Asymmetries in Supply Chain Management: Differences Between Poland and Spain

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Although asymmetries are commonly presented as a natural, almost organic, part of collaboration agreements, many researchers merely mention them in extant literature. This paper extends previous qualitative studies concerning asymmetric relationships by means of a quantitative and comparative, cross-sectional, supply chain study in two environments, one emerging (Poland) and one mature (Spain). It posits that asymmetries change the behaviors of participants in collaborative arrangements. The findings suggest that asymmetry in supply chain management is multi-faceted and influences various relationships disparately. The results of this investigation clarify real problems of supply chain collaborations and performance improvements.

INTRODUCTION

Research frequently identifies inefficiencies in real-world applications of supply chain management (SCM). Moberg et al. (2003) define seven constraints that block supply chain collaboration, including lack of trust, different goals, and lack of transparency in information systems. These constraints limit collaboration agreements with strategically important partners and products (Tang & Gattorna, 2003; Fynes, Voss, & Burca, 2005) and reduce supplier involvement in SCM in many sectors. Morgan, Kaleka and Gooner (2007) and Lambert (2008) present similar viewpoints, affirming that development of the right types of relationships, without constraints and limitations, and the creation of value propositions for customers are critical for supply chains. The rationale behind this is that cooperation and mutual interest lead to performance improvement at the system level (Vaaland & Heide, 2007).

Limitations and constraints increase complexities in SCM processes and motivate organizations to introduce new tools and forms of inter-organization relationships. Measurements of total costs (LaLonde & Raddatz, 2002), customer satisfaction (Chan, 2003), effective consumer response (ECR), vendor-

managed inventory (VMI) (Bailey & Francis, 2008), and continuous replenishment programs (CRP) (Van Hoek, Kaleka, & Gooner, 2001) are a few of them. Bailey and Francis (2008) and Monczka, Trent, & Petersen (2006) report that results from the use of these tools are unsatisfactory. Their application reduces costs but does not result in other expected benefits such as reduction of tensions in relationships among supply chain partners through the exchange of information and transparency.

In this situation, a question arises concerning what promotes these kinds of managers and organizational behaviors in the SCM process. Recent research suggests that one of the causes of such varying behaviors and constraints is the presence of asymmetries in the SCM process (Chen & Chen, 2002; Blomqvist, 2002; Johnsen & Ford, 2008; Thomas & Esper, 2010). Understanding the characteristics of asymmetries and their influences on critical success variables such as trust, collaboration, integration, innovation, and costs (LaLonde & Raddatz, 2002) may enable a clearer view of the real situation for SCM partners (Johnsen & Ford, 2008) so they can better define business strategies and evaluate operations management. Better understanding of asymmetries may clarify influences on behaviors, communications, perceptions, and feelings of partner relationships in political and economic tumult (especially that occurred in Europe in recent years). Consequently, this paper addresses the following research questions:

- What effects do asymmetric behaviors have on critical success variables of the SCM process such as trust, collaboration, integration, innovation, and costs?
- Does the relationship between asymmetries and critical success variables of the SCM process display similar behaviors in various markets?
- Of SCM processes can asymmetries influence the total performance?

Thomas and Esper (2010) suggested in their research that investigation of asymmetries in the SCM process is lacking in the literature. They present an exploratory, qualitative study concerning asymmetric relationships that we extend to a quantitative, comparative, cross-sectional, supply chain study of two environments; one emerging (Poland) and one mature (Spain). According to Gupta Hanges, and Dorfman (2002), Latin European and eastern European regions represent disparate economic environments. The Spanish market is characterized by a weak performance orientation, institutional collectivism, humane orientation, and medium to high maturity in management relationships due to an affective autonomy orientation. As an emerging environment, the Polish market has a strong focus on future, high-level risk; it represents relevant societal influence on management practices and medium to low maturity in management relationships. Although the markets differ, it is possible to observe similarities in how the two markets conduct development of management processes, population, territory, and economy transition processes.

This study is one of the first quantitative examinations of asymmetries. Our proposal investigates relationships between SCM success attributes and managers' behaviors under the influence of asymmetries in different operational environments. We hope results of this investigation clarify real problems of supply chain collaborations and performance improvements.

SUPPLY CHAIN RELATIONSHIP CHARACTERISTICS AND THEIR IMPORTANCE IN UNDERSTANDING ASYMMETRY

A number of different attributes and behaviors have been incorporated into frameworks that have attempted to define the nature of supply chain relationships. However, as supply chain relationships are complex phenomena, describing their characteristics meaningfully proves difficult without simplifying reality. For this reason, we will focus our suggestions related to asymmetries on some aspects, while leaving others in the background (Holmlund, 2004).

Thomas and Esper (2010) define asymmetry as a lack of perceived dyadic balance or proportionality of relationship attributes and/or behaviors. Following this definition, we define asymmetry as a relationship in which only one part (partner) controls most or all actions and resources used in business relationships, and two or more parts (partners) are different in terms of information, knowledge, power,

negotiation, and cost. These control activities should enable acting, organizing, and thinking differently from opponents to maximize benefits to one, exploit an opponent's weaknesses, retain an initiative, and/or gain greater freedom of action (Manwaring, 2001). Accordingly, we present some samples of these differences and relate them with managers' behaviors.

Information asymmetry exists where differences in quantity and quality of information among organizations are identified. These differences negatively influence bargaining power and decision-making processes (Ewans & Wurster, 2000). Technologies used during the management process influence strategic decisions made by organizations. Organizations often ignore the capacity and level of technology currently available in supply chain partnerships (Sarkis & Talluri, 2004). These behaviors denote knowledge asymmetry.

Regardless of size, any organization in a supply chain must assume a leadership function. Large organizations do not easily accept leadership from other organizations. They believe that bigger size suggests automatic occupation of a leadership role (Moberg, Spey, & Freeze, 2003). This behavior is an example of size asymmetry. As one form of relationship among partners in a supply chain, negotiation reflects commitment that exists for both parties (Morgan & Hunt, 1994). Lack of commitment in a relationship can destroy the negotiation process and that behavior pattern will lead to asymmetry (Xiao, Xia, & Zhang, 2007). Power asymmetry is an imbalance of power in the collaboration process. One firm authoritatively transfers responsibilities of performance to others, forcing them to comply with strict operational guidelines (Maloni & Benton, 2000). Cost asymmetry is associated with a lack of adequate compensation made by supply chain partners who have not obtained expected benefits due to cost reductions (Gunasekaran & Kobu, 2007).

Asymmetries normally have a negative influence on SCM, especially in medium and long-term relationships. Asymmetries hinder benefits (Gundlach & Cadotte, 1994), create interest conflicts (Heide & John, 1990), increase inefficiencies in the improvement process, and distort the orientation of relationships (Kumar, Stern, & Anderson, 1995). Asymmetries reinforce the supply chain relationship as a zero-sum game in which one player wins because another loses (Brandenburger & Nalebuff, 1996). Under these conditions, asymmetries lead to undesirable effects from management's behavior (Williamson, 2008), but can also lead to positive effects, especially in short-term relationships where minimizing overall costs produces additional income (Williamson, 1988) or stabilizes a relationship due to a dominant leadership position (Thomas & Esper, 2010). Asymmetries support the dominant position of one part, forcing other parts to invest in their own skills, technologies, and organizations to maintain product competitiveness (Griffith, Harvey, & Lusch, 2006) and stimulate the search for and implementation of innovation (Cox, 2004). We shall now turn to the conceptual developments that will be the basis for our examination of asymmetric relationships in supply chains.

CONCEPTUAL DEVELOPMENT

Extensive research focuses on explaining sources of supply chain problems that hinder development (Case, 2002; Dröge et al., 2003; Fawcett & Magnan, 2002; Mentzer et al., 2001; Moberg et al., 2003; Munson et al., 2000; Sabath and Fontanella, 2002; Simatupang & Sridharan, 2002 and 2005b; Zhou & Benton, 2007). However, research focuses on only partial, secondary causes of supply chain inefficiencies, without paying much attention to asymmetries. We shed some light on the complex role of asymmetry in SCM.

