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Abstract

This paper examines how alliance experience accumulation at the parent firm level and alliance features at the transaction level jointly and interactively shape the termination outcomes of high-tech collaborative agreements. We draw upon the knowledge-based view of the firm and work on governance design to differentiate alliance termination outcomes, investigate where favorable terminations occur, and evaluate factors from multiple levels of analysis affecting alliance dynamics. The evidence suggests that partner-specific experience is beneficial for non-equity alliances affording less control than equity structures as this experience facilitates the development of inter-partner routines. Broad-based collaborative experience and alliance experience in a technological domain do not affect how alliances end, however. The findings also indicate that alliance complexity and how parent firms assign responsibilities among themselves influence alliance termination outcomes.
INTRODUCTION

There is growing recognition that alliance instability is a central feature of inter-firm collaboration as well as a potentially important determinant of the net benefits firms obtain, or fail to obtain, from partnering (e.g., Ariño & de la Torre, 1998; Doz & Hamel, 1998). Many empirical studies over the last three decades have provided evidence that joint ventures and other forms of collaborative agreements tend to be short-lived and are inherently unstable organizational forms (e.g., Barkema, Shenkar, Vermeulen, & Bell, 1997; Beamish, 1985; Franko, 1971; Gomes-Casseres, 1987; Killing, 1983; Kogut, 1989; Li, 1995; Park & Russo, 1996; Pennings, Barkema, & Douma, 1994). On a theoretical level, however, recent developments in the alliance literature have suggested that instability may be a natural, and even desirable, aspect of collaboration. While many alliances no doubt come to an end simply due to failure, alliances can also termination simply because a firm’s strategic objectives were met. Furthermore, alliance termination can be a logical consequence of firms’ desire to invest sequentially (e.g., Balakrishnan & Koza, 1993), exploit emerging opportunities (Kogut, 1991), learn from their partners (Hamel, 1991; Khanna, Gulati, & Nohria, 1998), and adapt strategically (e.g., Koza & Lewin, 1998).

Despite renewed interest in alliance instability, little is known empirically about how post-formation alliance dynamics affect firms and how firms might manage alliances to their advantage. First, most research examines the antecedents of alliance instability rather than whether the performance implications of alliance changes are positive, negative, or more neutral. As discussed in the literature review, empirical research commonly makes use of the assumption that longevity is an indicator of alliance success and instability reflects failure by the alliance or parent firms. Theoretical perspectives such as those mentioned above challenge this assumption, but empirical research has not kept pace with these new
conceptions of inter-firm collaboration. We therefore wish to consider the extent to which alliances terminate due to success, failure, or other reasons.

Second, theory development on alliances has been constrained by the “instability” construct itself. The concept of alliance instability has been used over the years to represent many different types of alliance change, ranging from various forms of termination (e.g., liquidations, partner buyouts, and third party sales) to venture reorganizations as well as minor equity shifts and incremental governance changes in on-going alliances. The literature review shows that empirical studies aggregate these different types of alliance instability, which may be subject to very different antecedents and may have diverse implications for parent firms. One of the primary objectives of this study is therefore to differentiate qualitatively different alliance termination outcomes and analyze the factors that might influence them.

Third, the alliance literature has investigated many factors at multiple levels of analysis that can have an impact on alliance dynamics. However, over the last three decades, individual studies have often emphasized one level of analysis over another. We underscore the need to bridge multiple levels of analysis to probe the boundary conditions of theory and explore potential interactions among them. By focusing on how factors from parent firm and alliance levels of analysis interact in explaining the termination outcomes of high-tech collaborative agreements, the analysis also provides evidence relevant to the current debate between work that highlights the primacy of individual transactions in determining firm behavior and efficiency (e.g., Oxley, 1997) and research emphasizing the embeddedness of alliances in the adaptation practices of parent firms (e.g., Koza & Lewin, 1998).

The paper is organized as follows: The next section offers a literature review of alliance instability research. This overview brings out major themes in this body of research since the 1970s and motivates an analysis of alliance dynamics that examines multiple levels
of analysis and the performance implications of alliance termination. The following section develops hypotheses on how different types of alliance experience at the parent firm level and alliance characteristics at the transaction level jointly and interactively influence whether an alliances ends as a failure, successfully, or more neutrally because the agreement expired as planned or one firm withdrew unilaterally from the collaboration due to a change in strategic objectives. A subsequent section takes up research design issues, and findings for a sample of strategic alliances in the biotech industry follow. The paper concludes with a discussion of these findings and avenues for future research.

We find that only one-third of the alliances terminated due to failure, whereas fifteen percent ended following the achievement of partners’ objectives and half terminated due to unilateral withdrawal or natural expiration of the collaborative agreement. The multivariate results indicate that parent firms’ accumulated alliance experience as well as transactional characteristics shape alliance termination outcomes. More specifically, partner-specific alliance experience contributing to the development of interorganizational routines is helpful for non-equity collaborations that do not involve the formal coordination and control provided by equity structures. By contrast, general collaborative experience and alliance experience in the technological domain of the focal agreement do not appear to influence alliance termination outcomes. At the transaction level, the scope of collaborative activity adversely affects termination outcomes, and alliances with a sharper division of labor tend to end more favorably.

