HOW BUYERS SHAPE SUPPLIER PERFORMANCE: CAN GOVERNANCE MECHANISMS SUBSTITUTE FOR TECHNICAL EXPERTISE IN MANAGING OUTSOURCING RELATIONSHIPS?

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ABSTRACT

This paper compares how a firm's internal technical expertise and its supplier governance mechanisms, including contractual and relational governance, influence supplier performance. The core question is whether interfirm governance mechanisms can substitute for technical skills or whether a firm risks hollowing itself out by de-emphasizing internal expertise. We find that technical expertise influences multiple dimensions of supplier performance, particularly quality and price, while contractual governance and supplier relational governance mechanisms affect supplier cooperation. The study suggests that firms benefit by retaining their technical skills even as they increase their use of relational governance to manage buyer-supplier relationships.
Outsourcing is a growing trend in many industries as firms strive to compete in markets throughout the world. Dell, Nike, and Toyota produce few of their components internally, for instance, relying heavily on relationships with suppliers to help them achieve industry leadership in prices and quality. While there has been extensive political debate concerning the employment implications of increased domestic and international outsourcing, a parallel strategic question remains open: what technical and governance skills do firms need to be successful outsourcers?

The success of firms such as Dell, Nike, and Toyota has led some scholars and managers to stress the importance of interfirm governance activities in helping buyers achieve satisfactory price, quality, and cooperation from their suppliers. Important governance activities include using long term contracts to specify terms and align incentives (Williamson, 1975; Macneil, 1978), and using relational governance mechanisms, such as monitoring performance and sharing information, to increase commitment and generate common goals (Dyer, 1997; Lincoln, et al., 1998; Dyer and Singh, 1998). It is unclear, though, whether buyers can rely on interfirm governance via long term contracts and/or relational mechanisms to ensure satisfactory supplier performance. Or, as Business Week asked twenty years ago, and several scholars have recently echoed, do firms risk hollowing themselves out if they do not retain sufficient internal technical expertise to allow them to evaluate and assist their suppliers (Richardson, 1993; Brusoni, et al., 2001)?

While several studies of buyer-supplier performance have examined governance mechanisms, few studies have considered how a buyer’s technical expertise affects supplier performance, and no research has examined the mechanisms jointly. It is not clear whether the different tools complement each other or provide substitutes for managing supplier relationships. Some work suggests that contractual and relational governance techniques might be complementary (e.g., Poppo and Zenger, 2002). Other research has suggested that technical expertise interacts with hazards in determining governance structures (Mayer and Salomon, 2005). However, we have little understanding of how technical expertise more directly influences either contractual or relational governance mechanisms. Moreover, little research considers
whether governance mechanisms and technical expertise have differential effects on distinct types of 
supplier performance. Examining these issues allows us to probe the limits of effective outsourcing.

This paper investigates how a firm’s level of technical expertise and use of governance 
mechanisms independently and jointly shape the firm’s satisfaction with supplier price, quality, and 
cooperativeness. Determining how these mechanisms and skills relate to each other will shape our 
understanding of effective mixes of firm capabilities for industries in which outsourcing is common. If 
governance mechanisms can substitute for technical skills, then firms might be able to increase their 
outsourcing activities to the point that they primarily become successful assemblers of outsourced 
components and services or even pure contractual brokers of outsourced activities. If not, firms that 
attempt to substitute governance mechanisms for their own technical skills might find themselves on a 
downward spiral of unsatisfactory supplier relationships, becoming a hollowed out failure in their own 
end-product markets. Moreover, it is possible that firms require both strong underlying technical expertise 
and the active use of one or both types of governance mechanisms to achieve strong supplier performance 
on key dimensions. Thus, we seek to determine whether firms can delegate their technical knowledge to 
suppliers and still achieve the desired outcomes through the use of contractual and relational governance 
mechanisms or whether firms must retain this knowledge in order to be successful buyers, since the 
effective use of these governance techniques are predicated upon some level of technical knowledge.

No one theory provides a full conceptual base to examine these issues. Therefore, we draw from a 
range of literatures to develop arguments that compare the ways in which contractual and relational 
governance mechanisms and technical expertise might shape supplier performance. In doing so, the 
research contributes most generally to the literature on relationship management, with a particular focus 
on outsourcing performance in buyer-supplier relationships. We contribute conceptually by integrating 
the discussion of how governance and technical expertise can influence the performance of interfirm 
relationships. We contribute empirically by developing multi-dimensional measures of relational 
governance mechanisms, technical expertise, and supplier performance. The study examines buyer-
supplier relationships among 182 firms in the U.S. metal forming industry in 2002.
BACKGROUND AND PREDICTIONS

Examples of Outsourcing Successes and Difficulties

To motivate our predictions and to illustrate how technical expertise may relate to contractual and relational governance mechanisms, we begin by discussing how several firms in the auto, computer, footwear, and investment industries manage their suppliers. Toyota is an obvious example of a company that is widely credited with having an emphasis on both relational governance activities and strong technical expertise. Their relational governance activities allow the company to share information among suppliers while building high performance, long-term relationships. Enright (2003), for instance, notes the importance of both formal contracts and informal relational governance processes in Toyota’s supplier governance. In turn, the base of technical expertise means that the company can evaluate suppliers effectively and can help them move forward. As Liker (2004: 208) puts it, “Toyota believed that it needed to truly master any core technology in order to manage its suppliers effectively”. Liker gives the example of semiconductor technology for hybrid cars, in which Toyota first developed its own technical expertise so that the company would then be able to outsource effectively.

General Motors and Ford provide counter-point examples to Toyota in the auto industry. Both companies have high production expertise but, until recently, have had lesser emphasis on relational governance, especially regarding information sharing and developing long-term perspectives on supply relationships. As a result, these companies have often been able to pressure their suppliers concerning price and quality, because they have strong enough capabilities and specific enough contracts to address cost and quality demands. They have, however, frequently struggled to maintain cooperative relationships that contribute to longer-term goals such as innovation (Enright, 2003).

In the computer sector, Dell is an example of a company that relies heavily on outsourcing. To support the outsourcing, Dell places great emphasis on formal and informal supplier governance, typically providing long term contracts to their partners and sharing information with them freely. At the same time, Dell also maintains its own pool of technical expertise, rather than relying solely on supplier skills. Magretta (1998) notes that Dell’s Research & Development group focuses on process and quality
improvements in manufacturing, and works closely with suppliers, both to evaluate supplier skills and to integrate them into Dell’s “virtual integration” production process. Tan and Young (2003) also note that Dell maintains the skills needed to assemble and test vendor procured parts and assemblies, again so that the company can both evaluate suppliers and help improve their processes.

Nike is another company that uses an extensive outsourcing strategy to generate high end-product performance. While Nike’s attention to governing its partnerships receives some recognition (though not nearly as much as the firm’s marketing strength), the importance of the company’s own technical expertise receives much less attention. We discussed this study with a Nike executive, asking him about the importance of supplier governance and Nike’s own technical expertise. He noted that Nike first undertakes extensive relational governance activities, with extensive quality, delivery, and cost auditing processes. The company both evaluates suppliers closely and presses them for quality and cost performance. Second, Nike typically uses formal contracts with its suppliers, often exceeding 15 years in length. Third, Nike has strong technical expertise in footwear and is responsible for advanced R&D, manufacturing R&D, and product development. Technical groups within the company provide a significant amount of direction to their suppliers. Much of the company’s product and manufacturing innovation comes from groups at Nike headquarters or locations in Asia, where they have manufacturing directors in each outsourcing location who assist suppliers on site. Nike also funds and runs learning centers, where visiting suppliers learn manufacturing techniques, particularly lean manufacturing principles. Finally, he noted that the relational governance activity and technical expertise reinforce each other, particularly in generating cooperation.

Another example arises in investment banking. In early 2005, Morgan Stanley reported that it had begun actual trading of oil, rather than only dealing in options and derivatives, because the activity helps the company create technical expertise to deal with financial trading (Davis, 2005). This decision points to the idea that technical expertise might increase the value of contracting skills.

