MANAGING GOVERNANCE ADAPTATIONS IN STRATEGIC ALLIANCES

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Abstract

One important question confronting firms engaged in a strategic alliance is how to adapt the relationship over time. This article identifies specific governance changes firms make in strategic alliances. Using illustrative data on strategic alliances in the biotechnology industry, the authors consider the frequency of governance adaptations and explore some of the factors affecting parent firms' interventions in their collaborative agreements. The data patterns demonstrate the relevance of parent firms' prior experiences with alliances as well as specific features of the alliance in influencing the likelihood and type of adjustments undertaken by parent firms. While alliance adaptation has previously been a black box in the alliance area, the article begins to specify some of the dimensions of alliance adaptation and their drivers.

Keywords: alliance dynamics; collaborative strategy; governance changes

INTRODUCTION

Prior writings on alliances point to many benefits that firms can derive from interfirm collaboration, ranging from speed and flexibility to capability development and risk sharing. Indeed, textbooks and articles on alliances have identified more than a dozen reasons firms enter into collaborative agreements. At the same time, firms' failure rates with alliances are equally great, sometimes estimated as high as 70-80 percent. No doubt many of these failures result from the fact that alliance investments are undertaken in highly uncertain environments and by firms undergoing transitions in their business portfolios or resource bases. Other implicating factors reflected in these high failure rates might include the use of alliances where other investment vehicles would be more appropriate and the lack of expertise in managing collaborative agreements. Like acquisitions, many alliances falter at the juncture between alliance formation and implementation. The question then arises as to how firms can actually claim the potential benefits that alliances offer.

Many recent perspectives on alliances highlight the importance of flexibly managing a collaborative relationship over time. In fact, Doz and Hamel (1998, p. xv) submit that "[m]anaging the alliance relationship over time is usually more important than crafting the initial formal design." Research viewing joint ventures (JVs) as options suggests that firms can enhance flexibility and reduce risk by staging commitments to a business over time (Kogut, 1991), but collaborators do face challenges in implementing domestic and international joint ventures (IJVs) to achieve these outcomes (Reuer & Leiblein, 1999). Similarly, learning views of alliances emphasize the need for parent firms to alter their resource commitments to an alliance as learning accumulates (e.g., Khanna, Gulati, & Nohria, 1998). Nanda and Williamson (1996) discuss how firms can also use JVs to sequentially exit a

business by smoothing the transition process by providing the ultimate buyer hand-over assistance and ensuring that key stakeholders stay committed. Recent empirical research also reveals that the way in which firms manage post-formation alliance activities affects the total value that a firm creates or dissipates from collaboration (e.g., Reuer & Miller, 1997).

For practitioners engaged in alliances, two guidelines or broad approaches to managing alliance dynamics have been commonly advocated. First, many writings on alliances are grounded in the popular courtship-marriage metaphor of collaboration (e.g., Kanter, 1994). This metaphor encourages progressive increases in commitment, underscores trust as a foundational element of alliance success, and holds out lifetime association as both an end for and a reward of collaborative relationships. While the metaphor strains under certain alliance features and partner behavior, proponents point to successful ventures like Dow Corning; CFM International, the aircraft engine venture between General Electric of the U.S. and SNECMA of France; and Fuji Xerox as long-standing collaborations worthy of emulation.

Second, alliance writings often invoke the notion of an alliance life-cycle. The life-cycle concept is helpful in differentiating phases of collaboration that arise during an alliance's life span, from seeking a partner to terminating the venture. Alliance life-cycle stages can be identified in coarse or more fine-grained categories. For instance, Newburry and Zeira (1997) distinguish the challenges of two stages – pre-incorporation and post-incorporation – for international joint ventures and other investments such as acquisitions and greenfield expansions. Parkhe (1996) differentiates eleven distinct stages, specifying in greater detail the activities involved in managing a JV over time: introspection and internal audit, partner scanning, pre-contractual negotiations, courtship, partner selection, contractual negotiations, formal

contract design, informal role specification, JV initiation, JV implementation/partner monitoring, and organizational learning/adaptation. Other authors have developed similar schemas that group together some of these elements of alliance management.

When considering these two approaches to understanding alliance implementation, it is worth noting several things. First, both approaches emphasize the importance of post-formation alliance activities to value creation. In contrast to more static views of collaboration, this focus on the phases of the alliance process is useful. The marriage metaphor highlights trust-building and deepening commitment as success factors in alliances, while the life-cycle concept brings out the phases of collaboration that firms must manage effectively to create value.

Second, it can become easy to view alliance implementation in a deterministic fashion. However, cooperation can break down; partners may lengthen, curtail, or even skip some stages; collaborative phases might recur as an alliance's mandate changes; and a firm developing a portfolio of relationships may need to attend to multiple IJV life-cycle stages simultaneously in different ventures. Managers involved in an alliance or portfolio of alliances are aware that collaborations often do not proceed in a linear or orderly fashion.