**RESEARCH ON ALLIANCE INSTABILITY**

The research base on alliance instability dates back to the 1970s, though research attention given to the topic has grown significantly in the last few years. The renewed interest in alliance instability coincides with the maturity of research on alliance formation,
the growing use of methods that can accommodate alliance dynamics and, more fundamentally, the application and extension of theoretical perspectives such as real options theory (Kogut, 1991), organizational learning (Hamel, 1991; Inkpen & Beamish, 1997; Khanna, Gulati, & Nohria, 1998), industrial organization economics (Kogut, 1989), and co-evolution (Koza & Lewin, 1998), all of which identify instability as a central property of alliances.

This work departs in important ways from most literature on alliances. On a conceptual level, this research submits that different types of instability are often natural by-products of collaboration rather than uncommon or dysfunctional states that firms can, and should, avoid. Focusing on sequential investment, knowledge accumulation, partner rivalry, and organizational adaptation, these recent streams of research emphasize the importance of understanding alliances and their dynamics from the vantage point of the collaborators involved rather than solely from the perspective of the alliance itself. Accordingly, given that alliances are hybrid organizational and competitive entities joining two or more collaborators, they provide an attractive empirical testing ground for investigating the confluence of factors from multiple levels of analysis that potentially shape organizational outcomes.

The level of analysis issue is also clearly present in the empirical alliance literature when viewed as a whole. This research has thrown light on the importance of many different levels of analysis as sources of alliance instability, though individual studies have often approached these levels of analysis in a particularistic fashion rather than attempting to bridge them. The levels of analysis influencing alliance trajectories include the host country environment, the alliance’s industry context, the parent firms, and the alliance itself. In the review of alliance research presented below, we trace alliance instability research since the 1970s to identify dominant themes relating to each of these levels of analysis.
In studying corporations’ alliance portfolios, Franko (1971) observed that certain corporate strategies are more conducive than others to the shared control and decision-making required by JVs. His empirical research confirmed that shifts in strategy, as proxied by changes in organizational structure, precipitated JV instability. Joint venture instability encompassed changes such as increasing a parent firm’s ownership beyond the 95 percent threshold, crossing the 50-50 ownership boundary, and selling or liquidating the venture. For instance, firms that maintained an international division had the lowest rates of JV instability due to the emphasis given to international expansion, independent subsidiary strategies, and a consultative role for the international division. However, the adoption of standardized marketing policies or the rationalization of production proved destabilizing to JVs, and instability rates were highest for non-diversified, centralized firms using an area-functional structure. Thus, his research findings demonstrated that alliances are tools of corporate strategy and, since alliances are embedded in parent firms’ corporate strategies, the termination or continuation of an individual collaboration depends on the stability or lack of continuity in the firm’s corporate strategy as the firm develops internationally.

Just as this research drew attention to the functioning of alliances in firms’ corporate portfolios, other alliance research reported on the host country’s environment as a contextual factor influencing alliance dynamics. For example, Reynolds (1979) documented U.S. firms’ withdrawal from JVs in India as the government called for more local R&D, less foreign ownership, and greater exports by joint ventures. Subsequent research tracked the movement toward minority ownership in countries with activist local policies during the 1970s (i.e., Brazil, India, Iran, Mexico, and the Philippines) (Franko, 1989) and the broad-based reversal of this trend in the late 1970s and 1980s as governments liberalized their investment policies (Contractor, 1990). Thus, firms’ alliance decisions appeared to be responsive not only to
internal changes in strategy and structure, but also to external changes affecting cross-border operations.

While this research addressed more aggregate alliance investment patterns, one important theme of research during the 1980s was the control of individual ventures. Killing (1983), for instance, found that shared management ventures were more likely to terminate or undergo reorganization than ventures subject to dominant control by one parent firm. Beamish (1985) examined venture control and dynamics in the developing country context and not only found higher instability rates, but the control-performance relationship reversed: In developing countries, dominant foreign control adversely affected the performance of JVs. Harrigan’s (1985) conceptual framework also noted contingencies affecting the balance between the parent firm’s need for control and the individual venture’s requirements for autonomy as a competitive entity in its own right.

More recent studies have been unique in adopting a more deductive and technical orientation in studying the sources of alliance instability. A second characteristic of this work is that partner interaction and organizational learning came to the fore as explanations of alliance instability. For instance, Kogut’s (1989) survival analyses showed that changes in industry concentration affecting partner rivalry increased the likelihood of JV dissolution. Related research found that alliances between direct competitors were more likely to fail (Park & Russo, 1996), and the threat of opportunism appeared to be more important than organizational variables in bringing about JV termination (Park & Ungson, 1997). Nakamura, Shaver, and Yeung (1996) found that alliances are more likely to terminate when partners’ capabilities converge over time, while alliances between parent firms with diverging capabilities are more durable. Other research using an organizational learning perspective has shown that unrelated, non-majority owned, and start-up ventures experience reduced longevity (Li, 1995; Pennings, Barkema, & Douma, 1994), as do entries into culturally
distant markets (Barkema, Bell, & Pennings, 1996; Barkema & Vermeulen, 1997) and ventures unsupported by prior domestic collaborative experience (Barkema, Shenkar, Vermeulen, & Bell, 1997).