These examples suggest that all three sets of skills – technical expertise, contractual governance mechanisms, and relational governance mechanisms – can contribute to achieving strong outsourcing
performance. The next section provides arguments as to why this may be the case, showing how these factors influence supplier performance, both individually and in combination.

**Supplier Performance**

Firms commonly produce a subset of the goods and services that make up their end products internally, while purchasing other services and physical components from external suppliers. Supplier performance affects buyer outcomes on several dimensions. The prices suppliers charge influence buyer profitability; in some industries, over sixty percent of a firm’s costs can arise from purchased components (Degraeve and Roodhooft, 2001). The quality of purchased items affects a buyer’s production processes, the quality of its end products, and its reputation with customers (Mascarenhas, et al., 1998; Womack, et al., 1990). Cooperative relationships with suppliers affect short-term performance by smoothing deliveries and reducing tactical coordination costs, while also influencing longer-term performance by helping firms develop new capabilities (Dyer and Nobeoka, 2000; Novak and Eppinger, 2001). Research has measured supplier performance on dimensions such as quality, cost, responsiveness, improvements in product or process design, lead time, and inventory turns (Kotabe, et al., 2003; Noordewier, et al., 1990; Poppo and Zenger, 1998). The core conclusion is that multiple aspects of supplier performance strongly influence a buyer’s short-term and long-term performance in its end-product markets. The challenge for buyers is to maximize as many dimensions of supplier performance as possible (Elmaghraby, 2000).

In order to understand overall firm performance, therefore, it is important to identify factors that influence different aspects of the performance of a firm’s supplier relationships. We consider the direct effects of the buyer’s own technical expertise and its supplier governance activities, as well as possible interactions among these factors. We develop predictions for each factor rather than attempt to predict which factor will be most important, either alone or in combination. The empirical analysis will help determine the relative impact of the different factors on different performance dimensions.

We will state the hypotheses in terms of the general concept of supplier performance, but will test the impact of technical expertise and governance mechanisms on quality, cost, and cooperation performance. We take this approach, in part, because an argument that differentiated among types of
performance would become highly complex. Moreover, there is only a limited conceptual basis from which to predict which aspects of performance that governance activities and technical skills will affect. The analyses will help provide implications for generating such distinctions.

**Technical Expertise**

We define technical expertise relating to outsourced goods as the extent to which a buyer understands the production processes and affiliated technologies related to a purchased good. This definition draws most directly from the technology literature. The skill involves technical know-how, is specific to the good, and is developed over time. Firms gain this expertise directly through production of the component or indirectly through producing related products and conducting relevant research activities (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Pisano, 1994). We focus on technical skills rather than on other functional expertise, such as marketing skills, because technical expertise is particularly important in facilitating upstream relationships—a buyer needs to be concerned with the technical characteristics of the inputs to its products (Brusoni, et al., 2001). Arguments in the technology literature (e.g., Dosi, 1988) imply that firms with greater technical expertise will better predict how varying attributes of the good can affect downstream production processes and, ultimately, the performance of the end product.

The functional capabilities literature suggests three reasons that buyers’ technical expertise will contribute to supplier performance: buyers will be able to identify better suppliers, provide greater assistance to suppliers, and attract better suppliers. First, firms that understand core elements of the development and production process will be better able to identify strong suppliers. Technically proficient buyers will be adept at screening and selecting suppliers because they can accurately interpret their offerings, comparing them not only on price but also on technical attributes (Wheelwright and Hayes, 1985). Second, buyers with strong technical expertise also will be better able to communicate technical details to suppliers. Their expertise provides them with a component evaluation capability by which they are better able to designate appropriate quality metrics and levels, making these both strict and achievable (Lincoln, et al., 1998). Thus, they can provide assistance in improving supplier skills (Bradach, 1997).
Third, suppliers may be attracted to customers with strong technical expertise, due to the learning potential, reputation spillover, and future business prospects of these relationships (Richardson and Roumasset, 1995). Like buyers, suppliers strive to gain a technical understanding about their products, so they prefer relationships with technically strong customers (Hayes, et al., 1988). Through these relationships, suppliers can learn more about the latest developments and gain knowledge to trade with new customers (Powell, et al., 1996). These suppliers may want to be part of an elite group of firms supporting a high status lead firm (Dyer and Noeboka, 2000; Lorenzoni and Lipperini, 1999). By being connected with highly regarded buying firms, suppliers can increase their status and gain business as other buyers seek them out (Podolny, 1993). Therefore, more cooperation between the firm and its suppliers should arise, because suppliers will be motivated to exchange knowledge. The fact that strong customers are likely to survive into the future also will attract suppliers and encourage them to cooperate, because they can anticipate a long-term relationship (Heide and Miner, 1992).

The above logic leads to our first hypothesis:

**Hypothesis 1**: The stronger a buyer’s technical expertise relevant to an outsourced good, the greater its satisfaction with the performance of its suppliers.

**Governance Mechanisms: Supplier Relational Governance and Formal Contracts**

A firm’s governance activities also may influence supplier performance. We start by discussing the concept of relational governance mechanisms in the context of supplier management. We then develop a parallel governance argument that focuses on contractual governance.

We define relational governance mechanisms for supplier management as the processes a firm uses to manage its connections with suppliers, such as processes for evaluating suppliers and for sharing information with them. For simplicity, we will refer to these processes as supplier relational governance mechanisms. This definition draws from ideas in the relational capability literature (e.g., Dyer and Singh, 1998), applying the ideas directly to the context of supply management. Supplier relational governance mechanisms accumulate over time, become reinforced through regular routines (c.f., Nelson and Winter, 1982), and are analogous to alliance management mechanisms in that firms will be more successful if
they are aware of how they manage suppliers and dedicate resources to this activity (Kale, et al., 2002).
Firms vary substantially in their use of supplier relational governance mechanisms, even if they have
common institutional or industrial contexts (Lincoln, et al., 1998).

Womack, Jones, and Roos (1990) demonstrated the profoundly positive impact of strong supplier
relationships in their studies of the automotive industry, which contrasted Japanese firms that emphasized
long-term developmental relationships against U.S. firms that took more adversarial approaches. Several
Japanese firms had a distinct advantage in operating results, particularly in terms of quality. Supply
relationships can be a self-fulfilling prophecy, as firms that strive to create and maintain partnerships with
suppliers will be likely to have more harmonious relationships than those that emphasize more adversarial
roles (Hayes, et al., 1988). Dyer and Singh (1998) investigated knowledge exchanges between buyers and
suppliers, noting that a firm that develops these relational capabilities can gain competitive advantage.
Firms may create supplier associations or transfer personnel to promote knowledge flows between
themselves and suppliers as well as between suppliers (Dyer and Noeboka, 2002; Ring and Van de Ven,
1992). Dyer (1997) suggests that firms can manage supplier relationships without increasing their
transaction costs, because firms can adapt relational governance activities to different suppliers and
different components whereas other investments, particularly those involving physical assets, are often
both partner and component specific.

The relationship management literature identifies three key aspects of supplier relational
governance mechanisms: evaluating suppliers, sharing information, and building effective relationships.
Through accurate supplier evaluation, firms can benchmark suppliers’ performance against a common
standard and screen out poor performers (van Weele, 1994). Part of this evaluation process involves
sharing technical information and performance results with suppliers and helping them improve. Regular
and substantial sharing of information about tactical and technical details is vital to robust supplier
relationships (Hayes, et al., 1988). Firms that share more information with suppliers will enjoy better
coordination, less haggling, and mutual assistance in problem solving. This will create greater trust
among the partners in a relationship (Zaheer, et al., 1998) and, in turn, result in greater cooperation and
higher quality relationships (Heide and John, 1990). Active engagement in evaluating suppliers, sharing information, and building relationships will lead to increased satisfaction with supplier performance, which is our second hypothesis:

**Hypothesis 2**: The more extensive a buyer’s use of supplier relational governance mechanisms, the greater its satisfaction with the performance of its suppliers.

