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The Role of Procedural and Distributive Fairness in R&D Collaborations

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This research examines the value of developing procedural and distributive fairness under a variety of favorable and adverse transacting conditions in R&D collaborations. The parties in these collaborations have symmetrical power and make significant investments in joint activities. A survey of approximately 300 R&D collaborations indicates that while procedural and distributive fairness facilitates performance outcomes, these forms of fairness are also able to improve performance under favorable transacting conditions (e.g., knowledge of the transformation process) and mitigate the negative effects of adverse transacting conditions (e.g., asymmetric inputs and transacting hazards). Interestingly, we also find evidence that the development of fairness can undermine performance, particularly when credible commitments of collaboration (e.g., joint transaction-specific investments) are in place. Implications for the development of interorganizational relationships and the management of complex collaborations are also discussed.

Keywords: procedural fairness, distributive fairness, R&D collaboration

Introduction

Over the years, the marketing, strategy, and management literatures have devoted a great deal of attention to the crafting of collaborative relationships between organizations. Such relationships can be particularly difficult to build, as they often fall prey to information sharing issues, competitive tensions, goal incongruence, coordination costs, and lack of commitment on one or both sides of the collaboration (Anderson and Weitz, 1992; Das and Teng, 2000; Eliashberg and Michie 1984; Gulati, Khanna and Nohria 1994; Hamel, 1991; van Burg et al. 2013). The social justice literature has emphasized the importance of fairness for achieving cooperation and satisfactory outcomes in interorganizational collaborations. In particular, fair processes have been identified as essential for achieving voluntary cooperation when the parties to a collaboration are inclined to hoard information or refrain from useful citizenship behaviors (Lind and Tyler, 1988; Kim and Mauborgne, 1998; Bertsimas, Farias and Trichakis, 2012).

In the marketing literature, scholars have also highlighted the importance of fairness in interorganizational relationships. For example, Anderson and Weitz (1989, 1992) find that fairness engenders trust and expectations of continuity. Fairness also figures centrally in periodic reviews of interfirm relationships (Dwyer, Schurr and Oh, 1987), and perceived unfairness will stimulate negative attitudes and potential detrimental long-term consequences (Frazier, 1983; Frazier, Spekman and O'Neal, 1988; Wagner, Coley and Lindemann, 2011). However, the concept of fairness remains underdeveloped in the marketing literature and has received only limited empirical attention. A notable exception is Kumar, Scheer and Steenkamp (1995) hereafter referred to as KSS, who examine relationships between powerful manufacturers and downstream resellers in the automotive industry. KSS distinguish between procedural and distributive forms of fairness, determining that both forms produce a positive impact on interorganizational relationship quality, although environmental uncertainty and varying outcomes moderate their impact. Interestingly, they also find that procedural fairness has a stronger effect, suggesting that channel resellers (the less powerful party) value fair process more highly than fair distribution of outcomes.

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This research expands and extends the ideas advanced in KSS but differs in several important ways. First, this research considers the roles of procedural and distributive fairness in R&D collaborations in which both partners make significant inputs and dedicated investments, engaging in interdependent processes to achieve their desired ends. Hence, the collaborations are more balanced in power and involve more significant mutual investments than the relationships examined in KSS. Second, the R&D context of this research is more complex than in KSS. That is, the scope of the partners' activities may vary widely from explorations in science and technology to the development of practical competencies or applied projects aimed at specific tasks (Hauser, 1998). These collaborations may form in risky, uncertain settings around nonstandard business objectives (i.e., to learn a technology or "keep a window" on an opportunity) in which it is difficult to articulate *ex ante* all the expected outcomes, partner roles, and necessary skills and competencies (van Burg et al., 2013).

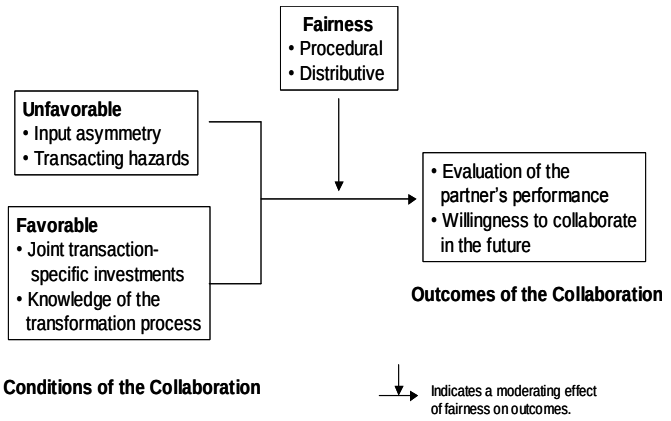
This research focuses on how procedural and distributive fairness affect key outcomes in R&D collaborations such as evaluations of the partner's performance and willingness to collaborate again in the future. According to transaction cost theory, exchange partners may face a variety of transacting conditions that can facilitate or mitigate potential maladaptation costs, opportunism-related losses, and investment cost recovery concerns (Williamson, 1996). Thus, we consider both adverse (i.e., input asymmetry, transacting hazards) and favorable (i.e., joint transaction-specific investments, and knowledge of the transformation process) transacting conditions under which procedural and distributive fairness might be particularly useful. We also consider how such forms of fairness would moderate the effects of these conditions on collaboration outcomes. These hold important implications for long-term relationship management and interorganizational coordination.

In the pages to follow, we develop a conceptual framework of the conditions under which procedural and distributive fairness would exert the greatest impact on performance outcomes and we describe their potential moderating effects. In doing so, we draw on research in marketing, management, and social relations as well as interviews with R&D managers, scientists, and engineers. The theoretical literature illuminates the motivational concerns that operate in collaborative contexts, while the field interviews identify the specific resource and organizational characteristics that comprise the R&D context. This section is followed by an empirical test of the hypotheses involving approximately 300 R&D collaboration participants. The results are then discussed, including limitations of the research, implications for management, and potential directions for future investigations.