Although relationships of collaboration and integration among organizations of similar size, strength, and power are highly recommended (Ramsay, 2001; Schoenher & Mabert, 2006), they rarely exist in real life. Some difficulties are related to a series of conflicts that appear during both processes. For example, conflicts of interest among the strongest partners, which prevent meeting objectives, are caused by the lack and inaccuracy of information (Cigolini et al., 2004), or conflicts of interest due to the lack of objective alignment or conflict related with environmental risk assessment, and create problems in SCM (Simatupang & Sridharan, 2008).

Possessing and distributing information within a relationship are primary attributes of power and decisions. In many cases, decision processes focus on avoiding unwanted results rather than identifying and solving basic problems because information and power asymmetries diminish coordination and increase risk and opportunism in managers' behaviors (Maloni & Benton, 2000), implying achievement is advantageous to a dominant manager (Thomas & Esper, 2010). Risk and opportunity are two critical elements in the process of managing an organization. Risk and opportunity influence costs (Laffont & Tirole, 1993; Williamson, 1988, 1991). Frequently, it is possible to observe a natural need for cost reduction and a desire to reduce internal conflicts to increase organization performance (Williamson, 1988). This trend obliges managers to reduce costs constantly using all means, formal and informal. The original balance of power breaks and the relationship becomes asymmetric again because not all partners have the necessary resources. Williamson (2008) suggests that solving this problem involves interchanging resources and power within collaboration or integration processes but this is likely be difficult under asymmetrical pressure.

Equilibrium between cost and performance in comparison to value of resources and capabilities provided by partners appears to be an appropriate strategy of asymmetric SCM processes. Companies cannot overvalue resources and capacities, considering only those that serve to create and consolidate competitive advantage (Logan, 2000). Again, this is difficult to achieve under asymmetrical pressure, where subjectivity in assessing benefits of supply chain influences, perceptions of risk and lack of security held by all participants, diminish the protective value of resources and increase asymmetric behaviors of managers (Skjoett-Larsen, 1999).

In negotiations among supply chain partners, convictions of benefits concerning trust and integration encourage symmetry in the balance of power. Asymmetry means destruction of this balance, resulting in negotiation reductions and position destabilizations. In decentralized chains where there is participant decision-making independence, asymmetries increase both strong competition for limited resources and demands from the same customer among all partners (Stewart & Fenn, 2006). Each partner increases individual benefits, which may reduce total results for the chain (Hall & Porteus, 2000).

In essence, organizations and managers must actively manage asymmetric relationships to prevent their disappearance. We propose that the best way to find solutions for problems related to managers and organizations operating under asymmetrical pressure are using game theory concepts and tools. Game theory is concerned with analysis of situations involving conflict, cooperation, and decision-maker (players) interactions (Leng & Parlar, 2005). These relationships correspond to decentralized forms of supply chains that are frequently today's reality. This type of supply chain is characterized by a presence of multiple and independent decision-making processes, with different players and varying tactics, roles, and scenarios (Stewart & Fenn, 2006). In centralized networks where a unique decision-maker defines the optimum solution and coordinates activities of participants to achieve better results, application of game theory is not viable (Leng & Parlar, 2005). Game theory applies cooperative and non-cooperative games to solve problems related to conflict, cooperation, and decision-making processes. Cooperative games are developed in a scenario where partner organizations enjoy good communication and leaders reach agreements on improving overall benefits and effectiveness of the supply chain. Managers act rationally to achieve goals by achieving overall objectives established by consensus (Carter, 1993), a typical scenario for symmetric relationships. Under asymmetries, it is more appropriate to apply non-cooperative games. The theory of non-cooperative games studies behaviors of participants who try to maximize individual goals in competitive situations characterized by a lack of communication or when one partner takes on a leadership position while other partners moderate decisions, seeking improvement in this new scenario (Wang & Parlar, 1989).

When considered through a game theory lens, it is likely that firms will seek solving conflicts and managing asymmetries through cooperation, though it obligates rules negotiation, forms, and methods of carrying out cooperative agreements. A partner's cooperation could be appropriate in cases of conflict where managers do not control factors that influence performance, do not control conflicts of interests, and do not manage the relationships that are affected by asymmetries (Taylor, 2004). Naturally, such solutions can only be achieved if managers in each stage of the SCM process agree to cooperate.

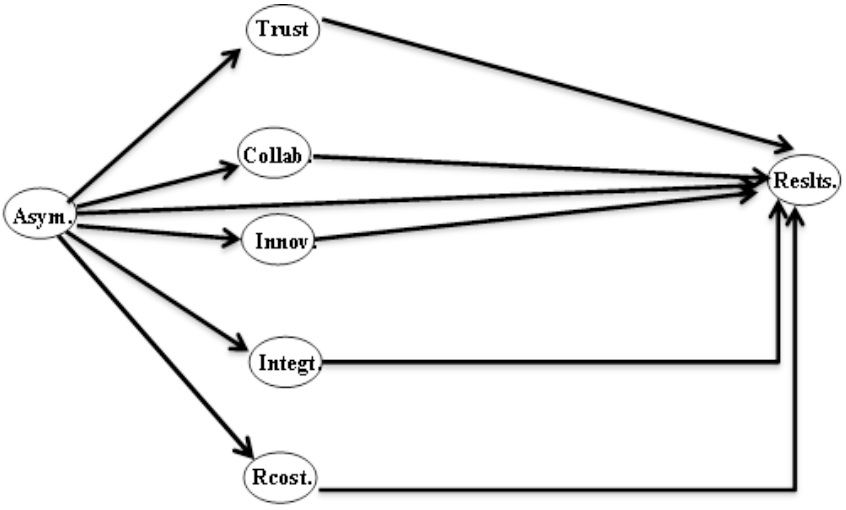
RESEARCH PURPOSE

A major contribution of this research is analyzing difficulties caused by asymmetries in the SCM process. This study demonstrates that a combination of asymmetries, not just one, is a primary source of supply chain discontent. We posit that asymmetries have direct and indirect negative influences on critical SCM success variables such as trust, collaboration, integration, cost and innovation (Figure 1).

To define measures of the influences that produce asymmetries, we draw on Spekman et al. (1998) who analyzed complexities of supply chain management from a partnership perspective in dynamic environments. These measures allow us to discover the effects of asymmetry reliably, thereby reflecting the intensity of relationships among supply chain partners. This selection also makes possible a detailed analysis of restrictions that prevent or hinder the full development of SCM.

The literature demonstrates a lack of clarity concerning definitions of collaboration, especially in sequences or combinations of elements (Baratt, 2004). Following Anthony (2000), we define collaboration as an agreement established between two or more organizations for participation to carry out joint planning and management for overall supply chain performance. In line with this definition, collaboration among supply chain partners means setting common objectives related to the achievement of mutual benefits through a process of decision making and solving problems collectively (Stank et al., 2001). Collaboration promotes joint actions to reduce costs, improve communication and coordination of knowledge creation, and help develop strategic and operational plans (Bowersox et al., 2003; Cannon & Homburg, 2001). The asymmetries can distort the process of collaboration despite the application of non-cooperative game tools that can diminish their influence.

FIGURE 1
RESEARCH MODEL



Recent literature identifies and measures trust as a multidimensional construct (Handfield & Bechtel, 2002; Kwon & Suh, 2004, 2005). We use a single dimension of trust because we can then present relationships among variables, trust, and asymmetries more easily. The relationship between asymmetry and trust as a multidimensional construct leaves room for future research. According to Maloni and Benton (2000) and Rousseau et al. (1998), trust is defined as confidence in the honesty and integrity of a partner, which permits acceptance of vulnerability of their expectations, intentions or behaviors. A lack of trust is observed when activity coordination is difficult and where inter-organizational commitment during cooperation meets barriers. Without trust and commitment among partners, efficient SCM based on skills and common actions is difficult to attain (Gao et al., 2005). Considered through a game theory

lens, trust implies that supply chain partners elect cooperative games and do not consciously make unexpected decisions that affect norms and roles. We expected, following Anderson and Weitz (1992), that inter-organizational asymmetry destroys both trust and commitment and has a negative influence on supply chain performance.