Firms often support supplier relationships through formal contracts, to complement or substitute for hands on supplier relational governance mechanisms. Formal contracts spell out the ex ante details of the exchange. They also assist in subsequent monitoring of the exchange (Alchian and Demsetz, 1972). Firms can consider supplier incentives and occasions for opportunism and try to build safeguards into the agreement (Williamson, 1985). By agreeing to a contract, both the firm and the supplier explicitly or implicitly agree to deal fairly with each other (Helper and Levine, 1992).

The existence of a formal agreement can influence performance outcomes. The process of creating the agreement assists in developing more robust communication between the firm and its supplier (Arrow, 1974), which should increase the firm’s satisfaction with performance. Both the firm and its suppliers have a common understanding of each other’s goals. Suppliers in a formal contract may be more likely to make investments to support the agreement and will work harder to maintain performance levels to extend the relationship and protect these investments (Williamson, 1985). The contract signifies that this purchase is important to both the firm and its supplier, so that the firms may be more likely to pay attention to the arrangement and try to fix any performance problems before they become serious. Similarly, Kulwani and Narayandas (1995) argue that the supplier may be likely to pay more heed to a contracted customer relationship and strive for better performance, because the formal agreement increases the profile of the relationship. These arguments provide the basis for our third hypothesis:

**Hypothesis 3**: Buyers that use formal contractual agreements to govern supply relationships will have greater satisfaction with the performance of their suppliers than firms that rely on only informal agreements.

The first three hypotheses test what are sometimes posed as competing views on relationship management, but may well have parallel influences on supplier performance. In addition to parallel
influences, there may be interactions among the different aspects of relationship management. That is, the different perspectives on supply management may reinforce each other, rather than stand as alternative or parallel influences.

**Joint Effects of Technical Expertise and Governance Mechanisms**

We consider three possible joint effects. First, greater technical expertise may reinforce the power of supplier relational governance mechanisms. A buyer’s technical expertise will assist in developing accurate and detailed specifications that can then be used within superior evaluation tools, resulting in higher supplier performance. The buyers should be better able to detect quality slippage and assist their suppliers in modifying their processes. Buyers should also benefit from deeper information sharing with suppliers, because they can exchange more complex technical details. The combination of technical expertise and supplier relational governance mechanisms may help the firm develop dyadic communication, promoting greater learning and cooperation (Tunisi and Zanfei, 1998). Such exchanges will be valuable in managing changes in production that might be required as volumes and shipment timing of current components vary. In addition, buyers with a greater technical understanding will be better able to predict the next generation of products and work with suppliers to develop these, extending their relationships. Recent case studies support the notion that firms excelling in both technical activities and in creating close external relationships enjoy advantages over competitors (Mascarenhas, et al., 1998). These firms can better identify and act upon opportunities, resulting in superior performance, as we propose in the following hypothesis:

**Hypothesis 4**: The stronger a buyer’s technical expertise relevant to an outsourced good, the more that the use of supplier relational governance mechanisms will increase the buyer’s satisfaction with the performance of its suppliers.

Second, a firm’s technical expertise will heighten the effectiveness of formal contracting. Firms that have a better technical understanding about a component can create fuller and more meaningful specifications for suppliers to follow. They can better anticipate technical changes and incorporate contingencies into the contract, making it more complete. Technical expertise will enable the firm to monitor and evaluate suppliers and thus better enforce contract terms. Suppliers will also recognize the
firm’s expertise and be less likely to engage in opportunistic behavior, such as substituting inferior raw materials, because the firm will be able to recognize such infractions. A firm’s technical reputation can also supplement contracting. Lyons (1996), for instance, noted that reputation and frequent trade can reinforce formal contracts. This logic leads to the following hypothesis:

**Hypothesis 5**: The stronger a buyer’s technical expertise relevant to an outsourced good, the more the use of formal contracts will increase the buyer’s satisfaction with the performance of its suppliers.

Third, it is possible that joint use of supplier relational governance mechanisms and formal contracts will contribute to superior supplier performance. Some scholars suggest a complementarity between formal and informal aspects of the supply relationship (e.g., Sako, 1992). Macauley (1963) noted that the give and take of business goes more smoothly without lawyers; they also viewed formal contracts as operating in the background rather than the foreground. In this view, firms benefit by handling the details of most business exchanges based on industry customs and non-legal sanctions. In a similar vein, Klein and Leffler (1981) demonstrate that reputation and the potential for repeat purchases are more important than contract sanctions for reinforcing good supplier behavior. While recognizing the importance of informal personal relationships, these scholars presume the existence of the formal contract as a baseline for the exchange, suggesting that the formal agreements and informal contacts work in concert. Poppo and Zenger (2002) investigated the relationship between formal complex contracts and relational governance, finding evidence supporting the complementary view. This leads to our final hypothesis:

**Hypothesis 6**: The more extensive a firm’s use of supplier relational governance mechanisms, the more the use of formal contracts will increase the buyer’s satisfaction with the performance of its suppliers.

An alternative view to this prediction suggests that formal contracts may inhibit relational governance activities (Ghoshal and Moran, 1996), especially in contexts where standardized contracts are commonplace. However, such constraints would only arise if firms systematically allowed contracts to impose limits on their relational activities, rather than creating a common language from which relationship management could proceed. As a basis of the prediction, we assume that firms tend to avoid
such irrationalities. The empirical analysis will help assess alternative views.

**Summary and Example**

In sum, we predict that both a firm’s governance activities and technical skills will influence its satisfaction with supplier performance. We expect individual and joint effects from technical expertise, supplier relational governance mechanisms, and formal contracting. Together, the predictions suggest that firms cannot rely solely on governance to maintain superior outsourcing performance, but benefit by complementing governance mechanisms with technical expertise. The joint set of predictions reflects a more general point of Macauley’s (1963: page 67) point that “to understand the functions of contract, the whole system of conducting exchanges must be explored fully.”

By testing these hypotheses, which address a system of exchange skills, we can uncover potential trade-offs for firms in managing their supply relationships. For example, if we find that technical expertise does not influence supplier performance, firms may be wasting efforts on developing their internal knowledge and would be better off developing their contractual and relational governance skills. If so, then the core capabilities of the outsourcing firm should be governance skills rather than technical expertise, such that hollowing out of the firm would not be detrimental. Similarly, if we find that relational governance does not affect supplier performance, firms could spend their efforts in other areas and perhaps benefit from more competitive supply relationships. Likewise, if contractual governance is ineffective, firms could feel justified in avoiding formal agreements and instead rely on other means of managing their relationships. Furthermore, if we find that technical expertise, supplier relational governance, and formal governance mechanisms are substitutes, then firms could select which of these to emphasize, potentially saving resources since the strength in one area could compensate for a lack of skills in the others. Conversely, if we find that these skills are complements, then firms would benefit by maintaining a base level of each of skill in order to achieve satisfactory supplier performance.

An example from our empirical setting helps illustrate how firms can use combinations of formal contracts, relational governance, and technical expertise to manage their supplier relationships. Windfall Products is a powder metal parts firm based in St. Marys, Pennsylvania. Windfall produces goods such as
gears, rod guides, and exhaust gas recirculation components that it sells to auto sector companies such as Delphi. Windfall is considered to have strong technical expertise in its product lines. One of Windfall’s suppliers is a zinc plating supplier, Monroe Plating, based in Rochester, New York. Windfall used several mechanisms to manage its relationship with Monroe. First, a formal contract specified major terms of the relationship, such as product specifications, annual volumes, and prices. In addition, Windfall personnel visited Monroe’s facility on a monthly basis, to conduct quality audits and to help maintain positive relations. Frequently, three people from Windfall would participate in these visits: a purchasing manager would discuss price and product flows; a supplier development coordinator would work with Monroe on quality issues and evaluate Monroe’s performance; and a metallurgist would help Monroe solve technical problems related to the plating and confirm that their processes met Windfall’s specifications. Thus, Windfall used formal contracts and active relational governance, as well as a considerable degree of technical expertise, in managing its relationship with Monroe.

