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THE ROLE OF INCENTIVES AND COMMUNICATION IN STRATEGIC ALLIANCES: AN EXPERIMENTAL INVESTIGATION

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This paper experimentally examines the determinants of the deviation between potential and realized value creation in strategic alliances. To better understand how decision making in alliances may influence success, we use an experimental design that juxtaposes two important factors that affect alliance members' decisions: economic incentives and communication. The evidence from our experiment sheds light on the relative impact of each, and more importantly, how both factors interact to explain successful outcomes. Copyright © 2009 John Wiley & Sons, Ltd.

INTRODUCTION

Strategic alliances are ongoing cooperative relationships and represent an important organizational form for governing transactions (Reuer, Zollo, and Singh, 2002; Zaheer and Bell, 2005). Strategic alliances have the potential to create economic value (Gulati and Singh, 1998; McEvily and Zaheer, 1999) and, on average, empirical evidence corroborates this view (Chan *et al*., 1997; Sarkar, Echambadi, and Harrison, 2001). However, approximately half of all strategic alliances fail (Kale, Dyer, and Singh, 2002). Indeed, the large gap between *potential* economic value creation and *realized* economic value creation in strategic alliances suggests that there are formidable impediments to successful alliance outcomes (Anand and Khanna, 2000; Gottschlag and Zollo, 2007).

Keywords: strategic alliances; economic incentives; communication; social dilemma; game theory; experiments
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The challenges in achieving successful outcomes in strategic alliances relate to the inherent tension between cooperation and competition (Hamel, 1991). To realize potential value, alliance partners must invest resources, share knowledge, and build synergies through cooperation (Dyer, 1997; Dyer and Singh, 1998). However, given that the benefits of alliance activity are commonly available to all alliance partners, there arises the potential for 'free-riding,' or engaging in learning races in the pursuit of private benefit at the expense of the total value creation (Khanna, Gulati, and Nohria, 1998). Thus, decision makers in strategic alliances must deal with substantial uncertainty and coordination failures, which can lead to real or perceived opportunism, miscalculation, and low performance (Dyer and Hatch, 2006; Shan, Walker, and Kogut, 1994). Managerial solutions to such impediments are often learned over time, albeit in a less than systematic fashion, through hard-earned experience with strategic alliance partners (Ahuja, 2000; Madhavan, Koka, and Prescott, 1998).

Researchers have begun to systematically examine factors that facilitate successful outcomes (Kale and Singh, 2007; Luo, 2008, Tiwana, 2008). Within

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the context of alliance dynamics specifically, Khanna *et al*., (1998) use an economics game theoretic lens and develop theoretical propositions relating economic incentives to success in strategic alliances. This research underscores the potential for learning races when strategic alliance partners may benefit more through noncooperation than by pursuing a common goal in the absence of incentive alignment. Zeng and Chen, in contrast to such 'structural' solutions, emphasize, using a social psychology lens, the role of 'motivational' solutions (Zeng and Chen, 2003: 591) (e.g., communication) as a potential way to increase cooperative rather than competitive outcomes. This work thus highlights the role of organizational design and deliberate efforts to develop a common understanding and trust among strategic alliance partners.

While both research literature streams provide important insights regarding each mechanism in isolation, several fundamental questions remain unanswered. How important are incentive alignment and communication to achieving success in cooperative alliances? What conditions may impact their efficacy in achieving success? Are there synergies between the two underlying mechanisms, or do these mechanisms substitute for each other?

We examine the interplay of both mechanisms in this paper, and employ experimental methodology that permits the disentangling of the effects of these mechanisms on decision making in strategic alliances. Widely employed in economics, psychology, and to an increasing extent in strategic management (Davis 2003; Kagel and Roth 1995; Song, Calantone, and Di Benedetto, 2002), our empirical approach complements extant research methods used for examining success in strategic alliances (e.g., stock market returns, survey-based post-alliance perceptions of success). Despite increased recognition of endogenous selection in strategy research and adoption of new empirical methods, there are limits to the extent to which one can adequately control for endogenous selection given the dearth of valid instruments in most empirical contexts relevant to strategy (Hamilton and Nickerson, 2003). In contrast, the laboratory setting in experimental methodology allows the creation of a simulated environment that controls for selection effects by random assignment of strategic alliance partners. It also enables a direct and clean measurement of both the dependent variable (success in the strategic alliance), and the independent variables (economic incentives and communication) through the creation of independent 'treatments' that represent each underlying causal mechanism. A salient feature of this methodology is that by simulating treatments that may not occur in the field, it enables us to identify the independent and combined effects of these variables (Friedman and Sunder, 1994). This type of evidence is critical for advancing our understanding of the theory of economic organization. The premise of our paper, thus, is in line with the recommendation of Ireland, Hitt, and Vaidyanath (2002) that multiple theories and methodologies be used for studying how alliances can be effectively managed for achieving competitive advantage.

We posit and show that alignment of economic incentives is a necessary, but not a sufficient, condition for achieving successful alliance outcomes. Contrary to economic theorizing that *talk is cheap* (Ledyard, 1995), we find strong empirical evidence of additional benefits of communication. Our paper thus shows that economic incentives (as emphasized, for example, in property rights theory) *and* interpersonal (communication) processes to overcome bounded rationality problems (as emphasized in social psychology and classic organization theory) are both important to decision making in strategic alliances. In the next section, we develop our theoretical framework and hypotheses for the mechanisms that impact decision making in strategic alliances. We then describe the experimental methodology that simulates participants in an alliance setting and provide the empirical results. The concluding section includes a discussion, limitations of our study, and avenues for future research.

THEORETICAL FRAMEWORK

Strategic alliances are an interorganizational form where multiple exchange partners agree to invest resources, share knowledge, and engage in economic value-creating activities that build on synergies between the resources and capabilities that each of the exchange partner firms bring to the alliance. While strategic alliances are formed with the intent that all exchange partners will gain from cooperation through economic value creation, there is nonetheless a competitive element; strategic alliance partners have an incentive to compete

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for the largest share of the economic benefits. In addition, exchange partners can pursue their own interest over the strategic alliance by engaging in economic holdup and/or in learning races (Doz, 1996; Khanna *et al*., 1998).

Since our primary objective is to move beyond *potential* value creation and analyze economic and strategic management issues concerning *realized* value creation in alliances, Olson's (1965) seminal research *The Logic of Collective Action* is especially salient. Olson (1965) combines aspects of property rights theory (e.g., the tragedy of the commons) with game theoretic insights (Camerer, 1991; Saloner, 1991) in which social dilemma situations can result in persistent severe underperformance of economic value creation potential (Arend and Seale, 2005). The key idea is that strategic alliances typically create economic value that have a 'common pool' component, and this lack of well-defined property rights invites potential opportunistic behavior and free-riding (Mowery, Oxley, and Silverman, 1996; Oxley, 1997). The 'common-pool problem' has many applications in economics and sociology. For example, an extensive literature on depletable natural resources, such as oil fields and fisheries, describes how inefficiency arises due to a lack of well-defined property rights that causes individuals or firms to overharvest resources (Libecap, 1989). Therefore, a few researchers have underscored the usefulness of examining the conflict between competition and cooperation through the lens of game theory and social psychology, where strategic alliances can be represented as a public good or a social dilemma problem (Gulati, Khanna, and Nohria, 1994; Zeng and Chen, 2003). The social dilemma arises because exchange partners must decide on whether to pursue a higher individual payoff through competitive choices, even though the collective payoff is larger with cooperation. Furthermore, the common sharing of the economic value created in the alliance introduces the public good element: it is difficult to exclude alliance partners from sharing in the gains, regardless of whether or not they contributed toward the economic value creation.

When framed as a social dilemma problem, strategic alliances can be modeled as either a prisoner's dilemma or an assurance/coordination game (Gulati *et al*., 1994). While the prisoner's dilemma game is commonly discussed in the research literature, a few remarks about the assurance game are perhaps in order. The assurance game is also called the Stag Hunt game that was derived from a story of social contract originally told by Rousseau (1754/1984): Two individuals go on a hunting expedition together. Each person can individually choose to hunt a stag or a hare. Each individual must choose an action without knowing the choice of the other hunter. If an individual hunts a stag, he must have the cooperation of his hunting partner in order to succeed. An individual can get a hare by himself, but the hare is worth less than the stag. In this stag-hunt game, the rational choice for one person depends on what the other individual will do. There are two equilibria to this game: (1) both persons choose to hunt the stag (which is the larger mutual payoff) and (2) both persons choose to hunt the hare. The individual decision to hunt the stag entails both the potential for greater mutual benefit and the potential for greater personal risk (Skyrms, 2003).

