SUBJECTIVE UNCERTAINTY, INTERORGANIZATIONAL COOPERATION AND FIRM OPERATIONAL PERFORMANCE: A POSITIVE RELATIONSHIP

MARTA FABIANO SAMBIASE
Mackenzie University
Rua da Consolação, 930. Consolação. CEP 01302-907. São Paulo, S.P. Brasil
E-mail: martafsambiase@gmail.com

ELIANE PEREIRA ZAMITH BRITO
EAESP- FGV
Programa de Pós Graduação em Administração de Empresas Stricto Sensu
Avenida Nove de Julho, 2029 - Bela Vista São Paulo, 01313-001
E-mail: elianezbrito@gmail.com

ADILSON ADERITO DA SILVA
Mackenzie University
Rua da Consolação, 930. Consolação. CEP 01302-907. São Paulo, S.P. Brasil
E-mail: asilva@mackenzie.com.br

FERNANDO FERREIRA
Mackenzie University e EAESP - FGV
Rua da Consolação, 930. Consolação. CEP 01302-907. São Paulo, S.P. Brasil
E-mail**:** fcmferreira@gmail.com

Abstract

Business people in the same industry adopt different levels of cooperation when dealing with suppliers of the same type of goods. There can be many drivers to explain this difference in behavior. This study aims to examine to what extent a manager's perception of uncertainty, also called 'subjective uncertainty', influences cooperative behavior in inter-organizational relations, and how this behavior affects the operational performance of the firm. The theoretical justification and assumptions for this research are grounded mainly in the Theory of Profit (Knight, 2006); Game Theory (Nalebuff & Bradenburger, 1996), Cooperative Behavior (Heide & Miner, 1992) and the Relational View (Zajac & Olsen, 1993; Dyer, 1997). A survey of over 200 Brazilian managers from various industries was conducted. All measures were perceptual in nature. Measurement scales use d in previous studies were adapted to collect the data, which were analyzed using Confirmatory Factor Analysis (CFA) and then processed with the Structural Equation Modeling (SEM) technique. The Robust Maximum Likelihood method was adopted because it is recommended for the treatment of data from ordinal scales (Finney & DiStefano, 2006). This technique makes it possible to estimate, simultaneously, multiple dependence relationships between latent variables, especially when such variables exert influence in a relationship (exogenous) and are influenced in subsequent relationships (endogenous) – (Favero, et al, 2009; Hair, et al, 2009). The results reveal the multi-dimensionality of the uncertainty construct, characterized by the uncertainties of state, effect and response, in accordance with Milliken's proposal (1987, 1993). At the 5% level of statistical significance and statistical power of 99.8% it was found: a) the negative influence of the uncertainty of state on operational performance, b) the positive influence of the uncertainty of effect on the uncertainty of response; c) the significant influence of the uncertainty of response on cooperative behavior; d) the positive influence of cooperative behavior on operational performance. The results also indicated that cooperation and subjective uncertainty accounted for 18.8% of the variability of operational performance, corroborating Jeffrey Dyer's findings in field studies of Relational View.

Keywords: subjective uncertainty; cooperation; firm operational performance.

1. Introduction

This paper aims to examine the effect of the manager's perception of uncertainty on cooperative behavior in inter-organizational relationships, and how this behavior influences organizational operational performance.

The initial inspiration for this study not only comes from Coase (1937 p.6), to whom "the firm consists of a system of relationships", and Williamson (1985), through the contracts theory in the study of governance structures, in particular the hybrid form, but also from the belief that when markets adopt a competitive dynamics based on cooperative inter-organizational relationships, the shared benefits are greater and more effective than when adopting the single view of competition based on interfirm rivalry (Miles, Snow & Sharfman, 1993). The degree of cooperation in the inter-organizational relationships can vary between the agents, as can the managers' uncertainty about the value generated by hybrid governance structures. This has an influence on business results which can be observed through operational performance (White, 1996).

On the other hand, inter-organizational cooperation can be stimulated by external environment uncertainty (Knight, 2006; Schermerhorn, 1975; Williamson, 1975; Dess; Beard, 1984; Shervani; Frazier & Challagala, 2007). In this respect, Das & Teng (1998) observe that ambiguous objectives and uncertainty about the future are facts that lead firms to form alliances. Williamson (1975) points out as an influencing factor in the choice of market structures the existence of both internal as well as external environmental uncertainty. However, this study examines only external environmental uncertainty, particularly the manager's perception of uncertainty, namely 'subjective uncertainty'.

Sull & Escobari (2004) state that Frank Knight (2006) was one of the first economists to systematically analyze the effect of uncertainty on the executive's ability to make business decisions. He clarified the difference between risk and uncertainty, in that, whereas in risk assessment the difficulty lies in establishing probable outcomes for known scenarios, the difficulty presented by perceived uncertainty is that it requires defining the scenarios themselves. Knight (2006) and other authors (Duncan, 1972; Huff, 1978; Keynes, 1984; Milliken, 1987) believe that in the face of subjective probability or non-measurable uncertainty it is impossible to devise possibilities of action, the reason being the high level of the situation's uniqueness, either because of the situation itself or due to the interference of bounded rationality (Simon, 1983).

The theoretical model of this study is mainly underpinned by the Theory of Profit (Knight. 2006); Game Theory and Co-opetition (Nalebuff & Bradenburguer, 1996) and Relative Vision (Zajac & Olsen, 1993; Dyer, 1997). The research hypotheses were tested by collecting data from 227 managers working in Brazilian industry. The data were analyzed by utilizing the Structural Equation Modeling (SME) model by means of the Robust Maximum Likelihood Estimation method which is recommended for the analysis of data originating from ordinal scales (Finney; Distefano, 2006). This technique makes it possible to estimate, simultaneously, multiple dependence relationships between latent variables, especially when such variables exert influence in a relationship (exogenous) and are influenced in subsequent relationships (endogenous) – (Favero, et al, 2009; Hair, et al, 2009). The latent constructs were measured from previous studies, and validated via Confirmatory Factor Analysis (CFA). According to Kline (1995, p.61), through CFA it is possible to confirm whether the indicators measure the proposed dimensions, thus testing their dimensionality. The measurement of

'subjective uncertainty' was inspired by Milliken (1987; 1993); 'cooperation' had its base on the view from Heide & Miner (1992), and 'performance', adhered to White's view (1996).

Results point to the multidimensionality of the uncertainty construct, which is characterized by three uncertainties, namely, 'state', 'effect' and 'response', in accordance with Milliken (1987, 1993). At the 5% level of statistical significance and statistical power of 99.8% these were the findings: a) the negative influence of the uncertainty of 'state' on operational performance, b) the positive influence of the uncertainty of 'effect' on the uncertainty of 'response'; c) the significant influence of the uncertainty of 'response' on cooperative behavior; d) the positive influence of cooperative behavior on operational performance. As perceived by the managers who took part in this study, the results also indicated that cooperation and the uncertainty of 'state' accounted for 18.8% of the variability of operational performance, thus corroborating Jeffrey Dyer's findings in his studies of Relational View (Dyer, 1997; Dyer & Singh, 1998).