Two conclusions follow from this literature review and bear upon this study’s objectives. First, empirical research has generally operated under the assumption that alliance longevity is in parent firms’ interests, and instability, whether defined as some sort of termination or other types of alliance change, is indicative of failure on the part of the alliance or the collaborators. Recent theoretical research on alliances would suggest, however, that alliance instability may be a natural part of collaboration as parent firms alter their commitments in uncertain investment contexts (Balakrishnan & Koza, 1993; Kogut, 1991; Nanda & Williamson, 1995), learn from their partners (Hamel, 1991; Khanna, Gulati, & Nohria, 1998), and adapt strategically over time (Koza & Lewin, 1998). Hence, we seek to differentiate alliances that terminated due to the successful achievement of parent firms’ objectives from failed alliances as well as more neutral terminations, for instance those stemming from the unilateral withdrawal of one firm due to changes in its strategic interests. By disaggregating alliance termination outcomes in this way, we are able to assess the relative frequency of terminations due to success, changed strategic priorities, and failure as well as investigate the antecedents of these different alliance termination outcomes.

Second, the literature review indicates that individual studies over the last three decades have identified many different levels of analysis that provide sources of alliance instability. While the entire body of empirical research on alliance instability suggests the importance of investigating multiple levels of analysis and the embeddedness of alliances in the strategies of parent firms and the broader environment, individual studies often take a particularistic view of the phenomenon. However, theory development on alliances requires work that bridges levels of analysis to probe the boundary conditions of existing theory and
explore important interactions across levels of analysis. Thus, one of our objectives is to move in this direction by examining the individual and joint effects of parent firm- and transaction-level factors on alliance termination outcomes.

THEORY AND HYPOTHESES

As the literature review suggests, many factors stemming from multiple levels of analysis may influence alliance termination, and any single study cannot approach being exhaustive. Because of the recent debate on whether parent firm factors and/or alliance features contribute to alliance efficiency and effectiveness (e.g., Koza & Lewin, 1998; Oxley, 1997), we give attention to parent firm and alliance levels of analysis for a set of alliances within a single industry. More specifically, in response to recent interest in questions such as how firms can develop an alliance capability and what the implications of this capability are for future alliances (e.g., Anand & Khanna, 1998; Zajac, 1998; Barkema, Shenkar, Vermeulen, & Bell, 1997), we focus on different types of alliance experience at the parent firm level. Beyond examining the general effects of collaborative experience, we evaluate alliance experience that is specific to a technological domain and alliance experience that is specific to a partner. Focusing on different types of alliance experience allows us to draw upon the knowledge-based view of the firm and situate the focal alliance within the parent firm’s prior adaptation choices (Koza & Lewin, 1998). Following research on governance design, we also consider alliance features that reflect the complexity of the collaborative agreement as well as ways in which firms manage this complexity. Finally, we bring together parent firm and alliance levels by considering how alliance experience at the parent firm level and governance design choices (i.e., equity vs. non-equity) at the individual transaction level interact to shape alliance termination outcomes.
Parent Firm Effects

The prediction that alliance experience will contribute to improved alliance outcomes follows the more general proposition developed in several streams of research that experience accumulation translates into performance improvements. For instance, the learning curve literature has demonstrated the benefits of learning-by-doing in the manufacturing context (e.g., Dutton & Thomas, 1984; Epple, Argote, & Devadas, 1991; Yelle, 1979), and the behavioral school has examined the effects of experience accumulation for a broader range of organizational activities (e.g., Cyert & March, 1963; Levitt & March, 1988; March & Simon, 1958). In related research, evolutionary economics has developed theory on how firms change based on the evolution, adaptation, and replication of routinized behavior (Cohen & Bacdayan, 1994; Nelson & Winter, 1982; Winter, 1987, 1995). This work emphasizes that firms develop a collective, primarily implicit, understanding regarding the execution of a certain organizational task. This understanding is typically updated without explicit cognitive efforts as the individuals exposed to repeated events retain a memory of prior performance outcomes and of possible causal factors.

These theoretical traditions suggest a positive relationship between alliance experience and the favorability of alliance termination outcomes. For example, firms lacking alliance experience are likely to choose suboptimal partners, design a collaborative agreement that does not match well with the firms’ objectives, and persist in alliances that have outlived their purpose. Experienced firms, on the other hand, are more likely to master complex alliance processes (e.g., Doz, 1996; Doz & Hamel, 1998), monitor alliance and environmental developments better to take advantage of opportunities for sequential investment (e.g., Balakrishnan & Koza, 1993; Kogut, 1991), and know when a collaborative agreement is no longer needed due either to its success or to a necessary change in the firms’ strategic
priorities. For experienced collaborators, one would expect fewer alliances ending simply due to failure rather than successes or strategic changes.

While the prediction of positive alliance experience effects derives from multiple theoretical traditions and is fairly intuitive, there are reasons why firms may not benefit from the accumulation of alliance experience. First, in comparison with relatively homogeneous and repetitive tasks for which experience effects have been well-documented, alliances are more complex administrative processes. Prior research has detailed why hybrid organizational forms such as alliances are characterized by performance ambiguity and uncertainty (e.g., Anderson, 1990; Geringer & Hebert, 1991). The lack of clear performance metrics makes it hard for parent firms to learn from prior collaborations. Second, alliances tend to occur less frequently and are more heterogeneous than other organizational activities for which learning effects are known to exist. This implies that firms may transfer lessons learned in one alliance to another collaboration that appears to be similar yet is fundamentally different, a problem cognitive psychologists term negative transfer effects (Cohen & Bacdayan, 1994; Cormier & Hagman, 1987). Halebian and Finkelstein (1998) report how such effects are at work for corporate acquisitions, and such learning problems may also arise for strategic alliances. These issues suggest that there is value in unpacking general alliance experience to consider more specific alliance experience trajectories. We therefore consider alliance experience specific to a technological area and alliance experience specific to a partner.

