Structuring Inter-firm Relationships: A Meta-analytic Approach*

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Abstract

In this paper we use a multi-disciplinary perspective to identify two fundamental dimensions which characterize the structuring of inter-firm relations: contractual coordination and procedural coordination. Contractual coordination refers to the mutual exchange of rights among the parties involved. Procedural coordination refers to the mutual exchange of information among the parties. Through a quantitative meta-analysis of 32 empirical studies we show that both dimensions are influenced by the same underlying constructs; that they fulfil different but complementary roles in the governance of the relationship; and how their systemic fit impacts the performance of the relationship. These results are discussed to highlight their implications for the design of inter-organizational research.

Descriptors: meta-analysis, inter-organizational research, systemic fit

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Introduction

Inter-firm relations have received considerable attention during recent years (Oliver 1990; Grandori and Soda 1995). Scholars have approached the analysis of interactions among separate actors by following different perspectives and using different levels of analysis. On the one hand, the strategic appropriateness and the economic advantages deriving from inter-organizational relations both at the firm (Roberts 1980; Roberts and Berry 1985; Porter and Fuller 1987; Harrigan 1988) industry (Williamson 1979; Contractor and Lorange 1988; Kogut 1988), and larger community (Piore and Sabel 1984; Best 1990) level have been very thoroughly examined. On the other hand, studies on the role of social capital (Granovetter 1973; Harrison 1994), trust (Harrison 1991; Ring and Van de Ven 1992) and repetitive interactions (Granovetter 1985) have complemented the rational agent perspective of economic-based approaches.

Despite this growing body of research and its diversity, we believe that much less attention has been devoted so far to the analysis of the detailed structuring of these relations (Van de Ven et al. 1979). Managers and scholars are provided with empirically tested insights on whether or not to start an alliance or a joint venture (the if), but our understanding of the impact of its implementation (the how) on the effectiveness of the relation is still poor. Furthermore, the interplay between the contractual and the

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organizational dimension of a relationship has been neglected altogether. In this paper, we propose that two fundamental dimensions characterizing the structure of inter-firm relations can be distinguished: contractual coordination and procedural coordination. Traditionally, these two dimensions relate to different streams of research. Contractual coordination has been primarily investigated by research concerned with the distribution of rights within a relationship. Procedural coordination has been the focus of work concerned with how firms or organizational units align their joint processes through organizational mechanisms.

It is, however, more than an academic exercise to distinguish between these two forms of coordination. First, they fulfil different purposes in the governance of inter-firm relations. On the one hand, contractual coordination mechanisms legally define the mutual exchange of rights among the parties involved. On the other hand, procedural coordination mechanisms are necessary to implement the mutual exchange of information among the different actors involved to realize the expected goals. Second, managers' perceptual models may unduly limit their attention to one form of coordination or the other. For example, managers frequently act as if the real problem were the initial negotiation and the clear distribution of rights among the partners (Goshal and Haspeslagh 1990; Sjöberg 1992). By underestimating the relevance of procedural coordination mechanisms, however, they fail to anticipate the importance of the implementation of the agreements (Haspeslagh and Jamison 1991; Nanda and Williamson 1994).

Third, the two dimensions can be separated empirically. For example, in many organizations, the group initiating inter-firm relationships and involved in the crafting of the original contracts is quite distinct from the group in charge of the implementation of the agreement. The contractual coordination mechanisms are frequently negotiated by top-management and a group of lawyers, while the setting up of procedural coordination is left to business-unit managers, who have usually been involved in similar alliances in the past (Haspeslagh and Jamison 1991; Sjöberg 1992; Thomas and Trevino 1993). Whenever such functional separation is not carefully bridged, however, the negotiation and the implementation aspects of inter-firm relations are *de facto* detached, increasing the chances that the relationship will fail.

In the first part of this paper, we build on different theoretical perspectives to articulate the characteristics and specificities of contractual and procedural coordination. We argue that they are influenced — at least partly — by the same underlying constructs, but we stress how they describe complementary aspects of the relationship. We focus on how the mix of contractual and procedural coordination can be determined by characteristics of the tasks to be addressed in the relationship, and how this relates to the relationship performance. While other factors such as the partners' characteristics and the larger context can be expected to impact the structures and processes of a relationship, keeping the environment and firm-specific factors constant and concentrating on task characteristics allows us to focus on those explanatory variables that are more likely to be directly under partners' control.

In the second part of the paper, the third and fourth sections, we use a quantitative meta-analysis on a sample of 32 studies on inter-firm relationships published during the last 15 years to investigate whether the proposed link between task characteristics, contractual and procedural coordination, and relationship outcome is reflected in previous empirical studies. The meta-analysis reveals that previous research investigated both dimensions of a relationship structure. None of the studies, however, analyzed the two dimensions simultaneously. Task characteristics drive both contractual and procedural coordination, and these, in turn, appear to drive the performance of the relationship. Yet, since the empirical studies reviewed did not investigate contractual coordination and procedural coordination simultaneously, neglecting one of the dimensions might lead to spurious results, and validity concerns have to be raised. We conclude, in the fifth section, by discussing the implications of our results for the design of inter-organizational research.

Two Dimensions of Inter-firm Relationships: Contractual and Procedural Coordination

Several streams of research investigated inter-firm relationships, concentrating on different characteristics of the relationships (Oliver 1990; Ring and Van de Ven 1992; Grandori and Soda 1995). Two fundamental dimensions appear to be of key importance for the governance and management of such relationships: contractual and procedural coordination. Both dimensions characterize solutions to the coordination problem that arises when activities are distributed among several actors. These dimensions describe the distribution of rights and the coordination of information flows.

Contractual coordination refers to the mutual exchange of rights between the parties involved in a relationship in order to govern the combination of agents or functions towards the production of results. The nature and characteristics of these rights may vary along the notion of the hierarchical contractual elements proposed by Stinchcombe (1985). They can encompass the definition of a command structure and an authority system used to govern the exchange, as well as some predetermined incentive systems. Moreover, these rights define the setting up of operating procedures to govern the exchange and resolve possible disputes among the partners.

Whether related to the distribution of decision power or of information among partners, however, the formal definition of a governance structure based on the distribution of rights underscores the role played by the actual implementation of the relationship as a necessary complementary element to be designed. *Procedural coordination* relates to the mutual exchange of information for the combination of agents or functions towards the production of results. These exchange opportunities and mechanisms might be structurally identified by the form of contractual mechanisms chosen and someone might say that they are still governed by contracts, in the form of so-called internal or psychological contracts. Yet, the implementation of

how, when, by which means, and to what extent information is exchanged among the partners typically represents an area of direct organizational influence of the process, whose discretional enactment can sensibly affect the outcome of the relationship.

In the remainder of this section, we characterize these two dimensions, building on four different theoretical perspectives: transaction cost economics, structural contingency, organizational learning, and resource dependency. On the one hand, contractual coordination is a core construct of transaction cost economics (Williamson 1975; Williamson 1985), whose research concentrates on relationship governance mechanisms (Anderson 1985; Joskow 1985; Levy 1985; Joskow 1987; Masten et al. 1991). On the other hand, procedural coordination is strongly embedded in structural contingency (Burns and Stalker 1961; Woodward 1965; Lawrence and Lorsch 1967; Thompson 1967; Galbraith 1974; Duncan 1976) and organizational learning approaches (Fiol and Lyles 1985; Levitt and March 1988; Kogut and Zander 1993; Nonaka 1994), which are both primarily concerned with the differentiation, integration and adaptation of actions within organizations. Finally, resource dependency appears to link contractual and procedural coordination (Pfeffer and Salancik 1978; Astley and Van de Ven 1983; Ulrich and Barney 1984). However, the relating empirical work tends to concentrate primarily on the contractual dimension (Pfeffer and Nowak 1976; Shan 1991).