In both the prisoner's dilemma game and assurance game settings, strategic alliance partners decide how much to invest toward the joint alliance activity. Their investments are crucial for economic value creation, but the rewards of their investments are common to all alliance partners, and are contingent on how much the other alliance partners contribute. Gulati *et al*. (1994) note that while strategic alliances are often viewed as prisoner's dilemma games, they should be more appropriately characterized as assurance games. To explicate this logic, we provide a simple illustration of the different payoff matrices in two-person games in Table 1. In Panel 1, we start with the 'invisible hand' game where there is *no* social dilemma and the dominant strategy (Nash) equilibrium is for both players to cooperate. Each player is led, by their individual rational self-interest as described by Adam Smith (1776/1937), to the desirable Pareto optimal outcome of (170, 170). In contrast, the other three panels of Table 1 demonstrate social dilemma problems.

In the prisoner's dilemma game of Panel B, the dominant strategy (Nash) equilibrium is to *not* cooperate. Each player chooses their individually rational (self-interested) move, which results in a Pareto inferior outcome of (120, 120), rather than the collectively rational outcome of (170, 170). While there is a dominant strategy of no cooperation in prisoner's dilemma games, the assurance game, depicted in Panels C and D (for homogenous and heterogeneous payoffs respectively) has

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Table 1. Payoff matrices for social or public dilemma games

Panel A: Invisible hand game			
		Player 2	
		Cooperate	Do not cooperate
Player 1	Cooperate	**(170, 170)**	(130, 140)
	Do not cooperate	(140, 130)	(120, 120)
Panel B: Prisoner's dilemma game			
		Player 2	
		Cooperate	Do not cooperate
Player 1	Cooperate	(170, 170)	(110, 190)
	Do not cooperate	(190, 110)	**(120, 120)**
Panel C: Assurance game			
		Player 2	
		Cooperate	Do not cooperate
Player 1	Cooperate	**(170, 170)**	(100, 120)
	Do not cooperate	(120, 100)	**(110, 110)**
Panel D: Assurance game with heterogeneous payoffs			
		Player 2	
		Cooperate	Do not cooperate
Player 1	Cooperate	**(270, 80)**	(140, 75)
	Do not cooperate	(160, 65)	**(150, 70)**

two potential Nash equilibria outcomes—a payoff dominant strategy, and a risk dominant strategy (Harsanyi and Selten, 1988). The optimal decision for each strategic alliance partner is dependent on their alliance partner's decisions. If the strategic alliance partner cooperates, then the individual's best response is also to cooperate, while if the strategic alliance partner does not cooperate, the best response is to not cooperate as well. The cooperative equilibrium is payoff dominant (earning 170 for each player in Panel C). The do not cooperate equilibrium is risk dominant. This equilibrium outcome earns less for each player (110 in Panel C), but it is also less risky. Each player gains 10 if his strategic alliance partner chooses the other action. In contrast, in the cooperative equilibrium, each player loses 70 if his strategic alliance partner chooses the other action.

Successful strategic alliance outcomes thus rely on exchange partners choosing the payoff dominant strategy where they all cooperate toward the joint goal of economic value creation, rather than the risk dominant strategy of not investing in the joint alliance activity. Researchers in both economics and social psychology have emphasized different mechanisms through which a higher likelihood of successful coordination on the payoff dominant equilibrium can be achieved. Not surprisingly, economists assume perfectly rational decision makers and have tended to focus on structural solutions such as economic incentives alignment, while social psychologists assume that people act with limited rationality and emphasize motivational solutions such as communication (Zeng and Chen, 2003). We turn to the role of economic incentives and communication among

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strategic alliance partners as factors representing each dominant paradigm below.

Economic incentives

Property rights theory emphasizes the sanctioned behavioral relations among decision makers in the use of potentially valuable resources (Barzel, 1989; Libecap, 1989). Coase (1960) introduced property rights into the economics of organization and questioned why firms, formal alliance structures, and other institutions existed at all if the price system were perfectly efficient. Coase (1937, 1960) noted that in a world of positive transaction costs, organizational forms matter for achieving economic efficiency. Property rights theory has much to offer in developing a more systematic approach for understanding strategic alliances (Chi, 1994; Foss and Foss, 2005; Oxley, 1999).

Other related theories to property rights theory include agency theory and transactions costs theory. All three organizational economics theories hypothesize that it is necessary for the economic incentives to be right in order to attain efficient outcomes (Argyres and Liebeskind, 1998; Kim and Mahoney, 2005). Since our framework later also examines the role of bounded rationality, it is within the camp of incomplete contracting (e.g., transaction costs and property rights theory) (Coase, 1960; Libecap, 1989; Williamson, 1996) and not the complete contracting principal-agent model (Holmstrom, 1982). Thus, the current paper is more precisely about property rights theory than agency theory.

In particular, friction in establishing property rights helps to explain and predict why there can be large and persistent economic gaps between potential and realized value creation (Kim and Mahoney, 2005; Mahoney 2005). Property rights theory emphasizes 'getting the economic incentives right' (Kim and Mahoney, 2005: 233). Absent some mutual resource commitments from alliance members to align their economic incentives in a strategic alliance environment, the alliances will fail to achieve synergies and sustained economic value creation (Gulati *et al*., 1994). Following Khanna *et al*.'s (1998) theoretical model that is based on economic reasoning pertaining to property rights, we analyze the payoff structures of strategic alliances in terms of their private and common benefits. Khanna *et al*. define 'private' benefits as those accruing to individual firms from activities not governed by the alliance, and 'common' benefits as those accruing to all participants in the alliance (Khanna *et al*., 1998: 195). More specifically, in the context of the assurance game, private benefits occur when exchange partners 'take' from others in the form of unilateral learning of skills and knowledge and application in areas unrelated to the alliance's activities, while common benefits are realized by collective 'giving' or sharing of information and application of the learning in areas related to the alliance (Khanna *et al*., 1998).

Since strategic alliances typically result in both kinds of benefits, the decision makers in a strategic alliance face an inherent tension between competition and cooperation, as exemplified by learning races where an alliance partner can privately benefit at the expense of the others' in the alliance (Hamel, 1991; Khanna *et al*., 1998). Therefore, the probability of strategic alliance success depends on the extent to which the decision makers perceive common benefits to be greater than private benefits. From a property rights perspective, a strategic alliance has elements of the 'tragedy of the commons' (Hardin, 1968). If the benefits for contributing to the strategic alliance (and maintaining the economic value of the common pool) are less than the private benefits from 'raiding' the pool, then the strategic alliance is less likely to result in cooperative behavior among the decision makers. Consistent with property rights theory (Coase, 1960), we predict that aligning of economic incentives is critical to ensuring strategic alliance success. Accordingly, and consistent with Khanna *et al*. (1998), we posit:

> *Hypothesis 1: Alliances wherein decision makers have a higher ratio of common to private benefits are more likely to achieve success than alliances wherein decision makers have a lower ratio of common to private benefits.*

The above hypothesis is consistent with the early property rights research literature and the optimistic view that efficiency will be readily achieved (Demsetz, 1967). However, more recently, both theorists and property rights historians have challenged this optimistic view (Eggertsson, 1990; North, 1990). A key idea is that 'macro' (property rights) problems have 'micro' foundations in terms of communication and incentive problems. Recent property rights research literature,

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which works from an incomplete contracting perspective (Hart, 1995), emphasizes that the coordination procedures by which one can obtain the correct economic incentives are exceedingly difficult. For example, Libecap (1989) notes that asymmetric information and distributional conflicts often lead to persistent suboptimization of economic outcomes. Further, the more heterogeneous the contractual bargaining parties are, the greater the impediments to achieving the full potential of economic value.

