Jung, Y.L., Swink, M. and Pandejpong, T. (2011), ''The roles of worker expertise, information sharing quality, and psychological safety in manufacturing process innovation: an intellectual capital perspective'', *Production and Operations Management*, Vol. 20 No. 4, pp. 556-70.

Kline, B. (1995), *Principles and Practice of Structural Equation Modeling*, Rex Guilford Press, New York, NY.

Kogout, B. and Zander, U. (1992), ''Knowledge of the firm, combinative capabilities, and the replication of the technology'', *Organization Science*, Vol. 3 No. 3, pp. 383-97.

Kumar, J.A. and Ganesh, L.S. (2011), ''Balancing knowledge strategy: codification and personalization during product development'', *Journal of Knowledge Management*, Vol. 15 No. 1, pp. 118-35.

Leonard-Barton, D. (1994), *Wellsprings of Knowledge*, Harvard Business School Press, Boston, MA.

Levitt, B. and March, J.G. (1988), ''Organizational learning'', *Annual Review of Sociology*, Vol. 14 No. 3, pp. 319-40.

Li, Y., Liu, Y. and Liu, H. (2011), ''Co-opetition, distributor's entrepreneurial orientation and manufacturer's knowledge acquisition: evidence from China'', *Journal of Operations Management*, Vol. 29 No. 1/2, pp. 128-42.

Luo, Y. and Park, S.H. (2001), ''Strategic alignment and performance of market-seeking MNCs in China'', *Strategic Management Journal*, Vol. 22 No. 2, pp. 141-55.

Malhotra, M.K. and Sharma, S. (2002), ''Spanning the continuum between marketing and operations'', *Journal of Operations Management*, Vol. 20 No. 3, pp. 209-19.

Malhotra, N. (2006), *Marketing Research: An Applied Orientation*, Prentice Hall, New York, NY.

Masakure, O., Vieira, L.M., Traill, W.B. and Henson, S. (2004), ''Global food chain: what is the alternative for developing countries?'', in Bremmers, H.J., Omta, S.W.F., Trienekens, J.H. and Wubben, E. (Eds), *Dynamics in Chains and Networks*, Wageningen Academic Publishers, Wageningen.

Maturana, H.R. and Varela, T.J. (1980), *Autopoeisis and Cognition*, Reidl, London.

Menda, R. and Dilts, D. (1997), ''The manufacturing strategic formulation process: linking multifunctional viewpoints'', *Journal of Operations Management*, Vol. 15 No. 2, pp. 223-41.

Menon, T. and Pfeffer, J. (2003), ''Valuing internal vs external knowledge: explaining the preference for outsiders'', *Management Science*, Vol. 49 No. 4, pp. 497-513.

Miller, J.G. and Roth, A.V. (1994), ''A taxonomy of manufacturing strategies'', *Management Science*, Vol. 40 No. 3, pp. 285-304.

Modi, S.B. and Mabert, V.A. (2007), ''Supplier development: improving supplier performance through knowledge transfer'', *Journal of Operations Management*, Vol. 25 No. 1, pp. 42-64.

Mohanty, R.P. and Deshmukh, S.G. (1999), ''Evaluating manufacturing strategy for a learning organization: a case'', *International Journal of Operations & Production Management*, Vol. 19 No. 3, pp. 308-28.

Mohrman, S.A., Finegold, D. and Mohrman, A.M. (2003), ''An empirical model of the organization knowledge system in new product development firms'', *Journal of Engineering and Technology Management*, Vol. 20 Nos 1/2, pp. 7-38.

Mullen, M.R. (1995), ''Diagnosing measurement equivalence in cross-national research'', *Journal of International Business Studies*, Vol. 26 No. 3, pp. 573-96.

Narasimhan, R. and Wang, X. (2000), ''A re-examination of measuring the congruence between market requirements and manufacturing: a methodology and illustration'', *Decision Sciences*, Vol. 31 No. 1, pp. 223-31.

Nonaka, I. (1994), ''A dynamic theory of organizational knowledge creation'', *Organization Science*, Vol. 5 No. 1, pp. 14-37.

Nonaka, I. and Konno, N. (1998), ''The concept of *ba*: building a foundation for knowledge creation'', *California Management Review*, Vol. 40 No. 3, pp. 41-53.

Nonaka, I. and Takeuchi, H. (1995), *The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, New York, NY.

Nonaka, I., Toyama, R. and Nagata, A. (2000), ''A firm as a knowledge-creating entity: a new perspective on the theory of the firm'', *Industrial and Corporate Change*, Vol. 9 No. 1, pp. 1-22.