DATA AND METHODS

We studied sourcing decisions of U.S. metal stamping and powder metal firms for production tooling and services. These two sectors of the metal forming industry consist of many independent small companies, most of which are private firms. This choice enables us to focus on relatively simple buyer-supplier relationships, ruling out joint ventures and other more complex relationships. The firms and their suppliers are similar in size, which helps to control for explanations based on power differentials. Both sectors share relatively homogenous production processes and common end product markets. This is particularly true in the automotive industry which stresses the importance of managing downstream suppliers (Womack, et al., 1990). Therefore, supplier costs, cooperation, and quality levels are vitally important to these firms.

We first undertook exploratory interviews with managers of eleven metal forming firms. The interviews helped us understand their production processes and identified five goods that firms commonly source: die designs, construction of progressive stamping dies (or, in the powder metal industry, powder compaction dies), die maintenance, end-part machining services, and end-part surface coating services.
These inputs were common to all firms, are strategically significant, and were often outsourced.

In order to produce their end product, these firms use dies and must source the designs, construction, and maintenance of these dies. Die design is a complex process, in which designers must select the proper type of steel, consider press features, and optimize the layout of the die to maximize its productivity. Dies involve numerous interrelated components, including top and bottom shoes, punches, bearings, springs, and guide pins. They typically are produced from tool-grade steel using computer numerical controlled (CNC) mills and electric-discharge machining (EDM) centers. A considerable degree of expertise is required for die design and construction, as suggested in a machining handbook: “…die design and die making are complex arts as well as technologies that require considerable skill, knowledge, and practical experience” (Walsh 1994, p. 792). Die maintenance is somewhat less sophisticated, typically involving the regrinding and replacement of punches after a set number of press strokes or after a problem with a press. Firms generally source one design or die at a time, comparing bids from several suppliers with in-house sources. Formal contracts are relatively rare but relationships develop between buyers and suppliers, since with increased experience the supplier can better understand the idiosyncrasies of the buyer’s presses and products.

End part machining and surface coating are downstream operations that the firms require to meet customer specifications. End part machining involves adding features such as slots or holes that cannot be stamped or molded into the part. Surface coating includes plating, electro-coating, or similar processes that are typically used for corrosion resistance. Firms generally obtain bids from numerous suppliers but prefer to source locally, due to relatively high volumes and the need for short turnaround times. End-part machining and surface coating are more often governed by contracts specifying the approximate annual volume required, price, and extensive specifications detailed in drawings and other related documents. Many of the end products of these buyers are, in turn, sold to OEM manufacturers (e.g., automobile producers), so the contract specifications or informal requirements include the OEM’s quality and technical demands. Because these OEM demands are often difficult to predict, relational governance mechanisms such as frequent supplier contact are common.
Based upon our understanding of the firms and the five inputs, we designed a survey booklet with six sections, one for data on each input and one for overall firm information. We chose scales based on reviews of the literature, refined by discussions during the preliminary interviews. See the Appendix for the items used and their sources. Most items used seven point scales (Fowler, 1995). The full survey was 24 pages long and contained about 300 items. The items covered several aspects of the sourcing decision in addition to formal and informal governance mechanisms and supplier performance. We pretested the survey by soliciting feedback from academic colleagues, conducting cognitive interviews with managers, obtaining reviews from industry association executives, and performing a pilot test with managers that replicated final survey conditions.

We considered also surveying the suppliers of the metal forming firms. However, such a bilateral survey was not feasible due to the fragmented nature of the industry, the difficulty in locating suppliers (firms can sometimes be as small as three people), and the lack of a supplier industry association or other entity that could provide a sampling frame. As a result, we followed common practice in the literature on buyer/supplier relationships and assessed the relationships from the buyer’s perspective.

Fortunately, industry associations exist for metal stamping firms (the Precision Metalforming Association) and powder metal firms (the Metal Powder Industry Federation). From these groups, we obtained membership lists that we used as the basis for our sample. We called each of the 509 member firms to identify the correct contact person to whom to send the survey, which typically was the general manager. In 2002, we sent the survey to the 453 firms that provided us with contact information. We initiated between two and six contacts with each firm, resulting in a 43% usable response rate, which is significantly higher than 20% rate that is common for firm surveys (Paxson, et al., 1995).

We adopted a key informant single-respondent approach for the survey. While in some cases it is preferable to have multiple survey respondents, we believe that due to the small size of these firms and the technical and specialized nature of the survey, it was better to request information from one highly knowledgeable respondent. The key informant approach is appropriate when one can identify respondents who, by virtue of their positions in an organization’s hierarchy, are able to provide opinions.
and perceptions that parallel those of other key decision makers in the firm (Li and Atuahene-Gima, 2002; Phillips, 1981). For many questions, the most qualified rater is a senior manager of the firm, who is likely to have the broadest interactions with group members as well as the broadest overview of the firm’s strategy and performance (Glick, et al., 1990; Parkhe, 1993).

In our case, the respondent was typically the president or general manager. Senior managers in metal forming firms typically have considerable experience in purchasing production items, particularly because this is a mature industry and technology, with well established buying and supplying firms. One of the authors worked for several years as a purchasing manager in this industry and can attest to the fact that one senior executive typically has oversight of sourcing decisions and managing suppliers. Our first-hand knowledge of this context and the fact we asked about their overall sourcing experience over the past year also gave us confidence in assuming relatively homogenous suppliers. Thus, use of a single, well-qualified respondent is the appropriate approach in this context.

Nonetheless, a common method variance bias can result from collecting dependent and independent variables from the same respondent. We checked for this potential problem by conducting the Harman one-factor test, which involves entering all the independent and dependent variable items into a factor analysis (Podsakoff and Organ, 1986). A principal component factor analysis of all measurement items yielded six factors with eigen value exceeding one. These factors accounted for 58% of the variance. The factor with the greatest eigen value accounted for 16% of the variance. Because no single factor emerged as a dominant factor accounting for most of the variance, common method variance is unlikely to be a serious problem in the data.

The responding firms had a common set of demographic features. Respondent firms were small, with 95% employing less than 500 people (the mean was about 75 people), non-union (86%), and fairly old, averaging 44 years in age. We compared respondents to non-respondents by firm type and size, and found no indication of non-response bias (Armstrong and Overton, 1977). Because the sample drew upon industry association listings that represent the overall firm populations, sample selection bias is unlikely (Tomaskovic-Devey, et al., 1994). After culling cases that did not include an external supplier, the survey
data represent 508 sourcing decisions of 182 firms for the five different inputs. In turn, our measures of 
supplier performance reflect buyer satisfaction with suppliers of each type of input.

Variables

Supplier performance. Following the work of other scholars, we used the firm’s level of 
satisfaction to indicate supplier performance (Poppo and Zenger, 1998). We devised three performance 
variables that executives in our preliminary interviews identified as important performance dimensions: 
each firm’s satisfaction with supplier cooperativeness, quality, and price (see Appendix 1). We used 
seven point Likert scales for the measures, ranging from “absolutely terrible” to “absolutely terrific”; 
Fowler (1995) notes that these anchor terms are more descriptive than the standard agree/disagree terms 
and, because they are more indicative of a buyer’s perception of supplier performance, should result in 
better measurement. We also examined satisfaction with delivery and communication, but found that the 
two measures correlated highly with the measures that we report, so that they produced little novel 
information. We asked about multiple performance dimensions for each of five different goods, while 
limiting ourselves to a single item for each performance dimension for each type of component, so that 
we would not overly burden the respondents. Fortunately, respondents reported no ambiguity in 
understanding the performance dimensions during pretests of the instrument, so that single-item measures 
are appropriate. The respondents reported that they typically dealt with four or fewer suppliers for each of 
these types of goods (the mean number was two suppliers), which reduces the possibility of an ecological 
fallacy of aggregating performance across multiple suppliers. The number of suppliers was similar over 
the five input categories, although firms tended to use slightly fewer suppliers for die maintenance and 
slightly more for surface coating.