These contributions in property rights theory are consistent with the theoretical reasoning in the strategic management research literature, which focuses on the impact of heterogeneity in partner scope and resultant differences in economic incentives on strategic alliance success and failure (Khanna *et al*., 1998). Given the need for coordination among strategic alliance partners, a key factor that can impact alliance success is whether decision makers are similar or different to each other in terms of perceived benefits of the strategic alliance. An increase in the heterogeneity of decision makers, as modeled in Panel D of Table 1, increases the difficulty of reaching the efficient economic outcome (Libecap, 1989). Khanna *et al*. (1998) discuss differences in relative scope of alliance partners and predict that asymmetric common benefits can cause problems in achieving coordination or cooperation in strategic alliances. There are several reasons why one may expect increases in heterogeneity to cause a decrease in success rates of strategic alliances. First, the need for coordination is greater when exchange partners must determine the optimal allocation of effort, given differences in relative common benefits from the alliance activities. Second, heterogeneity among alliance partners increases the perception of opportunistic behavior by exchange partners, even when none may be present. Heterogeneity increases the potential for misunderstanding and creating divergent expectations among strategic alliance partners (Goerzen and Beamish, 2005). Accordingly, we hypothesize:

> *Hypothesis 2: Alliances in which there is heterogeneity in strategic alliance partners' ratio of common to private benefits will have a lower likelihood of success than alliances where exchange partners are relatively homogenous in their ratio of common to private benefits.*

Communication

The two hypotheses above relate to factors influencing economic incentive alignment and heterogeneity, and focus on what social psychologists term structural solutions to a social dilemma problem (Komorita and Parks, 1994). Importantly, both hypotheses, and Hypothesis 1 in particular, rest on the implicit assumption made by economists: that strategic alliance partners act rationally, and when provided with full information about appropriate economic incentive alignment, gain a complete understanding of the coordination problem that they face.

However, as social psychologists and more modern property rights economists have noted, the strong form property rights theory abstracts away from considerations arising from coordination failure, miscalculation, free-riding behavior, and distributional conflicts (Libecap, 1989; North, 1990; Olson, 1965). The early strong form view had relied on optimization based on economic incentive alignment alone, and made many behavioral assumptions that may not hold in reality. Indeed, in an assurance game context, there is a strong likelihood that the risk dominant strategy overshadows the payoff dominant strategy (Harsanyi and Selten, 1988). Even in the absence of actual opportunistic behavior by any of the strategic alliance partners, the risk and associated fear that others may not contribute toward joint alliance interests may prevent individual decision makers from undertaking actions that will result in alliance success. Suspicion breeds distrust and reversion to competitive rather than cooperative actions. Such coordination costs are further exacerbated by decision-making biases caused by uncertainty (Zajac and Bazerman, 1991), the anchoring and/or framing problem (Kahneman, Slovic, and Tversky, 1982), or by differences in the considerations of *fairness* across strategic alliance partners (Messick, 1991).

In sum, even in strategic alliances wherein decision makers perceive a higher ratio of common to private benefits ratio, lack of coordination due to insufficient common knowledge, differential perceptions of other decision makers' actions, and the *bounded rationality* of the participants to clearly see what actions are in their best interests (Simon, 1947) can result in the *realized* value creation from a strategic alliance falling short of the *potential* value creation. Indeed, Simon's (1957) definition of bounded rationality suggests why a substantial

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gap between realized value creation and potential value creation may occur: 'The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world—or even for a reasonable approximation to such objective rationality' (Simon, 1957: 198) and 'it is only because individual human beings are limited in knowledge, foresight, skill and time that organizations are useful instruments for the achievement of human purpose' (Simon, 1957: 199).

When viewed through classic organization theory or social psychology lenses, strategic alliances may also benefit from incorporation of motivational/design solutions, chief among which is *communication* (Ledyard, 1995; Simon 1947). The fundamental insight from classical organization theory is that effective coordination requires not only monetary incentives, but also nonmonetary rewards, and that both formal and informal managerial communication can increase the likelihood of cooperation and coordination (Barnard, 1938). What sets organization theory apart from much of economics is this emphasis on the nonmaterial, informal, interpersonal, and moral basis of behavior (Scott, 1987). Contemporary organization theory concerning social capital—which can be defined as resources embedded in a social structure that are accessed and/or mobilized in purposive actions—is in many ways connected to classical organization theory (Koka and Prescott, 2002).

Within the context of the strategic management literature, institutional design factors such as the role of both formal and informal communication in achieving cooperation and coordination has been emphasized since Barnard (1938). A key difference between structural solutions (such as economic incentive alignment) and motivational/design solutions is that the former aims to change the underlying structure, such as the economic payoffs associated with the problem, while the latter solutions are more 'intangible,' and attempt to address the institutional design to elicit greater cooperation (Komorita and Parks, 1994; Ledyard, 1995). Importantly, Zeng and Chen (2003) note that communication among alliance partners can potentially offer more cost-effective solutions than structural modifications in economic payoffs, given the high costs associated with altering monetary reward structure, monitoring, and potential restructuring/consolidation of partner businesses.

Communication matters because it can help change strategic alliance partner perceptions of the problem from competitive to cooperative in two distinct ways. First, communication can reduce coordination costs and address management issues related to bounded rationality and decision biases. Strategic alliance research has recognized the role of personal communications among decision makers as a means to achieving cooperation and coordination (Rodan and Galunic, 2004; Zaheer and Venkatraman, 1995). Investing time and effort in improving communication improves economic returns (Adner and Helfat, 2003) by facilitating a *flow of information,* which can clarify expectations and causal connections between individual actions and group outcomes (Kogut, 2000). When decision makers are aware of each other's incentives and orientation toward the strategic alliance, there is an alleviation of fears related to potential exchange partner misconduct. By reducing the possibility of surprises, communication can provide convergent expectations that enhance the coordination and cohesion of the group (Malmgren, 1961; Williamson, 1975). Through communication, managers can minimize the bounded rationality problem through joint problem solving (McEvily and Marcus, 2005). Indeed, prior alliance related research has found a significant positive relationship between inter-partner communication and superior strategic alliance performance (Doz, 1996).

Secondly, communication can engender cooperation through moral suasion, development of group identity, and trust (Komorita and Parks, 1994; Zeng and Chen, 2003). Indeed, Orbell, Dawes, and van de Kragt (1990) underscore the use of multilateral promises in increasing cooperation. These communication efforts may exert *influence* on decision makers since appeals for cooperation may influence the decision, which may be reinforced by identification with the cooperative system (Barnard, 1938; Simon 1947). Communication can thus permit the development of social capital and trust among strategic alliance partners (Gulati, 1998, 1999).

Economists, however, have responded to these critiques by highlighting the possibility of 'cheap talk' (Farrell and Rabin, 1996). In game theoretic language, preplay communication carries no payoff relevant information, it is simply cheap talk and should have no effect on the equilibrium outcomes, particularly if there is a single

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dominant strategy (Ledyard, 1995). Indeed, in the single-period prisoner's dilemma context, there is substantial evidence that communication does not increase the probability of cooperation (Crawford, 1998; Farrell and Rabin, 1996). However, the evidence is mixed for game theoretic settings such as assurance games with multiple Nash equilibria that better represent the strategic alliance context; and several researchers have found significant support for communication enhancing the probability of successful outcomes (Crawford, 1998; Ledyard, 1995).

We posit that communication should increase the likelihood that partners choose the payoff dominant strategy over the risk dominant strategy (Harsanyi and Selten, 1988) when the underlying economic incentives are appropriately aligned. More specifically, we maintain that due to factors highlighted in this section, economic incentives are not by themselves sufficient, and that the addition of communication will significantly increase the rate of successful alliances. Thus:

Hypothesis 3: The effect of incentive alignment on the probability of success in alliances is higher in the presence of communication than in its absence.

METHODOLOGY

We test the above hypotheses using experimental methodology (Kahneman, Knetsch, and Thaler, 1990; Plott, 1982; Smith, 2000). Well established in the social psychology and economics of organization as a fruitful approach for the study of issues pertaining to social dilemma problems (Hazlett, 1997; Poppe and Utens, 1986), and considered commonplace within the economics and social psychology discipline (Kagel and Roth, 1995; Komorita and Parks, 1994; Samuelson, 2005), experiments have also begun to be utilized in the strategic management field (Knez and Camerer, 1994; Song *et al*., 2002). The use of experimental methodology enables us to directly test the theories proposed by implementing different treatments corresponding to each while controlling for factors that may confound with these mechanisms in the real world.

As indicated in the theory section, we model the strategic alliance context as an assurance game. Specifically, we model decision making within a strategic alliance as a threshold 'take some or give some' game, where decision makers either contribute to the alliance for common economic benefit, or use the alliance for private economic advantage. Each participant in the experiment represents a firm making a decision about the extent to which to engage in cooperative activities within their strategic alliance. Each alliance partner has different monetary benefits from the success of the alliance, which affects their decisions concerning how much of the resources to contribute (give) or extract (take) from the strategic alliance. In a series of experiments, we examine the behavior of participants under different assumptions of the ratio of common to private economic benefits accruing as a result of the strategic alliance. We also examine the impact of communication on strategic alliance performance by implementing communication protocols to examine their impacts.