Conceptual Framework

Figure 1 presents an overview of the conceptual framework. In this section, we define each construct and the potential relationships among them. The unit of analysis is the perspective of an organizational participant in an R&D collaboration consisting of two financially independent, non-competitive organizations; each participant supplies a complementary competency that enables the joint activities. Thus, the partners may be involved in programs either to develop or to test, use, and leverage needed skills, tools, or competencies. These collaborations are not procurement arrangements, as the parties do not exchange financial support. Hence, joint ventures, networks, competitor-dominated alliances, and vertically integrated relationships fall beyond the scope of this research. Although the organizations may differ in function, symmetry is expected in the nature and pattern of causation of the behavioral constructs that underlie their relationship.

Figure 1 Conceptual Framework



Performance outcomes

Two performance outcomes are considered: evaluations of the partner's performance and willingness to collaborate in the future. The former significantly determines each party's satisfaction with the collaboration in the short-term and the latter indicates each party's willingness to engage repeatedly with the partner in the long-term.

Evaluations of the partner's performance. Evaluation of the partner's performance is an economically significant short-term outcome. It reflects a holistic representation of the "degree to which the main objectives of the collaboration are achieved in terms of maximizing outputs relative to obstacles and costs" (Kumar, Stern and Achrol, 1992, p. 239). A positive evaluation justifies involvement in the collaboration.

Willingness to collaborate in the future. Willingness to collaborate in the future indicates the degree to which each partner will engage in mutual endeavors again, should the opportunity arise. Such willingness critically determines the actions of each party in both the short and long term. Without a longer-term perspective on the future, partners will be oriented toward the short-term and will refuse to engage in activities that do not pay off quickly and certainly (Williamson, 1993). If the parties do not anticipate worthwhile benefits in the future, they are likely to exit (Anderson and Weitz, 1989).

Fairness

An extensive management and social justice literature examines the issue of fairness (see Tyler and Lind, 1992 for a review). For the most part, this literature is organized around two types of fairness: procedural and distributive. Both forms of fairness are critical to interorganizational collaboration because they provide important assurances regarding how the parties share outcomes, how the parties will interact and operate together, and how satisfied the parties will be with the collaboration. These assurances can be particularly powerful in the context of R&D collaborations where the outcomes may be unclear, the necessary competencies ambiguous, and the settings risky and uncertain. Managing R&D collaborations requires a delicate balance between protecting the firm's core expertise and exposing the firm's core capabilities to a partner in order to promote mutual learning and joint product development. Unfairness in the sharing of expertise can lead to disproportionate learning advantages and early termination of R&D collaborations (Khanna, Gulati, and Nohira, 1998). Similarly, unfairness in the sharing of risk associated with avenues for developing new technologies often makes R&D collaborations fail (Bleeke and Ernst, 1991). R&D collaborations also require individuals from different corporate cultures to work cooperatively in cross-functional teams. Unfair treatment at the team or interpersonal level can impair team effectiveness (Kim and Mauborgne, 1998). Thus, fairness assurances have important implications for whether to escalate or dissolve a relationship, based on a comparison of time, effort, and money with potential payoff (Bertsimas, Farias and Trichakis, 2012).

Procedural fairness. Procedural fairness refers to the degree of fairness perceived in the dyad's interactions and collaborative processes (Leventhal, 1980; Lind and Tyler, 1988; Thibaut and Walker, 1975). The management literature has shown that procedural fairness plays a critical instrumental, social, and psychological role among organizational employees. Specifically, people care about procedural fairness because it affects tangible outcomes in the short and long run (Thibaut and Walker, 1975). Procedural fairness plays a functional role in collaborations and partnerships between private and public entities (Zhang and Jia, 2010). Procedural fairness also satisfies self-esteem, affiliation, and identity needs: people are more satisfied when they interact with others who are procedurally fair. Procedural fairness has been demonstrated to have real implications for the operational and financial performance of firms (e.g., Smith, Bolton and Wagner, 1999; Mahajan and Benson, 2013).

Distributive fairness. Distributive fairness has been considered more extensively in the interorganizational marketing literature as it directly addresses the fairness of the outcomes received by each party (e.g., Dwyer, Schurr and Oh, 1987; Frazier, Spekman and O'Neal, 1988). We define distributive fairness as the perception of fairness when parties share collaboration outcomes (Adams, 1965; Deutsch, 1975). It characterizes how the benefits of the collaboration are divided among the participants (Franke, Keinz, and Klausberger, 2013).

Interorganizational researchers also take the perspective that fairness produces an ongoing effect on the collaboration arising from each partner's reputation for fairness. A partner develops a reputation for fairness from prior opportunistic or benevolent actions in existing and prior relationships. A partner's fairness reputation encourages the trust of new partners and discourages opportunistic actions that may diminish the value of their reputation (Telser, 1980; Anderson and Weitz, 1989; Wagner, Coley and Lindemann, 2011).

In summary, distributive and procedural fairness, whether as a periodic evaluation or an ongoing reputation, perform two important functions in interorganizational collaborations. First, fairness reduces the propensity for opportunistic actions that create dysfunctional conflict and lead to relationship dissolution. Second, fairness has the synergistic effect of liberating the collaboration from on-going monitoring safeguards to create an open environment of formal and informal exchange, thus promoting successful R&D. As Gundlach and Murphy (1993) point out, perceived equitable distribution of rewards in relationships leads to forthright negotiations concerning exchange details, and such relationships are likely to transcend contractual mandates. Hence, it is expected that:

H1: Perceptions of procedural and distributive fairness are positively associated with performance outcomes.