Alliance experience specific to a technological area can lead to favorable alliance termination outcomes for two reasons in addition to those discussed above. First, firms’ experiences specific to a given technological area will be less heterogeneous than experience culled from alliances on any subject. While positive alliance experience effects may still be mitigated by factors such as low frequency and the lack of clear performance metrics, the
likelihood of negative transfer effects is lower. Second, Cohen and Levinthal (1990) have shown that firms engaged in creative efforts develop an absorptive capacity that is proportional to the amount of discovery in similar domains. Thus, firms with alliance experience in similar technological areas should develop greater absorptive capacity, which will enhance the success of new alliances in similar areas. Alliance termination outcomes are more likely to be favorable for such firms because they will learn more in their ventures, know how such ventures serve the firm’s strategy, and be able to decide on key alliance design parameters (e.g., contract length, safeguards, resource combinations, governance mechanisms, etc.) more effectively to meet the needs of the technology.

Alliance experience specific to the partner in question may provide benefits as in the case of general collaborative experience and experience specific to a technological area. However, partner-specific alliance experience is unique in that it deepens the relationship between two firms. Prior collaborations help firms refine their understanding of each others’ cultures, management systems, capabilities, weaknesses, etc. Such experience can therefore cultivate trust between partners (Gulati, 1995), and it fosters the development of interorganizational routines that influence the quality of the firms’ coordination efforts. By sequentially entering into alliances with each other, parent firms can reinforce stable patterns of interaction and ease the identification of solutions or remove obstacles to effective collaboration relative to collaborations with unknown parties. Research suggests that the development of interfirm coordination skills can become an important relational capability that can enhance transactional outcomes as well as generate firm-level advantages (Dyer, 1997; Dyer & Singh, 1998).

Based on the above discussion of alliance experience accumulation at the parent firm level, we wish to test the following hypotheses:

**Hypothesis 1:** The likelihood of a favorable alliance termination outcome will be positively related to the firm’s previous experience with alliances in general.
Hypothesis 2: The likelihood of a favorable alliance termination outcome will be positively related to the firm’s previous experience with alliances in similar product areas.

Hypothesis 3: The likelihood of a favorable alliance termination outcome will be positively related to the firm’s previous experience with alliances with the same partner.

Alliance Effects

We also expect that features of the collaborative agreement itself will have an impact on alliance termination outcomes. While different alliance characteristics may influence the performance of an alliance, we focus on the complexity of the alliance and how firms allocate responsibilities among themselves to manage the collaboration. A subsequent section takes up the alliance’s governance structure.

In comparison with mergers or internal organizational units, alliances tend to have a much narrower mandate. Collaborative agreements are often used for only one value chain activity and may not even be designed to generate profits (e.g., Harrigan, 1985). Because alliances are not efficient for close coordination when significant interdependencies among different tasks exist (e.g., Chesbrough & Teece, 1996), firms are often advised to keep their collaborations focused and flexible. While alliances generally do tend to be more focused than other organizational arrangements, there is also significant heterogeneity across alliances in the scope of collaborative effort. On the one hand, some collaborations involve limited downstream cooperation in promotion or upstream collaboration in basic research, while some ventures perform the full complement of value chain activities as independent competitors (Hladik, 1985).

Previous research has shown that firms design high tech alliances based on the scope of collaborative efforts, but research has not examined the performance implications of alliance complexity. Pisano (1989), for instance, notes that biotechnology alliances encompassing multiple projects are more likely to be equity alliances than non-equity
arrangements. Oxley (1997) shows that transactions encompassing a wider range of products or technologies tend to be either equity-based (e.g., joint ventures) or bilateral contractual agreements (e.g., cross-licensing agreements or joint research projects) than unilateral alliances such as long-term supply agreements or R&D contracts.

Alliances that are broader in scope not only involve greater uncertainty regarding the performance of individual tasks and the coordination of tasks, but they also require adjustments that expose parent firms to risks after the agreement has been implemented. In broad-based collaborations, partners face challenges in working out their obligations to the alliance as well as their claims on the alliance over time (Borys & Jemison, 1989). Because alliances are not well-suited to coordinated adaptations that are more likely to be necessary when the scope of the alliance is broad (e.g., Williamson, 1991), they will be difficult to manage and are more apt to fail. Alliances with a narrower scope are more likely to end due to a shift in collaborators’ strategic priorities or because the alliance has satisfied parent firms’ initial objectives.

While the complexity of an alliance increases with the scope of the collaboration, even alliances of a given scope can vary greatly in complexity. Alliance complexity depends not only on the number of activities performed in collaboration, but on how firms manage this complexity by allocating responsibilities among themselves. For instance, in traditional international joint ventures, one party is often fully responsible for one value chain activity, and the partner is responsible for a contiguous value chain activity. Typically a multinational provides technological skills and a local partner offers market access. Alliances involving a sharp division of labor based on value chain contributions have been referred to as X coalitions (Porter & Fuller, 1986), sequential ventures (Park & Russo, 1996), and link alliances (Hennart, 1988). In such alliances, collaborative efforts focus on coordination across activities rather than within activities. In other alliances – termed Y coalitions (Porter
& Fuller, 1986), integrative ventures (Park & Russo, 1996), and scale alliances (Hennart, 1988) – collaborators share responsibilities for one or more alliance activities. Thus, as the division of labor in an alliance decreases, collaborative efforts need to focus on coordination both across and within activities, and there is less clarity on firms’ obligations and rights in the alliance (Borys & Jemison, 1989). This leads us to posit the following hypotheses:

**Hypothesis 4:** The likelihood of a favorable alliance termination outcome will be negatively related to the alliance’s scope.