Experimental design

Our experimental design is developed for both external and internal validity. The experiments were designed so that strategic alliance issues grow organically out of the hypotheses that they are designed to distinguish (Kagel and Roth, 1995). Moreover, our experiments involve *induced valuation* of participants (Smith, 1976, 2000)—they are paid for their participation in the experiment in a way that is responsive to the choices they made—to ensure that participants are motivated by the same factors they would encounter in the real world.

For internal validity, we designed a setting where theories about strategic alliance behavior could be tested directly. Five treatments were developed for the experiment, each representing an interaction between economic incentives (ratio of common to private benefit) and communication. (Details of the implementation are provided in the next section.) The first treatment of *low common benefit* represents a scenario where the ratio of common to private benefits is low, that is, none of the decision makers have an economic incentive for the alliance to succeed. Second, we consider a scenario of *high common benefit* of alliance activity, where all of the decision makers have a high common to private benefit ratio, that is, the economic incentives are aligned so that the payoffs when the alliance succeeds are significantly higher for every decision maker than when the alliance is

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not successful. The third treatment of *mixed common benefit* allows for heterogeneity in the ratio of common to private benefit among the alliance partners. For some decision makers, the ratio of common to private benefit is very high, while for others, the ratio is very low.

The fourth and fifth treatments permit strategic alliance partners to communicate with each other. In the fourth treatment of *high common benefit with communication,* decision makers have a high ratio of common to private benefits and can communicate with each other, while in the fifth treatment of *mixed common benefit with communication* decision makers have heterogeneous ratios of common to private benefits, and the ability to communicate with each other. Thus, comparisons between the different treatments permit an assessment of the individual and interaction effects of economic incentives and communication on strategic alliance outcomes.

Experimental procedure

Our experiment involved 405 participants who participated as decision makers in strategic alliances. All participants were business students at a research one institution in the United States, with the majority of the students enrolled in the MBA (regular and executive) program. Specifically, there were 60 executive MBA students, 300 MBA students, and 45 senior-level undergraduate students. Since the undergraduate pool of students was relatively small, convenience in scheduling considerations caused us to mix these students with the MBA students. The executive MBA students had an average work experience of 12 years, while the regular MBA students had an average work experience of four years. The experiments were conducted in the context of coursework in corporate strategy, and the participants were familiar with both the concept of strategic alliances and the key management challenges within this context. As described below in greater detail, the participants were also provided with a realistic description of a learning alliance, to simulate their participation as managers in an alliance setting. Importantly, almost all of these students had been involved in social dilemma settings in their workplace—if not directly in an interfirm alliance setting, in settings that required team synergies and a similar tension between competition and cooperation. Subsequent to the alliance experiments conducted for research, there were additional experimental simulations conducted for pedagogical purposes in an executive education setting (not included in the data to be compliant with Institutional Review Board guidelines). The outcomes in these experiments were consistent with the results reported in the empirical section.

Participation was strictly voluntary, and in accordance with the principle of induced valuation, participants were paid in cash based on their performance. Participants were randomly assigned to one of the five treatments and to their role within the treatment. When they arrived at the laboratory, the participants were seated at a computer terminal. In compliance with Institutional Review Board guidelines, they read and signed a consent form. Participants were provided with a copy of their role-specific instructions, and prior to the start of the experiment, a composite version of the instructions was read aloud. To ensure that participants had understood the instructions, the necessary decisions they were being asked to make, and the resulting payoffs, each participant filled a pre-experiment questionnaire, and the answers to the questions were discussed until there was a consensus on the understanding of the experiment. In particular, the pre-experiment questionnaire explicitly asked the participants to calculate and report payoffs under scenarios where the alliance was successful and where the alliance was not successful. The entire experiment was computer-aided, and implemented using a Web-based Java application; participants input their decisions and were given feedback electronically at the end of each period of decision making. After the experiment ended, participants completed an exit questionnaire describing their experiences.

Participants were informed that they would role play managers who were responsible for allocating resources to their own firm or to an existing, five-firm alliance to which they belonged. Per Zeng and Chen (2003), we model a multiparty alliance rather than a two-person alliance. We designed the study so that participants were (privately) motivated via cash received at the end of the experiment. The experiment involved no deception and thus contamination effects are not a major concern. Further, participants were asked not to discuss the experiment with others.

The experimental context represented a threshold social dilemma game, wherein the common

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benefits are realized if strategic alliance partners meet a certain threshold level of collective contributions (Ledyard, 1995). At the beginning of the simulation, the alliance common pool was endowed with 100 resource units.[1] As members representing decision makers of a five-firm alliance, each participant received 20 resource units (created by their research and development [R&D] staff) in every period. The primary decision concerned how many resource units they chose to give to or take from the alliance common pool. At the end of every period, each alliance member received $1,000 experimental dollars for resources held within their own firm (private benefit).

Furthermore, if the alliance common pool had at least 150 resource units, the strategic alliance achieved a successful outcome and each alliance member received a bonus representing benefits accruing from the strategic alliance activity (common benefit). The common benefits (bonus amounts) were calibrated for the different treatments described above (low, high, and mixed common benefit). While each alliance member knew his or her own bonus, none knew with certainty the bonuses of the other strategic alliance members. However, in each treatment, the alliance members were informed about (a) whether the other strategic alliance members received similar (homogeneous) or different (heterogeneous) bonuses, and (b) the range of the bonuses across all alliance members: whether the bonuses were all high, all low, or a mix of the two. This information was sufficient to determine the type of game the participants faced.

At the end of each period, after the decisions had been made regarding resource transfer to or from the alliance common pool and the members had received their experimental earnings, two events occurred. First, the resources in the alliance pool were depreciated by 33 percent. The depreciation was implemented to ensure that if the strategic alliance threshold of 150 was met, the start of the next period would replicate the conditions for the first period (100 units of resources). Second, a random draw indicated whether the game would continue (80% likely) or end (20% likely) at that period. The random draw enabled us to implement an infinitely repeated game in the lab (with a discount rate of 0.2) avoiding endgame effects (Friedman and Sunder 1994). To ensure compatibility across treatments and to reduce variance, the realization of the continuation probability draws was determined in advance and applied to all five treatments, as recommended in Friedman and Sunder (1994). This random draw resulted in 11 periods, which we used in all treatments.

Implementation of experimental treatments and empirical model

As indicated above, the differences in the ratio of common to private benefit treatments were implemented by differences in bonus structure across the alliance simulations. The details of the implementation of the payoff matrices, the stage game equilibria, and the repeated game equilibria for each treatment are provided in the Technical Appendix. In the *high common benefit* treatment, the bonuses (in experimental dollars) were $35,000 for two of the firms and $40,000 for three of the firms. This bonus ensured that economic incentives made it worthwhile for each of the decision makers to contribute to the strategic alliance; in any one period, it collectively cost the firms in the strategic alliance $50,000 to contribute to the alliance common pool, and they collectively received $190,000 in the form of common benefits (bonuses). These parameters are chosen so as to make it unattractive for any player to take the alliances' resources in any given period as well. By taking, they earn at most $150,000, but they lose their bonuses in this and all future rounds, which occur with an 80 percent chance. Thus, the expected discounted value of the losses is at a minimum ($35,000 +0.8*$35,000 + 0.82*$35,000, ...) = $175,000 > $150,000.

Of course, there is still an economic incentive problem, since each firm would prefer that the *other* firms do the contributing while they free ride (or even worse, take resources), as long as the strategic alliance remained successful. Note that no one firm has an economic incentive (or the resources) to unilaterally contribute 50 resource units to receive the bonuses (costing $50,000 and gaining at most $40,000). Nonetheless, the payoffs are consistent with economic incentives being aligned toward success of the alliance. As in the assurance game, if others are contributing, it is in the best interests of a target firm to contribute as well.

[1] Given the focus on learning alliances, we used the term 'information units' rather than 'resource units' in the experimental simulation. The two terms, however, are interchangeable given the experimental context.

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In the *low common benefit* treatment, the bonuses were \$4,000 for two firms and \$5,000 for three firms. This bonus made it economically inefficient for any of the firms to contribute to the common alliance activity; in any one period, it collectively cost the firms \$50,000 to contribute to the alliance common pool, but their collective common benefit was only \$23,000. Thus, the payoffs in this treatment are consistent with economic incentives *not* being aligned for strategic alliance success.