Conditions

We extend the research on fairness in interorganizational collaboration by examining the role of procedural and distributive fairness in adverse and favorable conditions of R&D collaborations between firms. We use these terms in the sense that "adverse" conditions make collaboration more difficult to coordinate while "favorable" conditions make coordination easier. The transaction cost literature suggests that asymmetric inputs and transacting hazards represent adverse exchange conditions because they expose partners to uncertainty, coercive power, and opportunistic behavior. Alternatively, partners may improve coordination and collaboration by creating joint transaction-specific investments and by understanding the transformation of inputs to benefits. Such investments provide powerful incentives to act non-opportunistically and to operate in the best interests of the collaboration, while knowledge of the transformation process aids in monitoring and evaluating partner behavior and outputs. In this section, we consider the impact of these conditions on performance outcomes as well as the moderating effects of procedural and distributive fairness.

Input asymmetry. The objectives of the collaboration and core competencies of the partners may dictate that each firm make different levels of financial, technological, managerial, and human resource commitments to the joint effort. Input asymmetry means that one party contributes more resources to the collaboration than the other partner. This asymmetry presents an occasion for opportunism from the other partner who makes the smaller investment (Gundlach, Achrol and Mentzer, 1995). It also contributes to a tendency of the partner who has made larger investments to attribute causality for success disproportionately to its specific contributions while diminishing the other's contribution (Anand and Stern, 1985). Thus, the partner who has made larger investments in the relationship will be more likely to negatively evaluate their partner's performance and less likely to collaborate in the future.

H2: Input asymmetry is negatively associated with performance outcomes.

Transacting hazards. In many R&D collaborations a variety of transacting hazards undermine the likelihood of achieving outcome success. These hazards, such as information leakages, incorrect assessments, investment risk, etc., create uncertainty and a perceived lack of control when a partner achieves its targeted outcomes in the collaboration. Such hazards might also fuel tacit forms of opportunism such as evasion of duties and shirking by partners seeking to minimize exposure in the face of risk (Wathne and Heide, 2000). As suspicions of opportunism are fueled, less than favorable evaluations of a partner's performance emerge, and each partner's willingness to engage with the other in the future is decreased.

H3: Transacting hazards are negatively associated with performance outcomes.

Moderating effects of fairness with adverse conditions. We expect that fairness attenuates the tendency for adverse conditions to produce adverse results. Fairness thus averts the destruction of the collaboration.

Research in the literature on social justice explains how procedural fairness may mitigate the vulnerabilities associated with hazardous conditions and asymmetric commitments of partners. Specifically, Kim and Mauborgne (1997; 1998) observe that the domain of procedural fairness in business settings consistently includes active engagement, explanation, and clarity of expectations. Thus, the parties' engagement in decisions allows them to comment on the merits and shortcoming of each other's ideas and assumptions. Explanation allows the partners to understand decisions and, importantly, why unilateral positions and bilateral agreements may be subsequently overridden in the ultimate decision. Finally, clarifying explanations requires that parties have a firm understanding of expectations of them before, during, and after a decision. Together, engagement and explanation enable the identification of possible hazards and vulnerabilities and specify the ground rules for handling such problems. To the extent that these issues are foreseen, reactions can be specific and bilateral rather than ambiguous and unilateral. Clarity of expectations makes negative outcomes more palatable and affords early detection of problems and a more precise forecast of expected payoffs. To the extent that procedural fairness is practiced in R&D collaborations, we thus expect that adverse conditions such as input asymmetry and transacting hazards are less likely to result in negative outcomes for collaboration.

H4: Adverse transacting conditions (i.e., input asymmetry and transacting hazards) will be less strongly (less negatively) associated with performance outcomes as perceptions of procedural fairness increases.

Distributive fairness is a quid pro quo receipt of rewards for investments made within the collaboration. Hence, it improves satisfaction with outcomes more immediately in the short-term than procedural fairness, which has a more enduring attitudinal effect on relationships. In adverse conditions, we argue that distributive fairness allows partners to build coping capabilities; under favorable conditions, distributive fairness enables the partners to build cooperative capabilities.

When inputs are asymmetrical and transactions hazardous, distributive fairness provides powerful assurances to improve a partner's (particularly the minority partner) ability to cope with the adverse conditions. Fairness in the distribution of outcomes can reduce perceived income uncertainty and the hazards of collaboration. In particular, distributive fairness might also reduce partners' tendency to turn to punitive actions and intrusive forms of monitoring that may harm the relationship. When vulnerabilities to opportunism exist, the minority partner tends to develop punitive capabilities and to retaliate in kind to their counterpart's punitive actions (Frazier, Gill and Kale, 1989; Kumar, Scheer and Steenkamp, 1998). Punitive actions and retaliations can result in increased dissatisfaction and reduced expectations of relationship continuity. However, distributive fairness can mitigate the development of punitive actions and capabilities by providing the partners an assurance that they will ultimately receive a fair share of the collaboration outcomes. This assurance of future returns may inhibit a partner's need to act punitively in the short-term.

Distributive fairness might also reduce the minority partner's need to implement *ex post* controls for reducing opportunism. Williamson (1994) notes that many partners attempt to reduce the likelihood of opportunistic behavior by supplementing *ex ante* controls, such as prequalification of prospective partners and incentive designs, in addition to *ex post* controls such as on-going monitoring. However, when partners have the assurance of a fair division of the outcomes, they may be less likely to impose intrusive *ex post* controls such as monitoring because these controls may be less necessary and may create a sense of suspicion or distrust that could damage the collaboration. Hence, we expect that:

H5: Adverse transacting conditions (i.e., input asymmetry and transacting hazards will be less strongly (less negatively) associated with performance outcomes as perceptions of distributive fairness increases.