**Hypothesis 5:** The likelihood of a favorable alliance termination outcome will be positively related to the alliance’s division of labor.

**Interaction Effects**

Taken together, the previous five hypotheses suggest that factors from parent firm and alliance levels of analysis jointly influence alliance termination outcomes. Support for these hypotheses would indicate that both levels of analysis matter. Beyond considering the joint influence of different types of alliance experience as well as alliance characteristics, we also wish to examine whether factors from the two levels of analysis interact in shaping alliance termination outcomes.

At the alliance level, we focus on firms’ use of an equity versus non-equity arrangement as this feature of the alliance has received significant attention in research examining alliance design and its antecedents (e.g., Garcia-Canal, 1996; Gatignon & Andersen, 1988; Osborn & Baughn, 1990; Shan, 1991). For instance, research investigating firms’ alliance governance choices has argued that the fit between prior alliance experience and the firm’s decision to use an equity or non-equity structure affects the efficiency of the relationship (Gulati, 1995; Gulati & Singh, 1998). While prior work has focused on firms’ alliance design decisions to explore this relationship, our interest lies in investigating how the interaction of prior alliance experience and the use of an equity or non-equity arrangement affects alliance performance.
Following this research, we expect that the effects of partner-specific experience on alliance termination outcomes will vary across equity and non-equity alliances due to fundamental differences in these two governance structures. In equity joint ventures, firms have formal monitoring rights, and the establishment of a separate business entity facilitates coordination through sequential decision making and through incentives provided by shared ownership. These features of equity alliances are most helpful to parent firms that lack inter-organizational routines and familiarity with the partner. By contrast, for firms that have prior relationships with each other, the formal monitoring, control, and incentive alignment features of equity structures may be to some extent redundant with the informal coordination routines they have established and refined in prior alliances. Such capabilities allow firms to engage in iterative relationships using less formal structures (e.g., Williamson, 1979). As such, we expect that accumulated partner-specific experience will be particularly important for non-equity structures:

**Hypothesis 6:** The effect of partner-specific experience on the alliance’s termination outcome will be greater for non-equity alliances than for equity alliances.

**DATA AND METHODS**

**Sample**

We obtained a sample of strategic alliances by administering a survey to biotechnology and pharmaceutical firms engaged in inter-firm collaboration. This industry context is attractive for our study because alliances are important to these firms’ competitive strategies, and firms have rapidly developed alliance portfolios. We used the University of North Carolina’s (UNC’s) (1993) database to identify a relevant target population of collaborative agreements. The BioScan database and other library sources were then consulted to obtain contact information for 262 firms engaged in 445 collaborative
agreements out of a total of 753 collaborative agreements in the human diagnostic, therapeutic treatment, and equipment sub-fields identified by the UNC database.

The survey was pre-tested using five industry experts, and a final two-page questionnaire was faxed or mailed to the CEOs of the targeted firms. A letter that accompanied the questionnaire conveyed the study’s aims, promised a report on principal findings, and requested that the survey be forwarded to the person who is most knowledgeable on the alliance. Following two rounds of telephone calls, 81 firms had completed questionnaires for 145 alliances, corresponding to a 30.9 percent response rate, which was considered satisfactory given the heavy surveying activity in this industry and the seniority of respondents. The sample of collaborative agreements we obtained is representative of the biotech alliance population in covering 32.6 percent of the total number of observable transactions (i.e., 145/445). No response biases were present regarding the experience levels of respondents vis-à-vis the total sample of firms. Fifty-three alliances with complete information terminated, and descriptive statistics for the sample appear in the results section.

Measures

**Alliance termination.** In constructing the dependent variable, we sought to examine whether each alliance terminated due to failure, success, or other, more neutral, reasons. The dependent variable was coded as ‘one’ if the alliance failed, ‘two’ if a firm withdrew unilaterally due to a change in strategic priorities or the alliance ended with the natural expiration of the collaborative agreement, and ‘three’ if the alliance terminated because firms successfully fulfilled their objectives and there was no more need to collaborate.

**Explanatory variables.** To measure firms’ various types of alliance experience, we asked respondents to indicate the number of prior strategic alliances they had with any partner on any subject (i.e., Collaborative Experience), with any partner on technological
subjects similar to the alliance in question (i.e., Technological Experience), and with the focal partner (i.e., Partner-Specific Experience). Examination of these three count variables’ distributions indicated the presence of significant positive skewness, which we addressed by redefining these three variables using a logarithmic transformation.1

A second set of explanatory variables was used to characterize the alliance’s design and governance. First, a dummy variable classified collaborative agreements into equity and non-equity categories (i.e., Equity). This variable was incorporated into the model to investigate how the alliance’s governance structure affects the relationship between partner-specific experience and alliance termination outcomes. Inclusion of this variable is also motivated by the fact that the alliance’s governance structure can reflect the firm’s alliance experience levels (Gulati, 1995) and may influence the efficiency of the alliance by providing control rights as well as incentive alignment through residual claimancy (Chi, 1994; Hennart, 1988). Second, coordination of collaborative activities is also effected through other governance mechanisms, so we included a dummy variable to indicate whether or not parent firms put in place a board or committee overseeing the coordination of alliance activities (i.e., Coordination Committee).