Contractual Coordination

The use of interfirm relationships implies that at least some activities are divided up among the parties. This division of labour entails the need for coordination and re-integration. The distribution of rights among the partners is a central determinant of how coordination can occur. It affects the possibilities for each partner to control the coordination of activities performed within the relationship. When entering a relationship, each partner gives up some of its rights and gains others through either explicit or implicit contracts. The resulting allocation of rights and the institutions relating to these rights determine the governance structure.

The choice of the governance structure to minimize the sum of production and transaction costs for a given transaction is the core issue investigated by transaction costs economics (Williamson 1975; Williamson 1985). Although the term 'governance structure' is frequently used in a very broad sense to encompass every measure to organize, structure, and guide economic behaviour, the theoretical definitions (Williamson 1979) and empirical operationalizations (Armour and Teece 1980; Joskow 1987) primarily refer to the contractual dimension. That is, the governance structure consists of contractually determined means to coordinate the behaviour of the partners in the relationship.

According to this understanding, the governance structure encompasses how the partners obligate themselves to a specific course of action or establish a general commitment to a specific relationship via contractual mechanisms,

which define such aspects as how equity (and thus decision rights) is exchanged among the partners, and whether or how instruments such as joint board meetings, personnel exchange, and performance-based incentive systems are to be conducted to govern information rights. When setting up a governance structure, the partners have to choose between either prescribing and enforcing specific actions or using means to create a general commitment between the partners from which desirable actions evolve (Williamson 1983). In some cases, a general commitment to the relationship between the transaction partners can serve as a substitute and provide the necessary incentives to perform the desired actions (Parkhe 1993b).

Transaction costs economics propose that the necessary degree of relationship-specific commitment depends on two aspects of the underlying transaction: asset specificity and uncertainty (Williamson 1989). Asset specificity defines the irreversibility of the investments involved. It can be related to physical as well as human capital investments. The construct uncertainty is applied to a variety of phenomena ranging from individual tasks to market conditions. One common denominator appears to be that uncertainty is negatively related to the ability to bind actors in a meaningful way to a specific course of action through contracts (Joskow 1985; Joskow 1987).

A slightly different perspective on the question of how to govern transactions or relationships is offered by resource dependency (Pfeffer and Salancik 1978). Similar to transaction costs economics, resource dependency investigates which type of governance structure to choose in a specific situation.

> Each interaction, though varying in legality, represents an attempt to stabilize the transactions of organizations through some form of interfirm linkage (...). (...) organizations attempt to establish linkages with elements in their environments and use these linkages to access resources, to stabilize outcomes, and to avert environmental control.' (Pfeffer and Salancik 1978: 144)

Differences between these two approaches to the determinance of the appropriate governance structure depend on their epistemological roots. Transaction costs economics inherits from neoclassical economics the assumption that any transaction object is perfectly transferable (Conner 1991). In other words, it investigates only the enforceability of a specific transaction, taking its feasibility as given. Moreover, a main assumption is that the output of a specific transaction is not influenced by how the transaction is structured. For example, the design of a new chassis will not differ whether it is entirely developed by a car manufacturer or jointly developed with a supplier. Any consequences of task partitioning choices will only be reflected in the final costs.

Resource dependency theory, on the contrary, is based on an organizational perspective rooted in the work of Thompson (1967). Inter-firm relations are seen primarily as organizational issues (Ulrich and Barney 1984), and transactions are not assumed to be perfectly feasible in any environment. Two aspects of the feasibility are discussed (Pfeffer and Salancik 1978:

143). First, for any given transaction, the existence of external constraints may inhibit its occurrence, even within the most appropriate governance structure. Reasons may vary from a lack of resources to institutional decisions about agents' separation. Second, the nature of the task itself might limit the options available to govern its completion. For example, the acquisition of some assets, such as technical know-how, may require dense communication between the transaction partners. A governance structure not allowing for such communication flows would make the transaction unfeasible. Contractual coordination mechanisms, therefore, have to be aligned with procedural coordination mechanisms.

Procedural Coordination

Contractual coordination mechanisms provide institutions for achieving the alignment of incentives among the partners. However, from the availability of these institutions, it is impossible to deduce how they are actually employed to coordinate the activities of the partners in the relationship. Even if two organizations have contractually agreed on powerful institutions for coordination, it does not imply that they necessarily do coordinate their actions. Doz, Hamel and Prahalad argue that the actual coordination is not achieved through contractual mechanisms but, rather, is realized by the day-to-day communication of the employees involved in the activities of the relationship: 'Top management puts together strategic alliances and sets the legal parameters for exchange. But what actually gets traded is determined by day-to-day interactions of engineers, marketers, and product developers' (1989: 136).

These 'day-to-day interactions' are at the core of the construct 'procedural coordination'. This describes the extent to which the parties coordinate their processes by exchanging information, thereby making them learn to adjust their activities to each other. Procedural coordination does not refer to institutions that may be in place to govern the relationship, and which might as well include specific agreements about information rights, but asks how these institutions are used. In other words, the institutional perspective of the contractual coordination dimension is supplemented by a process-oriented perspective.

The problem of how to coordinate and re-integrate the activities of several actors is tied to the core research question of structural contingency theories: How should an organization structure and coordinate its activities among different units, given specific task characteristics and other contextual factors? Tasks can be characterized along a multitude of dimensions, such as the resources needed and the interdependency with other tasks. Building on information processing models (Galbraith 1974), the structural contingency framework focuses on task-related uncertainty, which has been operationalized in different ways such as, for example, the volatility of the task environment (Burns and Stalker 1961; Tushman and Anderson 1986) or the degree of differentiation in the task environment (Lawrence and Lorsch 1967).

Among the different definitions proposed, Thompson's (1967) dual notion of uncertainty seems appropriate in this context. He distinguished between uncertainty about the actions needed to achieve a certain goal and uncertainty about the goal itself. This distinction is implicit in several contributions following the decision-making tradition (Tversky and Kahneman 1974) and has also been formulated as a distinction between uncertainty and ambiguity (Schrader et al. 1993). Taken together, these two dimensions are useful in identifying the extent of complexity of the project observed, and where attention should be addressed in order to obtain the expected outcome.

Depending on the combinations of the different levels of uncertainty, different organizational structures are deemed appropriate and are articulated along dimensions such as degree of formalization, level of specialization, and direction of influence (Lawrence and Lorsch 1967; Duncan 1972). These organizational design variables characterize the mechanisms used to achieve procedural coordination between actors, given a specific task partitioning. They all influence patterns of information exchange within an organization (Galbraith 1974; Allen 1986; Larson and Gobeli 1988).

Despite its focus on the intra-organizational level, the structural contingency perspective can be transferred to the inter-organizational level (see, e.g. Rebentish and Ferretti 1993; Schrader 1994). In fact, the empirical evidence stemming out of recent studies on the impact of inter-organizational relations on actors' performance (see, e.g. Clark 1989) points to the interrelationship between level of task uncertainty, measures of procedural coordination, and performance.