Joint transaction-specific investments. Joint transaction-specific investments are non-fungible investments made by both partners in the collaboration. These investments may be tangible, such as capital equipment, laboratory facilities, and machinery, or they may be intangible, such as dedicated human resources or adaptation of organizational policies, procedures, and systems. Their non-fungible nature suggests that the full value of the investments cannot be recovered if the investments are redeployed in an alternative relationship. The joint investments serve as reciprocal safeguards or hostages that bind the parties together and motivate them to sustain the relationship, controlling opportunism and aligning their interests (Anderson and Weitz, 1992; Williamson, 1983). Joint transaction-specific investments have been empirically linked to mutually beneficial marketing activities and commitment intentions, which should subsequently bolster performance outcomes. Specifically, Gundlach, Achrol, and Mentzer (1995) found a positive relationship between joint inputs and long-term commitment intentions. Zaheer and Venkatraman (1995) show a strong correlation between reciprocal investments and joint action in the area of new product launches. Thus, the equitable exposure to risk resulting from the use of joint transaction-specific investments should promote heightened evaluations of the other partner's performance and willingness to collaborate again in the future (Heide and John, 1990; Noordewier, John and Nevin, 1990).

H6: Joint transaction-specific investments are positively associated with performance outcomes.

Knowledge of the transformation process. A partner's knowledge of the transformation process or an understanding of how inputs are converted to final outputs can be critical to the success of an R&D collaboration. This process may occur in several ways. First, this knowledge improves a partner's ability to detect tactile forms of opportunism such as shirking (Wathne and Heide, 2000). Knowledgeable partners are better able to detect hoarding of information or non-performance of duties that are not directly observable (Milgrom and Roberts, 1992). As firms become more experienced, their ability to monitor, anticipate, and avoid vulnerable circumstances improves. Second, as a partner's knowledge of the transformation process improves, responsibilities and obligations can become more precise. Ambiguity of role and responsibilities between partners often causes disagreements, which may worsen the relationship (Menon, Bharadwaj, and Howell, 1996). Therefore, the ability to detect and avoid disagreeable situations should improve the quality of the relationship. Third, as partners become more knowledgeable about the transformation process, they develop better-grounded *ex post* expectations of collaboration outcomes, reducing dissatisfaction associated with unfounded optimism. Considering these arguments, we anticipate the following:

H7: Knowledge of the transformation process is positively associated with performance outcomes.

Moderating effects of fairness with favorable conditions. We anticipate that fairness improves the partners' ability to develop relational and productivity capabilities that enable the creation of joint value. Although the dyad has structured their collaboration to include favorable conditions like joint transaction-specific investments and knowledge of the transformation process, coordination challenges can persist (Litwak and Hylton, 1962). Particularly in R&D collaborations, considerable uncertainty may surround the decomposition and integration of activities as well as the need for ongoing mutual adaptation and adjustment. Hence, we argue that the use of procedural fairness can improve cooperation even further when favorable collaboration conditions exist. This process occurs in three ways.

First, procedural fairness allows for the creation of fairness heuristics that improve the speed of decisions in a collaboration. Generally, the best defenses against opportunism are constant monitoring and involvement in decision-making. Decision-making must be informed by due diligence, weighing the costs and benefits of each action. However, this process is inherently costly in terms of the time and attention necessary for success. As a result, individuals tend to associate satisfactory results with fair process, particularly when the process is consistent with previous observations of fair process (Tyler and Lind, 1992). As a partner cultivates a reputation for fairness, counterparts are more likely to make quick heuristic-based decisions rather than to evaluate the details of every proposal. Hence, procedural fairness allows the use of heuristics that can shorten activity times through quicker decision-making and cost-saving processes by not having to second-guess collaboration partners.

The second method for procedural fairness to improve collaboration occurs when fairness increases organizational citizenship behaviors among partners. Such behaviors as sportsmanship and civic virtue enhance organizational effectiveness and evaluations (MacKenzie, Podsakoff and Ahearne, 1998). When individuals consider work processes to be fair, they reciprocate by undertaking extra-role activities that benefit organizational ends. This propensity to reciprocate can be explained by the group value model of procedural fairness, which suggests that a partner who experiences procedural fairness feels valued intrinsically as a member of the collaboration (Lind and Tyler, 1988; see Niehoff and Moorman, 1993 for discussion). This result implies that individuals tend to subjugate their individual goals and perhaps opportunistic tendencies for the greater good of the collaboration.

The final means by which procedural fairness improves the performance impact of favorable conditions occurs because fair procedures inherently improve the dyad's ability to capture and process market information (Kim and Mauborgne, 1998). As mentioned previously, elements of procedural fairness such as engagement, explanation, and clarity of expectations not only resolve disputes but also perform market sensing and information dissemination functions on customers and competitors as well. Although this process may slow down the decision, it may also produce greater consensus and commitment among collaboration partners. Considering these arguments, we hypothesize that:

H8: Favorable transacting conditions (i.e., joint transaction-specific investments and knowledge of the transformation process) will be more strongly (more positively) associated with performance outcomes as perceptions of procedural fairness increases.