Two explanatory variables were used to capture the scope of the alliance and how parent firms allocated alliance responsibilities. First, alliance scope was measured as the number of project activities encompassed by the collaborative agreements (i.e., Alliance Scope). Six potential project activities were identified: basic research, new product or process development, testing and obtaining regulatory approval, manufacturing, sales and marketing, and distribution. Thus, alliance scope takes on integer values from 1 to 6. Second, a variable was constructed to measure the allocation of responsibilities for the alliance (i.e., Division of Labor). Respondents indicated partners’ responsibilities by
allocating 100 percentage points between the collaborators across the alliance’s various project activities. The division of labor in the collaboration was then measured as follows:

\[
\text{Division of Labor}_i = \frac{1}{n_i} \sum_{j=1}^{n_i} \left| P_{1ij} - P_{2ij} \right|
\]

where \(n_i\) is the number of project activities undertaken by alliance \(i\), \(P_{1ij}\) is the percentage representing parent 1’s responsibility for task \(j\), and \(P_{2ij}\) is the percentage indicating parent 2’s responsibility for task \(j\) (i.e., \(P_{1ij} + P_{2ij} = 100\%\) for all \(j\)). Hence, division of labor is a continuous variable that ranges from zero to one. When the collaborators equally share responsibilities for each project stage, the variable attains its minimum of zero. When one partner is wholly responsible for each project stage, the variable takes on its maximum of one. Thus, the larger the variable, the sharper the alliance’s division of labor.

**Model Specification**

The model specification used to test the hypotheses developed earlier is as follows:

\[
\text{Alliance Termination} = \beta_0 + \beta_1 \text{Collaborative Experience} + \beta_2 \text{Technological Experience} + \beta_3 \text{Partner-Specific Experience} + \beta_4 \text{Partner-Specific Experience} \cdot \text{Equity} + \beta_5 \text{Alliance Scope} + \beta_6 \text{Division of Labor} + \beta_7 \text{Equity} + \beta_8 \text{Coordination Committee} + \epsilon.
\]

Because the dependent variable is ordinal, the model was estimated using an ordered logit model. The multiplicative term \(\text{Partner-Specific Experience} \cdot \text{Equity}\) is included in the model to test the hypothesized moderating effect of the alliance’s governance structure on the relationship between partner-specific experience and alliance termination outcomes (i.e., H6).

**RESULTS**

Table 1 presents descriptive statistics and a correlation matrix for our sample of biotechnology alliances. Only 18 (or 34.0 percent) alliances ended due to failure, while 8 (or 15.1 percent) ended following the achievement of partners’ objectives and 27 (50.9 percent) involved a more neutral termination inasmuch as the contract expired as planned or one firm
unilaterally withdrew from the collaboration due to a change in its strategic interests. Thus, our results on alliance termination run counter to the assumption in empirical research on alliance instability that termination is indicative of failure and longevity is a necessary condition for collaborative success.

On average, firms had 12.8 alliances prior to the focal collaboration. Only 26 percent of the firms had no prior experience with alliances. Firms’ average number of prior alliances in similar technological domains was 1.4, and 11.3 percent of the firms had prior alliances with the specific partner. Prior alliance experience in similar technology areas appears to substitute for the installation of a board or committee to coordinate the execution of alliance activities: Such coordination mechanisms are more likely to be employed by firms lacking alliance experience in related technological areas, whereas experienced firms are less likely to use them \((p<0.01)\). For complex alliances that are broad in scope, parent firms clarify partner responsibilities through a sharper division of labor \((p<0.01)\) and also institute controls and coordination through the use of equity-based governance \((p<0.10)\). However, the bivariate results do not indicate that the firm’s decision to use an equity versus non-equity structure is related to collaborative, technological, or partner-specific experience \(\text{c.f., Gulati, 1995}\). Based on the set of variables we are investigating, it would appear that this decision is more a reflection of transaction features such as alliance scope \((p<0.10)\) \(\text{Oxley, 1997}\).

Table 2 presents the results from the multivariate analysis. Model 1 provides estimates for a specification excluding the interaction term for partner-specific experience and governance design \(\text{i.e., equity vs. non-equity}\), and model 2 represents the full model. Both models are significant at the 0.05 level, and model 2 provides greater explanatory power.
For both models, a score test indicated that the parallel lines assumption is valid (i.e., $\chi^2 = 6.65$, 7 d.f.; $\chi^2 = 6.16$, 8 d.f.).

Contrary to the hypotheses that general collaborative experience and technological experience improve alliance performance (i.e., H1 and H2), neither variable appears to influence alliance termination outcomes for our sample of collaborative agreements in the biotechnology industry. Thus, we find that firms do not generally benefit from broad-based collaborative experience or alliance experience in similar technological domains.

By contrast, partner-specific alliance experience does influence firms’ termination outcomes, but only for certain high-tech collaborations. While the partner-specific experience variable is insignificant in model 1, the overall effect of partner-specific experience is indicated by model 2: This model has significantly greater explanatory power than a reduced model that excludes the partner-specific experience variable’s main effect and the interaction term (i.e., $\chi^2 = 6.74$, 2 d.f., p<0.05). The partial derivative of model 2 with respect to partner-specific experience is $4.98 - 7.81 \cdot \text{Equity}$. Thus, in support of H6, partner-specific experience has a positive impact on alliance performance for non-equity collaborations (i.e., Equity = 0), and such experience is less valuable for equity structures affording formal coordination and monitoring rights.