The coordination mechanisms proposed by structural contingency frameworks are based on information exchange. For such an information exchange to be an effective coordination mechanism, the interaction partners have to adjust their cognitive frameworks and have to develop a joint language, that is, they have to engage in learning processes. This dynamic perspective has been neglected by the structural contingency frameworks. However, several studies on inter-firm relationships indicate how they evolve over time (Boari 1993). Nanda and Williamson (1994), for example, show that joint ventures can serve as an instrument for companies to learn about each others' skills and resources. This learning enables the companies to determine which of the partner's resources are of interest and how to value these resources.

Organizational learning theory explicitly provides such a dynamic perspective. Although extremely varied in its focus and level of analysis (Levitt and March 1988; Huber 1991), the basic organizational learning question can be formulated as: How can learning processes be structured or enabled, given the nature of the knowledge to be learned? The emphasis is once more on the nature of the task, interpreted in this case as the transfer of knowledge between two or more agents. Nonaka (1994) uses two dimensions to describe knowledge: its manifestation (tacit vs. codified) and its location (individual vs. group). The first dimension can be assimilated to Thompson's (1967) distinction between the different types of uncertainty, which can be found

in the other three perspectives reviewed. The emphasis is on the specific characteristics of the task/object/action observed.

The second dimension introduces, from a theoretical perspective, the importance of the localization of information in any transaction. Learning possibilities exist whenever knowledge is unevenly distributed. However, as von Hippel (1994) points out, an uneven distribution *per se* does not imply that two tasks need to be strongly coupled, since some information is easily transferable, whereas other information is 'sticky' — i.e. context specific. Only in those cases in which information is sticky, is it necessary to invest in high levels of procedural coordination mechanisms. Consequently, the amount of task-related sticky information determines the choice of the procedural coordination mechanisms to be used to structure the relationship. Thus, the information location issue is isomorphic to the issue of task uncertainty.

The main difference between structural contingency and organizational learning is the acknowledgment by the latter that the nature of tasks may change during learning processes. This implies that the appropriate level of procedural coordination is not a constant, but needs to change as well. In other words, the search for the 'right' coordination structure is doomed to be fruitless as long as it is not taken into consideration that task and structures need to adapt to each other and thus change constantly in a continuous feedback system. A similar notion has been suggested by Cainarca et al. (1992), who found that the occurrence of different types of inter-firm relations changes during the technology life-cycle. At any given moment, however, task and structure need to be in accordance to each other. Thus, using a static view, the underlying structures of structural contingency and the organizational learning frameworks are similar.

In conclusion, both theoretical approaches help to identify mechanisms allowing parties to coordinate their processes. These mechanisms are based on the exchange of information. The higher the level of task uncertainty, the greater the need for procedural coordination. The purpose of procedural coordination is that actors exchange sufficient information so that they can adjust their mutual behaviour in a meaningful way for any given associated distribution of rights among the partners. In other words, the level of procedural coordination can be described through the quantity and complexity of the information exchanged. The organizational learning framework indicates, however, that relationships should not be viewed as static entities. Rather, through ongoing learning, task characteristics change constantly. Therefore, the mechanisms used for procedural coordination have to be adjusted accordingly.

Linking the Different Perspectives

With contractual and procedural coordination two different dimensions of inter-firm relations have been identified. The first dimension relates to coordination through the exchange of rights, while the second one describes coordination through the exchange of information. Several authors assume

that contractual and procedural coordination are closely linked to each other (Pfeffer and Salancik 1978; Helper 1991). Empirical evidence, however, suggests that this is not necessarily the case. There are several examples of firms having established a high level of procedural coordination without intense contractual coordination (Piore and Sabel 1984; Best 1990). Similarly, firms might set up institutions for considerable contractual coordination without establishing significant procedural coordination (Joskow 1987).

The choice along both dimensions is related to the characteristics of the tasks performed in the relationship. Combining the different perspectives reviewed, the task domain can be articulated by focusing on three aspects (Table 1). Asset specificity determines the extent to which the activities performed in the relationships have some economic value *per se* or not. The higher the asset specificity, the lower the chances for the partners to benefit from their activities outside the relationship. The level of task uncertainty can be referred to the action or to the goal domain. In the first case, the partners have agreed on the objective of their relationships, but have multiple options to achieve the goal. Ring and Rands (1989), for example, document how NASA and 3M were able to specify up front their goal for common projects on microgravity experiments and subsequently worked through the implementation of their collaboration. In the second case, the goal itself is unclear. These situations have been documented, for example, by studies of collaborative R&D projects, where the partners might initiate the relationship for some generic strategic reason, but lack an operational objective (Tripsas et al. 1995).

Given the different characteristics of the tasks to be performed within the relationship, the partners structure their interaction by (a) articulating the legal conditions governing the transaction and (b) identifying the mechanisms to transfer information among themselves in order to implement the transaction. Contractual coordination mechanisms are used to define the legal boundaries of the relationships (Table 1). They involve the choice of the legal form governing the agreement (ex. joint venture or strategic

Table 1
The Theoretical Constructs Related to the Analysis of Inter-organizational Structuring

Task Characteristics	**Structuring Dimensions**	
	Contractual coordination mechanisms	Procedural coordination mechanisms
– asset specificity	– type of legal agreement	– frequency of information transfer
– uncertainty in the goal	– length of legal agreement	– timing of information transfer
– uncertainty in the means	– specificity of legal agreement	– directionality of information transfer
	– distribution of information rights	– means of information transfer

alliance, equity and non equity joint venture, etc.), the length of the agreement, the extent to which partners are bound to the agreement (ex. exclusivity clauses, penalties, etc.) and the degree to which these choices are specific to the agreement or not (ex. standardized vs. personalized contracts), and the distribution of information rights.

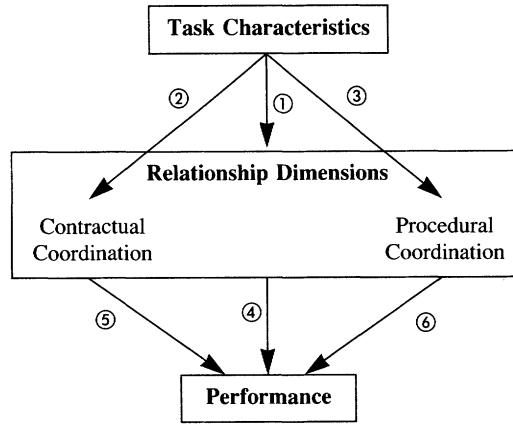
Procedural coordination mechanisms, instead, are used to put into place the relationships within the institutional boundaries defined by means of the contractual coordination mechanisms chosen. They are targeted to the structuring of the information flows between the partners (Table 1). Decisions on the frequency, timing and directionality of information flows, as well as the means through which these flows occur, identify the operational dimensions of procedural coordination mechanisms. For a given institutional setting, defined by a specific combination of contractual coordination mechanisms, alternative choices of procedural coordination mechanisms are going to impact the outcome of the relationship differently. Carter and Miller (1989), for example, show how frequent and bilateral communication between vendors and buyers limited the occurrence of quality problems in the materials delivered.