Finally, while these approaches call attention to alliance implementation and the specific collaborative phases comprising alliance management, they provide less guidance on the concrete actions firms must take in managing an alliance over time. To be useful, the approaches need to be seen as only a first cut at identifying alliance management activities. It remains for firms to decide how many "boxes" should occupy their alliance life-cycle, what should go in each box, how contingency plans should be developed and carried out, and how organizational priorities should be allocated among the various phases of collaboration.

As we assess the various perspectives on alliances and the academic research that has been carried out on interfirm collaboration, we reach a similar conclusion. Considering all of the alliance life-cycle stages, the least is known about alliance adaptation, which can be viewed in terms of the set of interventions parent firms make in alliances after collaborations have been set up and before they have been terminated. A substantial body of literature exists on alliance formation, and increasing emphasis has been given to alliance termination in the last few years, but intermediate phases of alliance management have gone relatively unexplored.

In this article, we begin to examine some of the key dimensions of alliance adaptation. In doing so, our aim is to make alliance adaptation less of a black box than it currently is in alliance thinking. The focus of the article is on the specific governance changes firms make in strategic alliances. We also consider some of the factors that contribute to these governance changes. Using illustrative data derived from a survey of biotechnology alliances, we explore the frequency of specific governance interventions parent firms make in these alliances and some of the sources of these changes.

We find that roughly forty percent of the more than one hundred biotechnology alliances we studied experienced contract alterations, major changes in the board overseeing the collaborative activities, or the introduction or formalization of monitoring mechanisms. The data patterns also reveal the importance of both parent firm and alliance features as drivers of alliance adaptation. More specifically, the data we present demonstrate that the different alliance experience trajectories followed by parent firms can either facilitate or substitute for governance changes, depending on whether alliance experiences are particular to a given partner or technological area, respectively. We also show that parent firms are more apt to alter

the governance structure of alliances that are broad in scope or have a less clear division of labor. Firms appear to be selective in implementing these changes in alliances, targeting alliances that are the most relevant based on the parent firm's resources commitments. Finally, we see that governance changes in high-tech alliances often accompany expansion of the collaborative agreement into new business domains.

The article is organized as follows: In the next section, we discuss some of the factors influencing alliance adaptation. We explore environmental conditions, parent firm factors, and alliance attributes. A subsequent section discusses our survey findings on the frequency and drivers of post-formation dynamics in biotechnology alliances. A concluding section offers some implications of our work and provides some initial thoughts on how firms might conceptualize alliance adaptation and enhance the effectiveness of their collaborative strategy.

GOVERNANCE CHANGES IN STRATEGIC ALLIANCES

Two broad classes of governance changes in strategic alliances are important. First, alliance termination involves a discrete change in the alliance's governance structure. For instance, over eighty percent of IJVs end by one firm acquiring the venture from the partner. The buyer converts the joint venture to an internal, wholly-owned unit. This process of "internalization" results in a qualitative shift in the alliance's governance. In other cases, a partner may sell its stake in the JV, sell the venture in its entirety, or liquidate the collaboration. Some of the factors contributing to alliance termination have been taken up in an earlier article (Reuer, 1998).

Second, parent firms may intervene in a collaborative agreement using other governance changes as a means of adapting an on-going alliance. In contrast to the discrete governance shifts resulting from alliance termination, these changes tend to

be smaller and more evolutionary in character. For instance, parent firms may agree to a minor ownership reallocation in an IJV to reflect new capital contributions. In other cases, the governance of the alliance may be altered by renegotiating specific contractual terms underlying the collaboration. Parent firms may also change the governance mechanisms of the alliance by changing the board overseeing the collaboration or by altering monitoring mechanisms and incentive systems in order to facilitate the execution of collaborative activities. These governance adaptations and their drivers are the focus of the present article.

Below we explore factors at three levels of analysis – environmental, firm, and alliance conditions – contributing to governance adaptations in collaborative agreements (see Figure 1). We do not attempt to develop an exhaustive list of governance changes in strategic alliances or their drivers. Rather, our objective is to provide a few illustrations and summarize some of our research on interfirm collaboration in the biotechnology industry, with the aim of stimulating executive thinking and academic research on this topic.