Okhuysen, G.A. and Eisenhardt, K.M. (2002), ''Integrating knowledge in groups: how formal interventions enable flexibility'', *Organization Science*, Vol. 13 No. 4, pp. 370-86.

Paiva, E.L., Roth, A.V. and Fensterseifer, J.E. (2008), ''Organizational knowledge and the manufacturing strategy process: a resource-based view analysis'', *Journal of Operations Management*, Vol. 26 No. 1, pp. 115-32.

Papke-Shields, K.E., Malhotra, M.K. and Varun, G. (2002), ''Strategic manufacturing planning systems and their linkage to planning system success'', *Decision Sciences*, Vol. 33 No. 1, pp. 1-30.

Penrose, E. (1959), *The Theory of the Growth of the Firm*, Wiley, New York, NY.

Peteraf, M.A. (1993), ''The cornerstones of competitive advantage: a resource-based view'', *Strategic Management Journal*, Vol. 14 No. 3, pp. 179-91.

Pettigrew, A.M. (1997), ''Strategy formulation as a political process'', *International Studies of Management and Organization*, Vol. 7 No. 2, pp. 78-87.

Platts, K.W. and Gregory, M.J. (1992), ''A manufacturing audit approach to strategy formulation'', in Voss, C. (Ed.), *Manufacturing Strategy – Process and Content*, Chapman & Hall, London.

Podsakoff, 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.

Polanyi, M. (1958), *Personal Knowledge*, Routledge Kegan Paul, New York, NY.

Polanyi, M. (1967), *The Tacit Dimension*, Doubleday Press, New York, NY.

Porter, M.E. (1980), *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, Free Press, New York, NY.

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

Richtnér, A. and Åhlström, P. (2010), ''Top management control and knowledge creation in new product development'', *International Journal of Operations & Production Management*, Vol. 30 No. 10, pp. 1006-28.

Rosenzweig, E.D. and Roth, A.V. (2004), ''Towards a theory of competitive progression: evidence from high-tech manufacturing'', *Production and Operations Management*, Vol. 13 No. 4, pp. 354-68.

Rosenzweig, E.D., Roth, A.V. and Dean, J.W. Jr (2003), ''The influence of an integration strategy on competitive capabilities and business performance: an exploratory study of consumer products manufacturers'', *Journal of Operations Management*, Vol. 21 No. 4, pp. 437-56.

Roth, A.V. (1996a), ''Achieving strategic agility through economies of knowledge'', *Strategy and Leadership*, Vol. 24 No. 2, pp. 30-7.

Roth, A.V. (1996b), *Neo-Operations Strategy in Handbook of Technology Management*, McGraw-Hill, New York, NY.

Roth, A.V. and Miller, J.G. (1992), ''Success factors in manufacturing'', *Business Horizons*, Vol. 35 No. 4, pp. 73-81.

Roth, A.V., Schroeder, R.G., Huang, X. and Kristal, M.M. (2008), *Handbook of Metrics for Research in Operations Management: Multi-Item Measurement Scales and Objective Items*, Sage Publications, Los Angeles, CA.

Rungtusanatham, M., Zhao, X. and Lee, T. (2008), ''Pooling data across transparently-different groups of key informants: measurement equivalence and survey research'', *Decision Sciences*, Vol. 39 No. 1, pp. 115-45.

Rungtusanatham, M., Forza, C., Koka, B., Salvador, F. and Nie, W. (2005), ''TQM across multiple countries: convergence hypothesis versus national specificity arguments'', *Journal of Operations Management*, Vol. 23 No. 1, pp. 43-63.

Schroeder, R.G., Bates, K.A. and Juntilla, M.M. (2002), ''A resource-based view of manufacturing strategy and the relationship to manufacturing performance'', *Strategic Management Journal*, Vol. 23 No. 2, pp. 105-17.

Siemieniuch, C.E. and Sinclair, M.A. (2004), ''A framework for organizational readiness for knowledge management'', *International Journal of Operations & Production Management*, Vol. 24 No. 1, pp. 79-98.

Siemsen, E., Roth, A.V. and Balasubramanian, S. (2007), ''How motivation, opportunity, and ability drive knowledge sharing: the constraining-factor model'', *Journal of Operations Management*, Vol. 26 No. 3, pp. 426-45.

Singh, K. (2003), ''Increasing replication for knowledge accumulation in strategy research'', *Journal of Management*, Vol. 29 No. 4, pp. 533-49.

Skinner, W. (1969), ''Manufacturing – the missing link in the corporate strategy'', *Harvard Business Review*, May/June, pp. 5-14.