Theoretical Background

Uncertainty

Ongoing discussions surrounding environmental uncertainty, dynamism and complexity often refer to either the globalization of the competitive environment, or technological speed, which originate from two theoretical approaches whose chronology is not at all associated with "currently" or "recently". The first approach, from economic scientists, recognized long ago that the difference between accessing knowledge information, and the way to deal with its absence, generates the difference in profitability among businesses (Knight, 2006; Keynes, 1984; Penrose, 1959; Arrow, 1984; Williamson, 1985; Foss, 1996). As for the second approach, from organization theorists, in an effort to understand and explain the ways in which internal and external environments interact as a prerequisite for satisfactory performance, it originated from Barnard (1938) and was then followed by several authors (Thompson, 1967; Lawrence & Lorsch, 1967; Duncan, 1972; Pfeffer & Salancik, 1977; Milliken, 1987; Kreiser & Marino, 2002).

According to Knight (2006) uncertainty is the pivot of the Theory of Profit, which argues that the connection between change and profit is uncertain and always indirect, which in turn means that uncertainty is the indirect connection between change and profit. Dynamic changes lead to a peculiar form of revenue only if the changes and their consequences are unpredictable, since "It is the fact that change is a necessary condition of us being ignorant of the future that has given rise to the error that change is the cause of profit." (Knight, 2006, p.37). In the absence of a pattern in which events occur, it is impossible to devise a group of possibilities of action, given the situation's high level of uniqueness. If all changes happened according to universally and invariably known laws, they would be predictable and, therefore, gain (or loss) would not occur. The human being's value in business lies in his ability to judge correctly and make considered decisions (Knight, 2006; Duncan, 1972; Huff, 1978; Keynes, 1984; Milliken, 1987).

Knight (2006, p.252) suggests that the consolidation or size of a business can lead to a decrease in the effects of uncertainty because decisions with negative effects on profit would be supplanted by positive effects. It would be possible to suppose that consolidation derived from inter-organizational cooperation would present a similar effect/result.

Williamson (1975) argues that transaction costs are not directly measurable since they represent potential consequences for alternative decisions. This is why he proposes the Transaction Costs Economics (TCE) model based on the level of asset specificity in internal and external uncertainty. Internal uncertainty is the degree of difficulty in achieving performance. When ambiguity is present in performance, the firm cannot easily discern the level of performance it is achieving. When internal uncertainty is high it is not possible to establish outcome measures, or only poor measures are established; market choice would lead to high transaction costs because the firm would need to monitor seriously and direct/guide closely the activity of independent firms. As a result, TCE predicts that the more internal uncertainty increases, the more favorable towards adopting integrated governance options firms are (Shervani; Frazier & Challagala, 2007). Thus, trust emerges as an expectation between exchanging partners – partners will not act opportunistically unless they are offered short-term incentives and uncertain long-term results (Bradach; Eccles, 1989). According to Williamson (1975; 1985) opportunism considers the possibility of uncertainty in the behavior of the other party, and that most of investment transactions are made under uncertain.

External uncertainty is the extent to which it is difficult to predict future world events/states. This type of uncertainty is guided by a very dynamic business environment which changes rapidly and/or is very complex. High external uncertainty, taken as a perceived interval/gap between expected outcomes and achieved outcomes, is associated with bound rationality (Simon, 1983) and rigorous governance mechanisms based on contracts which specify most of all possible eventualities, if that is feasible (Eriksson & Sharma, 2003). Thus, the non-regularity of facts can lead to asymmetric information and potential situations for external intermediary agents to act opportunistically. In the presence of high external uncertainty, transaction costs tend to be higher in the market because of the level of sophistication of contracts, directing alternatively towards higher levels of channel integration (Shervani; Frazier & Challagala, 2007).

The operationalization of uncertainty for this study's empirical test was based on the multidimensionality of the proposal construct of Milliken (1987). She defines uncertainty as the individual's perceived inability to make a prediction and maintains that the origin of uncertainty lies in the external environment, 'outside' the firm, and follows the same line of thought as Knight (2006). Milliken (1987) defends the three-dimensionality of the uncertainty construct and classifies it into three types. The first, state uncertainty, relates to the information the manager has available to him, or believes he has available to him. The second, effect uncertainty, comprises the manager's cognitive processing of the information about the environment. The third, response uncertainty, relates to the manager's actions in response to the environment. Milliken (1987) adds that the difference between the three types of uncertainty is the type of information the manager/administrator perceives to be lacking. The following hypotheses are presented in Figure 1 – Theoretical Reference Model.

H1- State uncertainty influences effect uncertainty.
H2- Effect uncertainty influences response uncertainty.
H3- Response uncertainty influences the degree of cooperation.
H4- State uncertainty influences business operational performance.

Cooperation

Given the diversity of the academic roots of the literature on cooperation, there are difficulties in interpreting the theories and studies available on this concept. Many of the existing definitions of cooperation focus on the process through which individuals, groups and organizations interact and form psychological relationships for mutual gain or benefit (Smith; Carrol & Ashford, 1995). In addition, a significant number of the studies available on cooperation consider the antecedents or effects of cooperation, but do not define or measure the construct itself.

Organization theory defines cooperation in terms of voluntary joint activities or programs between a set of parties (Aiken & Hage, 1968; Guetzkow, 1966; Heide & Miner, 1992), allowing variation in the degree of formality or intensity of the interactions (Schermerhorn, 1975; Mulford & Rogers, 1982). Ring and Van de Ven (1994) made the definition of cooperation dynamic by including the individuals' willingness to maintain cooperative relationships; they noted that cooperative relationships are "social mechanisms for collective actions, continually shaped and restructured by actions and symbolic interpretations of the parties involved" (1994, p.96).

Smith, Carrol and Ashford (1995) find that there are at least two types of cooperative relationships: formal and informal. Informal cooperation is associated with adaptable arrangements where behavioral norms, rather than contractual obligations, determine each party's contribution. Formal cooperation, however, is characterized by contractual obligations and formal control structures. According to these authors, the type of cooperation can also vary according to how the different parties are connected to one another. Individuals, groups and organizations who are linked vertically can cooperate with each other, as can individuals, groups and organizations who are kinked horizontally.

Ring and Van de Ven (1994), based on the original formulation of transactions developed by Commons (1950), propose a group of heuristics to explain the development and evolution of a cooperative relationship, consisting of a repetitive sequence of negotiations, compromises and execution stages – each of these evaluated in terms of efficiency and equity. Furthermore, although these stages may occur almost simultaneously in the case of simple transactions, the duration of each stage varies in accordance with the uncertainty of the concepts involved, the trust between the parties involved and the relationship between the roles of the parties involved. According to the authors, to sustain a business agreement the cooperative relationship may need to be maintained long term.

Revogation of the cooperative contract may also occur as a consequence of, or flaw in, a contractual condition (Ring & Van de Ven, 1994). There are several outcomes relating to the existence of cooperative behavior, but one of the most sought is effective coordination, since it is associated with higher performance levels. Coordination refers to the combination of the efforts of all parts to achieve the most effective and harmonious outcomes (Thompson, 1967). Smith, Carrol and Ashford (1995) indicate that coordination deriving from cooperation is particularly important in new/modern types of organizations where relationships are much more spontaneous than those imposed by hierarchic organization.