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Insert Figure 1 about here
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Environmental Conditions

Rivalry conditions. Like other forms of organizations, alliances are competitive entities, and governance changes in alliances can stem from intense competition or changes in rivalry. For instance, Fuji Xerox, a 50-50 joint venture established in 1962 between Fuji Photo Film and Xerox through its Rank Xerox subsidiary began as a marketing arrangement designed to sell xerographic products in Japan. By 1990, the venture was considered to be one of the firm's key strategic assets. In the intervening years, integrated competitors like Canon globalized, and

Fuji Xerox became an important source of innovation for Xerox at the low end of the market. As a consequence, Xerox needed to balance its desire to integrate the joint venture within Xerox's global strategy with the JV's need for autonomy, which had been one of the reasons behind its innovation in the first place. "Codestiny" reviews during the 1980s altered contracts and agreements between the firms. The third codestiny review in the 1990s resulted in the sale of Rank Xerox's South Pacific Operations to Fuji Xerox, changes in coordination across value chain activities, and the creation of a new alliance, Xerox International Partners, for laser printers.

By many accounts, Fuji Xerox has been one of the most successful international joint ventures and a model of alliance transformation. Because parent firms find it more difficult to coordinate jointly-controlled IJVs than wholly-owned operations, many firms seeking to build global strategies have decided to terminate their joint ventures instead. For instance, globalizing U.S. multinationals that decided to rationalize production or standardize marketing policies and adopt more integrated organizational structures experienced significant IJV instability rates during this transition (Franko, 1971).

Rivalry for partners. Just as industry globalization can influence governance changes in an alliance, the intensity of competition can also affect the post-formation dynamics of an alliance. In many scale-driven competitive contexts, firms have entered into multiple alliances, forging together multiparty alliances or entering into portfolios of relationships to leverage a technology. Swissair's development of the Qualiflyer group to compete with the Star Alliance and other airline coalitions is just one example. As such alliances engage each other in rivalry, competition exists not only for ultimate market presence, but also for allies. Unlike in the case of dyadic

alliances, however, the member turnover that can result from this process does not coincide with alliance termination *per se*.

Mips Computer Systems, a start-up semiconductor company taking on established rivals, formed a network in which each partner added a specific part of the value chain. Mips promised not to compete with partners by making or selling chips, and the rest of the network was also designed to limit internal competition. For example, semiconductor partners to which Mips licensed technology were limited to six and were distributed across different regions of the world. Later, Mips entered the PC market with its RISC chip by forming the ACE consortium. Unlike Mips' earlier network, ACE was dominated by PC firms and had much more competitive overlap among members. Compaq later abandoned ACE, Wang and Bull left the Mips fold for IBM's group, and Olivetti switched to DEC's Alpha chip. Intense rivalry inside and outside of the ACE consortium, its sheer size, and Mips' weakened position led to instability (Gomes-Casseres, 1996).

Host country conditions. Other environmental conditions can be identified that affect the post-formation dynamics of alliances. At the host country level, liberalization of restrictions on foreign direct investment has historically been one reason behind equity changes in market entry IJVs in developing countries. Foreign exchange rate movements can be another source of instability in alliances. For instance, after AT&T formed its alliance with Olivetti to market each other's products in North America and Europe, appreciation of the U.S. dollar left AT&T's products more expensive in Europe, while Olivetti's became cheaper in North America. Given the parties' lack of integration mechanisms, the alliance could not effectively respond to this problem and other challenges confronting the collaboration.

Parent Firm Factors

Partner capabilities. Parent firms often adapt alliances that have upside potential but are unable to seize their opportunities under the current structure. For example, in 1994 Whirlpool Corporation increased its equity holding in its TVS-Whirlpool joint venture in India to address the JV's failure to meet its marketing and financial aspirations. The collaboration suffered from increased competition, quality problems, differences in organizational cultures and management systems, and a host of other difficulties across the value chain. By acquiring majority ownership in a corrective move, Whirlpool sought to enter new product segments, deal with new entrants and branding requirements, and institute quality management practices.
In other joint ventures attempting to meet growth opportunities, one partner often provides capital infusions and this partner's equity stake rises accordingly. For example, to increase its commitment to the elevator market in China when competitors were moving quickly, Otis provided an additional investment of $10 million in its China Tianjin Otis Elevator Company (CTOEC) joint venture in 1991, raising its equity position to 44 percent. A later agreement for an additional investment gave Otis majority control of the venture. Reorganization of joint ventures requires more than simply increasing a firm's equity stake, however. Other firms involved in reorganizing joint ventures in China have faced considerable challenges in changing organizational systems and implementing any layoffs that might be required as part of a venture reorganization.

Many other factors besides capabilities and other resources potentially affect the willingness and ability of parent firms to adapt the governance structures of strategic alliances. If the firm has a centralized organizational structure, rigid management systems, and a competitive organizational culture, it is unlikely that such

a firm will have the capabilities to manage governance adaptations in alliances. Ironically, it may be these very attributes that created the need for adapting the relationship in the first place. Such firms also face difficulties even knowing governance changes are needed in their collaborative agreements.