Slack, N. (1994), ''The importance-performance matrix as a determinant of improvement priority'', *International Journal of Operations and Production Journal*, Vol. 14 No. 5, pp. 59-75.

Spencer, J.C. (1989), *Industries Recipes: The Nature and Sources of Managerial Judgement*, Blakwell, Oxford.

Stewart, T.A. (1997), *Intellectual Capital: The New Wealth of Organizations*, Doubleday Currency, New York, NY.

Swamidass, P. and Newell, W.T. (1987), ''Manufacturing strategy, environmental uncertainty and performance: a path analysis model'', *Management Science*, Vol. 33 No. 4, pp. 509-24.

Swink, M., Narasimhan, R. and Kim, S.W. (2005), ''Decision manufacturing practices and strategy integration: effects on cost efficiency, flexibility, and market-based performance'', *Decision Sciences*, Vol. 36 No. 3, pp. 427-57.

Teece, D., Pisano, G. and Shuen, A. (1997), ''Dynamic capabilities and strategic management'', *Strategic Management Journal*, Vol. 18 No. 7, pp. 509-33.

Teigland, R. and Wasko, M.M. (2003), ''Integrating knowledge through information trading: examining the relationship between boundary-spanning communication and individual performance'', *Decision Sciences*, Vol. 34 No. 2, pp. 261-87.

Tracey, M., Vonderembse, M.A. and Lim, J.S. (1999), ''Manufacturing technology and strategy formulation: keys to enhancing competitiveness and improving performance'', *Journal of Operations Management*, Vol. 17 No. 4, pp. 411-28.

Venkatraman, N. (1989), ''The concept of fit in strategy research: toward verbal and statistical correspondence'', *The Academy of Management Review*, Vol. 14 No. 3, pp. 423-44.

Vickery, S.K. (1991), ''A theory of production competence revisited'', *Decision Sciences*, Vol. 22 No. 3, pp. 635-43.

Vickery, S.K., Droge, C.E. and Markland, R.E. (1993), ''Production competence and business strategy: do they affect business performance?'', *Decision Sciences*, Vol. 24 No. 2, pp. 435-55.

Von Krogh, G., Nonaka, I. and Aben, M. (2001), ''Making the most of your company's knowledge: a strategic framework'', *Long Range Planning*, Vol. 34 No. 4, pp. 421-39.

Voss, C.A. (1992), ''Manufacturing strategy as a process'', in Voss, C.A. (Ed.), *Manufacturing Strategy – Process and Content*, Chapman Hall, London, pp. 86-91.

Voss, C.A. (2005), ''Alternative paradigms for manufacturing strategy'', *International Journal of Operations & Production Management*, Vol. 25 No. 12, pp. 1211-22.

Ward, P.T. and Duray, R. (2000), ''Manufacturing strategy in context: environment, competitive strategy and manufacturing strategy'', *Journal of Operations Management*, Vol. 18 No. 2, pp. 123-38.

Ward, P.T., Leong, G.K. and Boyer, K.K. (1994), ''Manufacturing proactiveness and performance'', *Decision Sciences*, Vol. 25 No. 3, pp. 337-58.

Wernerfelt, B. (1984), ''A resource-based view of the firm'', *Strategic Management Journal*, Vol. 5 No. 2, pp. 171-80.

Wheelwright, S.C. (1978), ''Reflecting corporate strategy in manufacturing decisions'', *Business Horizons*, Vol. 21 No. 1, pp. 57-66.

Wheelwright, S.C. (1984), ''Manufacturing strategy: defining the missing link'', *Strategic Management Journal*, Vol. 5 No. 1, pp. 77-91.

Whittington, R. (2003), ''The work of strategizing and organizing: for a practice perspective'', *Strategic Organization*, Vol. 1 No. 1, pp. 117-25.

Whittington, R. (2006), ''Completing the practice turn in strategy research'', *Organization Studies*, Vol. 27 No. 5, pp. 613-34.

Zahra, E. and Das, S.R. (1993), ''Building competitive advantage on manufacturing resources'', *Long Range Planning*, Vol. 28 No. 2, pp. 90-100.

Zhang, C. and Dhaliwal, J. (2009), ''An investigation of resource-based and institutional theoretic factors in technology adoption for operations and supply chain management'', *International Journal of Production Economics*, Vol. 120 No. 1, pp. 252-69.

Further reading

Amundson, S. (1998), ''Relationships between theory-driven empirical research in operations management and other disciplines'', *Journal of Operations Management*, Vol. 16 No. 4, pp. 341-59.