Among the theoretical approaches that make it possible to describe cooperation are exchange theories, in which cooperation is defined as a means of maximizing economical and psychological benefits (Blau, 1974). The parties involved in a relationship are willing to cooperate when the benefits of cooperation supersede the costs. Exchange theories can be used appropriately to explain conscious and calculated reasons why the parties involved

should cooperate among themselves and maintain cooperative relationships. Social structure theories provide a different perspective for cooperation, emphasizing the role of structural factors in providing cooperation (Blau, 1974). More specifically, structural theories aim to explain the emergence of cooperative relationships in terms of the aggregated conditions of the system in which such cooperation occurs. In line with modeling theories, social structure theories aim to measure/quantify a relationship in order to cooperation and coordination. Thus, the fifth operationally viable hypotheses is presented.

H5- Cooperation influences business operational performance.

Heider and Miner (1992), based on Kaufman and Stern's work (1988), state that cooperation is a phenomenon that manifests itself in different ways or behaviors. They indicate four cooperative behaviors which can represent cooperation, namely: flexibility in problem-solving, exchange of information, joint problem-solving and restrictive use of power. The authors stress that these behaviors are not indicators of one single construct, but possible ways to cooperate. Therefore, it would be possible to affirm that the higher the number of cooperative behaviors adopted by organizations and the higher the intensity of these behaviors, the more cooperation there will be (and vice-versa). In addition, it is expected that the correlation between them is positive. For the operationalization of cooperation in this study, Heide and Miner's proposal was used (Heide & Miner, 1992). A search of scientific articles databases showed that their article was cited in over 800 studies dealing with cooperation or collaboration between organizations. Heide and Miner's scale has also been successfully utilized in the Brazilian language (Hashiba, 2006).

Operational Performance

Organizational performance is widely recognized as an important – if not the most important – construct in Strategy research (Combs *et al*, 2005). In fact, the emphasis on company performance is one of the elements which distinguishes this field from other areas of organizational studies (Glick *et al*, 2005). According to Venkatraman and Ramanujam (1986), financial performance and operational performance are the main indicators of company effectiveness. In their view, whereas the financial domain includes performance indicators such as sales growth, profitability and shares gains, the operational domain is associated with performance measures such as market-share, introduction of new products, product quality and value-added manufacturing, to name a few. However, the way in which company performance is measured varies greatly.

A study conducted by Combs *et al* (2005) involving analysis of 374 articles published in the *Strategic Management Journal* (SMJ), over the period 1980-2004, revealed 56 different performance indicators, out of which 33 related to financial performance and the remainder to operational performance. Such plurality of indicators suggests that company performance is a multidimensional construct (Combs *et al*, 2005). Nevertheless, this does not prevent researchers from presenting the construct by means of one single indicator (Murphy, Trailer & Hill, 1996; Glick, Washburn & Muller, 2005).

Despite general agreement over the need to utilize non-financial performance measures, there seems to be little, if any, agreement over which ones to use. Part of the reason for this lack of consensus is the obvious need of each company to adopt measures which are relevant to its own situation. On the other hand, a common base for the selection of

performance measures would be something valuable, not only because it would avoid unnecessary proliferation of measures, but also because it would ensure the correct measurement of important variables. The latter reason is particularly true when it comes to academic research where, more recently, data have been collected for the evaluation of performance (Neely *et al*, 1997).

According to Roth and Miller (1992) operational strategy is associated with three different performance measures: (1) relative manufacturing capabilities: strength measures of an operation in relation to its main competitors in terms of quality, trustworthiness, costs, flexibility and delivery speed; (2) relative managerial success: the company's executive body's ability to utilize operational capabilities and other functional areas in order to achieve the company's objectives and (3) economic performance: absolute results from the business unit, including Return on Assets (ROA) and profitability.

As regards relative manufacturing capabilities (quality, trustworthiness, costs, flexibility and speed), they are nothing but classic objectives of operational performance which companies use to establish their competitive priorities in relation to the market (Boyer & Lewis, 2002). Recent decades have seen the emergence of a structure, regarding the content of operational strategy, which has achieved relative consensus. Similarly, there is consensus that the effectiveness of an operational strategy is determined by the degree of consistency between the emphasized competitive priorities and the corresponding decisions relating to operational structure and infrastructure.

Essentially, ensuring company practices that suit the company's competitive priorities is crucial for the development of operations as a source of competitive advantage (Boyer & Lewis, 2002). In this regard, recent studies have been concerned with understanding the role that the development of competences and capabilities in operations has to play in the performance of organizations, mainly in operational performance. Alolayyan, Mohd All and Fazli (2011), for example, found a strong correlation between flexibility and operational performance in the hospital sector in Jordan. Duarte *et al* (2011), on the other hand, following analysis of a sample of 1200 companies located in the state of São Paulo, did not find evidence that could prove a positive relationship between the adoption of recognized operational practices (such as quality management, International Organization for Standardization – ISO – certifications, *Just in Time* and service outsourcing) and financial performance. Brown, Squire and Lewis (2010) after observing 15 personal computer (PC) production units located in different countries in the world, they concluded that the factories they defined as "strategically fragmented" (marked by the absence of operations personnel at the company's strategic levels and the absence of operational strategies which connect to the company's business strategies) had worse operational performance than the companies they described as "strategically integrated" where operations had a key role in company strategy.

Notwithstanding the fact that operational strategy is a topic of great interest, White (1996) acknowledges that to the business, as well as academic environments, consensual structuring of operational performance measures still remains distant from the need for agreement between the interested parties in order to achieve improvement of business performance systems. By means of a thorough literature review, White (1996) detected 125 operational performance indicators, and organized them into five performance objectives in operations relevant to the proposed system: costs, quality, delivery speed, trust in the delivery and flexibility. Among the dozens of indicators found for each performance objective, some are exemplified in Figure 2, in the Research Methods section of this paper. Most of these indicators are of a subjective nature, that is, they serve to indicate the manager's perception of

his company's development compared with his main competitors. In this study operational performance was measured as a multi-dimensional construct based on the performance objectives proposed by White (1996).

2. Research Methods

This descriptive study aimed to examine the relationship between subjective uncertainty, inter-organizational cooperation and operational performance, looking at the extent to which a manager's perception of uncertainty influences cooperative behavior in inter-organizational relations, and how this behavior affects the company's operational performance.

The unit of analysis adopted for this study is a relationship, namely, the organizational relationship between managers as individuals. Dyer; Kale & Singh (1998) argue that a company's critical resources can go beyond the company's limits and may be embedded in the resources and routines of other companies; thus, a unit of analysis which is important for the understanding of competitive advantage is the relationship between companies, since companies are potential sources of inter-organizational competitive advantage.