We will briefly discuss why we use subjective measures of supplier performance. As we 
discussed earlier, supplier performance in the eyes of a buyer is a multi-dimensional concept involving 
assessments that are difficult to measure objectively. The literature and the interviews suggested three 
important elements of supplier performance that we want to assess: cooperation, price, and quality. 
Cooperation is inherently a subjective concept. Price might be determined objectively, but without a clear
understanding of the complete package being purchased and the other options on the market, this data would be difficult to interpret. Although one could measure quality objectively in some contexts (e.g., number of defects per shipment), this data is often difficult or impossible to obtain. Moreover, from the buyer’s point of view, each type of supplier performance requires assessments against other options, including sourcing the good elsewhere or producing it internally. Hence, all types of supplier performance involve subjective assessments that one can measure with a construct such as satisfaction with performance. As we discuss above, the executives we surveyed have extensive knowledge about their firms’ satisfaction with supplier performance. Moreover, the survey inquires about the sourcing experience over a one-year period, which provides sufficient time for a respondent to compare the performance of multiple suppliers. Therefore, we follow the work of prior scholars in using satisfaction with multiple dimensions of activities to assess supplier performance.

**Technical expertise.** We created a variable for firm technical expertise, reflecting the extent to which the firm possesses capabilities for producing the focal input. These attributes result from a deep understanding of the technology related to the input and from experience in production. This variable used four items, some of which we adapted from prior work (Walker and Weber, 1984). All items used seven-point scales. We used a weighted average of the four items with the weights based upon a confirmatory factor analysis; this analysis also gave us confidence in the convergent validity of this measure. We then mean-differenced the value in the interaction models (Aiken and West, 1991). The reliability coefficient for the technical expertise measure exceeded 0.80, based on the Cronbach’s alpha, well above recommended benchmarks.

**Supplier relational governance mechanisms.** We began with 22 items for supplier relational governance. The items measure formal aspects of relational governance, such as ISO quality certification, plus informal mechanisms such as communication channels. We chose items based on prior work (Dyer, 1997; Noordewier, et al., 1990) and on factors that emerged in our preliminary interviews. We omitted nine items due to non-normality, missing data, and poor reliability. The remaining thirteen items encompassed key aspects of the firms’ processes for managing suppliers, including information sharing,
the tendency to maintain a long-term relationship, and performance evaluation techniques. We used a mean-differenced weighted average of the items. The reliability of the supplier relational governance measure as computed by the Cronbach’s alpha was 0.69, sufficient for the exploratory nature of this study (Nunnally, 1967).

These items measure the extent to which a firm used a particular relational governance mechanism, rather than how well the firm used the mechanism, because it is not clear how one would create an objective measure of the quality of the mechanisms. Therefore, our approach assumes that more extensive usage of relational governance mechanisms associates with higher quality relational management. Clearly, usage frequency and quality may vary, but intensity will correlate with quality so long as a firm has been able to learn from its experience.

In supplemental analysis, we separated the 13-item measure of supplier relational governance mechanisms into three sub-measures, which included performance evaluation, information sharing, and relationship management. Analysis with the three sub-measures produced similar results to using the aggregate variable. We have no conceptual reason to split the supplier relational governance variable into the three sub-measures. Moreover, modeling and assessing interactions between relational governance and other factors became highly complex with the larger number of relational governance variables. Therefore, we elected to use the 13-item variable.

**Formal contracts.** We created a formal contracts variable with an item that asked whether the buyer used a formal written agreement for the purchased component and whether or not they also used relational governance. As in the case of the supplier relational governance variable, the approach assumes that firms that use contracts will develop skills in designing and negotiating formal agreements. A 0-1 binary variable indicated whether the buyer had a formal contract with supplier(s) for this input. Missing data reduced our dataset to 368 cases, but we detected no systematic difference by firm or input type for this set of data relative to the larger dataset. We found similar usage of formal contracts among the different goods, from 13% to 23%, with a mean of 19% (i.e., a substantial majority of firms relied on informal agreements rather than using formal contracts as part of their governance mechanisms).
Control variables. Several items addressed alternative explanations. The controls included firm age (years), volume of the input required (annual units, based on a 5 point scale), and dummy variables for the five input types. Because we do not have dyadic data, we could not control for relationship duration or prior exchanges between a particular buyer and supplier. We also could not control for the size of the buyer’s legal staff, but this does not appear to be relevant because the firms are relatively small and typically do not employ legal counsel.

RESULTS

Table 1 reports descriptive statistics. The presence of only moderate correlation among the cooperation, quality, and price performance measures suggests that they arise from different processes.

********** Insert Table 1 about here **********

We chose ordered logit for the model specification, adjusting the standard errors to account for potential interdependence of observations. This model is more suitable than OLS regression because the data are ordinal rather than interval in nature (Agresti, 2002); ordered logit better reflects the dependent variable data because the survey collected the information as eight discrete choices. The 508 input cases come from 182 firms, each of which provided data from one to five inputs. It is likely that the within-firm observations will not be independent, which is a common clustering phenomenon in survey research (Hosmer and Lemeshow, 2000). To account for this, we used robust standard errors adjusted for repeat observations by firm (Mizruchi and Stearns, 2001). This adjustment increases the standard errors but does not affect the coefficient estimates (Long and Freese, 2001). We estimated regressions for each of three types of supplier performance. The focal independent variables included the firms’ technical expertise, use of supplier relational governance mechanisms, use of formal contracts, and interaction terms. All models also included the control variables for firm age, volume, and input-type dummy variables.

Table 2 reports how the firm’s technical expertise and supplier relational governance influence the three supplier performance outcomes. Models 1a and 1b display statistically significant explanatory power for the performance measures of cooperative and quality satisfaction, based on the chi-squared test. Model 1c was weaker in explaining pricing satisfaction (nonetheless, model 1c had significant overall
explanatory power when the analysis omitted the non-significant coefficients, while the technical expertise and firm age influences remained significant in the simpler model).

********** Insert Table 2 about here **********

The results in Model 1 support hypotheses 1 and 2 on several performance dimensions. In support of hypothesis 1, technical expertise had a positive impact on all performance variables, with a significant effect on quality (1b) and price (1c) performance. The positive relationship between technical expertise and quality is a conservative result if buyers with greater expertise are more critical of quality. Based on the loglikelihood ratio test, model 1b did not increase the statistical fit relative to a model with only control variables, but a model that dropped the insignificant relational governance variable from the quality analysis and retained technical expertise did improve relative to the control variables.

Consistent with hypothesis 2, use of supplier relational governance mechanisms had a positive and significant effect on cooperation (model 1a). Relational governance had no significant impact on quality or price performance.

Model 2 in Table 2 adds an interaction term between the firm’s technical expertise and supplier relational governance activities, to test hypothesis 4. The analysis replicated the results of model 1 for hypotheses 1 and 2.

Model 2 in Table 2 provided at least moderate support for hypothesis 4 on two performance dimensions. The interaction of technical expertise and supplier relational governance displays significant explanatory power for cooperation (model 2a). Model 2b also shows that technical expertise interacted with supplier relational governance has a moderately significant positive on quality performance, although model 2b does not improve the fit of model 1b based on the loglikelihood ratio test. The interaction has no impact on pricing performance (model 2c), which again has a weak overall fit.

Table 3 tests hypotheses 3 and 5, which addressed the impact of formal contracts. We first create a base model that includes technical expertise, supplier relational governance, and our binary variable for formal contracts. This reduces the number of observations because some firms did not respond to the contracts question. Model 4 adds the binary variable for formal contracts to model 2. The analyses in
models 3 to 6 provide similar support for hypotheses 1, 2, and 4 as in the prior models (Table 2), although the moderate impact of technical expertise combined with supplier relational governance on quality performance in model 2 becomes insignificant in Table 3.