Alliance experience. To us, the potential effects of alliance experience on governance changes in strategic alliances are particularly interesting. On the one hand, one would expect that a firm with prior alliances would be better able to appropriately design alliances at the formation stage. Such a firm would have a better handle on questions such as whether an equity or nonequity structure is more appropriate for the collaboration, which tasks should be done jointly and which separately, where organizational linkages and firewalls are necessary, how to design the board, and so forth. Thus, one might predict that prior alliance experience is, in effect, a *substitute* for post-formation governance changes.

On the other hand, one might expect prior alliance experience to *facilitate* governance adaptations in alliances. Prior alliances with a partner, for instance, allow firms to better understand partners' routines for managing collaborative processes. Prior alliance experience might also serve to build trust among collaborators, which aids any adaptations that are needed after the alliance is formed. If alliance adaptations occur regularly, prior alliance experience enables the firm to know when such changes are needed and how best to carry them out. Further, when two firms have prior alliances with each other, this is apt to heighten expectations for the new collaboration, which has the effect of setting in motion cycles of learning, re-evaluation, and adjustment (Doz, 1996). The facilitating effects of alliance experience are therefore apt to be strongest for prior alliances with a given partner.

Alliance Attributes

Finally, we expect many specific features of an alliance will influence whether or not it experiences governance changes. Two important alliance attributes that we anticipate will affect the post-formation dynamics of alliances are the scope of collaborative activity and the division of labor among partners. When parent firms perform multiple tasks together, there is uncertainty about whether partners have appropriate capabilities for the tasks at hand and how tasks will interface with each other. Given these uncertainties, it is unlikely that all of the potential problems will be anticipated upon alliance formation and can be fully accommodated by the initial alliance design. However, firms can better define the responsibilities of collaborators in alliances that have a clear division of labor.

Another important attribute of alliances that we expect will influence their post-formation dynamics is their relevance to parent firms. Interventions in on-going alliances can pose risks and costs, so firms are likely to be selective in changing the governance structures of collaborative agreements. When alliances involve considerable resource contributions by parent firms, they are likely to attract the attention and commitment of top management and justify adaptation costs, as was the case in the Fuji Xerox illustration discussed earlier. For smaller collaborations that are less central to the firm's strategic priorities and competitive advantage, governance adaptations are likely to be less prevalent.

One of the basic prescriptions for alliances is that no one alliance design or governance structure is ideal in all settings. Rather, an alliance's design needs to match the alliance's business domain, features, objectives, etc. A distinctive characteristic of collaborative relationships, however, is that they often expand beyond parent firms' initial expectations. To the extent that this evolution brings

about a disequilibrium, a mismatch between the alliance's initial design and its business domain, one would expect that parent firms would intervene in the alliance's governance. Fujitsu's alliance with ICL, for instance, evolved from a technical support alliance to a broad technology, product, and marketing alliance. Over time, Fujitsu moved toward majority ownership of ICL.

RESEARCH ON BIOTECHNOLOGY ALLIANCES

Having explored some of the factors that potentially influence post-formation dynamics in alliances, we turn to an examination of results derived from a survey of 119 U.S. biotechnology alliances. Our focus is on the extent of post-formation changes in alliances' governance structures and how parent firms' experiences with alliances and specific alliance characteristics shape these changes in high-tech collaborations. Details on our survey appear in the appendix.

Frequency of Governance Changes

We first examined the occurrence of three types of governance changes in biotech alliances. Respondents indicated whether the agreement contract was altered significantly, whether there had been major changes in the joint board overseeing the alliance, and whether monitoring mechanisms for the project had been introduced or formalized. Table 1 reports on these changes. Roughly 40 percent of the collaborative agreements experienced one or more of these changes. We considered the frequency of post-formation governance changes for these alliances to be significant, particularly in view of the fact that the average age of the collaborations at the time of the survey was eighteen months.

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Alliance Experience Effects

Figure 2 graphically illustrates the effects of prior alliance experience on alliance governance changes. We considered three types of alliance experience: the number of prior alliances with the given partner (i.e., Partner-Specific Experience), which takes on a maximum value of five for our sample; the number of prior alliances in the same product area (i.e., Technology-Specific Experience); and the number of prior alliances with any partner in any area (i.e., General Collaborative Experience). The graph shows some interesting and contrasting effects of prior alliance experiences. The positive slope indicated for the Partner-Specific Experience line reveals that prior alliances with a given partner facilitate monitoring adjustments in alliances. Conversely, Technology-Specific Experience has a negative effect on the likelihood of monitoring changes. Thus, technology-specific experience appears to substitute for such changes. Finally, general collaborative experience has no impact on the likelihood of monitoring changes. The findings suggest that the inter-organizational routines firms develop from prior relationships with each other facilitate adjustments in an alliance, and firms can draw upon prior alliance experience in a given technological domain to anticipate an alliance's governance needs.