Finally, the *mixed common benefit* treatment involved heterogeneity among the bonuses received by the alliance members; while three of the firms received high bonuses (\$35,000, \$35,000, and \$40,000), two firms received low bonuses (\$5,000 each). Importantly, the bonus values are still consistent with incentive alignment for the strategic alliance to succeed (\$120,000 of benefits versus \$50,000 of costs); however the heterogeneity in bonuses creates a problem. For instance, were the alliance only among the three firms with high bonuses they could contribute enough to make the threshold and collect their bonuses (the alliance pool shrinks by 50 units each period, and these three members together control 60 units). However, there is an incentive for the low common benefit firms to take the resources in the alliance pool (earning together \$150,000 and losing only their total bonuses of \$10,000), and thus preventing the strategic alliance from succeeding. A successful outcome requires that the members of the strategic alliance configure the optimal amount of contributions so that the low common benefit firms are also better off from alliance success.

The two treatments that permitted communication were implemented via a free-form chat box. For both the *high common benefit with communication* treatment and the *mixed common benefit with communication* treatment, the strategic alliance members had the ability to chat with all of the other members in their strategic alliance, or send private messages to any one alliance member. The 'chat' feature was implemented using a 'chat box' resembling instant messaging, and a record of all prior messages was available for each member as the strategic alliance progressed across periods.

Our primary dependent variable, *alliance success*, is coded as one if the alliance common pool resource units exceeded the threshold of 150 in a particular period, and zero otherwise. Our second dependent variable, *transfer of resources*, is measured as the net amount of resources transferred to the alliance common pool (total giving minus total taking by all alliance members in each period). Our last dependent variable, *resources in alliance* is the total amount of resources in the alliance pool at the end of each period, which is the sum of the residual resources from the prior period (after depreciation) and the net transfer of resources in the current period. As expected, these measures are highly correlated but they capture multiple aspects of the same question: to what extent did strategic alliance members create value?

We note that our unit of analysis is at the alliance rather than the firm level. However there is consistency across the two levels, since the payoffs are higher for each firm if they cooperate rather than compete where there are high or mixed common benefits, and vice versa for low common benefits. Therefore, while there may be relative greater benefits to some firms than others, there are no clear winners or losers if they all play the optimal strategy (i.e., either they all collectively win by cooperating in a high common benefit strategy, or they 'compete' in the form of learning races, and others, in the low common benefit scenario).

The main independent variables in the model include the indicator variables for each of the five treatments described above (e.g. *high common benefit* = one if the observation was drawn from that treatment, and zero otherwise), and the *period* in which the decisions were made. In addition, since the experiments represent hierarchical data (alliance members are grouped together), we include group fixed effects to control for unobserved heterogeneity due to idiosyncratic, group specific factors. We use a logistic regression analysis for our first dependent variable, and multivariate regression analysis for the other dependent variables.

RESULTS

Table 2a provides the distribution of the observations across each treatment type, the number of groups per treatment, and the number of periods in each treatment. We conducted one-way ANOVA tests for homogeneity across the executive MBA and MBA/undergraduate participant pool. As can

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Table 2a. Sample statistics across treatments

	Low common benefit	High common benefit	High common benefit, with communication	Mixed common benefit	Mixed common benefit, with communication
Number of observations	187	165	176	176	187
Number of groups	17	15	16	16	17
Number of periods	11	11	11	11	11

Table 2b. Tests of homogeneity across participant pool

	Low common benefit	High common benefit	High common benefit, with communication	Mixed common benefit	Mixed common benefit, with communication
Executive MBA	0.00	0.19	0.59	0.11	0.22
	(0.00)	(0.15)	(0.24)	(0.11)	(0.18)
MBA[a]	0.00	0.27	0.58	0.10	0.21
	(0.00)	(0.15)	(0.24)	(0.09)	(0.16)
F-statistic[b]	n.a	2.45	0.07	0.08	0.14

[a] Included in this pool are 300 MBA students and 45 senior level undergraduate students. Since the undergraduate pool of students was relatively very small, convenience in scheduling considerations caused us to mix these students with the MBA students.
[b] The critical F-statistic for a 5% level of significance is 3.85, thus the hypothesis that the two samples are drawn from the same population cannot be rejected.

be seen in Table 2b, there is no statistically significant difference in the success rates across the executive MBA and the MBA/undergraduate participants in any of the treatments, justifying our pooling of these two samples.

Tables 3a and 3b provide information regarding the differences in the dependent variables across the treatments, and the results from the formal hypotheses testing are reported in Table 4. In particular, the regressions control for unobserved heterogeneity by including an indicator variable for each group and for the period in which the decisions are made. Consistent with Hypothesis 1, economic incentives do matter, and Panel A of Table 3b shows the difference between the low and high common benefit treatments. In the *low common benefit* treatment where there is no economic incentive to participate in an alliance, alliances never succeeded. On average, less than one unit of resources is transferred to the alliance, and very little of the initial resource stock remains. In stark contrast, in treatments where there is an economic incentive for the alliance to succeed, the alliance success rates are positive. For example, 27 percent of the strategic alliances in the *high common benefit* succeed. The average amounts of resources transferred and the total of resources in the common pool is significantly higher as well. More formally, based on the results in Panel A of Table 4, Hypothesis 1 is supported. Economics incentive alignment is a necessary condition for alliances to succeed, and the coefficient of high common benefit is significant and positive for all three dependent variables.

Furthermore, consistent with Hypothesis 2, heterogeneity in the ratio of common to private benefits reduces the likelihood of success; only 10 percent of the strategic alliances in *mixed common benefit* treatment result in successful outcomes relative to 27 percent in the *high common benefit* treatment (Panel B of Table 3b), and the success rates with communication are 22 percent rather than 59 percent, respectively (Panel C of Table 3b). The formal test of Hypothesis 2 is reported in Panels B and C of Table 4: regardless of whether there is communication or not, the homogeneous *high common benefit* treatment has significantly higher performance than the heterogeneous *mixed common benefit* treatment for all three of the dependent variables in our analysis.

Also, contrary to the optimistic predictions of property rights theory, economic incentives alone are not sufficient. The success rate of 27 percent in the *high common benefit* treatment is a far cry from

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Table 3a. Success rates across treatments

	Without communication	With communication
Low common benefit	0%	n.a.
High common benefit	27%	59%
Mixed common benefit	10%	22%

Table 3b. ANOVA tests across treatments

Panel A. High vs. low common benefit, no communication

	High, no communication	Low, no communication	Chi-squared/F-ratios
Observations	165	187	
Alliance success	27.27%	0.00%	$\chi^2 = 75.75^{**}$
Transfer of resources	13.59	0.47	$F = 9.61^{**}$
	(3.09)	(2.90)	
Resources in alliance	47.00	24.47	$F = 37.37^{**}$
	(3.00)	(2.52)	

Panel B. High vs. mixed common benefit, no communication

	High, no communication	Mixed, no communication	Chi-squared/F-ratios
Observations	165	176	
Alliance success	27.27%	10.11%	$\chi^2 = 17.20^{**}$
Transfer of resources	13.59	3.01	$F = 5.28^{*}$
	(3.09)	(3.37)	
Resources in alliance	47.00	31.78	$F = 13.24^{**}$
	(3.00)	(2.98)	

Panel C. High vs. mixed common benefit, with communication

	High, with communication	Mixed, with communication	Chi-squared/F-ratios
Observations	176	187	
Alliance success	58.52%	21.93%	$\chi^2 = 52.06^{**}$
Transfer of resources	35.40	20.53	$F = 11.27^{**}$
	(2.98)	(3.27)	
Resources in alliance	78.64	55.93	$F = 29.85^{**}$
	(2.90)	(2.91)	

Panel D. High common benefit, with vs. no communication

	High, no communication	High, with communication	Chi-squared/F-ratios
Observations	165	176	
Alliance success	27.27%	58.52%	$\chi^2 = 34.57^{**}$
Transfer of resources	13.59	35.40	$F = 25.92^{**}$
	(3.09)	(2.98)	
Resources in alliance	47.00	78.64	$F = 57.49^{**}$
	(3.00)	(2.90)	

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Table 3b. (*Continued*)

Panel E. Mixed common benefit, with vs. no communication			
	Mixed, no communication	Mixed, with communication	Chi-squared/F-ratios
Observations	176	187	
Alliance success	10.11%	21.93%	$\chi^2 = 9.63^{**}$
Transfer of resources	3.01	20.53	$F = 13.89^{**}$
	(3.37)	(3.27)	
Resources in alliance	31.78	55.93	$F = 33.64^{**}$
	(2.98)	(2.91)	

Standard errors in parentheses; * significant at the 5% level; ** significant at the 1% level.