The ordered logit results also indicate that the complexity of the alliance, and how firms manage this complexity, influence alliance termination outcomes. Consistent with H4, more focused collaborations fare better than alliances that are broad in scope (p<0.01). The bivariate results suggest that firms cope with complexity by providing the alliance with a clearer division of labor. In accordance with H5, the results in Table 2 indicate that alliance termination outcomes tend to be more favorable the sharper is the alliance’s division of labor.
(p<0.05). Finally, alliances coordinated by a board or oversight committee are likely to end more favorably than collaborative agreements lacking this governance mechanism (p<0.01)

DISCUSSION

Our results have several implications for future alliance research and for firms seeking to build portfolios of collaborative agreements. First, the findings on alliance termination outcomes indicate that the majority of alliances do not end because of failure. Indeed, nearly two-thirds of the terminated alliances we studied came to an end due either to the alliance’s success in meeting firms’ objectives or other reasons unrelated to performance. Nearly half of the collaborations ended due to the expiration of the agreement or a change in one party’s strategic priorities that led to a unilateral withdrawal. Thus, these findings are in contrast to the assumption in empirical research that termination reflects failure and alliance longevity is an indicator of success. This suggests that the normative implications drawn from survival analyses of alliances can be questioned, and future studies would benefit from studying the performance implications of alliances more directly and from being explicit in establishing that assumptions employed regarding alliance survival are justifiable.

Second, our findings reveal that both parent firm and alliance levels of analysis matter in shaping alliance termination outcomes. We find that factors from both levels of analysis jointly influence whether alliances end as failures, successfully, or more neutrally. Moreover, the results show that the interaction between partner-specific experience at the parent firm level and governance design (i.e., equity vs. non-equity) at the transaction level affects alliance termination outcomes. These findings are relevant to the debate between research arguing for the primacy of transactional characteristics in determining the efficiency of collaborative agreements (e.g., Oxley, 1997) and research suggesting that alliances need to be viewed from a parent firm perspective since collaborative agreements are embedded in the
parent firms’ strategies (Koza & Lewin, 1998). Our results situate strategic alliances within the history of firms’ adaptation practices and show that both alliance experience trajectories and features of the focal transaction considered in prior studies of alliance design (e.g., scope, division of labor, and governance) jointly and interactively influence alliance termination outcomes. Consideration of multiple levels of analysis is therefore important for specifying models of alliance performance.

Third, our results demonstrate the importance of disaggregating alliance experience trajectories in future research. We find that partner-specific alliance experience has a positive impact on termination outcomes for non-equity alliances. Such collaborative agreements do not afford the control and coordination provided by equity structures and, as a result, the development of interorganizational routines to smooth partner interactions and facilitate the process of collaboration are important. The negative interaction effect between partner-specific experience and governance design therefore indicates that parent firms’ prior relationships and their governance decisions can substitute for one another as coordination mechanisms: Firms that have developed an alliance history together and a corresponding set of routines have less need for equity structures to align incentives, provide monitoring rights, and institute formal controls over the relationship. By contrast, firms that are unfamiliar with each other will find equity structures helpful in facilitating coordination and protecting against opportunism.

However, we find that general collaborative experience and alliance experience within a technological domain do not appear to affect the termination outcomes of the focal alliance. There are several potential explanations for these results. First, alliances occur with lower frequency in comparison with manufacturing processes and other organizational activities for which positive experience effects have been documented. Thus, organizations are apt to experience decay in their abilities to recall past events, either due to personnel
turnover or because of natural limitations to human memory. Second, alliances are also more heterogeneous than production processes or other standardized administrative tasks. Heterogeneity in alliances means that it will be difficult for individuals to see commonalities across diverse experiences and transfer knowledge appropriately (Cormier & Hagman, 1985). Third, alliances are causally ambiguous in that the links between managerial actions and performance are unclear (e.g., Lippman & Rumelt, 1982). This ambiguity and the lack of performance metrics make it difficult for collaborators to improve future alliances.

Our evidence for different alliance trajectories has implications for firms developing alliance portfolios as well as for applications of network theory to inter-firm collaboration. While we do not explicitly characterize the structure of the interfirm network, the results indicate that the depth of ties appears to matter more than the breadth of alliances. This finding on alliance termination outcomes parallels Walker, Kogut, and Shan’s (1997) evidence on alliance formation patterns. They also note that the effects of relational embeddedness (Coleman, Katz, & Menzel, 1966) are stronger than those derived from structural embeddedness (Burt, 1992) in shaping alliance formation patterns. For firms seeking to develop a collaborative strategy, this evidence underscores the importance of choosing the right partner up front since gains can be derived in the future by deepening the relationship with this partner. The results would also caution against developing a broad-based portfolio of alliances over a more focused approach. For firms developing a portfolio of alliances, the findings also indicate the continued importance of appropriately designing individual transactions with regard to their scope, division of labor, and governance.