Becker, M.C. and Zirpoli, F. (2003), ''Organizing new product development: knowledge hollowing-out and knowledge integration – the FIAT Auto case'', *International Journal of Operations & Production Management*, Vol. 23 No. 9, pp. 1033-61.

De Geus, A.P. (1988), ''Planning as learning'', *Harvard Business Review*, Vol. 66 No. 2, pp. 70-4.

Porter, M.E. (1990), *Competitive Advantages of Nations*, Free Press, New York, NY.

Roth, A.V. and Giffi, C.A. (1995), ''Winning in global markets neo-operations strategies in US, Japanese manufacturing'', *OM Review*, Vol. 10 No. 4, pp. 1-36.

Roth, A.V. and Jackson, W. (1995), ''Strategic determinants of service quality and performance: evidence from the banking industry'', *Management Science*, Vol. 41 No. 11, pp. 1720-33.

Schroeder, R.G. and Lahr, T.N. (1992), ''Development of manufacturing strategy: a proven process'', in Ettlie, J.E., Burnstein, M.C. and Fiegenbaum, A. (Eds), *The Research Agenda for the Next Decade*, Klwer Academic Publications, Boston, MA.

Senge, P.M. (1990), *The Fifth Discipline*, Doubleday, New York, NY.

Tsoukas, H. and Vladimirou, E. (2001), ''What is organization knowledge?'', *Journal of Management Studies*, Vol. 38 No. 7, pp. 973-93.

Venkatraman, N. and Camillus, J.C. (1984), ''Exploring the concept of 'fit' in strategy management'', *Academy of Management Review*, Vol. 9 No. 3, pp. 513-25.

Appendix

Measurement equivalence was based on the configural equivalence (CE) and metric equivalence. CE ''[. . .] seeks to determine the extent to which the conceptual domain that a measurement instrument is designed to empirically capture is identical across different groups'' (Rungtusanatham *et al.*, 2008, p. 124). This is evaluated through a number of factors and their loadings in the measurement model in the CFA. Sample 1 was the Brazilian baseline sample (Paiva *et al.*, 2008) and sample 2 was the Spanish replication sample. The two models presented satisfactory fit indices and factor loadings, suggesting CE. Only one factor (IK1) was statistically significant in the Brazilian sample and not in Spain (Table AI). It is worth noting that the pooled sample indicate good fit indices (χ^2=4.38, d.f. = 2, $p < 0.11$, RMR = 0.03, RMSEA = 0.08, GFI = 0.99, AGFI = 0.94, NFI = 0.98, IFI = 0.99, CFI = 0.99) Table AI presents these results.

Complementarily, metric invariance was tested for the measurement model (Hausman *et al.*, 2002). The test of the calibration model for form invariance (*H*form) against the hold-out sample presented satisfactory results ($\Delta\chi^2$=1.24, Δdf = 2, $p = 0.68$). The fit indices also presented high values (above 0.97, see Table AII). Therefore, the first test suggests that both of the samples present the same form. Additionally, the second test of invariance (Hausman *et al.*, 2002). The authors constrained all the factor loadings to be equal across Brazilian and Spanish samples ($H_{\Gamma\beta}$). In this case, the results indicate a poor model fit, showing that the model varies across the samples. Finally, the authors analyzed the test of χ^2 difference. The results ($\Delta\chi^2$=797.36, Δdf = 7, $p = 0.54$) confirm that each sample is related to different form models. Therefore the results suggest that the coefficients were different across the samples, indicating the need for two separate path analysis.

Table AI Analysis of configural invariance for CFA

		Factor loadings				*Model fit*		
		Brazil	*Spain*	χ^2	*df*	*RMSEA*	*TLI*	*CLI*
Sample 1 – Brazil				29.82	29	0.02	0.99	0.99
Sample 2 – Spain				19.88	29	0.00	1.00	1.00
Factor								
Internal knowledge	IK1	0.81**	0.31					
	IK2	1.00	1.00					
External knowledge	EK1	0.69**	0.76*					
	EK2	1.00	1.00					
	EK3	0.89**	0.78**					
Cross-functional orientation	CF1	1.00	1.00					
	CF2	0.61*	0.97*					
Resource-based orientation	RBO1	0.58**	0.76*					
	RBO2	0.83**	0.95**					
	RBO3	1.00	1.00					

Notes: *p<0.01; **$p < 0.000$

Table AII Tests for invariance of path model across calibration and cross-validation samples

	Hform model	$H_{\Gamma\beta}$ model
Chi-square	1.24	798.60
Degrees of freedom (df)	2	9
Probability level	0.54	0.000
Goodness-of-fit (GFI)	0.99	0.54
Adjusted goodness-of-fit (AGFI)	0.97	0.24
Standardized RMR	0.01	6.77
RMSEA	0.00	0.65
Incremental indices		
Normed fit index (NFI)	0.98	−2.73
Incremental fit index (IFI)	1.00	−2.86
Comparative fit index (CFI)	1.00	0.00

Selected questions (Paiva et al.*, 2008)*

Figure A1 Selected questions

IK1 - Manufacturing knows how to explore the company's internal resources, which leads to a competitive advantage.