This chosen form of analysis is not very common in studies involving cooperation. The literature on cooperation is extensive. However, studies focusing on inter-organizational cooperation more frequently use, amongst other types, units of analysis representing a dyad, such as, the relationship between clients and suppliers; and buyers and suppliers (Aiken & Hage, 1968; Heide & Miner, 1992; Beansou, 1997; Pigatto & Alcantara, 2007; Hashiba, 2008); or organizational relationships and alliances between pairs (Hagedoorn, 1993; Ring & Ven, 1994; Sambiase-Lombardi & Brito, 2003; White & Lui, 2005).

The starting point for the definition of each research construct and appropriate selection of indicators as *proxies* for measuring them were the studies indicated in the theoretical references. In terms of measuring the research constructs, the authors of this study opted for tried methods which had achieved good results in previous studies. As regards nonobjective measurements, the research data were gathered by means of a structured questionnaire consisting of three phases: content specification, selection, and refinement of the selected indicators, in line with psychometric theory for the elaboration of the scales (Nunnally, 1967; Churchill, 1979; Anderson & Gerbing, 1991; Bagozzi 1994; Rossiter, 2000; Diamantopoulos & Winklhofer, 2001).

To measure the cooperation variable the tool based on Heide & Miner (1992) – whose validation in research with a Brazilian sample was conducted by Hashiba (2008) and confirmed by CFA confirmatory factor analysis *(*see Appendix A) – was used. The measurement of subjective uncertainty was made in accordance with Sambiase,-Lombardi & Brito (2010), who define the concept in three dimensions, as suggested by Milliken (1987). Milliken focuses on the individual's perceived inability to predict an event taking place in the external environment (outside the company) and describes three dimensions of uncertainty, namely, uncertainty of 'state', 'effect', and 'response'. Finally, the measurement of the operational performance construct was made in accordance with White's proposal (1996). White detected 125 operational performance indicators, and organized them into five performance objectives in operations relevant to the proposed system: costs, quality, speed, trust in the delivery, and flexibility.

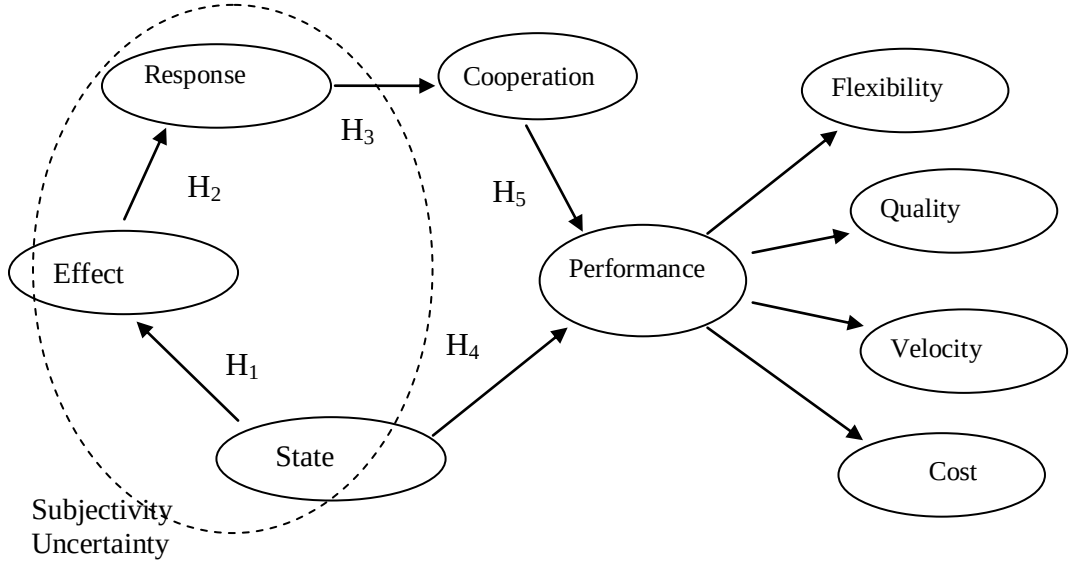
In addition to the steps involved in measuring the constructs, the research tool included sections on the characterization of the companies and respondents. The final

questionnaire was distributed to respondents via the Internet, via the following link: www.suapesquisa.com.br/mackpesquisa.

The latent nature of each research construct and the relationships outlined between them, involve, simultaneously, inter-dependence relationships between the indicators, and dependence relationships between the constructs, as illustrated in Figure 1.

The simultaneous relationships between these constructs, in the way proposed by this study, have not been estimated in previous empirical studies. The data were analyzed by using the Structural Equation Modeling (SEM) technique. This technique makes it possible to access the information subjacent to the replies, and to estimate, simultaneously, multiple dependence relationships between latent variables, especially when such variables exert influence in a relationship (exogenous) and are influenced in subsequent relationships (endogenous) – (Favero, et al, 2009; Hair, et al, 2009).

Figure 1 – Theoretical reference model



Source: Figure devised by the authors based on the research data.

One of the required presuppositions in SEM processing via the Maximum Likelihood (ML) method is the normal multivariate distribution of indicators, which can be tested by the multivariate kurtosis index measured by Mardia's PK statistic (Mardia, 1970). This statistic is asymptotically distributed as normal N(0.1), therefore, a sample can be considered normally distributed at 5% significance level when the multivariate kurtosis standard values are lower than the critical level of 1,96 (Mardia, 1970). However, values higher than 3 for Mardia-Based Kappa's normalized estimate, produce low error estimates and inflate the Chi-Square statistic, resulting in low significance levels significance levels (sig $\leq \alpha$) and rejection of adjusted models (Bentler; Wu, 2002).

The statistical modeling of data derived from ordinal scales with a minimum of five categories and approximately normal distributions can be carried out with the ML method as if continuous, without great distortion to adjustment levels (Finney; Di Stefano, 2006; Bollen, 1989; Muthén; Kaplan, 1985). However, because of the discrete nature of the data, some

degree of non-normality is introduced to the distribution. In such situations Finney and Di Stefano (2006) recommend the utilization of the Robust ML method, available on the EQS 6.1 software, which generates the Satorra-Bentler Scaled Chi-Square (SBx2) statistic. This statistic minimizes the effects of the non-normality of the distribution, as well as the complexity of the model and its adjustment. Furthermore, this statistic produces reliable and equally stable statistics when the sample is relatively small (Bentler, 1995).

To evaluate the model's adjustment the following statistical tools were used: Chi-Square statistic, an index of absolute fit (root mean square error of approximation RMSEA), and incremental and comparative indices - comparative fit index (CFI), incremental fit index (IFI), non-normed fit index (NNFI) - which are relatively less affected by the sample size and model complexity (Fan; Thompson & Wang, 1999; Gerbing; Anderson, 1993; Hu; Bentler, 1995). In line with these authors, this study will adopt magnitude references to indicate good model adjustment via comparative indices (CFI, IFI, NNFI $\geq$0.90) and the index of absolute fit (RMSEA $\leq$0.08).

The regression coefficient significances of the structural model will be evaluated by means of the Wald test (W test) whose null hypothesis determines that the estimated value of a parameter does not differ from zero in the population.