As this is the first paper that explores the occurrence and determinants of alliance termination with respect to performance outcomes, there are a number of opportunities to extend this analysis. First, work is needed to explore the generalizability of our findings on the distribution of alliance termination outcomes in other industry contexts, for alternative
types of alliances, and in different geographic markets. Second, additional work is needed to
further investigate the boundary conditions of alliance experience effects. For example,
future research might specify alliance experience trajectories in other ways and explore other
contingencies that bear upon firms’ abilities to benefit from prior alliances. Third, our
particular focus was on the parent firm and individual transaction levels of analysis for a
sample of alliances in a single industry, but the literature review indicates that alliances are
embedded in industrial and institutional contexts that could be examined in future work as
well. Finally, our research examined how firms might develop knowledge about managing
alliances through learning-by-doing processes, and we have not considered other mechanisms
for the creation and evolution of alliance capabilities. These include explicit steps for
articulating, codifying, and diffusing knowledge such as developing databases for
disseminating lessons learned and best practices, conducting alliance post-mortems,
implementing structural solutions such as corporate alliance groups, and instituting internal
training programs (e.g., Harbison & Pekar, 1997). Research in directions such as these could
significantly expand our understanding of the implications of the embeddedness of alliances
in parent firms’ adaptation choices and how firms might develop alliance capabilities.
ENDNOTES

1 Skewness can inflate the risk of Type I and Type II errors in multivariate models (Tabachnick & Fidell, 1996), and the logarithmic transformation has been shown to remedy this problem. The transformation ‘new variable’ = log(1 + ‘old variable’) was used since the untransformed measures can equal zero and the log of zero is undefined. Inspection of the transformed variables’ distributions revealed that this transformation corrected for skewness.

2 Four alliances ended via acquisition. Given that the frequency of occurrence of this termination outcome was very small and this outcome does not fit within the ordinal classification of the other termination events, these four observations were excluded from the sample and analysis.

3 To investigate whether multicollinearity posed a problem for our models, we investigated the Variance Inflation Factors (VIFs) for all of the specifications we estimated. The maximum VIF for the variables in these models was 4.1, which is below the rule-of-thumb cutoff value of ten for multiple regression models (Neter, Wasserman, & Kutner, 1985: 392).

4 To examine whether negative transfer effects are manifest in an U-shaped relationship between collaborative experience and alliance termination outcomes, model 1 was re-estimated using a quadratic term, but non-linear effects were not present.

5 We also tested the interaction between partner-specific experience and whether parent firms’ put in place a coordination committee, but the interaction effect was not significant.
REFERENCES


North Carolina Biotechnology Center Actions Database. 1993. North Carolina Biotechnology Center, Research Triangle Park, NC.


**TABLE 1**

Descriptive Statistics and Correlation Matrix$^a$

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Alliance Termination</td>
<td>1.81</td>
<td>0.68</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Collaborative Experience</td>
<td>1.67</td>
<td>1.32</td>
<td>-0.08</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Technological Experience</td>
<td>0.51</td>
<td>0.73</td>
<td>0.41$^{**}$</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Partner-Specific Experience</td>
<td>0.09</td>
<td>0.25</td>
<td>0.27$^*$</td>
<td>0.04</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Alliance Scope</td>
<td>4.92</td>
<td>1.83</td>
<td>-0.17</td>
<td>0.11</td>
<td>0.02</td>
<td>0.11</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Division of Labor</td>
<td>0.73</td>
<td>0.30</td>
<td>0.22</td>
<td>-0.06</td>
<td>0.03</td>
<td>-0.06</td>
<td>0.43$^{**}$</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Equity</td>
<td>0.17</td>
<td>0.38</td>
<td>0.05</td>
<td>0.09</td>
<td>-0.02</td>
<td>0.09</td>
<td>0.24$^*$</td>
<td>0.16</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>8. Coordination Committee</td>
<td>0.43</td>
<td>0.50</td>
<td>0.19</td>
<td>-0.08</td>
<td>-0.44$^{**}$</td>
<td>-0.08</td>
<td>0.10</td>
<td>-0.02</td>
<td>-0.02</td>
<td>---</td>
</tr>
</tbody>
</table>

$^a$ N = 53. $^\dagger$ p<0.10; $^*$ p<0.05; $^{**}$ p<0.01; $^{***}$ p<0.001.
### TABLE 2
Ordered Logit Estimation Results\(^b\)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative Experience</td>
<td>-0.20</td>
<td>-0.21</td>
</tr>
<tr>
<td></td>
<td>(0.25)</td>
<td>(0.25)</td>
</tr>
<tr>
<td>Technological Experience</td>
<td>0.65</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>(0.48)</td>
<td>(0.48)</td>
</tr>
<tr>
<td>Partner-Specific Experience</td>
<td>-0.34</td>
<td>4.98*</td>
</tr>
<tr>
<td></td>
<td>(1.33)</td>
<td>(2.44)</td>
</tr>
<tr>
<td>Partner-Specific Experience • Equity</td>
<td>---</td>
<td>-7.81**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.09)</td>
</tr>
<tr>
<td>Alliance Scope</td>
<td>-0.45*</td>
<td>-0.54**</td>
</tr>
<tr>
<td></td>
<td>(0.19)</td>
<td>(0.19)</td>
</tr>
<tr>
<td>Division of Labor</td>
<td>2.63*</td>
<td>2.63*</td>
</tr>
<tr>
<td></td>
<td>(1.10)</td>
<td>(1.15)</td>
</tr>
<tr>
<td>Equity</td>
<td>0.50</td>
<td>1.66†</td>
</tr>
<tr>
<td></td>
<td>(0.86)</td>
<td>(1.00)</td>
</tr>
<tr>
<td>Coordination Committee</td>
<td>1.52*</td>
<td>1.94**</td>
</tr>
<tr>
<td></td>
<td>(0.66)</td>
<td>(0.71)</td>
</tr>
</tbody>
</table>

\( \chi^2 \quad 13.44^* \quad 20.11^{**} \)

Log Likelihood \( L(\beta) \)

\(-2[L(\beta_1) - L(\beta_2)] \quad --- \quad 6.68^{**} \)

\(^b\) N = 53. Standard errors appear in parentheses. † p<0.10; * p<0.05; ** p<0.01; *** p<0.001.