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Alliance Complexity

Figure 3 shows how alliance scope affects whether or not there are major changes in the joint board overseeing the alliance. Alliances experiencing board changes are apt to be broader in scope than alliances that were not subject to board changes. Parent firms may anticipate uncertainties surrounding a broad-based

collaboration in the initial design of the alliance, but the results show that parent firms refine the governance of the alliance after it has been formed.

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If alliances of greater complexity owing to their broader scope are more likely to experience governance changes, then such changes should be less likely for alliances with a clear division of labor. This prediction is borne out by the data presented in Figure 4. For alliances experiencing contract alterations, collaborators tended to share responsibilities over individual project tasks more evenly, whereas the division of labor was sharper in collaborations that did not experience changes in the collaborative agreement.

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Alliance Relevance

As discussed earlier, changing the governance of an alliance is a negotiated intervention that involves costs. Figure 5 shows that firms are selective when changing the contractual agreement of a collaboration: Alliances experiencing contract alterations were more apt to be ‘important’ or ‘critical’ to the firm based on the parent’s resource commitments to the collaboration, whereas the average alliance not experiencing changes to its contractual agreement was ‘normal’ in terms of the parent’s contributions.

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Alliance Expansion

Finally, Figure 6 considers the relationship between alliance expansion and the introduction or formalization of monitoring mechanisms by parent firms. In alliances in which parent firms did not expand the scope of the agreement, parent firms later altered monitoring mechanisms only seven percent of the time. By contrast, monitoring changes occurred over four times as often for alliances that underwent expansion. These results suggest that parent firms intervene in an alliance to adapt its governance to the alliance's expansion into new business domains.

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MANAGING POST-FORMATION CHANGES IN STRATEGIC ALLIANCES

Several initial conclusions and implications follow from our discussion of the post-formation dynamics of alliances and our exploration of the occurrence and drivers behind governance changes in biotechnology collaborations. First, the article suggests that alliance adaptation is an important concern for firms engaged in collaborative agreements. Notwithstanding the average young age of the alliances we studied, roughly forty percent of them experienced one or more governance changes after they were formed. This contrasts other alliance writings that tend to view alliances from a more static vantage point or imply that alliance design is a once-and-for-all proposition. Rather than accommodating all alliance uncertainties at the alliance design stage, firms often refine the governance of alliances and revisit the alliance's design over time.

Second, our discussion and research suggests that alliance adaptation can be seen in terms of the specific inventions firms make in an alliance's governance structure to adapt the relationship over time. Much is now known about the economic

logic of alliance formation, and attention is being given to factors affecting alliance longevity versus termination, but the understanding of alliance adaptation is still very incomplete. All too often, alliance adaptation is portrayed as a black box between alliance formation and alliance termination – whatever happens in between. The life-cycle concept underscores the importance of distinct phases of collaboration as elements of value creation, but more specifics are needed. We believe that it is valuable for executives and academic researchers to begin to think about the particular dimensions of alliance adaptation. While there are likely to be many, our article has focused on specific governance changes firms implement in on-going alliances.

Third, the data analysis enabled us to identify some of the drivers behind parent firms' specific governance interventions in alliances, which suggests that the need for alliance adaptation is to some degree predictable. For instance, the results from our analysis of biotechnology alliances indicate that alliance adaptation is more likely required for collaborations that are broad in scope, have a less clear division of labor, are highly relevant based on the parent firm's resource commitments, and are apt to undergo expansions in their business domains. These findings also have implications at the alliance formation stage: Executives need to anticipate making such investments, design alliance monitoring approaches to detect when governance changes are needed, and learn how to manage the process of alliance adaptation. One important source of this learning can be prior alliances with the partner.

Clearly, alliance adaptation is only one component of the broader set of challenges raised by collaborative strategy. Firms also need to make the right initial investment decisions, choose the right partners, design alliances well, manage alliance termination appropriately, etc. to create value from an alliance. As we consider the vast literature on alliances, however, we see alliance adaptation as one of the

neglected topics. Based on some of our research in the biotechnology industry, the present article aimed to pin down some of the specific dimensions of alliance adaptation and to examine their frequency of occurrence and underlying drivers. Given the relevance of the topic and the exploratory nature of our findings, alliance adaptation appears to be a fertile area for work within the alliance research agenda.

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APPENDIX: THE SURVEY

A questionnaire was administered to executives in biotech and pharmaceutical firms to explore the governance changes experienced by biotechnology alliances. We located a set of potential alliances through the database on biotech alliances maintained by the University of North Carolina. We then searched the BioScan database and company directories to obtain addresses for 262 firms engaged in 445 collaborative agreements out of a total of 753 agreements in human, diagnostic, and therapeutic treatments and equipment that existed in the University of North Carolina data files.