To some extent, investments in procedural coordination mechanisms may substitute for contractual coordination mechanisms. Procedural coordination does not come for free, though (Sobrero and Roberts 1996). Learning has to take place, interfaces need to be established, lines of communication reorganized, etc. The investments necessary for these changes may already sufficiently commit the relationship partners to each other. Consequently, additional contractually based commitment mechanisms might not be necessary anymore. In other words, while the task characteristics may suggest that the partners should establish a high level of contractual coordination, it may actually be unnecessary to do so if the partners are already committed to each other through investing in procedural coordination.

In general, therefore, the simultaneous inclusion of the characteristics of the task partitioned among the partners, the choices along the structuring dimensions (contractual and procedural coordination) and the consequences of such choices should guide the design of inter-organizational research to address the following question: Do combinations of contractual and procedural coordination, given specific task characteristics, explain performance differentials? Not recognizing the complementarity of these dimensions might lead to different and narrower research questions.

Figure 1 summarizes the three constructs emerging from the analysis of the four theoretical perspectives on inter-firm relationships, and how they are linked. Moreover, it identifies a set of six distinct research questions which can be formulated to focus on one specific portion of the larger framework. Although clearly offering a partial view of a more complex set of interactions among the different constructs, each question reflects the main concern of the theoretical perspectives reviewed. In the following sections, we use this set of questions to guide the quantitative meta-analysis on previous research on inter-firm relationships to classify the studies reviewed. Our objective is twofold. First, we want to formally summarize the empirical

Figure 1
The Research Questions Investigated in the Meta-analysis



1. Do task characteristics influence task-partitioning decisions?
2. Do task characteristics influence the level of contractual coordination in inter-organizational relations?
3. Do task characteristics determine the level of procedural coordination in inter-organizational relations?
4. Are performance differences related to task-partitioning decisions?
5. Are performance differences in inter-organizational relations related to the level of contractual coordination?
6. Are performance differences in inter-organizational relations related to the level of procedural coordination?

evidence on the relationships among the theoretical constructs identified. Second, we want to examine the consequences of a partial research focus on specific aspects of the linkages between task characteristics, contractual and procedural coordination, and outcome of the relationship on the validity of the results.

Quantitative Meta-analysis of Inter-firm Relationship Research

Sample

To review the empirical results on inter-firm relations, we conducted an electronic search of the articles published in the major international management and economics journals from January 1987 to April 1994. After carrying out a review of the electronic sources by collecting and indexing abstracts of social science journals, we decided to rely on ABI-Inform only. Certain databases are too specific (ex. *Economic Abstracts*), while others are too generic (ex. *Lexis/Nexis*). ABI-Inform, on the contrary, lists all the major social science journals, covering a broad range of disciplines.

The list of the journals used for the search is reported in Table 2. Although certainly not exhaustive, it is a representative sample considering the range of disciplines covered, the differences in the targeted audiences (managerial vs. academic), and in the empirical approaches used. Moreover, the use

Table 2
Journals Selected for the Electronic Search between 1987 and 1994 on ABI-Inform

Academy of Management Executive	*Journal of Law and Economics*
Academy of Management Journal	*Journal of Management*
Academy of Management Review	*Journal of Marketing*
Administrative Science Quarterly	*Journal of Marketing Research*
American Journal of Economics and Sociology	*Journal of Product Innovation Management*
American Economic Review	*Long Range Planning*
Brookings Papers on Economic Activities	*Management Science*
Business History Review	*Managerial and Decision Economics*
California Management Review	*Marketing Science*
Columbia Journal of World Business	*Organization Science*
Decision Science	*Organization Studies*
Econometrica	*Quarterly Journal of Economics*
Harvard Business Review	*R&D Management*
IEEE Transactions on Engineering Management	*Rand Journal of Economics*
International Journal of Industrial Organization	*Research Policy*
International Journal of Technology Management	*Research/Technology Management*
Journal of Economic Behavior and Organizations	*Sloan Management Review*
Journal of Engineering and Technology Management	*Strategic Management Journal*
Journal of Industrial Economics	*Technology Review*
Journal of International Business Strategy	*Technovation*

of the file drawer procedure described below (see p. 600 below) will serve as an additional check for a possible bias in the selection process.

The search was conducted using an informed set of keywords derived from the theoretical analysis and from reviewing some older seminal articles. It included the words 'collaboration', 'cooperation', 'partnership', 'alliance', 'joint venture', 'inter-firm' and was specifically addressed towards empirical pieces by also including among the keywords 'data', 'empirical', and 'survey'. The search generated a list of 118 articles. Based on the abstracts, all articles involving the analysis of interactions among non-profit organizations or focusing on university–industry relations were excluded. Articles based on secondary empirical sources to formulate prescriptive indications were also excluded. These first filtering processes reduced the original list to 46 empirical articles on inter-firm relations published between 1987 and 1994 in the major academic journals. This list was completed by scanning the references of the selected articles and looking for those past works which were widely quoted, but not included in the sample. The whole process resulted in a total of 56 articles.

After a careful reading of each of the 56 articles, we retained 32 of them for the meta-analysis. In addition to the previously discussed exclusion criteria, several had to be excluded, because they reported results from surveys which were not based on any theoretical framework (e.g. Kleinknecht and Reijen 1992). Others approached inter-firm relationships by relating them to their external environment conditions, such as market structure, industry life cycle and the like (e.g. MacDonald 1985; Cainarca et al. 1992), but they did not take into account task-related factors. Finally, other researchers continued to move on a theoretical ground, limiting their empirical contribution to a purely speculative one (e.g. Hamel 1991).

The selected studies were grouped along the six questions presented in Figure 1. While some of the studies addressed more than one question, all

considered each question independently. In other words, interaction effects were not investigated. Within each group of studies, we recorded information concerning the theoretical framework used, the relevant dependent and independent constructs included in the analysis, their operationalization, the sample size, and the significance level of the results.

Methods

Meta-analytic procedures are used to transform literature reviews from purely qualitative realms into quantitative ones. Each study reviewed is treated as an observation, making it possible to compare or combine the empirical evidence emerging from the studies reviewed, using the reported significance level or effect size as a starting point (Hunter et al. 1982). The first purpose of any meta-analysis is to partition the overall variance observed in the reported results to partial out study-specific variance (Hunter and Schmidt 1990). After any spurious source of variation has been partialled out, meta-analysis can be used essentially for three purposes (Rosenthal 1991): (1) to help summarize the evidence emerging from several studies in which the relationship between two or more variables are investigated, as we do in this study; (2) to isolate a set of moderator variables and verify their overall impact on the relation being studied; and (3) to generate hypotheses by clustering the examined studies along variables not directly observed or measured.

Despite its merits, however, meta-analysis suffers from some substantial and computational limitations (Hedges and Olkin 1985; Rosenthal 1991), among which three are particularly relevant in our case. First, to fully benefit from all potential outcomes of meta-analytic techniques, experimental studies with reported effect size estimates are needed. While the use of experiments is rather common in certain disciplines (i.e. experimental psychology), social sciences often focus on levels of analysis which make experiments unfeasible — the analysis of inter-firm relations is such a case. Regardless of the perspective used, whether rooted in economics or in organization theory, we are dealing with non-experimental studies, where different covariates are often included.