When distributive fairness occurs in conjunction with favorable conditions, it may further reduce apprehensions of opportunism and may increase the partners' willingness to invest and commit, thus enhancing the competitiveness of the relationship and the likelihood of collaboration success. In many large corporations, R&D collaborations may compete for funding. Since key resources are scarce, they must be allocated among collaborative endeavors based on prospective returns and current alliance metrics. Committee members and experts are drawn from dispersed areas of the firm, external to the collaboration,

and must be provided with a compelling rationale for supporting one collaboration over another (Kale, Dyer and Singh, 2002). Collaborations that exercise distributive fairness under favorable conditions are more likely to qualify for scarce resources than collaborations with less distributive fairness, because distributive fairness provides assurances of a fair share of the "expanded pie" (Jap, 1999) and assurances of non-opportunism. By improving the quality of resource commitments available to the collaboration, performance outcomes should improve. Thus, we hypothesize the following:

> *H9: Favorable transaction conditions (i.e., joint transaction specific investments and knowledge of the transformation process) will be more strongly (more positively) associated with performance outcomes as perceptions of distributive fairness increases.*

Methodology

Sample and data collection

Research setting. The tests of hypotheses are conducted via a survey methodology used among the R&D groups of five participant organizations: a military and commercial jet aircraft manufacturer, a manufacturer of aerospace products (e.g., commercial aircraft, defense systems, and space systems), a tire manufacturer, a steel bearing manufacturer, and a federal research laboratory. All the manufacturing organizations were leaders in their industries, with annual sales ranging from $2 billion to $52 billion. These organizations were offered a report of the overall results and customized analyses in exchange for their participation.

Each organization provided a list of R&D collaboration participants to serve as respondents for the survey: managers, scientists, and engineers who had participated in a collaboration during the previous five years. In these collaborations, the organizations would contribute personnel, facilities, expertise, or equipment toward a mutual problem of interest. These were not simply procurement transactions but mutual endeavors that required joint effort and cooperation from the partner organizations. To understand the nature of these collaborations more clearly, we included a measure of collaboration types, based on the tiers of R&D as described by Hauser (1998). This measure is displayed in the Appendix. The tiers describe varying types of R&D collaborations ranging from basic research (tier 0) and long-term explorations (tier 1) to applied projects (tier 3) and routine engineering for continuous improvement of products and processes (tier 4). Over 70% of the respondents classified their collaborations as tier 2 and 3 levels of research. Tier 2 research includes directed programs of activities to develop practical competencies.

Questionnaire development. A survey instrument was created, based on depth interviews with 31 R&D managers, scientists, and engineers in the automotive, chemicals, petroleum, and telecommunication industries. These interviews were designed to assess the context and nature of various forms of R&D collaboration that the sample represents. The survey incorporated the language of the informants and was subsequently pretested with an independent sample of R&D participants to assure that the measures were comprehensible and accurately represented the organization's viewpoint.

All the constructs in the conceptual framework were measured with multiple items, and the respondent indicated his/her response along a 7-point rating scale where 1=strongly disagree and 7=strongly agree. The scales for procedural and distributive justice were adapted from Oliver and Swan (1989). The scales for evaluation of the partner's performance was based on Kumar, Stern, and Achrol (1992), while the scales for input asymmetry, knowledge of the transformation process, and willingness to collaborate in the future were based on Jap (2001). The scale for joint-transaction-specific investments was modeled after Anderson and Weitz (1992). All other scales were designed specifically for this research. The listing of all measures is displayed in the Appendix. Table 1 overviews the means, standard deviations, and correlations between all constructs.

Procedure. The questionnaire was mailed along with a postage-paid envelope and a cover letter from the university researchers informing the respondent of their organization's participation in the research and that the purpose of the research was to understand R&D collaborations more clearly. The respondents were guaranteed anonymity and offered a summary report of the results of the research.

Since the federal laboratory provided us with a list of the specific R&D collaborations that had formed over the past five years, these respondents were directed to complete the questionnaire in direct reference to the specific collaboration. Respondents from the manufacturing firms were asked to select a collaboration from recent years and told that the collaboration "does not have to be a highly successful or complex collaboration, although it could be. We are trying to sample from a variety of relationship types and would like to consider many possibilities." In this way, we insured that significant heterogeneity would be present to capture statistical variation among the constructs and to increase the representativeness of the relationships studied.

The collective lists of the five participant organizations created a mailing list of 908 respondents. Of these, 299 surveys were returned, creating a response rate of 33% overall. The collaborations lasted an average of 2.1 years (s.d. 2.8), and the types of respondents were as follows: 118 managers, 66 scientists, 106 engineers, and 9 staff. The respondent's knowledge of the collaboration was assessed via a battery of specific items at the end of the questionnaire, measuring his/her knowledge of each organization's inputs and outputs of the collaboration, the overall success of the collaboration, and the intended goals and purpose of the joint effort. The respondents marked their responses using a 7-point rating scale where 1=hardly knowledgeable and 7=very knowledgeable. The average response to these items was 6.3 (s.d. .82).

Nonresponse bias was assessed using Armstrong and Overton's (1977) test of early to late respondents. This test indicated no significant differences among the responses of early and late responses. Nor did differences emerge in the type of collaboration (Tiers 0-4) reported on or the duration of these collaborations.

Empirical analysis

Measurement estimation. The discriminant and convergent validity of the measures is assessed via the use of a confirmatory factor analysis involving the constructs of the conceptual framework. A measurement model consisting of eight first-order factors and their observable indicators, loadings, measurement errors, and intercorrelations was estimated. The chi-square index of fit is 598.5 (271 df, p<00). The comparative fit index is .92, the Tucker-Lewis index of fit is .91, and the incremental fit index is .92. The item loadings and measurement errors are significant and in acceptable ranges, suggesting convergent validity of the measures. Discriminant validity among all possible pairs of constructs is stringently assessed using the test of Fornell and Larcker (1981); all pairs of constructs pass this test.