********** Insert Table 3 about here **********

The impact of formal contracts in models 4 and 5 of Table 3 supports hypothesis 3 and rejects hypothesis 5. Formal contracts improve cooperation performance, as models 4a and 5a indicate, consistent with hypothesis 3. However, the interaction of technical expertise and formal contracts has no impact on supplier performance (models 5a to 5c), counter to hypothesis 5.¹

Finally, to test hypothesis 6, we examined whether the interaction of supplier relational governance and the use of contracts influenced supplier performance. Model 6 in Table 3 shows that relational and formal governance have a joint impact in improving price satisfaction (6c), but no joint influence on cooperation (6a) or quality (6b). Moreover, the main effect of formal contracts on price performance is negative in model 6c, indicating that firms often encounter pricing problems if they use formal contracts while applying only limited relational governance activity. Model 6c is a statistically significant improvement over model 4c (p < 0.10), based on the loglikelihood ratio test.

The joint impact of contracts and relational governance on price satisfaction is intriguing, especially when coupled with the negative impact of formal contracts and the lack of impact of relational governance alone. The presence of the joint effect suggests that firms tended to be most satisfied with contracted pricing performance when they were also practiced at identifying desirable suppliers and managing the flow of information between the two firms. That is, contracts alone are not sufficient to achieve satisfactory prices – the firm also benefit by managing the relationship actively.

Several control variables provided intriguing results. We focus on the results in Table 2, which include the full sample. Older firms tended to be more satisfied with supplier performance, perhaps

¹ Scholars often decompose the effects of interaction terms in order to improve interpretation (e.g., McGrath 2001). While this task is straightforward for linear models, the technique is more difficult in non-linear analysis. Norton, et al (2004) provide a decomposition algorithm for binary logit models that computes the marginal effect of a change in two interacted variables by calculating the cross derivative (the true interaction effect is conditional upon the value of the variables). However, we could find no comparable program for ordered logit models.
because they had more experience. Higher volume components resulted in somewhat lower satisfaction with cooperation, perhaps because of the need for frequent deliveries. Firms had somewhat higher price satisfaction but lower satisfaction for cooperation with end-part surface coating suppliers. Surface coating is more generic than the other components, resulting in more competition from a greater number of suppliers; therefore, surface coating buyers tend to purchase on price, switching suppliers more readily and thus limiting the development of cooperation.

Sensitivity analyses examined several other influences. First, we found equivalent results when we added the number of suppliers. Second, we defined a control for type of firm (powder metal v. others), but dropped the variable because it correlated negatively with age. Third, we considered the possibility that the level of the respondent might affect their perception of supplier performance; because we had the titles of all respondents, we could determine which were higher-level executives (e.g., President, Vice President, other officers and directors) and included a binary variable for this characteristic. The respondent level variable was never significant and no substantive differences arose in any of the models when we included the variable.

We assessed several alternative specifications. We found similar results when we replaced age with the log of age. We estimated models in which we dropped the item for use of contracts from the supplier relational governance construct (item 4), in case this was conflicting with the formal contracts variable, but found similar results. Including this item reflects multiple arguments that contracts are an important aspect of relational governance (the relational governance construct had slightly greater reliability when it included the contracts item). We estimated OLS models as a robustness check of methods choice, finding similar results (the one difference was that OLS estimated an insignificant interaction of technical expertise and relational governance for quality performance in Model 2).

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2 Work by several scholars suggests that contracts are a relevant part of relational governance. Macauley (1963) and Arrow (1974) note that contracts can act as communication devices. Heide and Miner (1992) argue that contracts indicate a firm’s intent to maintain a relationship, while Macneil (1978) argues that contracts support cooperation because both parties project the relationship to last. Helper and Levine (1992) suggest that contracts support cooperation and relationship building. Sako (1992) identifies contracts as providing a form of trust that complements two other forms of trust (competence and goodwill), suggesting that contracts help stabilize relationships.
To summarize, the results support hypotheses 1 to 4 and hypothesis 6, albeit on different performance outcomes. Technical expertise improved quality and price performance (hypothesis 1). Greater use of supplier relational governance mechanisms led to improved cooperation (hypothesis 2), while formal contracts also improved cooperation (hypothesis 3). Greater technical expertise intensified the positive effect of relational governance for cooperation and quality (hypothesis 4). More relational governance enhanced the impact of formal contracts on pricing satisfaction (hypothesis 6). By contrast, the interaction of technical expertise and formal contracts had no influence on supplier performance (rejecting hypothesis 5). Overall, a firm’s technical expertise was the most general driver of its satisfaction with supplier performance. At the same time, though, both the relational and contractual elements of supplier governance mechanisms also influenced supplier performance, most strikingly in the ability to engender cooperative relationships and, in combination, on pricing satisfaction.

DISCUSSION

We started by asking whether firms could rely on relational or contractual governance skills to achieve high performance in their sourcing relationships, or whether they also needed to maintain their own internal technical expertise. The study demonstrates the importance and complementarity of governance and technical skills. Firms can neither successfully hollow themselves out by neglecting their technical expertise nor ignoring their interfirm relationships, but rather need both of these sets of skills. The simplest implication is that firms that lack both technical skills and governance skills will engender very low satisfaction with the performance of their outsourcing activities. On a more nuanced level, the results suggest that technical skills and governance activities influence different dimensions of outsourcing performance. Technical expertise affected both price and quality outcomes but had weaker influence on cooperation, which drew more strongly from governance activities. The contrast raises the issue of how firm expertise affects learning, which connects closely to cooperation. It appears that a firm’s knowledge exchange and information sharing processes strongly contribute to supplier cooperation. In other words, the firm’s emphasis on managing the relationship may be most important in fostering learning and cooperation. The key conclusion is that a firm requires both technical expertise and
governance skills to maintain high performance supplier relationships. This conclusion reinforces MacDuffie and Helper’s (1997) suggestion that suppliers look for customers that are technically competent, cultivate goodwill in the relationship, and will stand by their formal agreements.

Contributions

This paper offers several contributions. The study adds to work that indicates the importance of firm characteristics on exchange relationships (e.g., Argyres and Liebeskind, 1999), while contributing to our understanding of the complementarity between formal and informal governance mechanisms (Poppo and Zenger, 2002). The work also highlights the multidimensionality of both supplier governance and performance. From a practical viewpoint, the results demonstrate the need for firms to maintain their technical skill even as they follow an outsourcing strategy. These technical skills offset some of the transaction cost barriers to outsourcing, such as bounded rationality and opportunism, by improving supplier selection and management (Williamson 1985, Mayer and Salomon 2005). In this sense, transaction costs do not arise purely as exogenous features of the characteristics of particular components, but vary depending on a buyer’s own technical expertise and ability to manage supply relationships.

More generally, supplier relational governance mechanisms are an aspect of what Dyer and Singh (1998) refer to as a relational capability. The study increases our understanding of the relational capability and how it affects supplier performance, both alone and in conjunction with technical expertise. We found supplier relational governance influenced cooperation more directly than price or quality. It is possible that price and quality are more objective criteria that are less affected by relatively informal mechanisms, stemming more from a firm’s ability to undertake credible evaluation of a supplier’s cost and quality potential. Moreover, contractual governance increased cooperation, but did not affect price or quality outcomes, possibly because formal agreements facilitate supplier commitments and investments by protecting the terms of the exchange. Suppliers may be more cooperative because they do not want to cause problems that would place these investments at risk.

The work suggests that different aspects of supplier performance arise from distinct antecedents. Price performance, in particular, was difficult to model, although we did identify an impact of technical
expertise as well as a joint impact of relational and contractual governance. The modeling difficulty might arise because firms commonly are dissatisfied with prices obtained from external suppliers, evidence of which arises from the lower mean and standard deviation of this variable relative to the other performance measures. We identified significant models for quality and cooperation, but with different explanations for superior performance. This would be important for applications in which firms desire one type of performance more than others. For example, if quality is vitally important, a firm can focus on improving its own expertise to determine how best to specify the good. In addition, it is possible that suppliers focus their efforts differentially toward more technically adept and demanding customers, assuming that they will not tolerate poor performance. Therefore, the ex-post mechanisms of quality evaluation may be less important, which could lead to our positive but not significant relational capability result for this outcome.