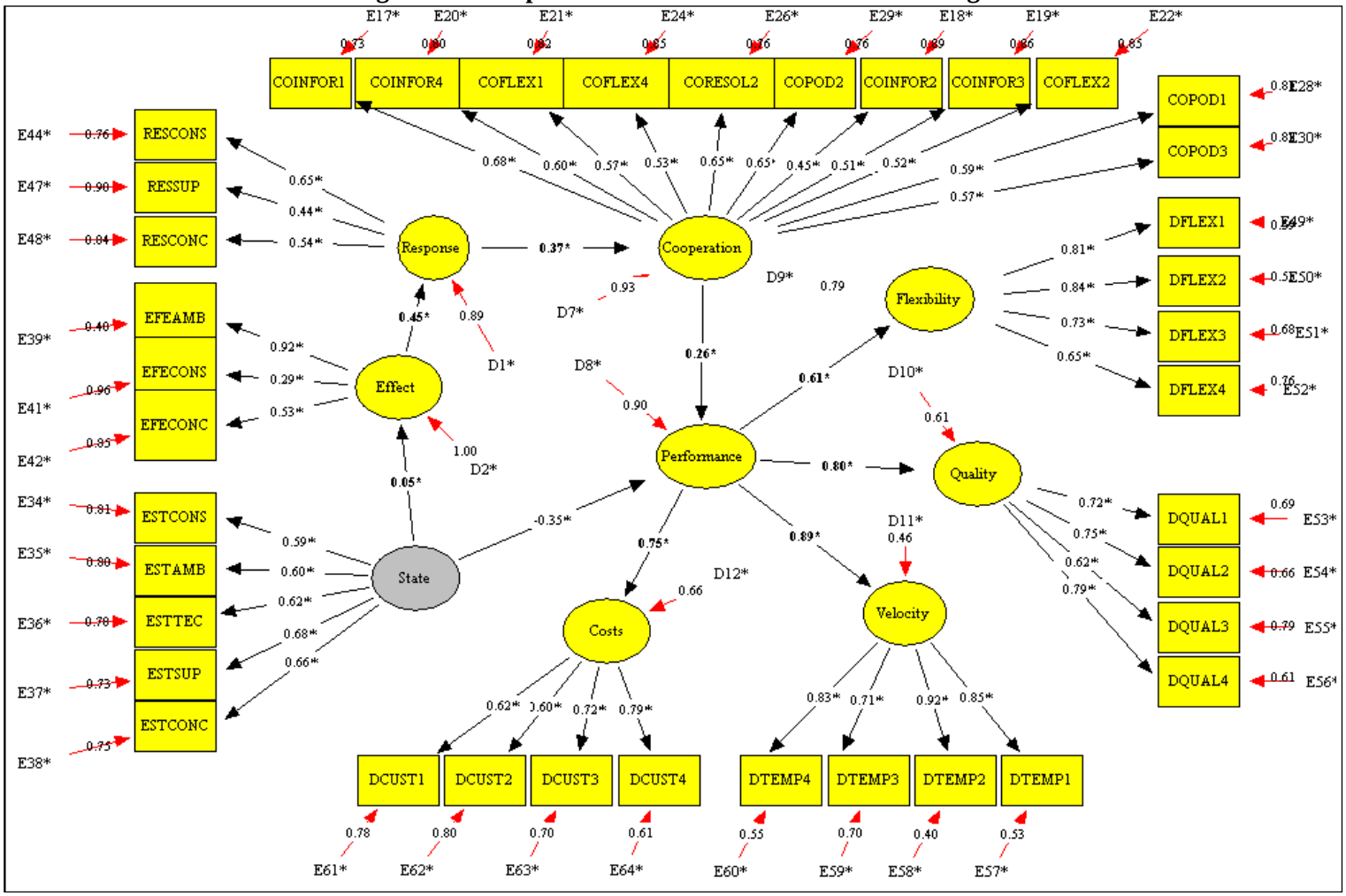
3. Research findings

The collected data were analyzed through SPSS software. Descriptive analysis of the data in a sample of 227 respondents revealed two influential cases, resulting in a valid sample of 225 respondents, out of which 85% are of masculine gender. As regards educational level, 78.4% of respondents are graduates or post-graduates; 65% are between 31 and 50 years of age and 68.3% work in medium or large sized companies (of these, 58% work at management level or higher).

The multivariate normality test produced by EQS 6.1 resulted in Mardia's PK normalized multivariate kurtosis statistic (PK=13.62) and Mardia-Based Kappa (PK_{based}= 0.0659). Taking into account the deviation of normality showed by these results and the fact that research data derived from ordinal scales, it was decided to adopt the Robust ML method in modeling the sample.

Data analysis with pre-defined relationships in the theoretical model did not result in good adjustment regarding the Satorra Bentler Chi-Square statistic (SB_x^2=917.78; gl=647; sig=0,000). On the other hand, the values obtained for the index of absolute fit (RMSEA=0.043; IC 90% = 0.037 to 0.049) as well as comparative and incremental indices (NNFI=0.902; CFI=0.909; IFI=0.911) are within the limits propsed in SEM literature. The CFI index indicated that 90.9% of data covariance can be replicated in the population via the theoretical model proposed by Fan, Thompson and Wang (1999). The factor loadings of the measurement model and the structural coefficients generated in the processing of the data are illustrated in Figure 2.

Figure 2 – Complete model structural and factor loadings



Source: Figure devised by the authors based on the research data

The statistical significances of the structural coefficients summarized in Table 1 reveal that at 5% significance level all coefficients generated in the data processing differ significantly from zero, except for the structural coefficient between 'state' uncertainty and 'effect' uncertainty (ß=0.0543; sig=0.2732). This result indicates that only the relationship proposed by **Hypothesis 1** was not supported, i.e. 'state' uncertainty does not significantly influence 'effect' uncertainty. This result can be explained by Milliken's definition of the multi-dimensionality of the uncertainty construct (Milliken, 1987) which places the origin of uncertainty in the external environment (the environment outside the organization), as well as in the manager's inability to perceive it and interpret it. The fact that 'state' uncertainty refers to the manager's ability to perceive changes in the environment and 'effect' uncertainty is the manager's ability to understand how such changes will affect the company, means that both types of uncertainty are within the scope of the individual manager's cognitive mental processes, which makes it more difficult to measure them with a more generic data collection tool, as was the case in this study.

Table 1 – Structural model standardized coefficients

Structural relationships	Coef.	*"t" Student*	*Sig.*	R^2	Test results
H1: State→Effect	0.0543	0.6031	0.2732	0.0029	Not Supported
H2: Effect→Response	0.4522	4.3939	0.0000	0.2045	Supported
H3: Response →Cooperation	0.3657	3.6939	0.0001	0.1337	Supported
H4: State →Performance	-0.3458	-4.2857	0.0006	0.1851	Supported
H5: Cooperation →Performance	0.2560	3.2303	0.0000		Supported

Source: Figure devised by the authors based on the research data.