Tests of hypotheses. The hypotheses are tested using a hierarchical moderator regression of the following form:

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_1 X_5 + \beta_7 X_2 X_5 + \beta_8 X_3 X_5 + \beta_9 X_4 X_5 + \varepsilon$$

Where Y is the dependent variable (evaluations of the partner's performance or willingness to collaborate in the future), $X_{1\text{-}4}$ refers to the conditions: input asymmetry, transacting hazards, joint transaction-specific investments, and knowledge of the transformation process, respectively. X_5 is fairness (distributive or procedural) and $X_{1...4}X_5$ refers to the interaction of each condition with fairness. α_0 is the intercept, β_{1-9} are regression coefficients, and ε is the error term for the equation.

Three stepwise hierarchical regressions are estimated for each performance outcome. In step 1, the main effects of the transaction conditions are estimated. In step 2, the main effects of either distributive or procedural fairness are added to the equation. In step 3, the data is mean-centered and the full model described above is estimated. The step 2 and 3 regressions for each performance outcome are displayed in Table 2. The adjusted R^2 for these regressions range from .48 to .52. The step 2 estimation results using uncentered data are displayed because the main effects of the step 3 regression are changed in the presence of higher order terms.

Table 1 Construct Means, Standard Deviations, and Correlations

	1	2	3	4	5	6	7	8
1. Input asymmetry	1							
2. Transacting hazards	0.18	1						
3. Joint transaction-specific investments	-0.21	-0.07	1					
4. Knowledge of the transformation process	0.10	-0.21	0.23	1				
5. Procedural fairness	-0.26	-0.28	0.35	0.30	1			
6. Distributive fairness	-.36	-0.29	0.35	0.36	0.69	1		
7. Evaluation of the partner's performance	0.42	-0.41	0.39	0.18	0.64	0.63	1	
8. Willingness to collaborate in the future	-0.24	-0.28	0.46	0.19	0.65	0.63	.72	1
Means	3.46	2.85	4.57	5.52	5.65	5.25	5.32	5.80
Std. Dev.	1.66	1.16	1.35	1.14	.99	1.09	1.46	1.34
Min.	1	1	1	1	2	1	1	1
Max	7	6	7	7	7	7	7	7

Note: All correlation coefficients >.10 are significant at $p < .05$

Results

Perceptions of procedural and distributive fairness are significantly related to performance outcomes. Specifically, the coefficient for the effect of procedural fairness on evaluations of the partner's performance is positive and significant (β_5=.69, p<.01), and the effect of distributive fairness on the same outcome is (β_5=.63, p<.01). Similarly, the effects of procedural fairness (β_5=.71, p<.01) and distributive fairness (β_5=.65, p<.01) on willingness to collaborate in the future are also positive and significant, providing support for H1.

Input asymmetry is negatively related (β_1=–.17 and –.13, both p<.01) to evaluations of the partner's performance but has a nonsignificant effect (β_1=–.02, p<.66 and β_1=.02, p<.59) on willingness to collaborate in the future. Thus, there is only partial support for H2. Transacting hazards are negatively related (β_2=–.29 and –.31, both p<.01) to evaluations of the partner's performance and willingness to collaborate in the future (β_2=–.12, p<.01 and β_1=–.14, p<.05), providing support for H3.

The interaction of input asymmetry and procedural fairness has a nonsignificant effect on evaluations of the partner's performance (β_6=.06, p<.15) and willingness to collaborate in the future (β_6=–.00, p<.83). The interaction of transacting hazards and procedural fairness has a significant positive effect (β_7=.11, p<.05) on evaluations of the partner's performance and a marginally significant positive effect (β_7=.08, p<.10) on willingness to collaborate in the future. Thus, there is partial support for H4.

The interaction of input asymmetry and distributive fairness has a significant positive effect on evaluations of the partner's performance (β_6=.12, p<.01) and willingness to collaborate in the future (β_6=.08, p<.01). The interaction of transacting hazards and distributive fairness has a nonsignificant effect on evaluations of the partner's performance (β_7=–.00, p<.96) and on willingness to collaborate in the future (β_7=.07, p<.14). Thus, there is partial support for H5.

Joint transaction-specific investments have a significant positive effect on evaluations of the partner's performance (β_3=.17 and .20, both p<.01) and willingness to collaborate in the future (β_3=.25 and .27, both p<.01). Thus, there is support for H6.

Knowledge of the transformation process has a marginally significant negative effect (β_4=–.10 and -.12, both p<.10) on evaluations of the partner's performance and a nonsignificant/marginally significant effect (β_4=–.07, p<.17 and β_4=-.09, p<.10) on willingness to collaborate in the future. Hence, there is no support for H7.

The interaction of joint transaction-specific investments and procedural fairness has a nonsignificant effect (β_8=-.01, p<.88) on evaluations of the partner's performance and a significant negative effect (β_8=-.13, p<.01) on willingness to collaborate in the future. The interaction of knowledge of the transformation process and procedural fairness has a nonsignificant effect on evaluations of the partner's performance (β_9=.01, p<.88) and willingness to collaborate in the future (β_9=.02, p<.72). Thus, there is no support for H8.

The interaction of joint transaction-specific investments and distributive fairness has a significant negative effect (β_8=-.08, p<.05) on evaluations of the partner's performance and a marginally significant negative effect (β_8=-.07, p<.07) on willingness to collaborate in the future. The interaction of knowledge of the transformation process and distributive fairness has a nonsignificant effect (β_9=-.04, p<.40) on evaluations of the partner's performance and a significant positive effect (β_9=.04, p<.04) on willingness to collaborate in the future. Thus, there is only partial support for H9.

Table 2 Hierarchical Regression Results

	Evaluation of the Partner's Performance			
	Procedural Fairness		Distributive Fairness	
	Step		Step	
	2	3	2	3
Intercept α_0	2.61***	5.4***	3.1***	5.36***
Input asymmetry β_1	-.17***	-.18***	-.13***	-.12***
Transacting hazards β_2	-.29***	-.29***	-.31***	-.31***
Joint transaction-specific investments β_3	.17***	.19***	.20***	.21***
Knowledge of the transformation process β_4	-.10*	-.10	-.12*	-.14**
Procedural fairness β_5	.69***	.63***		
Distributive fairness β_5		-	.63***	.61***
Procedural fairness x input asymmetry β_6		.06		
Procedural fairness x transacting hazards β_7		.11**		
Procedural fairness x joint transaction-specific investments β_8		-.01		
Procedural fairness x knowledge of transformation process β_9		. 01		
Distributive fairness x input asymmetry β_6				.12***
Distributive fairness x transacting hazards β_7				-.00
Distributive fairness x joint transaction-specific investments β_8				-.08**
Distributive fairness x knowledge of transformation process β_9				-.04
Adjusted R^2	.49	.50	.48	.52

Willingness to Collaborate in the Future

	Procedural Fairness		Distributive Fairness	
	Step		Step	
	2	3	2	3
Intercept α_0	1.42***	5.89***	2.0***	5.88***
Input asymmetry β_1	-.02	-.03	.02	.02
Transacting hazards β_2	-.12***	-.12**	-.14**	-.16***
Joint transaction-specific investments β_3	.25***	.26***	.27***	.29***
Knowledge of the transformation process β_4	-.07	-.03	-.09*	-.07
Procedural fairness β_5	.71***	.65***	-	-
Distributive fairness β_5	-	-	.65***	.59***
Procedural fairness x input asymmetry β_6		-.00		
Procedural fairness x transacting hazards β_7		.08*		
Procedural fairness x joint transaction-specific investments β_8		-.13***		
Procedural fairness x knowledge of transformation process β_9		.02		
Distributive fairness x input asymmetry β_6				.08***
Distributive fairness x transacting hazards β_7				.07
Distributive fairness x joint transaction-specific investments β_8				-.07*
Distributive fairness x knowledge of transformation process β_9				.09**
Adjusted R^2	.48	.49	.45	.49

Discussion

Consistent with our expectations, the results suggest that fairness (both procedural and distributive) and the collaboration conditions influence performance outcomes. Specifically, favorable conditions such as joint transaction-specific investments appear to facilitate performance outcomes while adverse conditions such as the presence of transacting hazards may impede performance. Input asymmetry harms evaluations of the partner's performance.

In adverse collaboration conditions, both forms of fairness can mitigate the potential negative effects of asymmetric inputs and transacting hazards on evaluations of the partner's performance and willingness to collaborate in the future. Specifically, procedural fairness during risky, uncertain transacting conditions can ameliorate the negative impact of these conditions on performance outcomes. This amelioration may occur because procedural fairness provides additional assurances as the parties work together, leaving less room for the other party's opportunism and exploitation. On the other hand, when the parties' inputs to the collaboration are asymmetric, distributive fairness is positively related to performance outcomes. This may be because distributive fairness provides an assurance that the parties will receive a fair share of the expanded pie. Collectively, these results suggest that both procedural and distributive fairness can act as a powerful safeguard when the collaboration conditions are unfavorable.

When the collaboration conditions are more favorable, procedural fairness does not incrementally improve performance outcomes, possibly because joint transaction-specific investments and knowledge of the transformation process sufficiently safeguard performance outcomes such that procedural fairness is redundant in conjunction with these conditions. On the other hand, when conditions are favorable (i.e., parties have knowledge of the transformation process), distributive fairness improves willingness to collaborate in the future. Hence, it appears that while procedural fairness does not improve performance outcomes in the short-run, distributive fairness does appear to improve the customer's prospects for the future, particularly when the customer understands the transformation process necessary in the collaboration.

We were surprised to find that distributive fairness had a detrimental effect on evaluations of the partner's performance in collaborations involving joint transaction-specific investments. Since fairness takes considerable time and effort to develop and joint transaction-specific investments are strong credible signals of each party's commitment to mutually beneficial outcomes, the development of fairness in these investments is time-consuming and unnecessary; hence, it can undermine evaluations of the partner and future intentions (cf., Kim and Mauborgne, 1991). It might also be that joint transaction-specific investments provide each party enough bargaining leverage to have strong assurances of a fair share of the expanded pie. Hence, distributive fairness is less useful in the presence of these investments. Consistent with this line of thinking, Johnson, Korsgaard, and Sapienza (2002) argue that fairness becomes an important means of protecting self-interest when a party has limited influence over outcomes. Our results suggest that when a party has significant influence over outcomes, fairness is less critical. In fact, its development may impede the relationship.

Procedural fairness was also found to have no significant interaction effect with either asymmetric inputs or knowledge of the transformation process. Apparently, these conditions have such a direct impact on outcomes that assurances of *how* the parties will work together becomes less relevant than assurances of pie-division, which are more closely related to distributive fairness. This result contradicts the findings of Kumar, Scheer and Steenkamp (1995), who concluded that procedural fairness was more important than distributive fairness. However, their research context did not include situations of balanced power in which the parties made significant investments into the relationship. Since asymmetric inputs and knowledge of the transformation process represent significant commitments to the collaboration, the parties attempt to balance their dependence in the collaboration (Heide and John, 1988) by exercising distributive fairness, which provides assurances of fair outcomes. Accordingly, we observe distributive fairness to exert a significant, positive interaction effect with asymmetric inputs and knowledge of the transformation process, but we do not observe a similar pattern with procedural fairness.