Coupled with collaboration and trust, integration is one of the primary factors in the process of improving performance, and represents an important source of competitive advantage in SCM (Gimenez & Ventura, 2005). We define integration according to Teck-Young (2005) as the degree to which supply chain activities, functions and resources have been networked together. This connection must provide increased speed of adaptation of the supply chain to changes in a business environment, thereby reducing risk (Van Hoek, Harrison, & Christopher, 2001; Bowersox, Closs, & Stank, 2003). Integration is an opportunity, especially for small firms, in an asymmetric environment. Specialization strengthens the position of small businesses in an asymmetric relationship concerning larger partners (Blomqvist, 2002), reducing risk. Therefore, integration involves recognizing relevant changes within organizations. To obtain the best performance, organizations employ various forms of integration in their relationships, from personal and casual to formal bilateral or multilateral agreements reflecting contracts (Heide, 1994). According to game theory, contract becomes a tool in the integration process, especially in decentralized supply chains. During the game, supply chain members coordinate individual strategies to improve total supply chain performance and individual profits (Leng & Parlar, 2005). According to Liu and Çetinkaya (2009), we expected that asymmetries influence negatively establishment of contracts, producing intractable conflicts, opportunistic behavior, and decreased performance.

Innovation is particularly important, especially from the perspectives of partnership duration, transparency, accessibility to information, integration, and sharing risks and benefits (Teck-Young, 2005). The term innovation is notoriously ambiguous and lacks a single definition. Following Miotti and Sachwald (2003), we define innovation as a platform for diversification and improvement of products and/or processes that permits efficient firms to achieve success. In dynamic, contemporary environments, most collaboration agreements require frequent redesign, improving efficiency and performance of the entire supply chain (Lam, 2003; Corsten & Felde, 2004). This means that changes cannot produce improvements through price increases alone; they must also include increases in research and development investment (Wouters & Kopczak, 2000). Innovation improves competitive advantage in a supply chain and encourages organizations to adopt necessary technological given the inherent and organizational changes. However, variability of asymmetry, partners might have differing objectives and varying degrees of tolerance toward organizational change, including IT innovation. Under the influence of power, technology, and information asymmetries, it is difficult to predict the needs of innovation to ensure products required by customers. We expect asymmetries to affect the innovation process negatively, distorting the effectiveness of demand hedging and formulation of strategies. According to game theory, firms align objectives, share profits, and manage asymmetries to construct shields to innovation.

Savings implemented by one organization in a supply chain (the initiator) may produce a cost increase for other participants. According to relational models of collaboration, inequality requires compensation, the amount of which depends on the savings and cost structures of supply chain partners (Sucky, 2006). If a compensation system is not working properly, deviations reinforce cost asymmetry and damage performance. The social model of organizations, in which rational goals are achieved through member commitment and loyalty, allows participants to subordinate individual goals to organization goals. High satisfaction, trust, and integration lead to suitable environments for relationships among members of different organizations (Cummings, 1977). We expected that asymmetries would make these difficult.

RESEARCH DESIGN

Unit of Analysis and Data Collection

We conducted a survey among Polish and Spanish firms. As a control element, we introduced a number of organizational parts of the supply chain that reflect market maturity (Appendix A). An emerging market satisfies two criteria: rapid economic development and large increases in opportunism and rent-shifting (Nelson, Tilley, & Waler, 1998). Emerging markets require large investments to cover customer needs, distribution infrastructures, brand adaptations, and development of specific knowledge (Porter, 1990). These requirements are difficult to cover with supply chains made up of few partners. Opportunism, uncertainties, and risks in emerging markets are additional factors that promote large supply chains (Plomp & Batenburg, 2010). In the Polish market, a majority of supply chains include more than three partners, which confirms previous observations.

A mature market is characterized by high economic development and well-established market mechanisms (Kotabe & Helson, 2000). Maturity systematically increases capabilities of a business process and an organization's ability to deliver higher performance over time (Rosemann & de Bruin, 2005). In a mature market, domestic and global suppliers compete intensely for market share and customer satisfaction (Johansonn, 2000). At this stage of development, organizations focus on competition and cost control (Porter, 1985). This is much easier to obtain with smaller supply chains, which is reflected in the Spanish market, where most supply include fewer chains than three members.

The firms included in both samples were selected randomly, and operate in various industries (e.g., electronics, metal, mining, auto, food, construction, logistics services, electric materials, pharmaceutics, cosmetics, energy, textiles, and others) to obtain multi-sector data. Annual sales for the organizations ranged from fewer than €10 million, from €10 to 60 million, and to more than €60 million. For both populations, we selected companies employing at least 50 people and those that had an identifiable purchasing department (Appendix A). Polish and Spanish samples characteristics are presented in Table 1.

TABLE 1
SAMPLE CHARACTERISTICS
POLISH AND SPANISH

PROPERTY STRUCTURE		Poland		Spain
	N	%	N	%
Majority capital – Polish/Spanish	62	76.5%	10	19.3%
Majority capital – Foreign	18	22.2%	38	73.0%
Difficult to say	1	1.2%	4	7.7%
TOTAL	81	100%	52	100%
SALES VOLUME	N	%	N	%
less than 10 mln euro	26	32.1%	5	9.6%
between 10-60 mln euro	20	24.7%	10	19.2%
more than 60 mln euro	7	8.6%	0	38.5%
Difficult to say/have not to say	23	28.4%	2	23.1%
Declined	5	6.2%	5	9.6%
TOTAL	81	100%	52	100%

Most cross-cultural researchers consider the more rigorous back-translation process superior to simple direct translation from one language to another (Brislin 1970; Brislin et al., 1973). Questionnaire items were translated into Polish and Spanish simultaneously using back-translation method to ensure the same meaning and interpretations of variables. The surveys were sent to a representative set of firms belonging to CEL (Spanish Center of Logistics) in Spain which cooperates with L. Kozminski Academy in Poland.

Following Dillman (2000) and Scandura and Williams (2000), a web-based questionnaire was e-mailed to each organization and manager in the samples. Questionnaires were sent directly to purchasing and supply chain managers. They are involved largely in negotiations and contacts with suppliers and the most important customers, and are the most knowledgeable information sources (Hill & Jones, 1992; Kumar, Stern, & Anderson, 1993). The survey was conducted in two stages. The first took place in Poland. The initial sample size in Poland included 387 companies; 173 agreed to participate. The number of returned surveys was 99. Following a thorough analysis of the answers, 18 questionnaires were rejected due to incomplete answers; 81 questionnaires were considered valid, which is a 20.93% response rate. In the second stage, the questionnaire was e-mailed to 168 Spanish managers. The response rate after the first mailing was 12%, insufficient for the purposes of this study (Basnet et al., 2003). The outcome of the second mailing led to an increase in the number of returned questionnaires to 52, a response rate of 30.95%.

Measurement Development

Measurement scales for the constructs were adapted from well-validated measures reported in extant literature. Items adapted from Heide and John (1990) and Teck-Yong (2005) measured collaboration, a construct that measures cooperative behavior among supply chain members, measured collaboration. Managers evaluated responsibilities of conducting joint actions for overall supply chains. Trust is from Kumar, Stern and Anderson (1993) and Hanfield and Bechtel (2002); this measure focuses on the relationship among partners in the management process. Respondents evaluated confidence in the honesty of supply chain members. Innovation is from Gilley and Rasheed (2000) and Spekman et al. (1998); these items relate tracking links among supply chain partners, with particular attention given to tracking tools such as electronic data interchange (EDI) and computer aided design/computer aided manufacturing (CAD/CAM). We asked managers whether they considered supply chain innovation to be a platform for diversification and improvement in firm efficiency. Integration is from Teck-Yong (2005) and Chen and Paulraj (2004); this measure captures dedication to logistics integration and inter-firm communication. Participants were asked how integration improves firm performance. Cost is from Power, Sohal, and Rahman (2001) and Cannon and Homburg (2001), measuring purchasing, production, and logistics costs. Performance is from Dröge, Germain and Spears (1996) and Dröge and Germain (2000), capturing dedication to financial and non-financial items. In both cases, respondents evaluated each partner's performance. Finally, Thomas and Esper (2010) and Maloni and Benton (2000) inspired items for asymmetry. We asked managers to evaluate differences in supply chain partner behaviors (Appendix B).

Each construct was defined using 3 to 5 items and a 7-point Likert-scale (Kumar, Stern, & Anderson, 1993). Following Dillman (2000), the original research instrument was pretested with interviews of Spanish and Polish managers, ensuring that items were formulated accurately. Several items were reworded and edited, and some were dropped to improve overall comprehension, establishing content validity of the instrument.

A three-phase cycle estimated the effect of non-response bias. Initially, responses selected randomly from the earlier phase were compared with responses from the latest survey phase (Lambert & Harrington, 1990). Since there were no differences between responses, it was concluded that there was no non-response bias in the data (Armstrong & Overton, 1977). Following Mentzer and Flint (1997), approximately 30 non-respondents from each sample group were contacted to determine why they did not participate. Managers alleging lack of time was a major cause of non-participation.

As recommended by Podsakoff et al. (2003), we performed Harmon's single-factor test for both the Polish and Spanish samples. Results demonstrated that no single factor accounted for the majority of model variance (22.92% for Poland and 35.01% for Spain) suggesting that common method bias was not

of great concern and was unlikely to confound not an issue, and that data were robust. Interpretations of results are in (Tables 2 and 3). The conclusion was that non-response biases were robust.

TABLE 2
COMMON METHOD BIAS HARMON'S TEST
SPAIN

Total Variance Explained							
Component		Initial Eigenvalues			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Dimension	1	9.453	35.009	35.009	9.453	35.009	35.009

TABLE 3
COMMON METHOD BIAS HARMON'S TEST
POLAND

Total Variance Explained							
Component		Initial Eigenvalues			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Dimension	1	6.188	22.919	22.919	6.188	22.919	22.919

The research model of the study was quantitative positivist (Straub et al., 2004), and the research objective was explaining and predicting (Gregor, 2006). To estimate parameters of the model, we used structural equation modeling (SEM). We consider asymmetry (Asym), collaboration (Collab.), integration (Integt.), trust (Trust), innovation (Innov.), cost reduction (Rcost), and performance (Rslts) as latent variables.

Research Model Estimation and Validation

SEM assessed relationships between latent constructs, and structural relationships between them (Figures 2 and 3).

FIGURE 2
SEM ANALYSIS RESULTS FOR POLISH MODEL

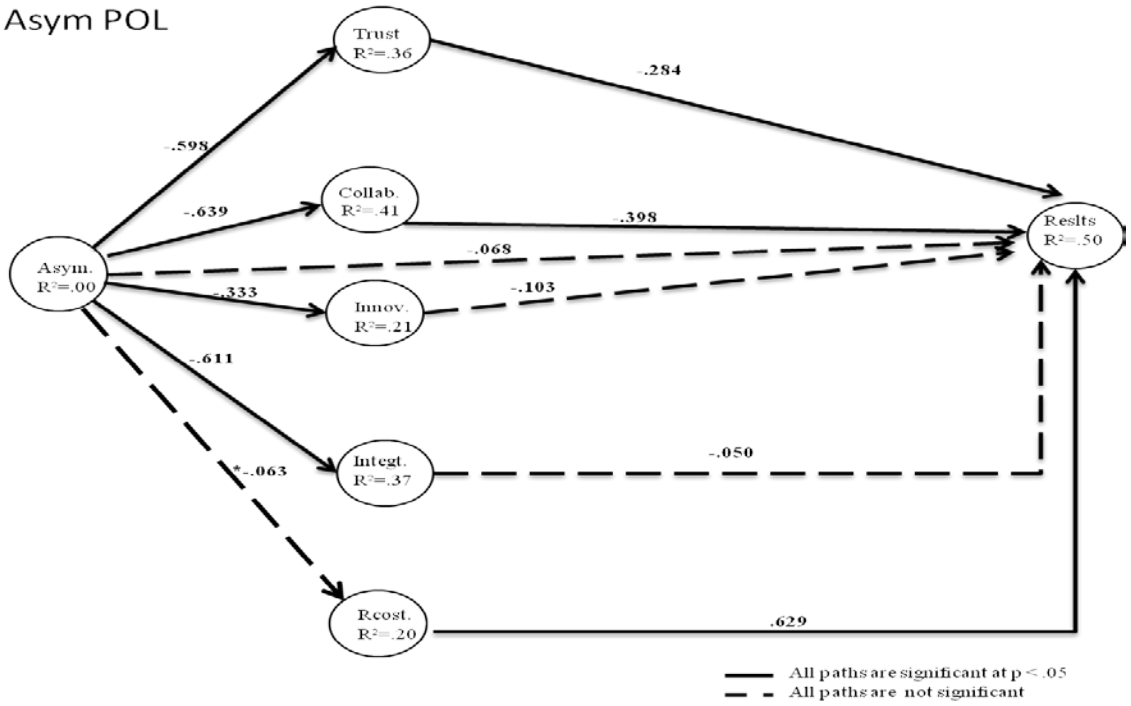
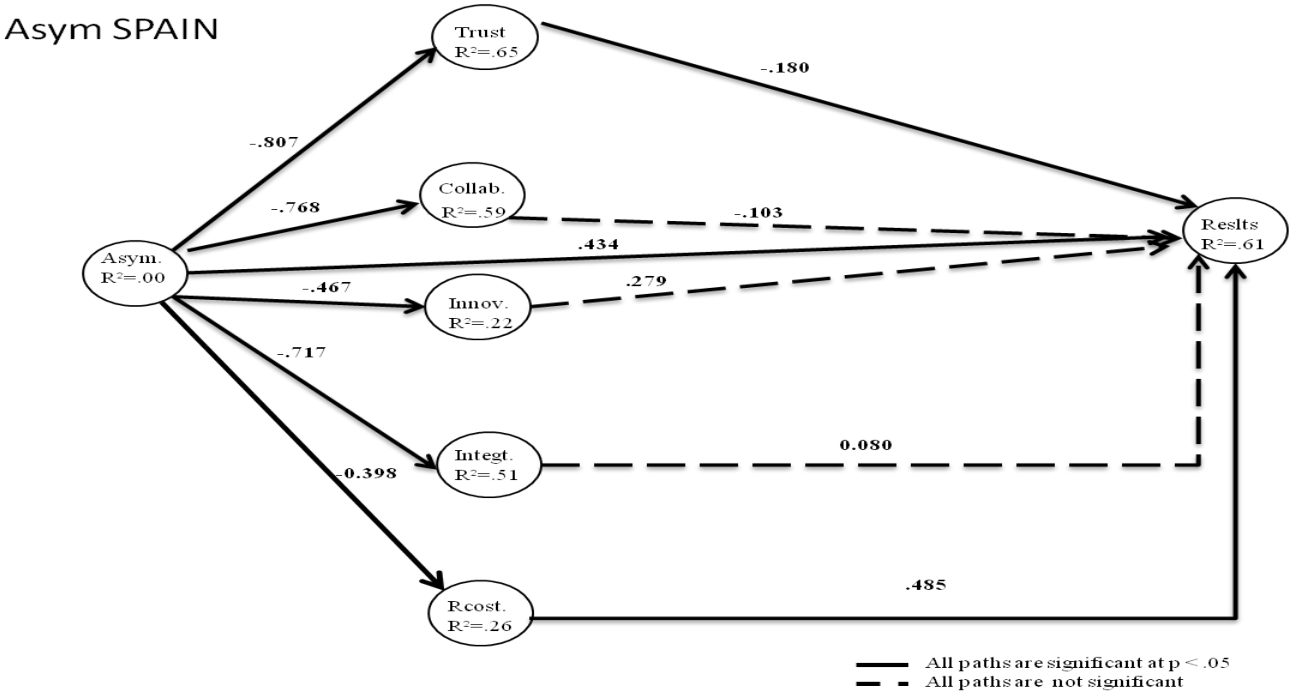


FIGURE 3
SEM ANALYSIS RESULTS FOR SPANISH MODEL



The model was estimated by applying the Partial Least Squares (PLS) algorithm using smart PLS2.0.M3 software (Ringle, Wende, & Will, 2011). The PLS algorithm choice was made according to several criteria. The phenomenon under investigation is relativity new, and its modeling is in a developmental stage. PLS's recommendations concerning sample size, prediction accuracy, and comparatively low demands on data multinormality requirements (Joreskög & Wold, 1982; Henseler et al., 2009) were well suited to this study. Analysis was conducted in three steps. First, the models were estimated for Poland and Spain. We tested whether there was a difference between the two countries on the SCM aspects considered in this research. This last test was made by means of the GeSCA software (Hwang & Park, 2011). Model validation was conducted in two phases. We assessed the measurement model in the first and the structural model in the second. Each construct was assessed following Anderson and Gerbing's (1988) suggestions for unidimensionality, internal consistency, indicator reliability, and convergent and discriminant validities. Constructs representing asymmetries, collaboration, results, and integration were reflective (Figures 2 and 3). An overview of model quality criteria is presented in Table 7 for Poland and Table 8 for Spain.

Considering the measurement model for the Polish sample (Table 10 in Appendix C), we checked for unidimensionality of the factors using an exploratory factor analysis (EFA). Loadings were between 0.838 and 0.481 and four of 33 values were above the 0.6 threshold, admissible as high, and none were below 0.4, considered low. For the Spanish sample (Table 11 in Appendix C), values ranged from 0.856 to 0.417 with seven values of thirty-three between 0.6 and 0.4, and none were below 0.4 (Gefen & Straub, 2005; Gerbing & Anderson, 1988).

Internal consistency was measured using Cronbach's alpha coefficient and the composite reliabilities (Tables 6 and 7). For both samples, internal consistency indicators exceeded the threshold for exploratory research of 0.700 (Cronbach, 1951; Werts et al., 1974; Nunally & Bernstein, 1994). Statistical significance was assessed by means of 200 re-sample bootstrapping (Tables 8 and 9).

As for the indicator reliability, all path values were significant ($p<0.05$), and most (Tables 10 and 11 in Appendix C) had values greater than 0.7. The minimum path value was 0.417, admissible for an exploratory model (Chin, 1998). Convergent validity was assessed by the average variance explained (AVE) whose values (Tables 6 and 7) in most cases were above the 0.5 threshold for both samples (Forner & Larcker, 1981).

As a criterion for discriminant validity, we considered cross-loadings (Tables 13 and 14 in Appendix C) obtained by correlating component scores of each latent variable with all other variables. For both samples, loadings of each indicator were higher for their own constructs than for other constructs, suggesting the constructs differed sufficiently (Chin, 1998). To conclude validation of the external model, we assessed discriminant validity following Fornell and Larcker's (1982) criterion, requiring a latent variable to share more variance with its assigned indicators than with any other latent variables. The AVE square root of each latent variable should be greater than its squared correlation with any other latent variables. This condition was fulfilled in both samples (Tables 4 and 5). Latent variable correlations for both countries show moderate to high values, indicating convergent validity (Tables 2 and 3).

We assessed validity of the structural model (Tables 4, 5, 6 and 7). In both samples, the models' coefficients of determination (R^2) showed values not substantially high (>0.670), but certainly more than moderate (>0.333), and clearly above the lower weak threshold of 0.19 (Chin, 1998; Ringle, 2004). For Poland (Table 6), four path coefficients were not significant: Assym with Costred (t=0.466), Assym with Results (t=0.395), Innov with Results (t=0.771), and Integ with Results (t=0.319). The remaining relationships were significant at $p<0.05$. For Spain (Table 7), all latent variable path coefficients were significant except Coll with Results (t=0.548), Integ with Results (t=0.391), and Integ with Results (t=1.085). We also tested whether there was a difference between the two countries concerning SCM. We imposed cross-group (Poland and Spain) equality constraints on path coefficients. Results showed that the null hypothesis of equality between groups was rejected for the relationships Assym with Coll and Assym with Integ, not rejected for the remaining correlations, Assym with Results, Coll with Results, and Integ with Results (Tables 8 and 9).

TABLE 4
POLAND
LATENT VARIABLE CORRELATIONS
AVERAGE SQUARE ROOT ON DIAGONAL PER THE FORNELL-LARCKER CRITERION

	ASSYM	COLL	COSTRED	INNOV	INTEG	RESULTS	TRUST
ASSYM	0.685						
COLL	0.639	0.769					
COSTRED	-0.063	0.047	0.715				
INNOV	0.333	0.619	0.061	0.663			
INTEG	0.612	0.610	0.108	0.480	0.651		
RESULTS	0.068	-0.034	0.638	0.061	0.113	0.713	
TRUST	0.598	0.638	0.134	0.448	0.610	0.243	0.676

TABLE 5
SPANISH
LATENT VARIABLE CORRELATIONS
AVERAGE SQUARE ROOT ON DIAGONAL PER THE FORNELL-LARCKER CRITERION

	ASSYM	COLL	COSTRED	INNOV	INTEG	RESULTS	TRUST
ASSYM	0.774						
COLL	0.768	0.693					
COSTRED	0.398	0.353	0.641				
INNOV	0.467	0.505	0.655	0.719			
INTEG	0.717	0.663	0.486	0.534	0.679		
RESULTS	0.434	0.366	0.733	0.649	0.507	0.715	
TRUST	0.807	0.632	0.375	0.379	0.665	0.445	0.796

TABLE 6
POLAND
QUALITY MODEL MEASUREMENTS OVERVIEW

	AVE	Composite Reliability	R Square	Cronbach's Alpha	Communality	Redundancy
ASSYM	0.470	0.813		0.709	0.470	
COLL	0.591	0.878	0.408	0.826	0.591	0.240
COSTRED	0.511	0.805	0.104	0.776	0.511	0.002
INNOV	0.414	0.776	0.111	0.765	0.414	0.041
INTEG	0.423	0.783	0.374	0.761	0.423	0.151
RESULTS	0.508	0.837	0.497	0.759	0.508	-0.008
TRUST	0.456	0.765	0.358	0.711	0.456	0.157

TABLE 7
SPAIN. QUALITY MODEL MEASUREMENTS OVERVIEW

	AVE	Composite Reliability	R Square	Cronbach's Alpha	Communality	Redundancy
ASSYM	0.554	0.859		0.794	0.554	
COLL	0.480	0.808	0.589	0.696	0.480	0.282
COSTRED	0.411	0.726	0.158	0.789	0.411	0.059
INNOV	0.517	0.839	0.219	0.761	0.517	0.108
INTEG	0.461	0.805	0.514	0.711	0.461	0.228
RESULTS	0.511	0.839	0.614	0.760	0.511	-0.006
TRUST	0.634	0.873	0.651	0.804	0.634	0.404

TABLE 8
POLAND TOTAL EFFECTS

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
ASSYM->COLL	-0.639	-0.646	0.060	0.060	10.598
ASSYM->COSTRD	-0.063	-0.043	0.136	0.136	0.466
ASSYM->INNOV	-0.333	-0.349	0.117	0.117	2.840
ASSYM->INTEG	-0.611	-0.633	0.074	0.074	8.285
ASSYM-RESULTS	-0.068	0.078	0.173	0.173	0.395
ASSYM->TRUST	-0.598	-0.608	0.071	0.071	8.382
COLL->RESULTS	-0.398	-0.367	0.136	0.136	2.918
COSTRD->RESULTS	0.629	0.609	0.097	0.097	6.458
INNOV->RESULTS	0.103	0.112	0.133	0.133	0.771
INTEG->RESULTS	-0.050	-0.066	0.157	0.157	0.319
TRUST->RESULTS	-0.284	0.288	0.121	0.121	2.349

DISCUSSION

In this section, the findings from this study are used to describe the influence of asymmetries for SCM success factors (attributes) and organizational behaviors related to them. The literature provides many examples that confirm the importance of asymmetry influences on SCM success (Thomas & Esper, 2010), but not all suggest similar valuations. SEM allows testing of all hypotheses simultaneously. Partial Least Squares (PLS) revealed that three hypothesized paths were not significant in the Spanish sample and four were not significant in the Polish sample (Figures 2 and 3). The remaining relationship paths were significant. Tables 8 and 9 illustrate the findings discussed below.

TABLE 9
SPAIN TOTAL EFFECTS

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
ASSYM -> COLL	-0.768	-0.769	0.055	0.055	14.078
ASSYM -> COSTRD	-0.398	-0.413	0.140	0.140	2.838
ASSYM -> INNOV	-0.467	-0.497	0.152	0.152	3.070
ASSYM -> INTEG	-0.717	-0.733	0.075	0.075	9.524
ASSYM -> RESULTS	0.434	0.464	0.134	0.134	3.230
ASSYM -> TRUST	-0.807	-0.817	0.046	0.046	17.691
COLL -> RESULTS	-0.103	-0.068	0.188	0.188	0.548
COSTRD -> RESULTS	0.485	0.489	0.143	0.143	3.383
INNOV -> RESULTS	0.279	0.274	0.145	0.145	1.919
INTEG -> RESULTS	0.080	0.040	0.206	0.206	0.391
TRUST -> RESULTS	-0.180	0.221	0.166	0.166	2.085

Asymmetry, Trust and Performance

Results suggest the importance of asymmetric influences regarding trust in both markets. In Poland, managers particularly valued organizational reputation in the market. In asymmetric environments, organizational reputation diminishes with reduced trust, precluding maintenance of equilibrium in partnership relationships and reducing the possibility of conflict reduction. In Spain, trust in asymmetric environments was particularly important for sharing knowledge, resolving problems through mutual agreement with supply chain partners, and improving a firm's reputation. These behaviors allow implementation of standards that maintain perceptions of partner honesty, especially in international relationships. These findings confirm Chen and Chen's (2002) observation that agreements with reputable partners improve the position of organizations in international networks, reduce competitive uncertainty, and strengthen bargaining power.

Trust showed a negative relationship with performance in asymmetric environments in both Polish and Spanish markets. Under asymmetry, joint interpretation of data suggests that a reduction in trust among partners generates diminished cooperative performance while influencing company components that integrate the supply chain. Partners remain cautious, especially when sharing asymmetric information. Negative results reinforce strong resistance from managers to provide data based on costs and benefits to other supply chain partners, limiting cooperation under supply chain agreements in both markets. This behavior may increase opportunism in strategic decision-making (Wathne & Heide, 2000), and reflects a preference for implementing local solutions as a way to obtain performance improvements (Simatupang & Sridharan, 2005b).

Asymmetry, Integration, Innovation and Performance

We expected asymmetry to hamper integration in the supply chain and to influence total supply chain performance negatively independent of market type. Surprisingly, results demonstrate that asymmetry reduces integration in both markets, but this negative effect does not influence performance value. This means that in both markets, integration is a key driver to achieve performance improvements in any type of relationship, symmetric or asymmetric. Managers operating in both markets pointed out that integration processes are especially critical for performance goals and future development projects. Extant

research supports these results. Bagchi et al. (2005) and Swink et al. (2007) highlight the importance of product-process technology integration and supply chain integration in terms of direct effects on business performance. In a study of supplier integration in new product development, Ragatz et al. (1997) found that supplier integration leads to performance improvements and competitive advantages for firms.

Related to asymmetry, innovation, and performance variables, we expected similar negative relationships as with integration. The results showed that asymmetries have a negative influence on innovation in both environments, but this negative influence does not affect total supply chain performance. It is interesting to note that Polish and Spanish managers indicated that in asymmetric conditions, risk and uncertainty - related to entry of a new partner in a supply chain - do not reduce investment in innovation. Previous research supports this result. Cooper and Yoshikawa (1994) argue that the alternative of not cooperating means losing business or competitive advantages obtained from an innovation. As Thomas and Esper (2010) suggest, small firms especially accept asymmetric relationships related to new partner entry if they permit maintaining the status quo.

Also interesting was the observation that managers in both markets indicated that several information technologies integrated in SCM process, especially computer-aided decision-making software, promised new opportunities for competitive advantages in business. This relates to the findings of Ranganathan et al. (2004) that internal assimilation and external diffusion of Web technologies affect benefits realized through SCM. According to these findings, integration and innovation are complex, exerting disparate impacts on supply chain relationships, especially in asymmetric environments.

Asymmetry, Collaboration, Cost Reduction and Performance

In both samples, relationships between collaboration and performance were strong and negative, but the hypothesis that collaboration, influenced by asymmetries negatively, affects supply chain performance was confirmed only in Poland. Managers in emerging markets indicated that collaboration process development is limited, especially when it is affected by asymmetries of information, costs, and benefits. The influence of such asymmetries also hinders the process of aligning objectives considered essential for development of collaboration. Previous research suggests a positive relationship between collaboration and performance. Simatupang and Sridharan (2005a) describe positive associations among collaboration, profits, and competitive advantages. Min et al. (2005) and Bowersox, Closs, and Stank (2003) argue that collaboration reflects the union of organizations with the purpose of reducing risk, sharing information, defining common goals, offering resources, and improving performance. Despite positive effects of collaboration, Sabath and Fontanella (2002) claim that this is the biggest disappointment that has appeared in the implementation of various strategies in SCM.

Costs such as inventory costs, production costs, and purchasing costs showed a tendency toward reductions. We used tendency of cost reductions because independent estimates of firm costs were unavailable. Analysis of observed effects of asymmetries (power and size especially) on costs demonstrated interesting findings in Spain. First, asymmetric relationships led to a lower potential for cost reductions in mature markets. Second, asymmetric relationships slowed the reduction of inventory costs. Third, asymmetric relationships pushed organizations to improve purchasing costs. Previous research supports these observations. Johnsen and Ford (2008) posit that large companies avoid highly specialized companies unwilling to establish common goals, and hence, lose influence. Wouters (2006) confirms that outsourcing often involves higher costs for third parties because they often need to make investments. Kouvelis, Chambers, and Wang (2006) suggest that high levels of information-sharing help coordinate the supply chain and avoid negative results from the bullwhip effect. Subramani and Venkatraman (2003) recommend safeguarding against asymmetries, especially in vertically oriented supply chain partnerships where buying or supplying firms are vulnerable to the exercise of power by more powerful partners. In the case of emerging markets, findings suggest asymmetries in SCM do not influence a tendency toward cost reductions. However, asymmetries reinforce instability of organizational cost structures, which reduce the capacity of outsourcing (Fine & Whitney, 1996).

Asymmetry - Performance

Analysis showed positive and direct relationships between asymmetries and performance in Spain. Contrary to expectations, results indicate that increasing asymmetry leads to performance growth in the supply chain. These findings confirm that the consequences of asymmetry vary widely across disparate relationships, with both positive and negative outcomes for organizations. We speculate that in mature markets, managers should consider a bilateral, short-term relationship under asymmetric conditions more equitable than a multilateral, long-term agreement in symmetric environments. They expect that the effect of the relationship is bigger in situations where the risk of opportunism is high than under the protective effect of symmetry. Findings are consistent with Simatupang and Sridharan (2008), who suggest that managers are unwilling to relinquish power and opportunity to achieve maximum profit even if it means reducing risk and symmetry. Findings also support Thomas and Esper (2010), who suggest that temporal aspects of asymmetric relationships in SCM demonstrate contradictory results. In Poland, we did not find a direct relationship between asymmetry and performance.

ACADEMIC AND MANAGERIAL IMPLICATIONS

Results provide knowledge of an academic and managerial nature that helps improve understanding of the nature of asymmetric environments. Examining the effect of asymmetries on SCM success factors provides valuable insights into searching for efficiency and performance improvements in partnerships. Such understandings of asymmetries not only allow SCM partners to manage them properly, but also create an opportunity to improve relationships between partners. The process of seeking the right position for each partner in supply chain relationships includes special implications for managers. Managers can apply asymmetry knowledge to consider options on the availability and ability to invest in innovation. The level of investment made by parties in product and process innovation depends directly on the value of risk related to return, but not on returns alone. Risk assessment depends largely on positions partners occupy in SCM. Asymmetries distort demand knowledge and the effectiveness of strategies to cover it. It is difficult to understand the needs of innovation in asymmetric conditions. Inclusion of asymmetries in management helps managers focus decisions and resources more effectively.

From an academic viewpoint, this study adds new applications of game theory to searches for solutions to SCM problems. Construction of game-theoretic models permits the finding new solutions to asymmetric behaviors adopted by managers in contemporary supply chain collaborations. These are important tools for assisting managers from varying organizations, enabling them to change strategic relationships while considering different asymmetry types, levels, sizes, and strengths.

CONCLUSIONS

Research generally investigates asymmetries across no more than one or two relationship characteristics; e.g., Chen and Chen (2002) study trust and commitment, and Harrison (2004) examines power. These analyses do not permit examination of the complexity of asymmetric relationships in SCM. Findings from this study confirm that asymmetry in SCM is a complex and multifaceted issue, influencing various relationships during collaboration processes differently. In asymmetric environments, profit is not fixed and can enlarge through collaboration (Simatupang and Sridharan, 2005), occurring when all supply chain members maximize gains for all participants. We do not find the same relationships among all partners; effectiveness or even a tendency toward optimization and information flow does not appear in SCM. Not all organizations understand their role in the supply chain, though some invest great effort to improve their positions. Despite the benefits derived from supply chain participation, cooperation among these organizations remains limited. In only a few cases did changes in organizational culture and cooperative decision-making accompany changes related to implementation of the supply chain strategy, even though these changes were regarded as essential. In accord with Moberg et al. (2003) and Zsidisin et al. (2005), our findings corroborate that delays in implementation of this strategy are due to widespread belief that the supply chain strategy is a long road that takes time.

Dyadic relationships among sellers and buyers were the most characteristic in SCM for both environments. Risks associated with relationships between buyers and sellers do not depend solely on power; they are the result of mismanagement (Williamson, 2008). Asymmetries increase opportunistic trends through inappropriate relationship structures, and foster malpractice in SCMs. Asymmetric conditions promote such practices as a natural part of management, hampering noticeable improvement.

Our observations corroborate that information, capacities for innovation and trust are essential in dynamic and unstable environments. Only a few organizations involved in SCM possess all three simultaneously. In most cases, organizations use these assets for asymmetric cost reductions, reductions that do not translate into a reduction of total costs for the supply chain despite the privileged position of the organization that initiated it. Regardless of all the benefits that create a balanced relationship, every organization wants collaboration in which its success depends on an ability to maintain control over critical assets. During negotiations of strategic objectives, purchase and supply agreements, price, delivery, and quality (among others), all parties look for opportunities to create an advantageous imbalance.

Recent research (Mentzer et al., 2001; Min et al., 2005; Moberg et al., 2003; Munson et al., 2000; Sabath & Fontanella, 2002; Simatupang & Sridharan, 2002, and 2005; Williamson, 2008) suggests several approaches that explain failures in collaboration agreements or barriers to their development. Based on empirical research, we believe the existence and influence of asymmetries in SCM are the causes of distortions. These distortions include differences in the definition of strategic objectives, low-level integration, lack of transparent decision-making, use of distorted information, and greater importance given to particular outcomes in supply chain performance. Results confirm the universal character of distortions produced by asymmetries in SCM. Regardless of the environment (mature versus emerging markets), sector of operation, value of transactions, and agreement sizes, causes of deviations in management are similar. Decisions or corrective actions also have universal character in operational applications. From this viewpoint, it is feasible to build a universal model of managerial behavior. This model is especially useful when organizations plan start-up or subsidiary business units in various markets.

LIMITATIONS

Although we found support for and confirmation of results in two organizational contexts, conclusions derived from this research should be guided by the study's limitations. Managers are basing their responses on perceptions and opinions. For this reason and despite statistical treatment, responses to the questionnaires are not completely free of the subjectivity. Another limitation relates to the general character of the hypothesis; this study is exploratory. This characteristic means that the approaches to the problems were made from general assumptions.

FUTURE RESEARCH

Future research should investigate factors regarding managerial behaviors in SCM in the United States market. Results of such research could close the spectrum of analysis dedicated to the influence of asymmetries in SCM from the viewpoint of a different market. The research design is based on a cross-sectional survey, which is advantageous because results are more representative than sector studies. However, it is desirable to perform similar studies with a larger number of firms. Future research should investigate the influence of asymmetries in value chain construction. A deeper analysis of issues relating to value creation in asymmetric conditions could lead to a different assessment of competitiveness and business strategy. However, the presence of differences between the behaviors of the samples are analyzed only in an exploratory way, leaving the study of how environmental factors can affect the stability of the relations proposed in the research model for subsequent research.

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APPENDIX A

SAMPLE COMPANIES IN POLAND

NUMBER OF PARTNERS IN SUPPLY CHAIN	N	%
more than 6	**44**	**86.4%**
3 to 6	**31**	**11.1%**
3 or fewer	**6**	**2.5%**
TOTAL	**81**	**100%**
Industry	**N**	**%**
Automotive	**16**	**19.8%**
Mechanical Electrical & Process Engineering	**12**	**14.8%**
Food & Drink	**10**	**12.3%**
Building sector	**10**	**12.3%**
Automation	**9**	**11.1%**
Electronics & IT Hardware	**8**	**9.9%**
Metals & Minerals	**4**	**4.9%**
Power	**3**	**3.7%**
Furniture & Furnishings	**2**	**2.5%**
Pharmaceuticals	**2**	**2.5%**
Cosmetics	**1**	**1.2%**
Chemicals	**1**	**1.2%**
Clothing, Footwear, & Fashion	**1**	**1.2%**
Legal services	**1**	**1.2%**
Mining	**1**	**1.2%**
TOTAL	**81**	**100%**

SAMPLE COMPANIES IN SPAIN

NUMBER OF PARTNERS IN SUPPLY CHAIN	N	%
more than 6	12	23.07%
3 to 6	10	19.23%
3 or fewer	30	57.69%
TOTAL	52	100%
Industry	N	%
Logistics	14	26.92%
Electronics & IT Hardware	8	15.38%
Clothing, Footwear, & Fashion	6	11.54%
Informatics' Industries	6	9.61%
Metals & Minerals	5	9.61%
Food Industries	5	9.61%
Building sector	2	3.85%
Printing house	2	3.85%
Air Lines	2	3.85%
Other	2	3.85%
TOTAL	52	100%

APPENDIX B

QUESTIONNAIRE

VARIABLE - ASYMMETRY - ITEMS
(Is the next act considered a sign of differences in behaviours of the supply chain partners? Completely agree =7; Completely disagree = 1)

Communication between supply chain partners has improved in the same level as their capacity and level of technology (Aa1_10)
Relations between supply chain partners are periodically and jointly evaluated (Aa1_13)
All partners easy accept leadership position one of them as the best policy for their interests (Aa1_14)
The level of commitment is always similar in the relationships between supply chain partners (Aa1_15)
The operational information on costs and profits is frequently shared with our partners (Aa1_2)

VARIABLE - TRUST - ITEMS

(Is the next act considered a sign of confidence in the honesty of members of the supply? Chain? Completely agree =7; Completely disagree = 1)

Our reputation on the market has improved since our integration in the supply chain (TRa1_4)
We believe that the level of knowledge shared with the supply chain partners is very high (TRa1_5)
Supply chain members should known cost and profit levels of the other partners (TRa1_7)
Problems are solved of mutual agreement by holding meetings (TRa1_8)
The opinions and suggestions of our supply chain partners are believed to be honest and true (TRa1_9)

VARIABLE - COLLABORATION - ITEMS

(Is the next act considered a sign of responsibility to carry out joint actions for overall supply? Chain and management members? Completely agree =7; Completely disagree = 1)

The collaboration is the basis of setting common goals (CLa2_1)
The SCM process means giving up our particular interests in benefits of those of the whole chain (CLa2_2)
The training process was carried out in common with the supply chain partners (CLa2_5)
Problems and opportunities related to costs and profits are analyzed jointly with our partners (CLa2_6)
Forecast information is frequently shared with our partners (CLa2_8)

VARIABLE - INTEGRATION - ITEMS

(Has supply chain integration improved your firm's performance in the following areas? - Completely agree =7; completely disagree = 1)

The integration with the supply chain partners has been positive for our profitability (ITa2_9)
Our integration can be viewed as critical for our profit margin (ITa5_1)
The company future projects will depend on the level of our partners integration (ITa5_3)
The level of integration with our supply chain partners meets our expectations (ITa5_7)
In our supply chain we have eliminated the functional and structural barriers among partners (ITa7_1)

VARIABLE - INNOVATION - ITEMS

(Has supply chain innovation as a platform for diversification of communications systems? - Completely agree =7; completely disagree = 1)

CAD/CAM/CAE is used for joint projects (INa7_2)
All supply chain partners are connected via EDI (Electronic Data Interchange) (INa7_3)
The trace and track system is open to all supply chain partners (INa7_5)
All partners are interested in product and process innovation (INa7_8)
Our investment in R&D have been reduced after becoming a supply chain partner (INa9_14)

VARIABLE - COST - ITEMS

(To what extent have supply chain success factors in asymmetric environments affected your firm's costs in the following areas? – We are lower = 1; we are higher than last year = 7)

Inventory costs reduction (CRa9-1)
Production costs reduction (CRa9_2)
Purchasing costs reduction (CRa9_3)

VARIABLE - PERFORMANCE - ITEMS

(To what extent have supply chain success factors in asymmetric environments affected your firm's performance in the following areas? – We are lower = 1; we are higher than last year = 7)

Growth and diversification of incomes (PFa9_4)
Profits (PFa9_5)
Productivity improvement (PFa9_6)
Market participation (PFa9_7)
Customer satisfaction (PFa9_8)

APPENDIX C

CROSS LOADINGS
POLAND

	ASSYM	COLL	COSTRED	INNOV	INTEG	RESULTS	TRUST
Aa1_10	0.811	0.479	-0.009	0.219	0.463	0.068	0.493
Aa1_13	0.444	0.395	0.062	0.303	0.382	0.261	0.739
Aa1_14	0.527	0.374	0.135	0.269	0.729	0.252	0.495
Aa1_15	0.450	0.499	0.111	0.370	0.521	0.019	0.640
Aa1_02	0.271	0.215	-0.036	0.097	0.481	0.143	0.390
TRa1_4	0.454	0.516	0.111	0.334	0.378	0.257	0.794
TRa1_5	0.195	0.289	0.097	0.169	0.478	0.030	0.490
TRa1_7	0.513	0.363	0.043	0.323	0.503	0.080	0.347
TRa1_8	0.651	0.323	-0.058	0.289	0.386	0.077	0.425
TRa1_9	0.720	0.342	-0.045	-0.006	0.286	0.053	0.364
CLa2_1	0.468	0.714	0.166	0.448	0.516	0.126	0.493
CLa2_2	0.697	0.607	-0.140	0.244	0.400	-0.035	0.385
CLa2_5	0.463	0.724	-0.063	0.276	0.416	-0.137	0.407
CLa2_6	0.441	0.734	0.015	0.522	0.419	-0.025	0.397
CLa2_8	0.488	0.825	0.066	0.521	0.476	0.042	0.550
ITa2_9	0.578	0.838	0.004	0.595	0.513	-0.114	0.584
ITa5_1	0.296	0.361	0.067	0.320	0.636	0.142	0.352
ITa5_3	0.436	0.510	-0.074	0.423	0.679	-0.229	0.382
ITa5_7	0.381	0.517	0.213	0.447	0.700	0.013	0.338
ITa7_1	0.101	0.141	-0.171	0.512	0.251	-0.098	0.168
INa7_2	0.301	0.382	0.028	0.748	0.239	0.027	0.287
INa7_3	0.155	0.359	0.080	0.654	0.234	0.088	0.373
INa7_5	0.239	0.533	0.136	0.723	0.412	0.169	0.366
INa7_8	0.189	0.485	-0.023	0.547	0.456	-0.121	0.215
INa9_14	-0.005	0.167	0.586	0.172	0.241	0.364	0.156
CRa9_1	-0.208	-0.101	0.459	-0.055	0.030	0.726	-0.001
CRa9_2	-0.213	-0.267	0.528	-0.094	-0.011	0.728	-0.035
CRa9_3	-0.022	0.106	0.828	0.059	0.069	0.499	0.185
PFa9_4	-0.153	-0.089	0.677	-0.089	-0.040	0.392	0.068
PFa9_5	-0.013	-0.030	0.746	0.043	0.066	0.539	-0.004
PFa9_6	0.191	0.078	0.532	0.208	0.141	0.761	0.293
PFa9_7	0.151	0.022	0.341	-0.004	0.001	0.695	0.178
PFa9_8	0.283	0.140	0.371	0.106	0.214	0.647	0.391

CROSS LOADINGS
SPAIN

	ASSYM	COLL	COSTRED	INNOV	INTEG	RESULTS	TRUST
Aa1_10	0.811	0.682	0.161	0.388	0.574	0.228	0.518
Aa1_13	0.738	0.626	0.316	0.334	0.438	0.385	0.857
Aa1_14	0.592	0.436	0.326	0.376	0.706	0.351	0.571
Aa1_15	0.617	0.389	0.392	0.409	0.629	0.392	0.695
Aa1_02	0.522	0.382	0.146	0.321	0.735	0.214	0.461
TRa1_4	0.602	0.483	0.228	0.250	0.468	0.321	0.768
TRa1_5	0.585	0.491	0.242	0.193	0.594	0.305	0.853
TRa1_7	0.716	0.548	0.373	0.438	0.616	0.330	0.559
TRa1_8	0.851	0.641	0.412	0.401	0.555	0.471	0.768
TRa1_9	0.734	0.388	0.363	0.304	0.563	0.390	0.666
CLa2_1	0.349	0.417	0.159	0.202	0.368	0.161	0.203
CLa2_2	0.579	0.625	0.105	0.154	0.316	0.125	0.445
CLa2_5	0.288	0.415	0.095	0.314	0.330	0.135	0.051
CLa2_6	0.674	0.882	0.275	0.434	0.550	0.155	0.529
CLa2_8	0.526	0.745	0.387	0.379	0.406	0.411	0.639
ITa2_9	0.692	0.849	0.241	0.396	0.601	0.343	0.538
ITa5_1	0.525	0.504	0.599	0.458	0.803	0.578	0.527
ITa5_3	0.493	0.630	0.295	0.410	0.654	0.298	0.497
ITa5_7	0.169	0.240	0.133	0.150	0.440	0.133	-0.101
ITa7_1	0.092	0.175	0.459	0.566	0.166	0.355	0.097
INa7_2	0.376	0.418	0.512	0.768	0.470	0.584	0.170
INa7_3	0.442	0.420	0.526	0.867	0.402	0.507	0.325
INa7_5	0.436	0.425	0.455	0.776	0.497	0.463	0.408
INa7_8	0.211	0.304	0.429	0.569	0.287	0.388	0.341
INa9_14	0.366	0.275	0.440	0.468	0.256	0.672	0.282
CRa9_1	0.348	0.230	0.535	0.602	0.444	0.716	0.214
CRa9_2	0.329	0.290	0.657	0.497	0.303	0.645	0.105
CRa9_3	0.167	0.192	0.517	0.394	0.336	0.658	0.332
PFa9_4	0.100	0.188	0.466	0.206	0.202	0.193	0.303
PFa9_5	0.272	0.259	0.541	0.358	0.249	0.235	0.440
PFa9_6	0.253	0.182	0.837	0.503	0.443	0.562	0.304
PFa9_7	0.345	0.371	0.644	0.514	0.453	0.796	0.393
PFa9_8	0.325	0.218	0.444	0.302	0.278	0.723	0.376