IK2 **-** Manufacturing knows how to seek more integration with other functional groupings of the company in order to reinforce their internal resources.

EK1 - Manufacturing clearly understands the primary opportunities to be explored in the marketplace.

EK2 - Manufacturing knows the performance of its main competitors.

EK3 - Manufacturing clearly understands the existing threats in the marketplace.

CF - Indicate to what extent the following activities are based on cross-functional activities:

CF1 Decisions related to manufacturing, marketing and R&D strategies.

CF2 Decisions related to the growth strategy of the business unit.

RBO - Indicate the extent to which the manufacturing strategy formulation is related to the following:

RBO1 Providing product characteristics that are valued by the customers.

RBO2 Seeking competitive resources, which the competitors do not have.

RBO3 Creating resources not easily imitable by the competitors.

Scale

Never	Rarely	Sometimes	Frequently	Always
1	**2**	**3**	**4**	**5**

PERF - How would you assess your position in your primary markets – the products and markets you focus on most?

− Market leader − clear number 1 or 2.	4
− One of the top 3 or 4 in the market, but not the clear leader.	3

About the authors

Ely Laureano Paiva is Associate Professor at Fundacao Getulio Vargas (FGV) in Sao Paulo, Brazil. He was Visiting Scholar at The University of North Carolina, Chapel Hill and at The University of Texas Pan American. He has published in journals like *Journal of Operations Management*, *Journal of Cleaner Production*, *Journal of Production Economics*, *International Journal of Innovation*, *Learning and Industrial Management & Data Systems* and the main Brazilian journals like *Brazilian Academy Review*. He has worked as a consultant for Brazilian

and international companies. Ely's research project is funded by the Brazilian Research National Agency (CNPq) and FAPESP. He is Editor of the *Journal of Operations and Supply Chain Management*. Ely Laureano Paiva is the corresponding author and can be contacted at: ely.paiva@fgv.br

Elena Revilla Gutierrez is a Professor of Operations Management at Instituto de Empresa, Spain. Elena holds a doctoral degree in Economics and Business Administration from the Universidad de Valladolid (Spain). She also holds an MA in Science and Technology from Universidad Carlos III, Madrid. She was a post-doctoral fellow at University of North Carolina, Chapel Hill and visiting scholar in MIT. She received the 1996 award for the best doctoral dissertation granted by the Club Gestión de Calidad. She has published in journals including *Journal of Operations Management*, *Decision Sciences*, *Journal of the Operation Research Society*, *Management Learning*, *Journal of Production Economics*, *International Journal of Technology Management*, *Scandinavia Management Journal*, *Journal of High Technology Management*, *Management Research*, and *Harvard-Deusto Business Review*. Her research interests are in collaborative learning and innovation in settings such as operations, product development and supply chain.

Aleda V. Roth is the Burlington Industries Professor of Supply Chain Management at Clemson University. She is an internationally recognized empirical scholar in service, manufacturing, and supply chain strategies. She is a prolific researcher with over 200 publications. She ranks in the top 1 percent of POM scholars in the US and in the top 2 percent of all Journal of Operations Management authors. Her latest co-authored book is entitled *Handbook of Metrics for Operations Management: Multi-item Measurement Scales and Objective Items*. Aleda has received over 65 research awards. She was named as a Distinguished Fellow of M&SOM Society (INFORMS), Fellow of the Production and Operations Management Society, Fellow of the Decision Sciences Institute, an International Fellow of the Advanced Institute of Management Research-UK, and Arizona State University's Center for Services Leadership Distinguished Faculty. Aleda received the 2009 Lifetime Achievement Award from POMS Service Management College and was listed as a Stellar Scholar in POM. She is a member of the Supply Chain Thought Leaders Roundtable, The Conference Board's Business Performance Excellence Council, and The Council on Competitiveness' flagship US Manufacturing Competitiveness Initiative. Aleda served as President of POMS; Department Editor for *Management Science* and Deputy Editor-in-Chief for *Manufacturing and Service Operations (M&SOM)*; and is currently a Department Editor for *POM* and an Associate Editor for *Decision Sciences* and the *JSCM*.