Managerial implications

The results of this work suggest that procedural and distributive fairness, while generally useful for facilitating collaborative outcomes, can be particularly powerful when used in conjunction with various collaboration conditions.

This result informs our understanding of successfully crafting complex interorganizational collaborations such as those found in R&D. For example, the use of joint transaction-specific investments is a powerful safeguard in these collaborations. Not only do they provide assurances of non-opportunism, but they align the parties' interests and motivate them to work for mutual good. If considerable risk emerges in collaborating with a party or if one party's inputs are asymmetric to the partner's inputs, the use of procedural fairness and distributive fairness can help facilitate both short-run outcomes and prospects for the future.

When the collaboration conditions are more favorable, these conditions are often powerful enough to facilitate key performance outcomes. Cultivating additional fairness, either procedural or distributive, does not appear to improve performance incrementally in the short-term, although distributive fairness may improve long-term prospects, particularly when an understanding of the transformation process is necessary.

Future directions

There are a few limitations of the research. Many more conditions of the collaboration and potential performance outcomes could be examined but were not included here. We have included those most representative of R&D contexts and the interests of the theoretical literature while striving to be parsimonious in our model specification. We also acknowledge that alternative forms of collaboration arrangements exist and could not be examined here.

This research has provided evidence that under certain conditions, the development of fairness can harm interorganizational performance. Evidently, the development of fairness is not always desirable, particularly when credible commitments already in place may provide the same assurances that various forms of fairness would. Additional work on the downside or costs of developing fairness in interorganizational relations remains an intriguing area for future research.

A second avenue of future research would be to consider how procedural and distributive fairness interacts with alternative relationship safeguards such as relational norms, contracts, and the development of mutual commitment. Does fairness act as a substitute for these safeguards, or is its role more complementary? What are the implications of developing successful interorganizational exchanges?

Finally, we have considered fairness in the context of collaborations in which the partners have symmetric power and make significant investments. However, the role of fairness has yet to be considered in alternative contexts such as alliances between competitors. And while fairness has been considered in channel contexts and R&D collaborations, it might also play a significant role in new product development activities. These possibilities are left to future research.

Appendix
Scale Items and Reliabilities

Unless otherwise specified, the scale anchors for all multi-item scales are 1=strongly disagree and 7=strongly agree. "We" refers to the respondent's organization while "Their" and "Them" refer to the partner organization**.**

Input asymmetry (α =.87)
We have contributed more resources to this effort than the other party.
Our organization has made greater contributions to complete the task then the other party.
Our inputs to the R&D effort were greater than the other organization's inputs.

Transacting hazards (α =.78)
R&D collaborations can be risky endeavors. To what degree did each of the following represent a risk in your joint efforts with this organization? 1=minimal risk and 7=very risky.

Lack of control over process
Incorrect initial assessments
Investment risk
Risk of not achieving collaboration goals

Joint transaction-specific investments (α =.76)
If the collaboration were to end, both organizations would waste a lot of knowledge that's tailored to their relationship.
If either organization were to switch to a competitive buyer or vendor, they would loose a lot of the investments made in present relationship.
Both organizations have made investments that are unique to this relationship.
Both organizations have made investments that would be lost if the relationship were prematurely terminated.

Knowledge of the transformation process (α =.77)
We understand well what the role of the other organization is in completing this task.
We know the processes and actions that the other party must do in this task.
We can comprehend what the other party must do to accomplish their share of the task.

Procedural fairness (α =.84)
The collaboration was handled in a fair manner.
The procedures for working together in this collaboration have been fair.
Issues arising in this collaboration were handled in a manner that was fair and just.

Distributive fairness (α =.85)
The procedure for sharing the benefits of this collaboration was just.
The division of benefits has been handled in a fair manner.
The outcomes of the collaboration have been fairly shared.

Evaluation of the partner's performance (α =.83)
Their performance leaves a lot to be desired from an overall standpoint.
Taking all the different factors into account, their performance has been excellent.

Willingness to collaborate in the future (α =.94)
We would be willing to collaborate with them again, should the opportunity arise.
We would welcome the possibility of additional collaboration in the future.
We would be willing to work with them in the future.

Types of R&D Collaborations

R&D Collaborations differ in many ways. Which of the following best describe the nature of the collaboration between you and this organization? (*select only one)*

Frequency (% of sample)	
25 (8.4%)	*Tier 0:* Basic research that lays the foundations for additional R&D.
29 (9.8%)	*Tier 1:* Long-term explorations in science and/or technology to build or maintain basic capabilities. The use of basic foundations to explore tools of the future.
71 (24.1%)	*Tier 2:* Directed programs of activities to develop practical competencies that support or fulfill an organization's strategic directions. The creation of tools.
135 (45.8%)	*Tier 3:* Applied projects aimed at specific tasks with clearly defined, more immediate goals. Pioneering the use of created tools.
39 (13.2%)	*Tier 4:* Routine engineering for continuous improvement of products and processes. Routine use of the tools.

As an example, consider an organization that wants to communicate detailed 3- dimensional (3D) images to and from a remote field site. Tier 0 might be the development of the fractal mathematics that allow the images to be coded for transmission; tier 1 might include the development of algorithms that use fractal mathematics to code the images; tier 2 researchers might write the software and develop (or buy) the hardware to implement the algorithms; tier 3 research may involve the development of a pilot application to demonstrate the 3D imaging system and solve problems of implementation. Tier 4 might involve handing the 3D imaging system to the business units.

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