Table 1 also includes coefficient of determination (R2) values produced during the analysis. 'Effect' uncertainty has significant influence on 'response' uncertainty, 20.45% of the latter's variability is explained by the first. Given that 'effect' uncertainty is the manager's ability to understand how external environment changes will affect the company, and 'response' uncertainty relates to the manager's actions in response to external environment changes (Milliken, 1987), confirmation of **Hypothesis 2** can be explained by the proximity of 'effect' uncertainty to the tangible actions and policies chosen by the manager during the decision process, which makes it possible to measure part of this relationship.

The same can be observed in relation to cooperation, explained by 13.37% 'response' uncertainty, thus confirming **Hypothesis 3**. This relationship is described in the literature by Knight (2006); Schermerhorn (1975); Williamson (1975); Dess & Beard (1984); Shervani, Frazier & Challagala (2007), amongst others. These authors maintain that inter-organizational cooperation can be stimulated by external environment uncertainty where ambiguous objectives and uncertainty about the future are facts that lead firms to form alliances (Das & Teng, 1998). Uncertainty influences an executive's ability to make business decisions because the difficulty lies in establishing scenarios; in the face of subjective probability or non-measurable uncertainty, devising a group of possibilities of action can be better achieved in group than individually (Knight, 2006; Duncan, 1972; Huff, 1978; Keynes, 1984; Milliken, 1987).

Confirmation of **Hypothesis 4** regarding the influence of 'state' uncertainty on operational performance, with an explanation of 18.51%, corroborates the Theory of Profit (Knight, 2006) and affirms the manager's role according to his/her ability to make correct judgements in unique situations. It is this ability that makes a human being useful in business (Knight, 2006; Duncan, 1972; Huff, 1978; Keynes, 1984; Milliken, 1987).

Hypothesis 5 tested the operational performance variance through inter-organizational relationships, with the result of 18.51%. Cooperative relationships, whether formal or informal, can determine the contribution of different parties towards organizational outcome (Smith, Carrol & Ashford, 1995); such contribution or cooperation is defined in exchange theories as a means of maximizing economical and psychological benefits (Blau, 1974). Nalebuff and Bradenburger (1996) state that inter-dependence between parties is of central importance in the understanding of business and operational performance through the idea of complementarity, alongside competitive price mechanism (Leonard, 1995; Moulin, 1995; Fehr & Schmidt, 1999).

4. Conclusions

Uncertainty is present in the manager's life, mainly in his decision-making processes concerning strategy, and its presence in the economic and business environment has long been detected (Knight, 2006). As a result, several views regarding cooperative behavior in corporate relations have emerged; such views do not always coincide. Some authors emphasize the need to stimulate opportunistic behavior and increase transaction costs according to laborious and strict governance mechanisms (Williamson, 1975; 1985). Others identify above average opportunities for the benefit of an individual or group of individuals, as well as differentiation in the generation of value (Knight, 2006).

Uncertainty is an abstract concept which is complex to measure; its multidimensional nature allowed this study to reach some conclusions which may contribute towards further knowledge of the theme. Amongst the hypotheses tested in this study regarding the relationship between subjective uncertainty, cooperation and operational performance the following were confirmed/supported: the influence of the uncertainty of 'effect' on the uncertainty of 'response' (H2); the influence of the uncertainty of 'response' on cooperation (H3); and the influence of the uncertainty of 'state' on operational performance (H4). The most important dimension of subjective uncertainty when it comes to cooperation is the uncertainty of 'state', the reason being it represents actions which are visible in inter-organizational relationships. A manager's response during the decision-making process is exposed through his actions or policies.

The different phases involved in perceiving uncertain states and understanding their effect can suffer variations which do not necessarily influence the manager's response. This is indicated by the non-confirmation of the influence of the uncertainty of 'state' on the uncertainty of 'effect' (H1) - because these dimensions are within the scope of the manager's cognitive mental processes they could not be measured by the research tool and method utilized in this study. For future studies it is suggested that a more qualitative approach is used for the understanding of the influence of 'state' uncertainty on 'effect' uncertainty, focusing on each manager's environment and his own specific inter-organizational relationships.

In view of the importance of inter-organizational relationships in operational performance (Dyer, 1997) this study proved that cooperation influences business operational performance (H5) This finding corroborates Relational View which maintains that the

relationship between network participants is key to business success. This theoretical perspective focuses on network routines/practices and processes as an important unit of analysis for the understanding of a company's superior performance (Dyer; Singh, 1998). The central thesis of Relational View is that a partnership or network of companies can develop relationships which can result in competitive advantage. Such networks of companies can compete with other groups of companies. This theory aims to integrate the benefits of cooperation; it examines the inter-organizational process of income generation by creating specific relationship assets sharing knowledge, practices and routines, other complementary resources and effective governance.

Dyer and Singh (1998) state that the advantages and disadvantages of an individual firm are frequently related to the advantages and disadvantages of the network of relationships to which that firm belongs. In other words, a firm's critical resources extend beyond the firm's limits. Therefore, idiosyncratic interfirm relationships can be the source of relational income and competitive advantage, which constitutes another level of analysis. Relational income derives from: asset investment; exchange of information between parties; separate (i.e. per individual firm) technological and functional systems characterized by low inter-dependence levels; low transaction costs; and minimum investment in governance mechanisms (Dyer, 1997; Dyer & Singh, 1998; Dyer; Kale & Singh, 2001; Dyer, Singh & Kale, 2008).

In the Theory of Profit, Knight (2006) defends the view that the connection between change and profit is uncertain and always indirect. He argues that uncertainty is the indirect connection between change and profit. In this study, when 'state' uncertainty influences operational performance, this dimension of uncertainty captures not only the portion of uncertainty relating to the invidual's perception of uncertainty and his rationality (Simon 1983), but also a portion of uncertainty relating to the environment. The latter portion is associated with turbulent events in the macro-environment and/or the complexity and dynamism of the section of the environment in which the company lies.

In conclusion, operational performance depends on more variables than it is possible to estimate – quantitatively – in its construct. Among these, cooperation and uncertainty are elements that need managing during the administrative process.

A valuable contribution offered by this study of theories is to check the empirical validity of the following affirmations: 1) subjective uncertainty by managers influences inter-organizational cooperation; 2) subjective uncertainty perceived by managers influences business operational performance; and 3) cooperation in inter-organizational relationship influences business operational performance.

REFERENCES

Aiken, M.& Hage, J. (1968). Organizational interdependence and intra-organizational structure. *American Sogiological Review*, v. 33, n. 6, p. 912-930, 1968.

Alolayyan, M. N., Mohd All, K. A. &Fazli, I. (2011) The Impact of Operational Flexibility On Hospital Performance In Jordanian Hospitals: Some Empirical Evidences. *Journal of Global Management*, 2(1), 39-52.

Blau, P.M. (1974). Presidential Address: Parameters of Social Structure. *American Sociological Review.* Vol. 39, No. 5, pp. 615-635.

Boyer, K. K., & Lewis, M. W. (2002). Competitive priorities: Investigating the need for trade-offs in operations strategy. *Production and Operations Management*, 11(1), 9-20. Wiley Online Library.

Bradach J.L.& Eccles, R.G. (1989). Price, authority and trust: from ideal parts to plural forms. *Annual Review from Sociology*, v. 15, p. 97-118, 1989.