Table 4. Fixed effects regression

Panel A. High vs. low common benefit, no communication			
Independent variable	Alliance success	Transfer of resources	Resources in alliance
Intercept	—	3.60	55.32^{**}
		(4.18)	(2.21)
High common benefit	1.23^{**}	6.56^{**}	11.27^{**}
	(0.19)	(1.95)	(1.03)
Period	0.35^{**}	0.57	-3.26^{**}
	(0.04)	(0.62)	(0.33)
Observations	352	352	352
Log-likelihood	−134.56		
R2	0.08	0.25	0.74
$\chi 2$/F	$\chi^2 = 22.35^{**}$	$F = 3.25^{**}$	$F = 28.55^{**}$

Panel B. High vs. mixed common benefit, no communication			
Independent variable	Alliance success	Transfer of resources	Resources in alliance
Intercept	—	7.58	61.56^{**}
		(4.94)	(4.27)
High common benefit	0.60^{**}	5.29^{*}	7.49^{**}
	(0.15)	(2.31)	(1.99)
Period	0.05	0.12	-3.67^{**}
	(0.05)	(0.73)	(0.63)
Observations	343	343	343
Log-likelihood	−163.58		
R2	0.06	0.02	0.13
$\chi 2$/F	$\chi^2 = 18.29^{**}$	$F = 5.27^{*}$	$F = 14.07^{**}$

Panel C. High vs. mixed common benefit, with communication			
Independent variable	Alliance success	Transfer of resources	Resources in alliance
Intercept	—	25.47^{**}	73.08^{**}
		(4.37)	(2.84)
High with communication	0.79^{**}	7.42^{**}	11.35^{**}
	(0.11)	(2.04)	(1.33)
Period	0.05^{**}	0.42	-0.97^{*}
	(0.02)	(0.64)	(0.42)
Observations	363	363	363
Log-likelihood	−243.81		
R2	0.09	0.25	0.66
$\chi 2$/F	$\chi^2 = 43.33^{**}$	$F = 3.34^{**}$	$F = 19.10^{**}$

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Table 4. (*Continued*)

Panel D. High common benefit, with vs. no communication

Independent variable	Alliance success	Transfer of resources	Resources in alliance
Intercept	—	22.82**	74.55**
		(3.99)	(2.19)
High with communication	0.66**	10.90**	15.82**
	(0.12)	(1.86)	(1.02)
Period	0.04*	0.28	−1.96**
	(0.02)	(0.59)	(0.32)
Observations	341	341	341
Log-likelihood	−233.39		
R2	0.07	0.36	0.81
$\chi 2$/F	$\chi^2 = 32.48$**	F = 5.65**	F = 43.54**

Panel E. Mixed common benefit, with vs. no communication

Independent variable	Alliance success	Transfer of resources	Resources in alliance
Intercept	—	10.18*	59.87**
		(4.75)	(3.05)
Mixed with communication	0.35**	8.76**	12.11**
	(0.13)	(2.22)	(1.42)
Period	0.22**	0.27	−2.68**
	(0.02)	(0.70)	(0.45)
Observations	363	363	363
Log-likelihood	−161.47		
R2	0.11	0.22	0.61
$\chi 2$/F	$\chi^2 = 60.67$**	F = 2.80**	F = 15.76**

Standard errors in parentheses; group dummies included (not reported); * significant at the 5% level; ** significant at the 1% level.

the theoretical optimum of 100 percent. Even when payoffs would be uniformly higher for everyone if they all cooperated, some individuals choose the risk dominant strategy of not cooperating in almost 75 percent of the cases. Tables 3a and 3b show the importance of communication for successful

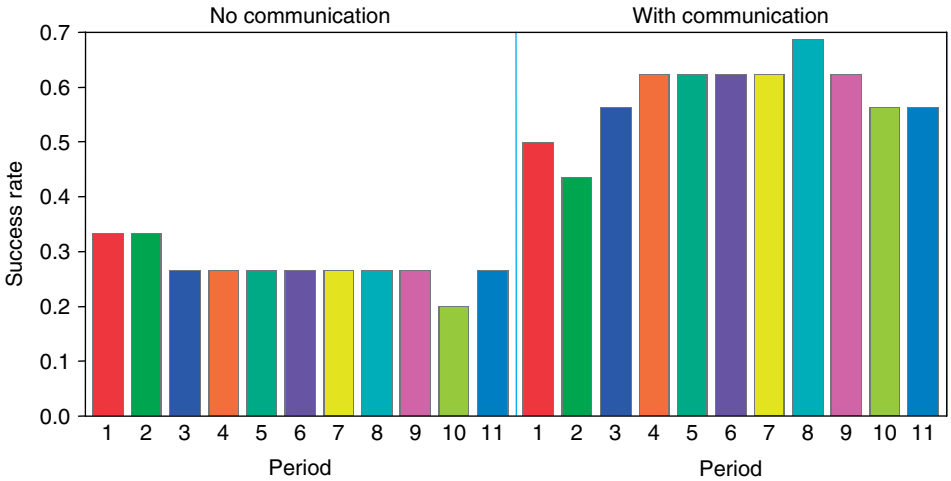

Figure 1. Effect of communication on success rate in high common benefit treatments. This figure is available in color online at www.interscience.wiley.com/journal/smj

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alliance performance. As seen in Panels D and E of Table 3b, when economic incentives are in place, adding communication in the *high common benefit* treatment more than doubles the success rate (from 27% to 59%) and the amount of resources transferred to the strategic alliance (from 13 units to 35 units), and increases the amount of resources contained in the alliance (from 47 units to 78 units). The same effect occurs when communication is included in the *mixed common benefit* treatment. This result is consistent with Hypothesis 3 and is further empirical evidence supporting organizational theory—that is, economic incentives are not, by themselves, sufficient, and the addition of communication significantly increases the rate of successful alliances. The formal tests of Hypothesis 3 reported in Panels D and E of Table 4 show strong support for all three dependent variables in the study.

DISCUSSION AND CONCLUSIONS

Strategic alliances are an important mode of capability development in the face of environmental changes and increases in competitive intensity. However, successful outcomes from cooperative alliances are contingent on exchange partners' decisions to contribute to the strategic alliance. In an attempt to better understand decision making in strategic alliances, our research brings together complementary streams of literature that emphasize the role of economic incentives (as in economic property rights theory) and the role of communication (as in social psychology and classic organizational theory) and tests their relative effects by using an experimental design that permits the isolation of the underlying causal mechanisms. Consistent with property rights theory, we find that aligning economic incentives is necessary for success (Barzel, 1989), but is not sufficient as some would predict (Demsetz, 1967). This finding suggests that a myriad of factors like coordination costs, bounded rationality, and lack of trust in the absence of shared knowledge can create endogenous uncertainty regarding partner actions, and cause realized value creation to be less than potential value creation. While designing the right payoff structure is a necessary condition for strategic alliance success (Khanna *et al*., 1998), it does not seem to be sufficient.

In this context, the ability to communicate significantly increases the probability of success. The results are both economically and statistically significant; communication approximately doubles the rate of strategic alliance success. As depicted in Figure 1, the success rates in the absence of communication are low and relatively constant across periods. If the decision makers did not 'get it right' the first time, the probability of success was very low for the strategic alliance across time. In contrast, communication increases success rates not only in the first period, but also causes success rates to increase as decision makers interact with each other in subsequent periods.

An informal inspection of the communication content of the decision makers revealed that communication allowed strategic alliance members to recover from mistakes and coordinate. The following excerpts from an alliance communication represent the various effects of communication, including but not limited to, creating a shared understanding of the rules, explanation of behavior, and development of trust.

> *Company 5: 'Alliance partners let's aim to maximize profits.'*
>
> *Company 2: 'I think it is beneficial if we all work together.'*
>
> *Company 4: 'If everyone enters 10 every time, there will always be 100 at the beginning of the quarter. Therefore, we can easily reach 150 every time [to make our bonus]. What does everyone think?*
>
> *Company 1: 'There are many [computer] windows to manage; hard to keep an eye on the clock . . . You guys . . . woops, I made a mistake! I am putting 15 now to win back your trust. [Otherwise] revenge will destroy us.'*
>
> *Company 3: 'Yeah, please do not do that again . . . You'll make me paranoid.'*

Thus, in line with classical organizational theory and social psychology, in our setting we believe that communication enables managers to set goals, to coordinate, and to provide initial communications and subsequent feedback. Communication can reduce defection from cooperative outcomes, mitigate problems of bounded rationality

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(Simon, 1947), lessen fears of opportunism (Hennart, 1988), and enable the group to recover from mistakes. Communication also enables leaders of the group to make appeals not to be selfish and to cooperate (Barnard, 1938; Miller, 1992), which seem to work for some of the participants for some of the time.