Since we have to accept the non-experimental nature of studies at the firm level, we are fairly limited in any meta-analysis involving the comparison and combination of effect sizes. Obtaining indicators partialling out the effect of covariates might be impossible, depending on the type of results reported. In addition, the presence of difference covariates in the different studies reviewed will increase the magnitude of the problem (Rosenthal 1991: Chapt. 2). We will therefore focus on the directionality and significance of the effects rather than on their magnitude, and concentrate accordingly on significance levels.

Second, the same theoretical constructs are frequently operationalized and measured in different ways. The effect that weaknesses in construct validity and reliability might have on the observed results is a common concern for meta-analysts. We address these limitations computationally

in the following pages, presenting how we combined multi-indicator constructs and how we used and interpreted the results of multivariate procedures.

Third, meta-analysis is frequently criticized as being based on biased data sets, since the published studies are only a fraction of all the studies performed on a certain topic (the so called 'file drawer problem'). Typically, the objection is that studies reporting non significant results rarely get published. While there is accordance on the other problems of meta-analysis discussed, this specific point is still harshly debated (Hunter and Schmidt 1990; Rosenthal 1991). On the one hand, it is argued that unpublished studies are such because inherent methodological flaws make their results unreliable and account for the weakness of their findings. On the other hand, one might argue that deviants to well established 'paradigms' are more likely to encounter resistance within the scientific community, and therefore are less likely to be published.

Both positions focus on the possible reasons for the presence of a high number of unpublished studies. Whatever these reasons are, however, one would like to estimate their potential impact on the external validity of the results of the meta-analysis. Rosenthal (1991: 103–109) has proposed approaching this issue by calculating how many studies reporting non-significant results, or even results contradicting theoretical predictions, need to be laying in some drawers waiting publication for the conclusions reached by the meta-analysis to be invalidated. The higher the number of unpublished studies needed to invalidate such conclusions, the smaller the selection bias and the greater the generalizability of the results (see also Hunter and Schmidt 1990: Chapt. 13). In this analysis we use the statistical procedures introduced by Rosenthal to assess the external validity of the results.

Data Coding

For each study, we recorded the one-tailed p-value associated with the reported test and found the corresponding standard normal deviate (Z). The sign of the Z-score was determined by whether the empirical evidence supported the underlying theory or not. If the theory was supported, the Z-score was recorded as positive. If it was not supported, the Z-score was recorded as negative. For example, transaction cost economics predicts that if asset specificity is high, task partitioning will be low. Results showing a negative association between the two constructs were coded as supporting the theory, while results showing a positive association were coded as not supporting the theory.

An alternative coding procedure is to use the indications emerging from the whole set to make choices as to the directionality issue. For example, if the majority of the study reviewed shows a negative association between X and Y, all the positive ones will be coded as negative, and *vice versa*. Since we were testing specific theoretical predictions, however, we did not use this coding schema. Finally, if p-values were not available or reported

only as threshold levels (e.g. $p<.05$), we used the reported t-statistic and found the exact p-value using the associated distribution.

Whenever more than one indicator was used in the study reviewed for a specific construct, we first determined the standard normal deviate (Z) corresponding to the p-value associated with each indicator. The Z's were then averaged to calculate the corresponding p-value (Rosenthal 1991: 27–28). The same procedure was used whenever more than one analysis was performed on the same functional relationship within the same study and on the same sample. For example, a standard procedure in economic research is to present and estimate different functional forms associated with the model developed, and compare the emerging results. In this case, we considered each estimate as a single set of results and combined them all (Hunter et al. 1982: Chapt. 5). Analyses on different samples performed within the same study, however, were treated as fully replicated designs, and therefore as independent observations.

Statistical Tests

To compare the studies reviewed along their probability levels, we tested for the heterogeneity of the corresponding Z's (Rosenthal and Rubin 1979). In particular, given N equal to the number of studies reviewed, Z_i the standard normal deviates computed as described above, Z_μ the average of the Z_i, we computed the following test, which is distributed as χ^2 statistic with $N-1$ degrees of freedom:

$$\sum_{i=1}^{N}(Z_i - Z_\mu)^2 \quad \text{Test of Heterogeneity of the Probability Levels} \qquad (1)$$

If results were not homogenous, the studies were carefully investigated individually to identify possible causes for the discordance of the results. Where there was accordance, we tested whether it was highlighted because of chance alone or rather because of an underlying pattern in the population. When finding accordance with respect to the results obtained, we were then interested in assessing whether the accordance was systematic or random. For this purpose, we combined the results.

The logic of the combining step is the usual one of statistical testing. The purpose is to get an overall estimate of the probability that the p-values of the studies reviewed might have been obtained if the null hypothesis of no relation between the variables observed were true. Different tests are available for combining independent probabilities obtained from two or more studies testing the same directional hypothesis (Rosenthal 1978). Each one presents advantages and disadvantages. Given the limited number of studies for each research question, we avoided relying on a single test, and used more than one to combine probabilities obtained from the review. Table 3 reports the tests used, their computation and a brief description of their advantages and disadvantages.

All these tests require that the studies reviewed employ quantitative analysis methods. Any evidence emerging from qualitative studies would therefore

Table 3
Description of the Methods Used to Combine the Results of the Studies Reviewed

Test	Computation	Advantages	Limitations	Reference
Adding p's	$P = \frac{\left(\sum p_i\right)^N}{N}$	Has considerable power and needs a very limited amount of information.	When the number of studies reviewed (N) is large and/or the numerator is >1, tends to be too conservative.	(Edgington 1972a)
Adding t's	$Z = \frac{\sum t_i}{\sqrt{\sum [df_i / (df_i - 2)]}}$	Is unaffected by N, given a minimum df per study.	The studies reviewed should have many df.	(Winer 1971)
Adding Z's	$Z = \frac{\sum Z_i}{\sqrt{N}}$	Very simple to apply and always applicable.	N should not be too small.	(Mosteller and Bush 1954)
Testing Mean p	$Z = (0.5 - p\mu)^* \sqrt{12N}$	Simple	N of studies should not be less than 4.	(Edgington 1972b)
Testing Mean Z	$t = \frac{\sum Z_i / N}{\sqrt{S^2_{(Z)} / N}}$	No assumption of unit variance	Low power when N of studies is small.	(Mosteller and Bush 1954)

Source: Adapted from Rosenthal (1991: 98)
Note: p_i is the p-level reported by study i, N is the number of studies reviewed, p_μ is the average p-value of the N studies reviewed, t_i is the t-statistic reported by study i, df_i are the degrees of freedom of study i, Z_i is the standard normal deviate corresponding to the p-level reported by study i.

be lost. Yet, in social science research, qualitative methodologies are frequently used. In this sample, for example, studies use firm-level cases (ex. Bertodo 1990) or industry-level longitudinal analysis (ex. Pisano 1991). To benefit from their results as well, we included each of these studies in the appropriate group/s and coded their result with respect to their theoretical expectations. Combining this information with that previously recorded for the quantitative studies, we derived for each group the number of studies that showed results in accordance with the theory and the number of studies that did not. We then used the binomial probability theorem to find the probability of k successes (with k equal to the number of studies supporting the theory) in n trials (with n equal to the number of studies reviewed) to assess the likelihood that the distribution of results could be obtained by chance alone. While less accurate, this procedure allows the inclusion of qualitative results in the analysis.