Brown S.; Squire B. &Lewis M. (2010). The impact of inclusive and fragmented operations strategy processes on operational performance. *International Journal of Production Research*, 48(14), 4179.

Coase, R. H. (1993). The nature of the firm (1937). In Williamson, O; Winter, S. G. (Org.). *The nature of the firm: origins, evolution, and development*. Oxford: Oxford University Press.

Combs, J. G.; Crook, T. R., & Shook, C. L. (2005). The Dimensionality of Organizational Performance and its Implications for Strategic Management Research. (D. J. Ketchen & D. D. Bergh, Eds.) *Research Methodology in Strategy and Management*, 2(05), 259-286. Elsevier.

Curran, P. J., West S. G. &Finch J. F. (1996). The robustness of test statistics to non-normality and specification error in confirmatory factor analysis. *Psychological Methods*, Vol. 1, No. 1, 1996, p. 16.

Das, T.K. & Teng, B.S. (1998). Strategic risk behaviour and its temporalities: between risk propensity and decision context. *Journal of Management Studies*, v. 38, n. 4, p. 515-534.

Dess, G. G.& Beard, D. W. (1984). Dimensions of organizational task environments, Administrative *Science Quarterly*. v. 29, n.1, p. 52-73.

Duarte, A. L. C. M.; Brito; L. A. L., Serio & L. C. D., Martins, G. S. (2011). Operational Practices and Financial Performance: an Empirical Analysis of Brazilian Manufacturing Companies. *Brazilian Administration Review* (BAR); 8(4), 395-411.

Duncan, R. B. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly*, v. 17, n. 3, p. 313-332.

Dyer, J.H. (1997). Effective Interfirm Collaboration: How Firms Minimize Transaction Costs and Maximize Transaction Value. *Strategic Management Journal.* Vol. 18 Issue 7, p535-556, 1997.

Dyer, J. H. & Singh, H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, v. 23, n. 4, p. 660.

Dyer, J.H.; Kale, P. & Singh, H. (2001). How to make Strategic Alliances Work. *MIT Sloan Management Review.*

Dyer, J.H.; Singh, H. & Kale, P. (2008). Splitting the pie: rent distribution in alliances and networks. *Managerial and Decision Economics*. Special Issue: Frontiers of Strategic Management Research. Volume 29, Issue 2-3, pages 137–148.

Eriksson, K.& Sharma, D. D. (2003). Modeling uncertainty in buyer – seller cooperation. *Journal of Business Research*, v. 56, n. 2, p. 961-970.

Fan, X.; Thompson, B. & Wang, L. (1999). Effects of sample size, estimation method, and model specification on structural equation modeling fit indexes. *Structural Equation Modeling* (6): 56-83.

Fávero, L.P. & Belfiore, P.; Silva, F.L.; Chan, B.L.. (2009). *Análise de Dados: Modelagem Multivariada para Tomada de Decisões*. Rio de Janeiro: Elsevier.

Finney, S.J., & DiStefano, C. (2006). Non-normal and categorical data in structural equation modeling. In G.R. Hancock & R.O. Mueller (Eds.), *Structural equation modeling: A second course*. Greenwich, CT: Information Age Publishing.

Gerbing, D.W. & Anderson, J.C. (1993). Monte Carlo evaluations of goodness-of-fit indices for structural equation models. In K.A. Bollen, & J.S. Long (eds.), *Testing structural equation models.* Newbury Park, CA: Sage.

Glick, W. H., Washburn, N. T., & Muller, C. C. (2005). The Myth of Firm Performance. Annual Meeting ff *American Academy Of Management* (p. 1). Honolulu: Academy Of Management Review.

Hair Jr, J. F.; Anderson, R. E. & Black, W. C. (2007). *Análise multivariada de dados*. São Paulo: Bookman, 2007.

Hashiba, L. (2008). O relacionamento colaborativo com fornecedores e clientes e sua influência no desempenho da firma: uma análise empírica na indústria brasileira de embalagens. São Paulo. 198 f. *Dissertação Mestrado em Administração de Empresas* – EAESP, Fundação Getúlio Vargas.

Heide, J. B. & Miner, A. S. (1992). The shadow of the future effects of anticipated interactions and frequency of contact on buyer-seller cooperation. *Academy of Management Journal*, v. 35, n. 2.

Hu, L.T. & Bentler, P. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural Equation Modeling*. Concepts, Issues, and Applications (pp. 76-99). London: Sage.

Huckman R. S. & Zinner, D. E. (2008). Does focus improve operational Performance? Lessons from the Management of clinical trials. *Strategic Management Journal*, 29, 173-193.

Huff, A.S. (1978). Consensual uncertainty. *Academy of Management Review*, v. 25, n.1.

Kaplan, R., & Norton, D. (1996). Balanced Scorecard; Strategy into action. Harvard Business S.Press.

Kaufmann, P. J. & Stern, L. W. (1988). Relational exchange norms, perceptions of unfairness, and retained hostility in commercial litigation. *Journal of Conflict Resolution*, v.32, n.3.

Keynes, J. M. (1984). *A teoria geral do emprego, do juro e da moeda*. São Paulo: Atlas.

Kline, R. B. (1995). *Princliples and practice of structural equation modeling*. 2 ed. New York: Guilford Press.

Knight, F. H. (2006). *Risk, uncertainty and profit* (1921). Washington: Beard Books.

Kreiser, P.; Marino, L. (2002). Analyzing the historical development of the environmental uncertainty construct. *Management Decision***,** v. 40, n. 9, p. 895-905.

Kushwaha, G. S. (2012) Operational Performance through Supply Chain Management Practices. *International Journal of Business & Social Science*, 3(2) 222-232.

Lawrence, P. R. & Lorsch, J. W. (1967). *Organization and environment: managing differentiation and integration.* Boston: Harvard University Press.

Leonard, R. (1995). From parlor games to social science: von Neuman, Morgenstern, and the creation of game theory, 1928-1944. *Journal of Economic Literature*, v. 3, n. 2, p. 730-761.

Mardia, K. V. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika*, Vol. 57, No. 3, pp. 519-530.

Milliken, F. J. (1987). Three types of perceived uncertainty about the environment: state, effect, and response uncertainty. *The Academy of Management Review*, v.12, n.1, p.133.

Milliken, F.J. (1990). Perceiving and interpreting environmental change: an examination of college administrators' interpretation of changing demographics. *The Academy of Management Journal*, v. 33, n. 1, p. 42-63.

Miles, R. E. & Snow, C. C. (1978). *Organizational strategy, structure, and process*. New York: Mc Graw-Hill.

Mulford, C.L. & Rogers D.L. (1982). Definitions and Models. In: Rogers, D.L. and Whetten, D.A. (eds.) *Interorganizational coordination: theory, research, and implementation*. Iowa State University Press, Ames.

Murphy, G. B., Trailer, J. W., & Hill, R. C. (1996). Measuring performance in entrepreneurship research. *Journal of Business Research*, 36(1), 15-23. Elsevier.

Muthén, B. & Kaplan D D. (1985). A comparison of methodologies for the factor analysis of non-normal Likert variables. *British Journal of Mathematical and Statistical Psychology*, Vol. 38, No. 1, pp. 171-189.

Nalebuff, B. & Brandenburger A. (1996). *Co-opetição*. Rio de Janeiro: Rocco, 1996. 308 p. (Administração & negócios) ISBN 8532506895.

Neely, A., Richards, H., Mills, J., Platts, K., & Bourne, M. (1997). Designing performance measures: a structured approach. *International Journal of Operations & Production Management*, 17(11), 1131.

Pfeffer, J. & Salancik, G. R. (1977). Organization design: the case for a coalitional model of organizations. *Organizational Dynamics*, v. 6, n. 2, p. 15-29, 1977.

Ring, P. S. & Van De Ven, A. H. (1994). Developmental processes of cooperative interorganizational relationships. *Academy of Management Review*, v. 19, n. 1, p. 90.

Roth, A. V., & Miller, J. G. (1992). *Success Factors in Manufacturing.* Business Horizons, 73-81.

Satorra, A. & Bentler, P. M. (2001). A Scaled Difference Chi-Square Test Statistic For Moment Structure Analysis. *Psychometrika*, 66(4), 507-514.

Shervani, T.A.; Frazier, G. & Challagalla, G. (2007). The moderating influence of firm market power on the transaction cost economics model: an empirical test in a forward channel integration context. *Strategic Management Journal*, v. 28, n. 6, p.635-52.

Simon, H. A.(1983). *Models of Bounded Rationality*. Cambridge, MA: The MIT Press, 1983. xxiii, 478 p. (An MIT press classic) ISBN 0262192055 (v.1)

Schermerhorn, J. R. (1975). Determinants of interorganizational cooperation. *Academy of Management Journal*, v. 18, n. 4, p. 846-856.

Skinner, W. (1974). The decline, fall, and renewal of manufacturing. *Harvard Business Review*, 47(3),

Smith, K. G.; Carrol, S. J.& Ashford, S. J. (1995). Intra- and inter-organizational cooperation: toward a research agenda. *Academy of Management Journal*, v. 38, n. 1, p. 7-23.

Sull, D. N. & Escobari, M. E. (2004). *Sucesso made in Brasil: o segredo das empresas brasileiras que dão certo*. Rio de Janeiro: Elsevier.

Swink, M., & Way, M. H. (1995). Manufacturing strategy: propositions, current research, renewed directions. *International Journal of Operations & Production Management*, 15(7), 4-26. MCB UPLtd.

Venkatraman, N., & Ramanujam, V. (1986). Measurement of Business Performance in Strategy Research: A Comparison of Approaches. *Academy of Management Review*, 11(4), 801-814. Academy of Management.

West, S. G. & J. F. Finch, J.F. (1996). Structural equations models with nonnormal variables. In *Structural Equation Modeling: Concepts, Issues and Applications* (pp.56-75), edited by Rick H. Hoyle. Sage Publications, Thousand Oaks, California.

White, G. P. (1996). A survey and taxonomy of strategy-related performance measures for manufacturing. *International Journal of Operations & Production Management*, 16(3), 42-61.

Williamson, O. E. (1975). *Markets and hierarchies: analysis and antitrust implications*. Nova York: Free Press.

_____. (1985). *The mechanisms of governance.* Nova York: Oxford University Press.

_____. (1999). Strategy research: governance and competence perspectives. *Strategic Management Journal*, v. 20, n. 12, p. 1087-1108.

Zajac, E. J.& Olsen, C. P. (1993). From transaction cost to transactional values analysis: implications for the study of interorganizational strategies. *Journal of Management Studies*, v. 30, n. 1, p. 173-191.

Appendix A: Validation of the Inter-organizational Cooperation construct

The mean values of all the items were above the mean (3.5) which demonstrates the sample's general tendency to establish cooperative relationships. The mean values of the responses to items "coflex2", "coreso3" and "coreso1" are much higher and present lower standard deviation values than the other items. In the aforementioned items the variation in opinion is small. Univariate normality tests present adequate values in all the items. According to Kline (1995), the attention parameter for absolute values in the asymmetry index (*skewness*) is above 3, which is considered extremely oblique. On the other hand, regarding *kurtosis*, absolute values between 8 and 20 indicate considerable normality deviation (the conservative parameter for *kurtosis* is limited to 10). Table A1 shows that cooperation data are closer to the ideal value (zero) than to attention limits.

Table A1: Descriptive Statistic - items per dimension of the Cooperation Scale

Descriptive Statistic

Items	Mean	Std. Deviation	Skewness *	Kurtosis**	Analysis N
coflex1	4.937	1.582	-0.823	0.219	222
coflex2	5.131	1.482	-0.808	0.393	222
coflex3	4.455	1.740	-0.446	-0.821	222
coflex4	4.662	1.542	-0.629	-0.608	222
coinfo1	4.901	1.433	-0.793	-0.039	222
coinfo2	4.640	1.530	-0.585	-0.428	222
coinfo3	4.716	1.547	-0.618	-0.358	222
coinfo4	4.613	1.579	-0.561	-0.673	222
copod1	4.734	1.679	-0.366	-0.878	222
copod2	4.009	1.712	-0.172	-1.214	222
copod3	4.450	1.635	-0.343	-0.914	222
coreso1	5.027	1.586	-0.890	0.347	222
coreso2	4.910	1.543	-0.780	0.030	222
coreso3	5.108	1.503	-0.718	0.064	222

Std. Error (*)=0.163; Std. Error (**)=0.325

Confirmatory factor analysis presented good adjustment regarding the four dimensions and 14 indicators proposed by Heide & Miner (1992). However, according to covariance and modification indices analysis, item "coflex 4" did not produce good adjustment and was removed from the model. As a result, the second model's indices presented excellent adjustment. For verification purposes, adjustment indices, residual evaluation and modification indices were used (Kline, 1995; Brown, 2006), as illustrated in Table A2 and Figure A1.

Source: Figure devised by the authors based on the research data.

Table A2: Cooperation Confirmatory Factor Analysis Indices

CFA	**Cooperation**		
Result (default method)	***All items***	***Without coflex4***	***Expected***
□2 *(chi-square)*	91.3	**69.2**	"Minimum was achieved"
Df (degrees of freedom)	59	**48**	
□2/ *df*	1.55	**1.44**	<3.0
p-value	0.004	**0.024**	>0.05
Model Fit Summary			
SRMR	0.119	**0.109**	<0.01
GFI	0.937	**0.947**	>0.9
AGFI	0.903	**0.914**	>0.9
CFI	0.952	**0.966**	>0.90
RMSEA (ou RMS)	0.005	**0.045**	<0.080
RMSEA (LO 90)	0.028	**0.017**	<0.050
RMSEA (HI 90)	0.069	**0.067**	<0.100
AIC	155.3	**129.15**	< saturated and independence models
AIC sat. model	182.0	**156.00**	
AIC indep. model	775.6	**709.67**	

Source: Figure devised by the authors based on the research data.