Our study thus provides a systematic analysis in a laboratory setting of issues encountered in the real world. Consider, for example, the many strategic alliances forged among automobile makers across the globe in the late eighties and nineties. In addition to the GM-Toyota learning alliance that has received some scholarly attention (Inkpen, 2000; Khanna, Gulati, and Nohria, 2000), the popular press has identified many other strategic alliances among U.S., European and Japanese corporations (e.g., Treece, Miller, and Melcher, 1992). While many of these provided less than stellar outcomes, an insightful *BusinessWeek* article by Treece *et al*. (1992) provides rich detail on how the interplay of the mechanisms identified in our study led to the success of the Ford-Mazda alliance over a 13-year period. Beginning in 1979, when Ford partnered with the ailing Mazda to help bolster its economic performance, the strategic alliance helped both corporations achieve synergies by combining Ford's international marketing and finance expertise with Mazda's engineering and product development know-how. Mutual economic incentive alignment was ensured, as exemplified by the following quotes from Treece *et al*. (1992: 102–107):

> *In choosing what to work on jointly, the partners operate on a project-by-project basis, with ideas coming from people throughout both organizations. The main criterion for approving an idea is that it benefits both companies.*
>
> *The Navajo project is indicative of how the relationship works. Back in the spring of 1987, Mazda, which didn't have a sport-utility vehicle of its own, decided it wanted to buy from Ford a modified version of its upcoming Explorer off-road vehicle. Ford was glad to oblige, partly because it was a chance to prove it could be trusted to manufacture Mazda's pickups in 1993.*
>
> *The [Europe] deal would guarantee Ford extra sales for a new car line while giving Mazda access to a key market where quotas limit Japanese imports. . . . [but] "the concern is always there that one party will benefit unfairly from what you're about to do" [David R. Gunderson, Mazda board member].*

However, much of the article describes why this underlying economic alignment was not sufficient in itself. The communication efforts undertaken by both corporations to ensure coordination, relationship management, expectations conformation, and even camaraderie development are illustrated by the following quotes from Treece *et al*. (1992: 102–107):

> *Ford and Mazda can call on some hard-learned principles for managing a successful strategic alliance, . . . many of which would apply to ties in any industry. Underlying them all is the idea that benign neglect is no basis for a partnership.*
>
> *Says Ford President Philip E. Benton Jr.: "There's a lot of hard work in making it work." To help smooth future deals, Ford and Mazda have even developed a set of Basic Business Principles. These tenets outline how to price a deal and how to share development costs, for example.*
>
> *Communication between the two groups could be hard at times, but they did their best to lighten the mood. There was a lot of arm-flailing and miming to get messages across. And one Saturday, as the Mazda group worked in the Louisville plant, the lights suddenly went out and the doors and windows slammed shut. They thought they were locked in for the weekend–until they were introduced to the American tradition of April Fool's Day.*
>
> *What's the secret? "The most important point is for people to meet face-to-face and freely talk,' explains President Wada [Yoshihiro Wada, president of Mazda Motors Corp.]. Much of the credit for keeping everyone talking belongs to the four men who monitor the alliance, W. Wayne Booker, Gunderson, Wada, and Shigeo Kasuga.*

In highlighting the above mechanisms, we also contribute to scholarly work that has built on Williamson's (1975) seminal work, aside from the rich transactions costs insights regarding the role

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of opportunistic behavior, uncertainty, asset specificity, and their interactions in determining the governance form choice among feasible alternatives (Leiblein and Miller, 2003; Villalonga and McGahan 2005). Williamson (1975) also identified other factors that are critical determinants of success, which our study highlights. For instance, Williamson (1975) underscored the presence of bounded rationality in decision making, and that heterogeneity among decision makers further exacerbates difficulties in achieving cooperative outcomes (Williamson, 1975: 239–240). Importantly, Williamson (1975) asserted that the development of *convergent expectations* is a vital managerial role, and that managerial communication promotes convergent expectations by attenuating uncertainties generated when interdependent parties make independent decisions (Malmgren, 1961). While transaction costs theory has emphasized the opportunism problem, our results suggest that greater attention be given to the problem of bounded rationality in alliance and relational contracting. More generally, our empirical results find strong support for the role that economic incentives, bounded rationality, heterogeneity, and communication play in determining successful alliance outcomes, which will hopefully generate new interest and empirical inquiry concerning factors that relate to strategic alliance success. Indeed, the theoretical logic and empirical results presented here can be applied to a large number of strategic contexts including buyer-supplier arrangements, joint ventures, franchising, internal corporate ventures, networks, R&D consortia, technology transfer agreements, and intraorganizational teams (Lerner and Merges, 1998; Phene, Fladmoe-Lindquest, and Marsh, 2006; Roethaermel and Deeds, 2004; Reuer and Ragozzino, 2006; Santoro and McGill, 2005).

Our research study has some limitations, which also open up avenues for future inquiry. Our laboratory setting and use of experimental methodology allowed us to disentangle the relative and interaction effects of the causal mechanisms underlying decision making in strategic alliances, but at some cost of realism incurred by our need to abstract away from the confounding issues that are clearly relevant in actual strategic alliances undertaken by corporations in the real world. For instance, our experiments controlled for selection effects by randomly assigning participants to the different treatments, and did not take into account exogenous uncertainty (either technological or demand driven). Future research examining the role of prior relationships, due diligence in the pre-alliance phase in exchange partner choice, and the use of contractual safeguards can help shed light on the effect of these factors on decision making. In the same vein, our anonymous experimental setting did not permit strategic alliance members to credibly threaten consequences for deviant behavior, and research in this area would be beneficial as well. All of these factors may be important additional criteria for increasing the likelihood of success. This is a particularly important area of further research since our empirical results show that even in the treatments where there were *both* incentive alignment and communication, there was a 40 percent likelihood that the strategic alliance would not succeed. Therefore, our experiment demonstrated that even in the simple game structures that we used, strategic alliance partners may place a nonzero probability that others will not cooperate, and accordingly choose the risk dominant strategy among the multiple Nash equilibria. Exogenous uncertainty may interact with the endogenous uncertainty about alliance partner actions to create additional challenges in the realization of the potential economic value creation, and research that examines such interaction effects would be fruitful.

The use of students as subjects is open to the criticism that students may not emulate the actual decisions of managers in a strategic alliance setting. We think that this concern is somewhat mitigated in our setting for the following reasons. First, the majority of the participants in our experiments had at least four years of work experience. Further, there was no significant difference in the results obtained for groups in which the alliance members were executive MBA's; the average of this cohort was approximately 40 years of age with a minimum of seven years work experience. Many of the executives had also participated in strategic alliance activity as part of their job descriptions. Finally, research in experimental economics has addressed this issue explicitly. Indeed, Dyer, Kagel, and Levine (1989) and Croson and Donohue (2006) find that 'real world' decision makers performed the same or sometimes worse in the laboratory setting than students. Nonetheless, additional research that uses other sampling frames, not just MBA/undergraduate students, would clearly provide additional value to the field.

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We contribute to the extant research literature by examining decision making that leads to alliance success or failure, and, in particular, focus on the relative and interaction effects of economic incentive alignment and communication. In doing so, we integrate across conceptual papers examining strategic alliances that have used either an economic game theoretic lens and highlighted the role of economic incentives (Gulati *et al*., 1994; Khanna *et al*., 1998) or a social psychology lens and highlighted the role of communication as a motivational solution (Zeng and Chen, 2003). By continuing in this under-researched route of examining strategic alliances using the social dilemma paradigm, we contribute to the research literature by developing and testing hypotheses based on some of the propositions of both, and developing novel ones that integrate across the two complementary strands of research. Methodologically, we contribute to the strategic management literature by deploying underutilized but powerful experimental methods to isolate the effects of alternative causal mechanisms; we hope that more researchers use this well-established technique to address additional strategic management issues.

Through the current empirical research, we can appreciate more fully the importance of organization activities that create a shared confidence in one another's cooperativeness (Barnard, 1938; Miller, 1992). In most real-world settings, people do not have a dominant strategy to defect or to cooperate. Instead, cooperation is rational when each person has a high level of confidence that others will cooperate. If an organization fails to gain and maintain convergent expectations of cooperation, the cooperative system can quickly unravel. In a world of limited information processing and bounded rationality (Simon, 1947), communication can be essential for obtaining 'common knowledge' that each strategic alliance partner intends to cooperate, that each alliance partner knows the other exchange partners intend to cooperate, and so on (Schofield, 1985). Thus, our empirical findings underscore Barnard (1938)'s emphasis that building a cooperative system requires inculcating belief in the real existence of common purpose.

In conclusion, by undertaking the integration and testing of complementary theories and underlying mechanisms, we contribute to strategic alliance theory. Consistent with Khanna *et al*.'s (1998) propositions, we find empirical evidence that payoff structures are critical for determining strategic alliance outcomes, and that increased heterogeneity in strategic alliance scope can result in lower rates of success. Thus, an important contribution to the organizational theory literature is that alliance partners need to give close attention to the underlying economics of a strategic alliance, and to ensure that win-win situations are created for all members in the strategic alliance. Furthermore, by integrating key insights from social psychology and classical organizational theory, we make an important contribution to property rights theory; that successful strategic alliance outcomes are more likely when *both* economic incentives *and* communication are present. These two mechanisms are thus complements, rather than substitutes, in determining the success of strategic alliances.

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TECHNICAL APPENDIX: PARAMETERS AND RESULTING EQUILIBRIA

Key characteristics of all treatments

Players	Five players
Endowment	20 units per period
Value	\$1,000 per unit when used for private production
Initial level	100 units in alliance
Threshold for success	150 units
Depreciation	33 percent
Continuation probability	80 percent

'Common benefits' or bonus earned by treatment

Player	Low benefit	High benefit	Mixed benefit
Player 1	4000	35 000	35 000
Player 2	4000	35 000	35 000
Player 3	5000	40 000	40 000
Player 4	5000	40 000	5000
Player 5	5000	40 000	5000

Stage game equilibria

High common benefit treatment:

There are multiple equilibria in this treatment. The payoff dominant equilibrium outcomes involve the set of five managers allocating enough resources for the strategic alliance activities to succeed. As is typical of these situations, there are multiple ways that this goal can be achieved.

For example, consider the unique symmetric payoff dominant equilibrium. Each firm contributes 10 units to the strategic alliance. The strategic alliance collects 50 units over its starting value of 100 units, and therefore meets its threshold for success. Each firm thus earns its own bonus (\$35,000 or \$40,000), plus \$10,000 in private consumption of its remaining units. So payoffs to each firm are \$45,000 or \$50,000 in this equilibrium.

To see that this is indeed an equilibrium of the stage game, consider a unilateral deviation by one player. First note that no firm has an incentive to deviate by contributing more than 10 units. Excess contributions cost the firm (\$1,000 per unit) and bring no additional benefit. Second, consider downward deviations. For example, imagine that a firm decided to contribute zero instead of their equilibrium strategy of 10. Their earnings from private consumption would increase to \$20,000. However, the alliance would not meet its threshold, thus they would not earn their bonuses. This deviating firm would earn only \$20,000 instead of \$45,000 (or \$50,000). No firm has an incentive to deviate by contributing less than their 'share' of 10. Thus this allocation of resources represents an equilibrium of the stage game (and, it turns out, of the infinitely repeated game as well).

Of course, there are *many* equilibria of this game; any outcome in which the strategic alliance is successful and each firm earns at least \$20,000 is a payoff dominant equilbrium. But, these equilibria are differentially attractive to the different players (that is, each firm prefers the equilibrium in which they allocate fewer resources toward the alliance activities and the others allocate more). For example, consider the allocation (20, 0, 20, 10, 0). Exactly 50 are allocated to the strategic alliance, so it succeeds and each firm earns its bonus. Each firm also earns \$1,000 for each unit of information it keeps, thus the net earnings for Firms 1–5 are (\$35,000, \$55,000, \$40,000, \$50,000, \$60,000). Again, no firm wants to deviate by contributing more, as those contributions would simply be wasted. No firm wants to deviate by contributing less, as this would involve the loss of their bonus and result in earning only \$20,000. Thus, each firm is playing a best response to the strategies of the other firms, and this contribution profile is also a payoff maximizing equilibrium (although an asymmetric one). Of course, Firm 5 prefers this equilibrium to the symmetric one, while Firm 1 prefers the symmetric equilibrium to this one. There are many such asymmetric equilibria (in this treatment, 116,601 of them); the task of the firms in the strategic alliance is to coordinate on one. Earnings for each firm range from \$35,000 to \$55,000 (\$60,000), depending on which equilibrium they are in (as can be seen in the asymmetric example above).

There is also a unique (risk dominant) equilibrium in which no resources are allocated toward the strategic alliance activity. Each firm receives \$20,000, yet no firm has an economic incentive to deviate by contributing more. Imagine one firm considering a deviation of contributing all 20 units. They would still not reach the threshold to collect their bonus, and their earnings would reduce to \$0. Given that other firms are playing their part of this strategy, the best response is to also contribute zero.

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Low common benefit treatment:

There is one equilibrium in this treatment where nobody contributes anything toward the alliance. Given that others are not contributing, no individual exchange partner has an economic incentive to contribute unilaterally to the alliance.

Given low common benefits for all players, there are no payoff dominant equilibria in which the strategic alliance is successful. In particular, the most each firm is willing to contribute to the alliance is the amount of its bonus, (4, 4, 5, 5, 5) units = 23 units, not enough to reach the threshold of resources necessary for success.

Mixed common benefit treatment:

As in the *high common benefit treatment*, there is again a risk dominant equilibrium for the mixed benefit where no firm contributes anything (zero). As before, no firm has an economic incentive to deviate from this outcome by contributing, as their contributions would simply be lost and no resources earned.

There are also a series of payoff dominant equilibria, but fewer than in the *high common benefit treatment*. In particular, the symmetric contribution profile of before (where each firm contributes 10) is no longer an equilibrium. While the high-valued firms would be happy with this arrangement, the low-valued firms would each earn only \$15,000 each (\$5,000 from their bonus, and \$10,000 from their retained resources), less than the \$20,000 they would earn if they simply kept their resources.

Still, there are many payoff dominant equilibria of this game; any outcome in which the alliance is successful and each firm earns at least \$20,000 is a payoff dominant equilbrium. For example, consider the contribution profile (16, 10, 20, 4, 0). The alliance is successful, and the firms earn (\$39,000, \$45,000, \$40,000, \$21,000, \$25,000). Each firm earns at least as much as it would by keeping its resources (\$20,000), eliminating the temptation to deviate by contributing less. As before, no firm is tempted to deviate by contributing more, as these resources are simply wasted.

Earnings from the risk dominant equilibrium are \$20,000 for each firm. Earnings from the payoff dominant equilibrium vary between \$20,000 and \$60,000, depending on the firm's bonus level and amount contributed.

Repeated game equilibria

In the preceding analysis we solved for the stage game equilibria of the game. However, we did not consider the possibility of individuals *taking* resources from the strategic alliance, only deviations which involved them not contributing. In order to constrain taking behavior, we rely on the infinitely repeated nature of the interaction.

High common benefit treatment:

Imagine an equilibrium in which four firms are contributing together 50 units to the strategic alliance. The fifth firm is considering playing their equilibrium strategy of contributing zero, or taking the entire 150 units available in the strategic alliance. We assume that all other players will play a *trigger strategy*, that is, once the pool has been harvested, they will not contribute in the future. (Note, this is a reasonable assumption since, even if everyone contributes all 20 units, it will take at least two periods of full contribution to reach the threshold of 150).

If our fifth firm takes the entire common pool, it earns \$150,000 in this period. However, it then loses the bonuses it would have received over the rest of the game. Since the continuation probability is 80 percent, it thus loses \$35,000 + 0.8*\$35,000 + 0.8*35, 000 + . . . = \$175,000 > \$150,000. Thus this fifth firm would prefer to play its part of the equilibrium (contributing 0) to deviating and taking the strategic alliance resources in this treatment.

Note that this example is the worst-case scenario for the equilibrium. We have maximized the amount the deviator can earn from taking (all 150) and assumed the lowest bonus firm (\$35,000). The result is strengthened when we consider the other firms, or lower earnings from taking.

Low common benefit treatment:

In the *low common benefit treatment*, the only equilibrium is an inefficient one. This means that in the first round, each of the five firms has an economic incentive to raid the strategic alliance, and never to contribute again.

Mixed common benefit treatment:

In the *mixed common benefit treatment*, the analysis from *high common benefit* applies to the

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high-valued firms. For the low-valued firms, they instead have an economic incentive to raid the common pool; their losses of the low bonus from raiding are outweighed by the current benefit of the raiding. Thus the challenge for the high-valued firms is to persuade the low-valued firms to leave the strategic alliance pool untouched (at the very least).

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