After pretesting the questionnaire among five industry experts, a two-page survey was mailed to the CEOs of the parent firms. The survey asked questions regarding the firm's alliance experiences, features of the alliance (e.g., scope, governance mechanisms, resource contributions, division of labor, etc.), and possible post-formation changes in the collaborative agreement. After two rounds of follow-up calls, the final sample consisted of 145 alliances, of which 119 had complete data for the variables of interest. Further details on the survey and methods can be found in Zollo, Reuer, and Singh (1998). This analysis employs multivariate logistic regression and ordered logit models to study the antecedents of post-formation governance changes in strategic alliances.

TABLE 1
Governance Changes in Biotechnology Alliances[a]

Type of Governance Change	Number (Relative Frequency)
None	73 (61.3 %)
Contract Alterations	14 (11.8)
Board Changes	12 (10.1)
Monitoring Changes	9 (7.6)
Contract Alterations & Board Changes	7 (5.9)
Contract Alterations & Monitoring Changes	2 (1.7)
Board Changes & Monitoring Changes	1 (0.8)
All Three Changes	1 (0.8)
Total	119 (100 %)

[a]N=119.

FIGURE 1
Factors Influencing Governance Changes in Strategic Alliances

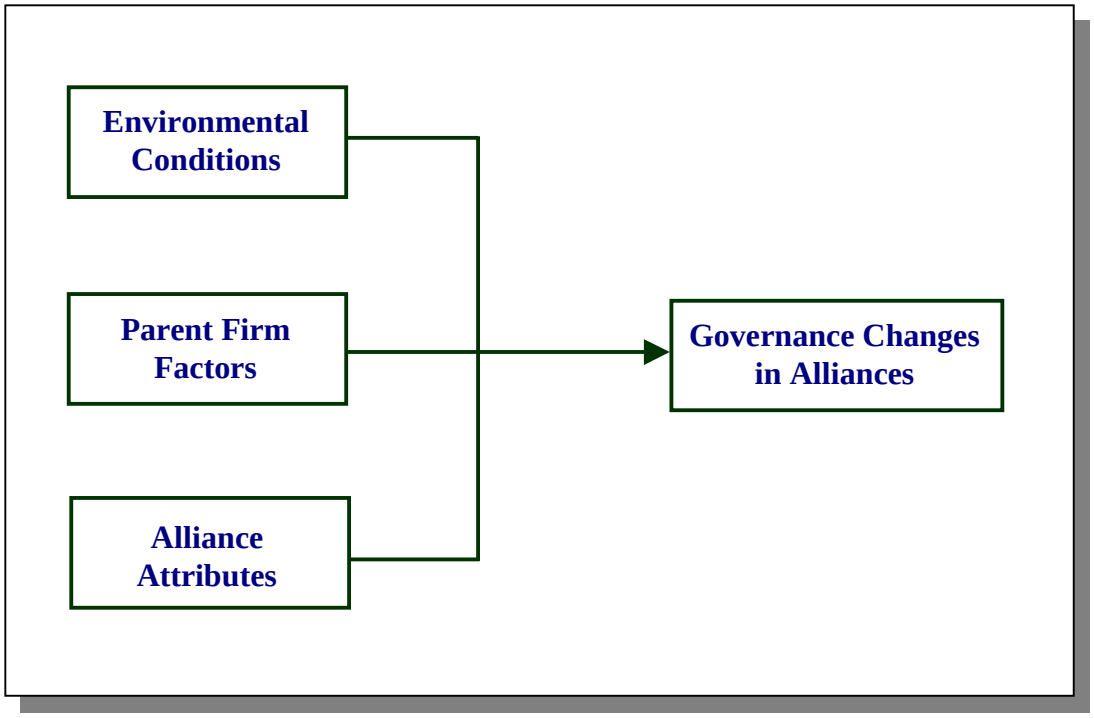
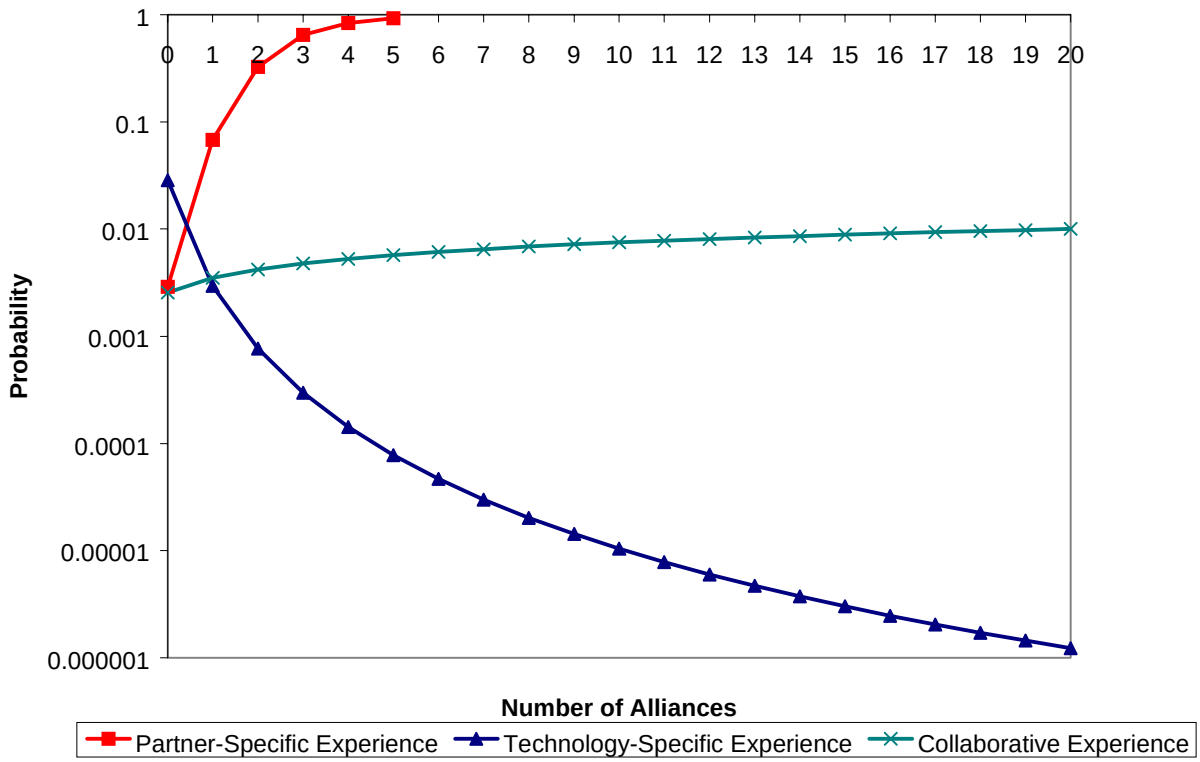
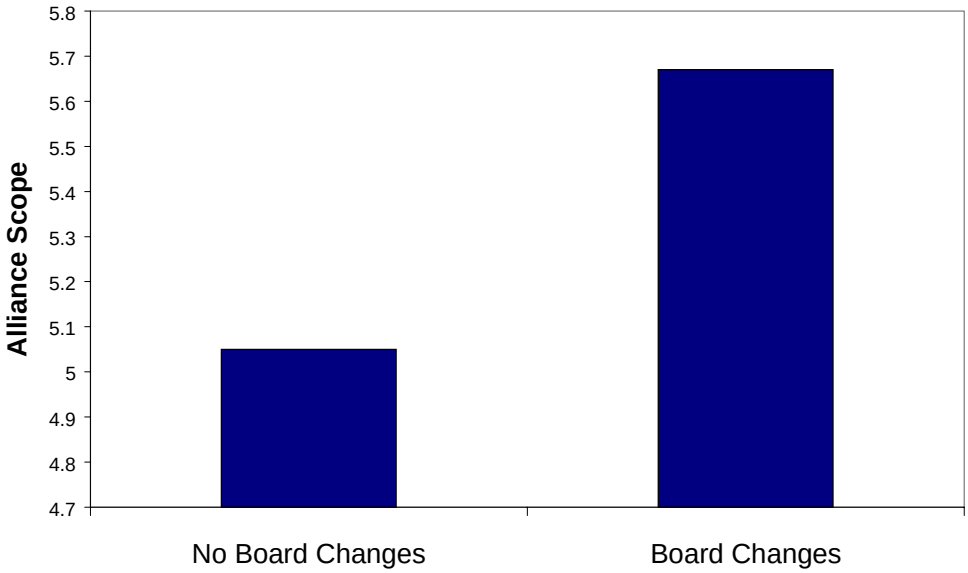


FIGURE 2
Alliance Experience Effects on
Monitoring Changes in Biotechnology Alliances[b]