Finally, to approach the 'file drawer problem' we followed the procedure recommended by Rosenthal (1991: 103–109). The purpose was to estimate the number of unretrieved studies averaging null results which should exist if the results obtained from the retrieved studies were due to chance alone. Traditionally, meta-analyses consider unretrieved studies as those which have not yet been published. The procedure, however, can logically be extended to consider the generalizability of the results, which might as well be affected by the sampling criteria used. The file-drawer test therefore also becomes a way to control for potential biases introduced by our decisions

to exclude some papers, as explained above at the beginning of the third section, and to have not included other journals in our analysis.
Technically we needed to calculate the number of unlocated studies averaging null results to bring the significance level of the combination test down to 0.05. Given that N is the number of studies reviewed, Z_μ the average of the Z_i obtained from each of the retrieved studies, we used the following to compute x, the number of studies to be exceeded to invalidate the results:

$$x = \frac{N}{2.706}[N(Z_\mu)^2 - 2.706] \quad \text{File Drawer Test} \tag{2}$$

Results

A first reading of the empirical studies collected for the meta-analysis reveals the absence of an integrated perspective that simultaneously considers the relationships between task characteristics, the contractual and procedural dimensions of inter-firm relationships, and the outcome of the relation. While studies on inter-firm relations are numerous, they are parsimonious and diversified in aim and scope. Table 4 lists all the studies reviewed, the dependent and independent constructs, the theoretical predictions as to the directionality of the effects, the directions of the effects observed in the empirical analysis, the corresponding p-values and the degrees of freedom used in the empirical analysis. The studies are grouped by the six questions previously discussed, each one addressing a separate relation highlighted by the theoretical framework. In particular, among the studies using quantitative methodologies, six examined the relationship between task characteristics and level of contractual coordination, nine the relationship between task characteristics and procedural coordination, five the relationship between level of contractual coordination and performance of the relation, and eight the relationship between organizational coordination and performance of the relation.
The remaining 20 studies using quantitative methodologies, while often declaring to be approaching a specific research question, present results on the more general questions linking task characteristics and task partitioning decisions (18 studies), and task partitioning and performance (2 studies). The first evidence emerging from the analysis is the heterogeneity of the significance levels reported in the studies investigating the relationship between task characteristics and task partitioning. A visual inspection of the data reported in Table 4 for the studies addressing Question 1 shows a general accordance between theoretical predictions and empirical observations. This is confirmed by the binomial probability test ($p<.001$). The heterogeneity test, however, reveals that the p-values are statistically different ($\chi^2 = 11.82$, $df = 17$, $p<.01$). The separate use of several different constructs to assess task characteristics might account for the detected heterogeneity. A further analysis at the construct level confirms this intuition.

Table 4. Summary of the Studies Reviewed

Research Question	Study Reviewed	Independent Construct	Exp. dir.	Obs.dir.	*p*-value one-tailed	*df*
1. Do task characteristics influence task-partitioning decisions?	(Anderson and Schmittlein 1984)	Ambiguity	–	–	.00360	158
	(Anderson 1985)	Ambiguity	–	–	.00009	152
	(Monteverde and Teece 1982)	Asset Specificity	–	–	.00019	124
	(Monteverde and Teece 1982)	Asset Specificity	–	–	.00057	124
	(Monteverde and Teece 1982)	Asset Specificity	–	–	.00102	124
	(Anderson and Schmittlein 1984)	Asset Specificity	–	–	.01629	138
	(Anderson 1985)	Asset Specificity	–	2 out of 3 –	.41034	152
	(Levy 1985)	Asset Specificity	–	3 out of 12 –	.73130	64
	(Masten, et al. 1991)	Asset Specificity	–	3 out of 6 –	.39942	65
	(Harrigan 1986)	Complexity	–	–	.02500	191
	(Masten, et al. 1991)	Complexity	–	3 out of 3 –	.02199	65
	(Monteverde and Teece 1982)	Complexity	–	–	.00076	124
	(Monteverde and Teece 1982)	Complexity	–	–	.00025	124
	(Monteverde and Teece 1982)	Complexity	–	–	.00028	124
	(Masten, et al. 1991)	Similarity	+	2 out of 2 +	.05744	65
	(Walker and Weber 1984)	Similarity	+	+	.20611	34
	(Balakrishnan and Wernerfelt 1986)	Uncertainty	+	+	.00415	275
	(Walker and Weber 1984)	Uncertainty	+	+	.49042	34
	(McMillan 1990)	Asset Specificity	–	–	*	*
	(Pisano 1991)	Asset Specificity	–	–	*	*
	(Pisano 1991)	Uncertainty	+	+	*	*
2. Do task characteristics influence the level of contractual coordination in inter-organizational relations?	(Heide and John 1990)	Ambiguity	+	+	.04034	134
	(Heide and John 1990)	Asset Specificity	+	+	.05064	134
	(Joskow 1987)	Asset Specificity	+	9 out of 9 +	.00001	270
	(Joskow 1987)	Asset Specificity	+	18 out of 18 +	.00001	163
	(Shan 1991)	Dependence	+	+	.04396	126
	(Shan 1991)	Dependence	+	+	.05029	32

Table 4. *Continued*

Research Question	Study Reviewed	Independent Construct	Exp. dir.	Obs.dir.	*p*-value one-tailed	*df*
3. Do task characteristics determine the level of procedural coordination in inter-organizational relations?	(Heide and Miner 1992)	Ambiguity	+	3 out of 4 +	.39471	128
	(Heide and Miner 1992)	Ambiguity	+	2 out of 4 +	.66472	39
	(Heide and Miner 1992)	Asset Specificity	+	4 out of 4 +	.12016	128
	(Heide and Miner 1992)	Asset Specificity	+	3 out of 4 +	.33821	39
	(Heide and John 1990)	Asset Specificity	+	2 out of 2 +	.00005	134
	(Heide 1994)	Complexity	+	+	.00192	141
	(Heide and Miner 1992)	Dependency	+	1 out of 4 +	.63297	128
	(Heide and Miner 1992)	Dependency	+	1 out of 4 +	.77783	39
	(Heide 1994)	Dependency	+	+	.00072	141
4. Are performance differences related to task-partitioning decisions?	(Armour and Teece 1980)	Task Partitioning	+	+	.04872	201
	(Clark 1989)	Task Partitioning	+	+	.08842	22
5. Are performance differences in inter-organizational relations related to the level of contractual coordination?	(Harrigan 1986)	Commitment through non recoverable investments	+	+	.00500	191
	(Hakanson 1993)	Ex-Ante Safeguard Definition	+	4 out of 4 +	.08262	25
	(Parkhe 1993b)	Ex-Ante Safeguard Definition	+	2 out of 2 +	.01167	106
	(Bucklin and Sengupta 1993)	Centralization	–	3 out of 3 –	.00565	89
	(Hakanson 1993)	Ownership Form	+	4 out of 4 +	.18363	25
6. Are performance differences in inter-organizational relations related to the level of procedural coordination?	(Anderson and Weitz 1989)	Communication	+	2 out of 2 +	.02003	683
	(Anderson and Narus 1990)	Communication	+	2 out of 2 +	.02500	614
	(Carter and Miller 1989)	Communication	+	+	.00700	393
	(Parkhe 1993a)	Communication	+	+	.00500	111
	(Anderson and Narus 1990)	Coordination	+	2 out of 2 +	.02500	614
	(Hakanson 1993)	Coordination	+	4 out of 4 +	.14838	25
	(Parkhe 1993a)	Coordination	+	+	.00500	111
	(Noordewier, et al. 1990)	Oc	+	2 out of 3 +	.09566	130
	(Morris and Hergert 1987)	Oc	+	+	*	*
	(Alter 1990)	Coordination	+	+	*	*
	(Bertodo 1990)	Coordination	+	+	*	*
	(Bertodo 1990)	Communication	+	+	*	*
	(Thomas and Trevino 1993)	Communication	+	+	*	*

* Qualitative study. Statistics not available.

While significance levels of studies investigating the relationships between complexity and task partitioning (χ^2 = 5.03, *df* = 4, n.s.), similarity and task partitioning (Z = 0.94, n.s.) and ambiguity and task partitioning (Z = 0.74, n.s.) are homogenous in magnitude, heterogeneity strongly emerged with regard to the relationship between asset specificity and task partitioning (χ^2 = 18.56, *df* = 6, $p<.01$) and uncertainty and task partitioning (Z = 2.76, $p<.01$).

Although there seems to be a diffused agreement about the role played by asset specificity and uncertainty in determining how and if tasks are split among multiple actors, the results do not show such a strong relationship. The few studies reviewed for each of the constructs, however, suggests caution in the interpretation of these findings. Yet, such theoretical agreement is often challenged on an operationalization ground where different types of asset specificity (i.e. human resource, location and physical asset specificity) are lumped in the same indicator.

The observed heterogeneity might therefore derive from operationalizations which fail to distinguish the different components of asset specificity. Similarly, in the case of uncertainty, the resulting contradictory evidence might derive from an unclear distinction between environment-related and task-related uncertainty. Indeed, while Balakrishnan and Wernerfelt (1986) carefully distinguish between environmental and task-related uncertainty, focusing only on the second one, Walker and Weber (1984) confuse an environmental variability indicator (the expected rate of future technological change) with an indicator of task-related uncertainty (the amount of expected changes in components), using the former to measure the latter. More generally, the analysis at the construct level suggests the need for a closer look at the individual studies reviewed whenever heterogeneity is detected.

The evidence for a relationship between task characteristics and level of contractual coordination, addressed by the studies grouped under Question 2, seems to be similar to what emerged with regard to Question 1. While all studies show agreement between expected and observed direction of effect (binomial probability test, $p<.001$), the comparison of the significance levels reported by each study detects heterogeneity of such significance levels (χ^2 = 11.24, *df* = 5, $p<.05$). A further inspection of the *p*-values reported by each study shows that this result is caused by the magnitude of the discrepancies among the four studies reviewed. In four out of six studies, the *p*-values are at or just below the 0.05 level, while two are much smaller (around 0.00001).

Therefore the heterogeneity detected does not prevent the combination of studies, since there is agreement in the directionality of the effect, and each study also statistically confirms the presence of an effect. Despite the small number of studies reviewed (6), all the different combining procedures applied confirm the generalizability of the results observed in the sample (see Table 5), pointing to a relationship between task characteristics and level of contractual coordination. Moreover, according to the 'file drawer test' there should be a very large number (more than 87) of unpublished

Table 5. Quantitative Meta-analysis: Comparison and Combination of Significance Levels

Research Question	Comparing[a]		Combining						File Drawer
	Test	Result	Test					Result	Test[e]
			Adding p's[b]	Adding t's[c]	Adding Z's[c]	Mean p[c]	Mean Z[d]		
1. Do task characteristics influence task-partitioning decisions?	χ^2_{17}=33.07 p=.011	The studies reviewed may not be combined	–	–	–	–	–	Relation not confirmed	–
2. Do task characteristics influence the level of contractual coordination in inter-organizational relations?	χ^2_5 = 11.24 p=.047	The studies reviewed may not be combined	p<.001	6.65 p<.001	7.10 p<.001	3.63 p<.001	–	Relation confirmed	88
3. Do task characteristics determine the level of procedural coordination in inter-organizational relations?	χ^2_8 = 24.44 p<.01	The studies reviewed may not be combined	–	–	–	–	–	Relation not confirmed	–
5. Are performance differences in inter-organizational relations related to the level of contractual coordination?	χ^2_4 = 2.25 p=.69	The studies reviewed can be combined	p<.001	4.18 p<.001	2.69 p<.01	3.42 p<.001	–	Relation confirmed	30
6. Are performance differences in inter-organizational relations related to the level of procedural coordination?	χ^2_7 = 2.27 p=.94	The studies reviewed can be combined	p<.001	6.45 p<.001	5.04 p<.001	4.76 p< .001	9.31 p< .001	Relation confirmed	87

[a] H_0: The significance levels of the different studies reviewed are homogenous.
[b] Probability that the significance levels obtained by the studies reviewed are due to chance.
[c] H_0: The significance levels of the different studies reviewed reflect a population pattern, Z-test.
[d] H_0: The significance levels of the different studies reviewed reflect a population pattern, t-test.
[e] Number of studies reporting results disconfirming theoretical predictions necessary to invalidate the analysis performed.

studies reporting findings that question the theoretical predictions invalidating this conclusion.

The meta-analysis, however, does not provide evidence for a relationship between task characteristics and procedural coordination mechanisms. Already a visual inspection of the studies listed in Table 4 shows discrepancies between theoretical predictions and empirical results. The binomial probability test confirms these indications with a value of 0.05. In addition, the *p*-values of five out of nine studies are all fairly large, ranging from roughly 0.4 to roughly 0.8. Accordingly, the heterogeneity test finds a significant difference among the *p*-values reported by the studies ($\chi^2 = 24.44$, $df = 8$, $p<.01$). Further analysis at the construct level shows that the heterogeneity detected also holds for the relationship between asset specificity and procedural coordination ($\chi^2 = 11.18$, $df = 2$, $p<.05$), and for the relationship between dependency and procedural coordination ($\chi^2 = 13.38$, df $= 2$, $p<.01$).

The concerns previously raised about the operationalization of asset specificity find here a first tentative confirmation. In addition, the studies addressing Question 3 rely on a fairly low number of observations which limit their power. The lack of power might also account for the results regarding the relationship between ambiguity and procedural coordination, which are statistically homogeneous, but clearly not significant, although generally in the predicted direction ($Z = 0.29$, n.s.). Finally, the discrepancies might suggest the presence of more fundamental issues related to the unfeasibility of a clear unidirectional relationship between task characteristics and procedural coordination mechanisms, due to the role of context-specific elements such as the emergence of heterogeneity in the partners' experience and 'learning-by-doing' processes.

The relationship between task partitioning in general and performance addressed by the studies investigating Question 4 is supported by the meta-analysis. Both Armour and Teece (1980) and Clark (1989) independently conclude, working at different levels of analysis, that task partitioning increases performance levels (innovativeness in the first case, product development efficiency in the second case). These results were confirmed when we examined the relationship between each of the two dimensions of task partitioning and performance levels at a more detailed level.

In answering Question 5, we found evidence for homogeneity of the findings reviewed regarding the relationship between levels of contractual coordination and performance ($\chi^2 = 2.25$, $df = 4$, n.s.). Combining tests confirmed the generalizability of that conclusion and the file drawer test indicated that 30 unpublished studies reporting results in the opposite direction would be needed to falsify this conclusion (see Table 5).

Similar results emerged when reviewing the studies investigating the relationship between procedural coordination and performance. The *p*-values of the eight studies addressing Question 6 were not heterogeneous ($\chi^2 = 2.27$, $df = 7$, n.s.) and could therefore be combined to test for their generalizability. The different combination tests strongly confirm that the significance levels of the studies reviewed are not homogeneous in magnitude

and direction by chance alone. Furthermore, the file drawer test indicates that a large number of unpublished studies, more than 85, reporting results in the opposite direction would be needed to falsify this conclusion. We can therefore conclude that there is strong evidence for a relationship between procedural coordination and performance.

Discussion and Conclusions

The quantitative meta-analysis of 32 studies presented in this paper supports the distinction between contractual and procedural coordination mechanisms as two separate and complementary dimensions for the structuring of inter-firm relationships. Moreover, it confirms the links between task characteristics, contractual and procedural coordination, and relationship outcome, although none of the analyzed studies simultaneously investigated all these different aspects.

Contractual coordination mechanisms are an important dimension in structuring inter-organizational relationships. Their choice depends on the task-related characteristics and it affects final performance. The evidence about the role of procedural coordination mechanisms, on the contrary, is mixed. They clearly appear to influence the performance of the relationship. The empirical findings regarding the relationship between task characteristics and the level of procedural coordination, however, is more ambiguous. First, it is statistically problematic to combine the studies relating task characteristics and procedural coordination due to magnitude differences in the reported significance levels. Second, substantive concern relating to the variance in the operationalization of the theoretical constructs used within the different studies needs to be raised. Finally, the limited results on the procedural coordination dimension might also depend on the characteristics of our sample of studies. Due to the choice of journals used for the analysis, the papers reviewed tend to have a stronger focus on economics and strategy, where more attention is usually paid to contractual coordination mechanisms, than in sociology or political science, where the focus tends to be on procedural coordination mechanisms (Oliver and Ebers 1998).

Neither the studies focusing on contractual coordination mechanisms nor those focusing on procedural coordination mechanisms, however, simultaneously considered the relationship between task characteristics, coordination, and performance. The research focusing on how task characteristics impact coordination, i.e. the structuring of a relationship, takes the performance implications as given; the research investigating how the structuring impacts performance, assumes that choices among structuring alternatives are not constrained by task characteristics. This separation between the determinants of the choice among structural alternatives and the effects of such a choice is unsatisfactory. Performance implications are neglected and the variables omitted raise considerable concerns with regard to validity.

(a) *Neglected performance implications*: Research investigating the correspondence between task characteristics and contractual or procedural coordination mechanisms use the same assumption as traditional context-structure models (Van de Ven and Drazin 1985; Scott 1990). Typically, these models test the fit between context and structure through correlation analysis of these constructs, not including any measures on performance or any interaction terms (Joskow 1987; Heide and John 1990; Shan 1991; Heide 1994). Decision makers involved in the choice among different structural alternatives are therefore not provided with any evidence on whether certain solutions are chosen because they are indeed the most appropriate ones, or rather because they are, for example, an institutionalized response. In other words, this research does not give any guidance regarding the structuring of relationships that goes beyond the repetition of existing patterns.

(b) *Omitted variables*: Research investigating the influence of contractual or procedural coordination on performance typically limits its investigation to one of the coordination mechanisms, thereby neglecting the other. From this, omitted variable biases may arise. Empirically, contractual and procedural coordination are not orthogonal (Parkhe 1993b). Consequently, limiting the research to only one coordination mechanism at a time is an inappropriate simplification, and it is not clear whether the results are valid. From a managerial perspective, this approach legitimizes an apparently inappropriate separation of the contractual and procedural aspects of relationships.

Although addressing separate needs of the structuring problems, contractual and procedural coordination mechanisms might be considered as complementary dimensions of investments in a longitudinal perspective. For example, specific investments in procedural coordination mechanisms such as specific interfaces, lines of communication and the like may already sufficiently commit the relationship partners to each other. Consequently, additional contractually based commitment mechanisms, once deemed appropriate, might not be necessary any more. Similarly, relationships might start out with tight contractual coordination and a need for complex procedural coordination. In the course of the relationship, however, the parties might develop trust or learn sufficiently so as to be able to loosen their contractual bonds or they may consider the information transfer to be embedded and relax their efforts to achieve procedural coordination (Roberts and Berry 1985; Nanda and Williamson 1994).

This suggests that it is not possible to determine the optimal combination of contractual and procedural coordination, given specific task characteristics alone. Several models of fit have been used to determine levels of coordination (Scott 1990). On the one hand, models which limit their analysis to univariate context-structure relations fail to account for the multidimensional nature of the context and of the structure, and they do not explicitly consider outcome implications (Van de Ven and Drazin 1985). On the other hand, models of fit which explicitly include outcome indicators typically fail to consider that alternative combinations of structural dimensions may have the same performance implications. They determine each structural

dimension independently of the others, without investigating the possible substitution and trade-off effects.

Instead, it is more realistic to assume that several combinations of contractual and procedural coordination are equally well fitted for a given task. This notion is similar to the interpretation of fit in the systems approach, where Van de Ven and Drazin (1985) use the concept of equifinality to define fit as 'any feasible set of equally effective, internally consistent context-structure combinations'. The relationship between task characteristics and structuring alternatives needs therefore to be articulated to incorporate a multidimensional combination of context and structure. Task characteristics are varied and can result in multiple combinations, depending on the actors involved and the context. Similarly, alternatives along the contractual and procedural coordination dimensions of structuring decisions can result in different outcomes, although identified to address similar task characteristics.

The cumulative evidence offered by our meta-analysis on these issues has several implications for the design of inter-organizational research. First, the single relationship rather than a firm, or a set of firms, should be the unit of analysis. Multiple relationships can occur among the same partners (Wellman and Wortley 1990). Moreover, different approaches can be used by the same partner to structure a relationship with different partners (Schrader 1991). Second, sampling on the legal dimension as the distinctive character of the relationship should be avoided, thereby limiting selection biases. Focusing on joint ventures, strategic alliances, or consortia is a typical approach in many studies, which severely limits *ex-ante* the variance in the contractual coordination dimension and might have similar effects on the procedural coordination dimension.

Third, while a relational perspective has been introduced in the analysis of contracts (MacNeil 1978), it is a promising and rather underexplored area of development for inter-organizational research. Despite all the work conducted in sociology within the social network tradition, only recently have these approaches and tools been rigorously extended to the analysis of inter-firm relationships (Gulaty 1995; Uzzi 1996), proposing interesting developments about the concepts and meanings of structure and coordination in a relational context (Sobrero and Grandi 1997).

Finally, the systemic notion of fit underlying the analysis of inter-firm relationships is also helpful in gaining a longitudinal perspective on how the structuring problem changes during the life of the relationship (Cainarca et al. 1992). Over time, consistency between the characteristics of the task and the structure of the relationship is achieved through a realignment of the structuring alternatives. Indeed, the very meaning of success of a relationship seems to depend on the partners' capability to constantly assess the congruence between the nature of the task and the coordination mechanisms chosen (Haspeslagh and Jamison 1991; Boari 1993; Lorenzoni and Baden Fuller 1995).

Note

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