The industry context of the study also produces insights. Most firms in this study produce goods for the auto industry and so must respond to the considerably larger end product manufacturers and first-tier suppliers in the industry. Despite years of focusing on supply relationships and a multitude of both scholarly and managerial studies, the automotive industry still often appears to be beset by contention between buyers and suppliers (Mudambi and Helper, 1998). Perhaps in some industries or for some goods, supplier relationships never evolve into true partnerships. Thus, the nature of the buying or supplying firms or the good itself might keep the exchange more distant. In our study, surface coating appeared to be a good that led to more competition, as evidenced by lower prices and less cooperation. Cultivating close supply relationships comes at a cost to firms, so it may not be worthwhile to do so for some commodity-type goods that have scant impact on the production process or downstream customer outcomes. Attributes of the item that the firms are sourcing will also affect the significance of both technical expertise and relational mechanisms on performance outcomes. For more generic goods that do not directly affect the production process, neither of these factors may matter. It would be intriguing to extend the concepts in the study toward purchases of more generic commodities or services.

**Limits and Future Research**

The survey has several limits that suggest avenues for continuing research. The data is cross-
sectional with only the buyer as the respondent. Because sourcing is a dynamic process, consisting of many stages, and because relationships develop over time, it would be interesting to determine whether the results also arise longitudinally. It would also be informative to gain the perspective of the supplier to determine whether they view the buyer as being technically or managerially skilled. We also were constrained by having subjective performance measures. An alternate explanation to our results would be that satisfactory supplier performance involves appropriate expectations, such that buyers with closer supply relationships will know more about their suppliers and thus be less likely to be dissatisfied with the suppliers’ performance. However, our strong and more general results for technical expertise over relational governance suggest that the results do not reflect self-fulfilling prophecies, but rather technically competent firms appear to be better at selecting and managing suppliers. Nonetheless, it would be insightful to understand how performance expectations are developed and understood by both parties and how these expectations relate to more objective measures of performance. Although we believe that price, quality, and cooperativeness are important to all buyers, it may be interesting to explore the relationships between technical expertise and governance for other types of performance, such as innovativeness. Finally, it would be informative to extend this work to technologically volatile contexts or in the service industry, perhaps with larger firms or where a considerable size difference exists between buyers and suppliers.

This study investigates outsourcing relationships and assumes that firms have chosen this type of sourcing appropriately. We assume that the characteristics of the firm, supplier, environment, and goods being purchased align with external sourcing rather than internal production or some other sourcing mode (Williamson, 1985). If data were available, one could create a multistage model predicting sourcing mode and then subsequent performance (e.g., Leiblein, et al., 2002), although care would have to be taken to avoid multicollinearity and find truly independent variables for each stage. Technical expertise, for example, is often associated with internal production, but we suggest that it is also required for satisfactory outsourcing. This type of approach could also address endogeneity concerns, although our findings suggest that there is sufficient variation in performance to indicate the sourcing mode itself does
not dictate performance, but rather the buyer’s technical skills and ability to manage the relationship influence performance.

Several other extensions to this work could broaden our understanding of supply relationships. One area of research could investigate the effect of relationship duration and prior exchanges on performance when also incorporating technical and governance skills. Fine-grained empirical work on the details of the contracts (Saussier, 2000; Mayer and Weber, 2005), along with a better understanding of the specific relationship dynamics within a particular dyad, could help uncover what specific features of formal and informal governance complement or conflict with each other. This work could also be extended into a retail setting, in which technical expertise may have a different impact. It would be instructive to consider how firms manage multiple suppliers, which could include internal production, to determine whether the governance features differ between specific suppliers and when firms have a different portfolio of suppliers.

As firms continue to outsource, they need to better understand how to manage supplier relationships. This study demonstrates that governance activities and technical expertise both influence supplier performance. Technical skills improve quality and price performance directly and, in conjunction with relational governance, also improve supplier cooperation. Both informal and formal governance affect supplier cooperativeness. Thus, firms need to maintain a multidimensional set of processes to manage their supplier relationships and, more generally, their interfirm relationships.
REFERENCES


Table 1. Descriptive Statistics and Correlations

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*p < 0.05.

Table 2. Ordered Logit Models for Supplier Performance: Technical Expertise and Relational Governance
(Positive coefficient = greater satisfaction with supplier performance)

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<td>0.01</td>
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<td>(0.23)</td>
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<td>(0.24)</td>
<td>(0.24)</td>
<td>(0.22)</td>
<td>(0.24)</td>
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<td>0.09</td>
<td>0.14</td>
<td>-0.03</td>
<td>0.07</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>(0.24)</td>
<td>(0.25)</td>
<td>(0.22)</td>
<td>(0.24)</td>
<td>(0.25)</td>
<td>(0.23)</td>
</tr>
<tr>
<td>End-Part Surface Coating #</td>
<td>-0.37*</td>
<td>-0.10</td>
<td>0.45*</td>
<td>-0.35*</td>
<td>-0.09</td>
<td>0.44*</td>
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<td></td>
<td>(0.26)</td>
<td>(0.25)</td>
<td>(0.29)</td>
<td>(0.25)</td>
<td>(0.25)</td>
<td>(0.29)</td>
</tr>
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<td>Log pseudolikelihood</td>
<td>-675.2</td>
<td>-713.5</td>
<td>-717.8</td>
<td>-672.6</td>
<td>-712.6</td>
<td>-717.5</td>
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<tr>
<td>Prob &gt; chi2</td>
<td>0.01</td>
<td>0.08</td>
<td>0.33</td>
<td>0.00</td>
<td>0.05</td>
<td>0.40</td>
</tr>
<tr>
<td>Loglikelihood ratio v. model 1 (df)</td>
<td>5.2 (1)**</td>
<td>1.9 (1)</td>
<td>0.7 (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LL ratio v. control variables only (df)</td>
<td>5.4 (2)**</td>
<td>3.1 (2)</td>
<td>6.0 (2)**</td>
<td>10.6 (3)**</td>
<td>5.0 (3)*</td>
<td>6.7 (3)**</td>
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</tbody>
</table>

*p < 0.10; ** p < 0.05; *** p < 0.01 (one-tailed tests); robust standard errors in parentheses.

# compared to “Die Building”
Table 3. Ordered Logit Models for Supplier Performance: Formal Contracts
(Please note: coefficients exceeding 0.5 decimal places are presented; positive coefficients indicate greater satisfaction with supplier performance)

<table>
<thead>
<tr>
<th></th>
<th>Cooperation</th>
<th>Quality</th>
<th>Price</th>
<th>Cooperation</th>
<th>Quality</th>
<th>Price</th>
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<th>Price</th>
<th>Cooperation</th>
<th>Quality</th>
<th>Price</th>
</tr>
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<tr>
<td>H1: Technical Expertise</td>
<td>0.13* (0.08)</td>
<td>0.15 (0.08)</td>
<td>0.18 (0.08)</td>
<td>0.13* (0.09)</td>
<td>0.15 (0.09)</td>
<td>0.18 (0.09)</td>
<td>0.10 (0.09)</td>
<td>0.17 (0.09)</td>
<td>0.19 (0.09)</td>
<td>0.13* (0.09)</td>
<td>0.15 (0.08)</td>
<td>0.18 (0.09)</td>
</tr>
<tr>
<td>H2: Supplier Relational Governance</td>
<td>0.08** (0.04)</td>
<td>0.00 (0.04)</td>
<td>-0.02 (0.04)</td>
<td>0.08** (0.04)</td>
<td>0.00 (0.05)</td>
<td>-0.02 (0.04)</td>
<td>0.08** (0.04)</td>
<td>0.00 (0.05)</td>
<td>-0.02 (0.04)</td>
<td>0.07* (0.05)</td>
<td>-0.01 (0.05)</td>
<td>-0.05 (0.04)</td>
</tr>
<tr>
<td>H3: Formal Contracts</td>
<td>0.39* (0.25)</td>
<td>-0.11 (0.23)</td>
<td>-0.25 (0.23)</td>
<td>0.46** (0.25)</td>
<td>-0.10 (0.23)</td>
<td>-0.25 (0.23)</td>
<td>0.48** (0.25)</td>
<td>-0.11 (0.23)</td>
<td>-0.26 (0.23)</td>
<td>0.43* (0.26)</td>
<td>-0.14 (0.24)</td>
<td>-0.40** (0.24)</td>
</tr>
<tr>
<td>H4: Technical Expertise * Supplier Relational Governance</td>
<td>0.06*** (0.03)</td>
<td>0.02 (0.02)</td>
<td>-0.01 (0.02)</td>
<td>0.06** (0.03)</td>
<td>0.02 (0.02)</td>
<td>-0.01 (0.02)</td>
<td>0.06*** (0.03)</td>
<td>0.02 (0.02)</td>
<td>-0.01 (0.02)</td>
<td></td>
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</tr>
<tr>
<td>H5: Technical Expertise * Formal Contracts</td>
<td>0.14 (0.15)</td>
<td>-0.09 (0.13)</td>
<td>-0.04 (0.11)</td>
<td>0.05 (0.12)</td>
<td>0.07 (0.10)</td>
<td>0.22** (0.10)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>H6: Supplier Relational Governance * Formal Contracts</td>
<td>0.01*** (0.00)</td>
<td>0.00 (0.00)</td>
<td>0.01** (0.00)</td>
<td>0.01*** (0.01)</td>
<td>0.00 (0.01)</td>
<td>0.01** (0.01)</td>
<td>0.01*** (0.01)</td>
<td>0.00 (0.01)</td>
<td>0.01** (0.01)</td>
<td></td>
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<tr>
<td>Firm Age</td>
<td>-0.05 (0.07)</td>
<td>-0.03 (0.06)</td>
<td>0.00 (0.07)</td>
<td>0.06 (0.07)</td>
<td>0.00 (0.07)</td>
<td>0.04 (0.07)</td>
<td>0.06 (0.07)</td>
<td>0.03 (0.07)</td>
<td>0.04 (0.07)</td>
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</tr>
<tr>
<td>Volume</td>
<td>-0.20 (0.23)</td>
<td>-0.37* (0.23)</td>
<td>-0.35* (0.25)</td>
<td>-0.20 (0.25)</td>
<td>-0.37* (0.25)</td>
<td>-0.36* (0.26)</td>
<td>-0.23 (0.25)</td>
<td>-0.35* (0.25)</td>
<td>-0.35* (0.25)</td>
<td>-0.20 (0.25)</td>
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<td>-0.39* (0.25)</td>
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<tr>
<td>Die Design #</td>
<td>-0.10 (0.26)</td>
<td>-0.11 (0.25)</td>
<td>0.13 (0.31)</td>
<td>-0.14 (0.27)</td>
<td>0.12 (0.25)</td>
<td>0.14 (0.31)</td>
<td>-0.15 (0.27)</td>
<td>-0.11 (0.25)</td>
<td>0.14 (0.31)</td>
<td>-0.14 (0.25)</td>
<td>-0.11 (0.32)</td>
<td></td>
</tr>
<tr>
<td>End-Part Machining #</td>
<td>0.01 (0.26)</td>
<td>-0.23 (0.28)</td>
<td>0.15 (0.25)</td>
<td>-0.03 (0.27)</td>
<td>-0.23 (0.25)</td>
<td>0.15 (0.27)</td>
<td>-0.03 (0.27)</td>
<td>-0.23 (0.25)</td>
<td>0.15 (0.27)</td>
<td>-0.03 (0.28)</td>
<td>-0.23 (0.25)</td>
<td></td>
</tr>
<tr>
<td>End-Part Surface Coating #</td>
<td>-0.33 (0.30)</td>
<td>-0.24 (0.30)</td>
<td>0.49* (0.34)</td>
<td>-0.31 (0.30)</td>
<td>-0.23 (0.30)</td>
<td>0.48* (0.34)</td>
<td>-0.32 (0.30)</td>
<td>-0.22 (0.30)</td>
<td>0.48 (0.34)</td>
<td>-0.32 (0.30)</td>
<td>-0.23 (0.34)</td>
<td></td>
</tr>
<tr>
<td>Cases</td>
<td>371 (0.30)</td>
<td>372 (0.30)</td>
<td>373 (0.34)</td>
<td>371 (0.30)</td>
<td>372 (0.30)</td>
<td>373 (0.34)</td>
<td>371 (0.30)</td>
<td>372 (0.30)</td>
<td>373 (0.34)</td>
<td>371 (0.30)</td>
<td>372 (0.30)</td>
<td>373 (0.34)</td>
</tr>
<tr>
<td>Log pseudo-likelihood</td>
<td>7.3(1)***</td>
<td>0.7(1)</td>
<td>0.1(1)</td>
<td>8.3(2)***</td>
<td>1.1(2)</td>
<td>0.2(2)</td>
<td>7.5(2)***</td>
<td>1.0(2)</td>
<td>3.9(2)*</td>
<td>1.0(2)</td>
<td>0.4(1)</td>
<td>3.8(1)**</td>
</tr>
<tr>
<td>Loglikelihood ratio v. model 3</td>
<td>1.0 (1)</td>
<td>0.5 (1)</td>
<td>0.1 (1)</td>
<td>0.2 (1)</td>
<td>0.4 (1)</td>
<td>3.8 (1)**</td>
<td></td>
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</tbody>
</table>
APPENDIX

Satisfaction with Supplier Performance (dependent variables)
Our current sources’ performance on….is…. (1-7 scale from terrible to terrific) [Poppo and Zenger 1998]
   1. Price competitiveness and value
   2. Quality level / defect rates
   3. Cooperation and dispute resolution

Technical Expertise Items (1-7 scale, from “not true” to “true”) [Walker and Weber 1984]
   1. Our manufacturing staff can/could easily produce dies.
   2. Making dies requires a deep expertise that our firm understands.
   3. We have internally produced dies for years.
   4. The skills used to make dies are closely related to those that we use to make other similar products.

Supplier Relational Governance Mechanism Items (1-7 scale, from “not true” to “true”)
   1. Our supplier relationships last for years [Noordewier, et al.1990].
   2. We will always work through difficulties with a supplier rather than switch to a new one [interviews].
   3. We regularly use confidentiality agreements with our suppliers [Dyer 1997].
   4. We use formal, written contracts whenever possible [Macauley 1963; Heide and Miner 1992, Macneil 1978].
   5. We immediately inform our suppliers whenever there’s a change in volume requirements [Noordewier, et al. 1990].
   6. We communicate daily with major suppliers [interviews].
   7. We advise suppliers of their performance in relation to that of other suppliers [Noordewier, et al. 1990].
   8. We evaluate our internal production using the same criteria and strictness as our suppliers [Helper 1991].
   9. We have a formal, written scorecard that we always use to evaluate our suppliers [Noordewier, et al. 1990].
  10. Level of quality certifications – highest if all, otherwise in order from high to low ISO/TS16949, QS9000, ISO900x (0 to 4 point scale) [interviews].
  11. Our engineers never travel to our supplier’s plants (reversed) [Dyer 1996].
  12. We frequently help our suppliers improve their processes by providing them with technical, engineering, quality, or other assistance [Dyer 1997].
  13. Our suppliers do not help us in reducing costs and overall problem solving (reversed) [Noordewier, et al. 1990].

Contractual Agreements (first two options coded as having a formal contract)
If you use external suppliers for progressive dies, which best describes your transactions?
   □ Long term, rarely modified contracts for multiple dies
   □ Long term, frequently modified contracts for multiple dies
   □ Written purchase orders for each die
   □ Verbal purchase orders for each die
   □ Some combination of these or Other (Please explain _____________________ )
   □ Not applicable – we source all of our progressive dies internally