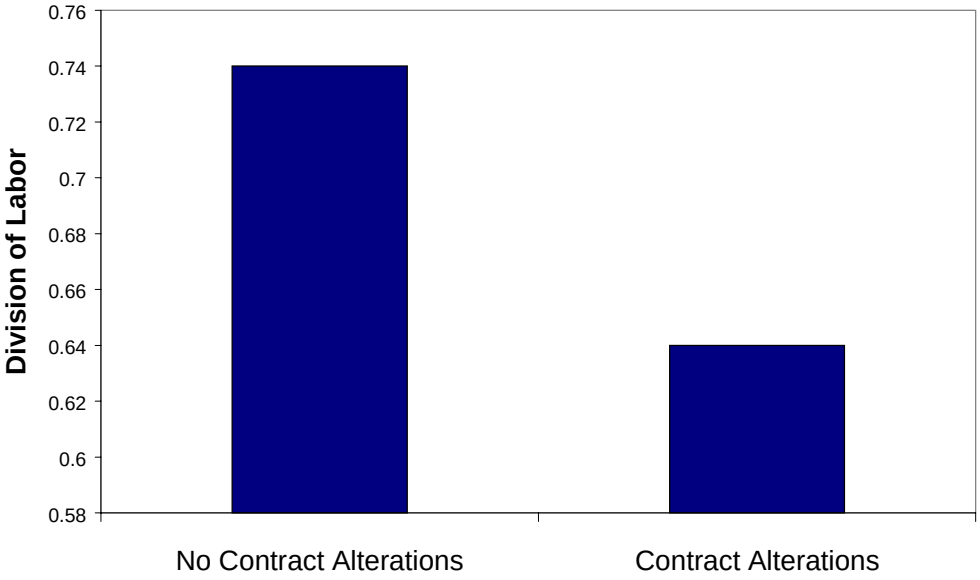
[b]N=114 alliances. Results are derived from estimates from a multivariate logistic regression model (Zollo, Reuer, & Singh, 1998). All variables except the one in question are held at their mean values. The X-axis is the number of the firm's alliances of the specified type. The Y-axis is the estimated probability of the introduction or formalization of monitoring mechanisms in the alliances, which appears on a log scale.

FIGURE 3
Alliance Scope and Board Changes[c]



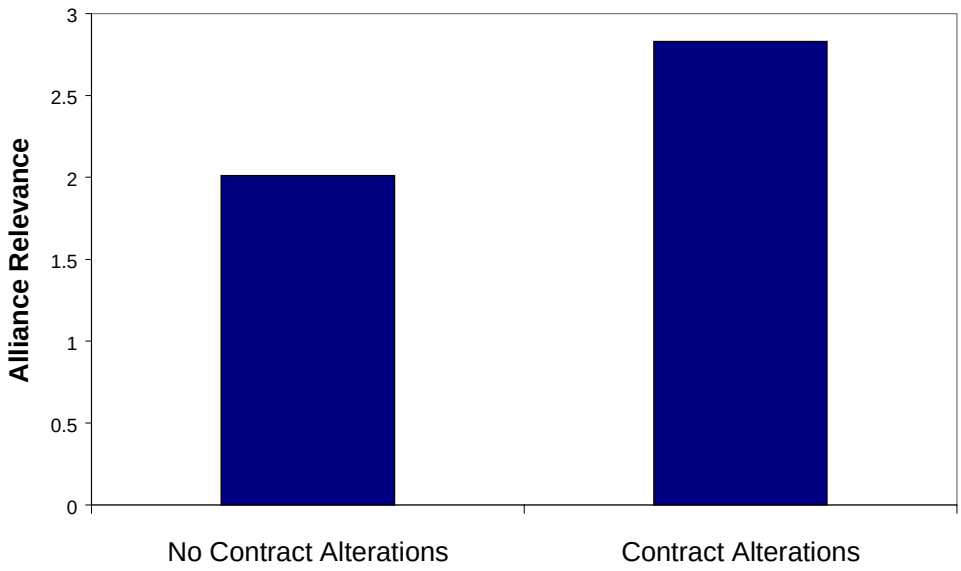
[c]N=119. 17.6 percent of the alliances experienced major changes in the joint board overseeing the collaboration. The Y-axis represents the mean alliance scope, measured by the number of project stages ranging from basic research to distribution undertaken in collaboration.

FIGURE 4
Alliance Division of Labor and Contract Alterations[d]



[d]N=119. 20.2 percent of the alliances experienced changes in the contract governing the collaboration. The Y-axis represents the mean alliance division of labor, which is measured based on percentage allocations of responsibilities across project stages undertaken in collaboration. When division of labor is zero, both parties share equally in all project stages. When division of labor reaches its maximum of one, one of the collaborators is wholly responsible for each of the project stages. Thus, the higher the value, the clearer the division of labor.

FIGURE 5
Alliance Relevance and Contract Alterations[e]



[e]N=119. The Y-axis represents the mean alliance relevance based on the importance of the alliance to the firm in terms of resources committed. The index was scored on a 1-4 scale (i.e., 1 is 'marginal,' 2 'normal,' 3 'important,' and 4 'critical').

FIGURE 6
Alliance Expansion and Monitoring Changes

Alliances without Expansion:

Alliances with Expansion: