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

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

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
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 (Richtrnér 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 (Siemensen 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
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

<table>
<thead>
<tr>
<th>Construct</th>
<th>Domain</th>
<th>Theoretical references</th>
</tr>
</thead>
<tbody>
<tr>
<td>External knowledge (EK)</td>
<td>Extent to which manufacturing knows the threats and opportunities in the marketplace</td>
<td>Cohen and Levinthal (1990); Leonard-Barton (1994); Roth (1996b); Grant (1997); Badri et al. (2000); Germain et al. (2001); Grant (2002); Nonaka (1994); Nonaka and Takeuchi (1995); Roth (1996b); Grant (1997); Dyer and Noboeoka (2000); Germain et al. (2001); Grant (2002); 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)</td>
</tr>
<tr>
<td>Internal knowledge (IK)</td>
<td>Extent to which manufacturing knows how to explore the firm's internal resources</td>
<td>Wernerfelt (1984); Barney (1991); Collis and Montgomery (1995); Stewart (1997); Schroeder et al. (2002); Coates and McDermott (2002)</td>
</tr>
<tr>
<td>Cross-functional orientation (CF)</td>
<td>Extent to which manufacturing participates in the strategic process</td>
<td>Wernerfelt (1984); Barney (1991); Collis and Montgomery (1995); Stewart (1997); Schroeder et al. (2002); Coates and McDermott (2002)</td>
</tr>
<tr>
<td>Resource-based orientation (RBO)</td>
<td>Extent to which manufacturing creates inimitable value in products from existing internal resources</td>
<td>Wernerfelt (1984); Barney (1991); Collis and Montgomery (1995); Stewart (1997); Schroeder et al. (2002); Coates and McDermott (2002)</td>
</tr>
</tbody>
</table>
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:

\[ H_2. \] Internal knowledge is positively and directly related to cross-functional orientation.

\[ H_3. \] 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:

\[ H_4. \] Internal knowledge is positively and directly related to resource-based orientation.

\[ H_5. \] External knowledge is positively and directly related to resource-based orientation.

\[ H_6. \] Cross-functional orientation is positively and directly related to resource-based orientation.

\[ H_7. \] External knowledge is positively related to market performance.

\[ H_8. \] 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
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>
<thead>
<tr>
<th>Table II</th>
<th>Industry sample distribution by country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>Brazil</td>
</tr>
<tr>
<td>Number of respondents</td>
<td>%</td>
</tr>
<tr>
<td>Food</td>
<td>30</td>
</tr>
<tr>
<td>Electronics</td>
<td>12</td>
</tr>
<tr>
<td>Machines</td>
<td>23</td>
</tr>
<tr>
<td>Transport equipment</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table III</th>
<th>Company size distribution by country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>Brazil</td>
</tr>
<tr>
<td>Number of companies</td>
<td>%</td>
</tr>
<tr>
<td>100-499</td>
<td>58</td>
</tr>
<tr>
<td>500-1,000</td>
<td>13</td>
</tr>
<tr>
<td>More than 1,000</td>
<td>7</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>RBO1</th>
<th>RBO2</th>
<th>RBO3</th>
<th>IK1</th>
<th>EK1</th>
<th>CF1</th>
<th>CF2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.17</td>
<td></td>
<td></td>
<td>0.12*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.33***</td>
<td></td>
<td></td>
<td>0.20**</td>
<td></td>
<td>0.18*</td>
<td>0.29**</td>
</tr>
</tbody>
</table>

*Note:* *p < 0.10; **p < 0.05; ***p < 0.01*
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, which leads to a competitive advantage” (IK1), and “manufacturing knows how to seek more integration with other functional areas of the company to reinforce 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 marketplace (EK1), manufacturing knows the performance of its 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).

### Table IV

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

**Notes:** General statistics for goodness-of-fit for the CFA: $\chi^2 = 54.65$, 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

<table>
<thead>
<tr>
<th></th>
<th>Internal knowledge</th>
<th>External knowledge</th>
<th>Cross-functional orientation</th>
<th>Resource-based orientation</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>3.87</td>
<td>3.46</td>
<td>3.75</td>
<td>3.75</td>
<td>3.24</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>0.61</td>
<td>0.84</td>
<td>0.93</td>
<td>0.89</td>
<td>0.82</td>
</tr>
<tr>
<td><strong>Correlation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal knowledge</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External knowledge</td>
<td>0.60**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-functional orientation</td>
<td>0.41**</td>
<td>0.21**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource-based orientation</td>
<td>0.42**</td>
<td>0.45**</td>
<td>0.37**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>0.05</td>
<td>0.06</td>
<td>0.15*</td>
<td>0.11</td>
<td>1.00</td>
</tr>
</tbody>
</table>
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 tested 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>
<thead>
<tr>
<th>Table VI</th>
<th>Path analyses results: regression weights and general statistics for goodness-of-fit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Predictor</strong></td>
<td><strong>Brazil</strong></td>
</tr>
<tr>
<td>Sample 1 – Brazil</td>
<td>0.64</td>
</tr>
<tr>
<td>Sample 2 – Spain</td>
<td>1.24</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td><strong>Performance</strong></td>
</tr>
<tr>
<td></td>
<td><strong>External knowledge</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Internal knowledge</strong></td>
</tr>
<tr>
<td></td>
<td><strong>External knowledge</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Internal knowledge</strong></td>
</tr>
<tr>
<td></td>
<td><strong>External knowledge</strong></td>
</tr>
</tbody>
</table>

Notes: Estimated from structural equation modeling; *p < 0.10; **p < 0.05; ***p < 0.01
identified regarding the statistical significance (Table VIII). Internal knowledge is positively related to external knowledge, confirming H1 \[\text{covariance} = 0.45 \text{ (Brazil), } p < 0.001 \text{ and covariance} = 0.23 \text{ (Spain), } p < 0.001\]. 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 \[0.40, p < 0.01 \text{ (Brazil) and 0.17, } p < 0.10 \text{ (Spain)}\] 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 in 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 VII: Support for hypotheses by country: results from path model

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Predictor</th>
<th>Hypothesis</th>
<th>Predicted sign</th>
<th>Support</th>
<th>Significant level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Resource-based orientation</td>
<td>8</td>
<td>+</td>
<td>Yes (Br)</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>+</td>
<td>No (Br)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>External knowledge</td>
<td>4</td>
<td>+</td>
<td>Yes (Br)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>+</td>
<td>No (Br)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Internal knowledge</td>
<td>6</td>
<td>+</td>
<td>Yes (Sp)</td>
<td>0.10</td>
</tr>
<tr>
<td>Cross-functional orientation</td>
<td>Internal knowledge</td>
<td>2</td>
<td>+</td>
<td>Yes (Br)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>External knowledge</td>
<td>3</td>
<td>+</td>
<td>Yes (Br)</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No (Sp)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Cross-functional orientation</td>
<td></td>
<td></td>
<td></td>
<td>Resource-based orientation</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td>Direct</td>
<td>Indirect</td>
<td>Total</td>
<td>Direct</td>
<td>Indirect</td>
</tr>
<tr>
<td>Internal knowledge</td>
<td>0.44**</td>
<td>0.64***</td>
<td>0.00</td>
<td>0.00</td>
<td>0.44**</td>
</tr>
<tr>
<td>External knowledge</td>
<td>0.22*</td>
<td>0.11</td>
<td>0.00</td>
<td>0.00</td>
<td>0.22*</td>
</tr>
<tr>
<td>Cross-functional orientation</td>
<td>0.40***</td>
<td>0.17*</td>
<td>0.00</td>
<td>0.00</td>
<td>0.40***</td>
</tr>
<tr>
<td>Resource based orientation</td>
<td>0.26*</td>
<td>0.06</td>
<td>0.00</td>
<td>0.00</td>
<td>0.26*</td>
</tr>
</tbody>
</table>

**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)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Z</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal knowledge</td>
<td>3.92</td>
<td>0.53</td>
<td>–1.43</td>
<td>0.15</td>
</tr>
<tr>
<td>External knowledge</td>
<td>3.42</td>
<td>0.84</td>
<td>–0.047</td>
<td>0.64</td>
</tr>
<tr>
<td>Cross-functional orientation</td>
<td>3.98</td>
<td>0.83</td>
<td>–4.50</td>
<td>0.00*</td>
</tr>
<tr>
<td>Resource-based orientation</td>
<td>3.78</td>
<td>0.90</td>
<td>–0.77</td>
<td>0.44</td>
</tr>
</tbody>
</table>

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


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


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


Further reading


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 ($\chi^2 = 4.38, \text{d.f.} = 2, p < 0.11$, $RMR = 0.03, \text{RMSEA} = 0.08, \text{GFI} = 0.99, \text{AGFI} = 0.94, \text{NFI} = 0.98, \text{IFI} = 0.99, \text{CFI} = 0.99$) 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 ($H_{\text{form}}$) against the hold-out sample presented satisfactory results ($\Delta \chi^2 = 1.24, \Delta \text{d.f.} = 2, p = 0.68$). 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 ($H_{\text{G} \beta}$). 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 $\chi^2$ difference. The results ($\Delta \chi^2 = 797.36, \Delta \text{d.f.} = 7, p = 0.54$) 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>
<thead>
<tr>
<th>Table AI</th>
<th>Analysis of configural invariance for CFA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor loadings</td>
</tr>
<tr>
<td>Sample 1 – Brazil</td>
<td>IK1</td>
</tr>
<tr>
<td>Sample 2 – Spain</td>
<td>IK2</td>
</tr>
</tbody>
</table>
| Factor | Internal knowledge | EK1 | 0.69** | 0.76*
| | External knowledge | 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>
<thead>
<tr>
<th>Table AII</th>
<th>Tests for invariance of path model across calibration and cross-validation samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>H_{\text{form}} model</td>
<td>$H_{\text{G} \beta}$ model</td>
</tr>
<tr>
<td>Chi-square</td>
<td>1.24</td>
</tr>
<tr>
<td>Degrees of freedom (df)</td>
<td>2</td>
</tr>
<tr>
<td>Probability level</td>
<td>0.54</td>
</tr>
<tr>
<td>Goodness-of-fit (GFI)</td>
<td>0.99</td>
</tr>
<tr>
<td>Adjusted goodness-of-fit (AGFI)</td>
<td>0.97</td>
</tr>
<tr>
<td>Standardized RM</td>
<td>0.01</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.00</td>
</tr>
<tr>
<td>Incremental indices</td>
<td>0.98</td>
</tr>
<tr>
<td>Normed fit index (NFI)</td>
<td>1.00</td>
</tr>
<tr>
<td>Incremental fit index (IFI)</td>
<td>1.00</td>
</tr>
<tr>
<td>Comparative fit index (CFI)</td>
<td>1.00</td>
</tr>
</tbody>
</table>
**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 knows 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**

<table>
<thead>
<tr>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Frequently</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

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.  

- One of the top 3 or 4 in the market, but not the clear leader.

**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


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.
This article has been cited by:

