# “The ex post use of formal contracts in high-tech alliances. A contingency perspective”


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# The *ex post* use of formal contracts in high-tech alliances. A contingency perspective


## Abstract

In this study we investigate key contingencies that determine the active use of a formal contract after the strategic alliance has started. The antecedents for this *ex post* contract use address the contracting process, the need to safeguard spill-over risks and the existence of trust. The model is tested with unique and comprehensive data that were collected directly from a field study of 391 Dutch business managers. The results provide convincing evidence to support our perspective of contractual governance in durable business relationships that strive for the development of new technological knowledge.


**Keywords:** contract use, contract design, spill-over risks, trust, contract clauses, dedicated assets, prior ties.
**JEL Classification:** L10, L14, L22.

## Introduction

This study investigates the governance of high-tech interfirm alliances. The governance of high-tech alliances is a challenge as it needs to balance between realizing benefits and safeguarding risks (Nooteboom et al., 2007; Tether and Tajar, 2008). Although the importance of formal contracts for strategic alliances is acknowledged (Mayer and Argyres, 2004), relatively little is known about whether and how partners actively use formal contracts once the alliance has started. We, therefore, pay ample attention to contingencies that determine *ex post* use of alliance contracts. Such an *ex post* analysis is important because a contract is the only tangible instrument that alliance partners have to regulate an interfirm cooperation in the absence of a formal hierarchy.

There is a subtle but important distinction between the content of the contract and the use of them. Many ongoing debates in the contract literature focus on the former while largely ignoring the latter. Contract studies, for instance, are dominated by the concept of contract completeness and the relationship between that and alliance performance (Grandori and Furlotti, 2006; Okamuro, 2007). Whereas an agreement may take a variety of forms, written or verbal, implicit or explicit, a formal contract refers to such an agreement in tightly written legal forms (Macneil, 1980; Lyons and Metha, 1997). A complete formal contract is a contract that is extensive – that is, all necessary aspects of the relationship are covered – and, specific, that is, the clauses are formulated such that they are verifiable and enforceable (Chen, 2000; Deakin and Wilkinson, 1998). Empirical research on alliance contracts is scarce but the available work presents interesting findings. For example, there is mounting empirical evidence that firms often prefer to rely on 'loose' contracts and verbal promises in their relations with others rather than on carefully planned, detailed contracts, even in highly uncertain and volatile circumstances (Lyons and Metha, 1997).

The findings above point to an empirical anomaly. Contracting theories often have little to say about *ex post* situations of alliance management. Transaction cost economics, for example, argues that particularly in conditions of asset specificity, alliance partners should safeguard to the maximum and write detailed contracts *ex ante* (Williamson, 1985) but it leaves *ex post* situations largely unaddressed. Herein lies our key contribution to the alliance literature: we investigate contingencies that determine the *ex post* use of a contract. It has often been suggested that alliance partners do design contracts but rarely use them because the legal enforceability of contracts may be limited due to contradictory terms in the contract and uncertainties of the legal system (Lyons, 1996), limited specificity of the contractual clauses (Chen, 2000) and the focal firm's dependence on future exchange with the partner firm (Klein Woolthuis et al., 2005). To the best of our knowledge, however, this proposition has not been tested extensively, at least not in the setting of high-tech alliances. In this article we aim to understand whether and why contracts are actively used to manage interfirm innovation processes. The dominant theoretical perspective considers a contract as an *ex ante* governance mechanism. We will investigate whether contracts have an *ex post* function as well.

The next contribution concerns our particular explanations for variations in *ex post* contract use. We study the impact of three contingencies, that is, the contracting process, the need to safeguard spill-over risks, and the existence of trust. We will argue that the process of collaboration plays a central role in the active use of a formal contract. Transaction cost economics (Williamson, 1985) is certainly right that positions need to be safeguarded in strategic alli-

ances. Hence, in line with various studies (e.g., Reuer and Ariño, 2007; Parke, 1993), we will propose that contracts are important instruments to mitigate contemporaneous and future risks (Brousseau and Glachant, 2002). But transactions are also embedded in ongoing alliance relationships. Alliance managers negotiate and agree on contract terms and the atmosphere of this *ex ante* negotiation process determines the *ex post* importance of formal contracts as well. Furthermore, we include the opportunity that trust between alliance partners develops and that this co-determines the need to use formal agreements as well. To summarize, the antecedents for *ex post* contractual governance in our study, therefore, incorporate the atmosphere of the contracting process and trust alongside the need to safeguard positions.

Our final contribution is the particular interfirm alliance that we study. Most contract literature focuses on vertical relationships such as procurement relationships where prices, quantities and qualities can be established and agreed upon (Crocker and Reynolds, 2006; Anderson and Dekker, 2005; Wuyts and Geyskens, 2005). There have been few studies of contracts in high-tech cooperative relationships, where parties have no hierarchical relationship and outcomes cannot be predetermined. Our sample is interesting as the relationships focus on the development of new knowledge (intangible assets); prices and budgets might be difficult to set *ex ante* and the verifiability of tasks and performance are likely to be low (e.g., man hours are specified but the result is still unknown). These differences in relationship characteristics and context, as compared to other contract studies, can encourage new insights into *ex post* studies of contracts and interfirm relationships.

The outline of this paper is as follows. In the next section, we will further explain the theoretical foundations of our study. We present three key hypotheses that explain how the *ex ante* contracting process, the need to safeguard positions and the existence of trust determine the *ex post* use of formal contracts to coordinate high-tech alliances. A discussion of the research methodology and our empirical results will follow. We conclude with an appraisal of the results and suggest avenues for future research.

## 1. Theory and hypotheses

**1.1. Contract design.** The atmosphere of the *ex ante* design of the formal contract is our point of departure. That is, we will argue that the design of a formal contract is the key initial condition for post-formation alliance contract use. The design of a contract is neither static nor one-dimensional. It is the interaction between parties that reveals mutual intentions and beliefs. We analyze the *ex ante* contracting process because the *ex ante* process of negotiating contracts will co-determine the firm's vulnerability to *ex post* problems and hence, the necessity to use formal contractual governance. A limited number of studies indicate that the contract negotiating process influences the subsequent use of a formal contract (Gulati and Singh, 1998; Roxenhall and Ghauri, 2004). Some alliance partners will find it easy to design a contract, whereas others are involved in lengthy discussions and a painfully established agreement (Ghauri and Fang, 2001). In alliances where parties trust each other, they are more likely to reach a 'fair' deal with a fair contract, and experience few troubles in establishing and formalizing the contract. As a result, the (*ex ante*) costs of establishing and formalizing the contract will be lower. This will foster cooperative behavior that will lead to a constructive atmosphere with more openness and little or no destructive conflicts (Ghauri, 1983). In alliances where parties lack trust, the opposite will be the case: contracts will be interpreted merely as a safeguard against opportunism and – as the partners cannot fall back upon relational governance mechanisms such as loyalty and trust – they will have to use the contract to manage the relationship. If the parties during the negotations thoroughly discuss each issue and all the technical details, it may hinder the development of close relations between the parties. Hence, the *ex ante* positive 'shadow of the past' of the contracting process will decrease the *ex post* active use of the formal agreement. So, we formulate:

*Hypothesis 1: More ease with the ex ante design of the contract will result in a less active ex post use of an alliance contract.*

**1.2. Safeguarding positions.** Business relationships in high-tech industries may offer substantial future benefits. Turnover and net profits can grow for many years in succession if companies join forces and manage to introduce new products in global consumer markets. Therefore, joint value creation is the *raison d'être* for the formation of high-tech alliances, and cooperation among partners is a prerequisite for the success. However, such relationships may involve risks and an active use of contracts can be explained by the fact that firms want to mitigate these risks. In this paper we address spill-over risks (Zeng, 2003; Nooteboom, 2004).

Knowledge is a key asset for high-tech companies for which technology development is a core activity. The purpose of a business relationship is to benefit from this firm-specific, path-dependent competen-

cies and resources as it complements the firm's own specialist knowledge and know-how (Nooteboom, 2002). The exchange of specialist knowledge is a prerequisite for the development of new knowledge. However, specialist knowledge is often highly confidential because it is part of the core competence of the firm and, therefore, offers sustainable competitive advantages. Spill-over is not the same as the loss of a resource (like the risk of dedicated assets). Under spill-over the company still owns the knowledge but it is no longer exclusive. There are direct and indirect spill-over risks (Hamel, 1991; Khanna et al., 1998). Direct spill-over risks result when the partner is, or soon will be, a competitor. In high-tech alliances this often is the case. Hagedoorn and Duysters (2002), for example, report that up to half of the alliances in the Merit-Cati database involved competitors, according to the firms in the database (cf. Hagedoorn and Hesen, 2007). Spill-over risk may also be indirect with knowledge spilling over to a competitor via a partner. Furthermore, spill-over risk is closely related to the notion of 'free riding' (Nooteboom, 2004). This entails that in collaboration one benefits from partners without fully contributing to collaboration. In the setting of high-tech alliances, this implies that a company gets knowledge but contributes little. Thus, we argue that in the setting of high-tech alliances contracts are actively used to manage spill-over risks associated with the knowledge exchange essential to innovation. As this specialist knowledge is often the basis of future competitive advantages, firms have a strong incentive to manage risks of spill-over, particularly when the existing or potential partner firm is or could be a competitor. This gives:

*Hypothesis 2: Spill-over risks will result in a more active ex post use of an alliance contract.*

**1.3. Interorganizational trust.** By bringing trust into the equation of contracting behavior, we align our research with the ongoing discussion concerning formal and relational governance (Knights et al., 2001; Nooteboom, 2002). Transaction cost economics denies the importance of trust as a meaningful governance mechanism (Williamson, 1993), but this is in conflict with empirical evidence showing that in interfirm alliances trust exists and has value (De Jong and Nooteboom, 2000): it facilitates joint action (Zaheer et al., 1998), reduces the need for hierarchical control (Gulati, 1995), and is a key condition for the development of new knowledge within and between organizations (Herting, 2002). In this study we focus on interorganizational trust (cf. Dyer and Chu, 2003; De Jong and Klein Woolthuis, 2008) defined as a positive perception of the partner's behavior, that is, the perception by the respondent of the focal firm that a partner organization will not engage in opportunistic behavior even in the face of opportunities and incentives to do so (cf. Hosmer, 1995). We can expect this confidence or perception (trust) where the partner firm a) shows forbearance from opportunism, b) acts with care and concern, and c) the focal firm, hence, shows a lack of monitoring. Zaheer et al. (1998) show that there is a strong correlation between interpersonal and interorganizational trust and that, although conceptually different, it is the latter in particular that improves interfirm performance.

Empirical studies in the alliance literature predominantly analyze the relationship between the trust and the content of a contract. This line of research shows that trust can precede as well as follow contracts (Larson, 1992; Zaheer and Venkatraman, 1995; Poppo and Zenger, 2002). Trust can result from contracts as they limit the possibilities for opportunism (Zucker, 1986). But trust can also precede contracts as trust can be instrumental to open communication and negotiations on all the issues, including the sensitive and, hence, difficult to negotiate ones (Fryxell et al., 2002). Hence, higher levels of trust can increase the details of a contract (the number of clauses as well as the content of each clause) by increased willingness to negotiate and commit to the partner and confirm this in the contract (much like a marriage contract), whereas lower levels of trust would likewise be related to more detailed contracts as the partners seek legal security through the contract as they lack trust in the benevolence of their partner. This could explain why the discussion on whether contracts and trust are substitutes (negative relationship) or complements (positive relationship) is still unresolved. Both trust and distrust can lead to more detailed contracts. The present paper does not deny the importance of these studies but takes another perspective. We suggest that the difference should be expected more often in the active use of the contract. In a trusting relationship parties will have alternative ordering mechanisms at hand (relational governance) to cooperatively manage the relationship and, hence, will refrain from actively using the contract to enforce behavior. We, therefore, expect the following:

*Hypothesis 3: Interorganizational trust will result in a less active ex post use of an alliance contract.*

## 2. Methods

**2.1. Data collection and sample.** This study focuses on business relationships between two or more firms and/or research institutes that operate in high-tech industries (biotechnology, new material development, information technology, maritime technologies and environmental technology). The

lifecycle of R&D in these industries is usually very short. Much of the new technological knowledge quickly becomes outdated, often even before it has been incorporated in new products and/or services. Hence, in the high-tech industries in particular, we find many collaborative efforts between firms, including rival firms. Furthermore, given environmental uncertainty, we expect contracts to operate in this context.

Our research proceeded in three stages. In the preparatory phase of the fieldwork, we conducted twenty-five semi-structured interviews with consultants of the Dutch Ministry of Economic Affairs that were involved in policy programs to stimulate interfirm collaboration on innovation. Additionally, the consultants selected 20 cases (ten successful and ten less successful ones) that we studied in great detail to obtain in-depth knowledge of the high-tech collaboration. Case research is suitable for exploratory research where understanding is the primary objective (Yin, 2003). The 20 cases dealt with collaborative innovation and, hence, involved complex transactions, for which close collaboration between partners was necessary over a considerable period of time. The cases involved legally independent partners that shared costs and benefits more or less evenly. All cases entailed uncertainty and/or complexity, and specific assets, and, hence, risks of dependence, opportunism and 'hold-up'. Under strict confidentiality, we received full access to all documents of the cases – including the interfirm contracts but also project plans, annual reports of the companies involved, personal notes and letters, and half-yearly progress reports – that were available at the Ministry. Among other things, this allowed us to examine the content of the contracts with respect to the clauses that were laid down in the contract and the exact content of each clause. Also, clippings from newspapers and trade magazines concerning the collaborations were collected. To enable comparison between the cases and to ensure the quality of the case analysis, a case protocol was written (Yin, 2003), to describe the alliance's history, development and outcome. The interviews with the consultants were transcribed into interview reports and sent back for verification and agreement. Hence, all of this allowed us to reconstruct the development of high-tech alliances and check the data from the interviews with the secondary sources. We used this information to design our survey. The survey was field-tested using a sample of ten companies involved in R&D alliances. This resulted in a number of modifications to the questionnaire.

In the second stage, a research team conducted telephone interviews with 572 business managers of interfirm R&D collaboration. Prior to these interviews, all managers received an explanatory letter inviting them to participate. We briefed the team on the features of R&D, high-tech industries and interfirm relationships. The team made three attempts to identify and interview the selected respondents. The case firms were identified from a database of Dutch interfirm high-technology alliances published by the Ministry of Economics Affairs. This enabled us to identify the business managers who were responsible for interfacing with the partner firms. They were considered to be the most knowledgeable informants about the interfirm relationships. During the interview main topics such as the history and purpose of the alliance as well as contracts, investments, and industry dynamics were discussed. One of the first questions required the respondents to identify the business partner in the alliance in question. We used this information to cross-validate the information from the database. Because high-tech alliances are typically concerned with specific projects and goals, we also asked the respondents to identify one project that was the most important to the interfirm alliance. By focusing on interfirm collaboration within one sector (high-tech industries), we reduced the range of extraneous variations such as the level of uncertainty or competition that might influence the constructs of interest. Some open questions were added to enliven the interview and to enable the respondents to tell their own story to some extent. In total 50 main questions (often divided in several sub questions) were asked. An outcome of this was that the interviews that were designed to take half an hour would sometimes take up to one hour depending on the respondent.

We obtained 391 useable responses, giving an effective response rate of 68.5 percent. This rate is considerably higher than those observed in prior studies on interfirm relationships that usually is in the 10 to 33 percent range (Parkhe, 1993; Poppo and Zenger, 2002; Subramani and Venkatraman, 2003). It was also satisfactory considering this studies' requirement for direct senior management involvement and the confidentiality of some of the requested information. Although the high level of response from knowledgeable executives that were closely involved in the management of the high-tech collaboration was encouraging, it does not directly address the potential issues of consistency motives and social desirability (Podsakoff and Organ, 1986). When self-reported on two or more variables are collected from the same source at one time, correlations among them may be systemically contaminated. However, for the purpose of this study, reliance on key informants such as our respondents seems to be the only realistic and feasible way to obtain the required infor-

mation (cf. Huber and Power, 1985). We first tested our data for common method variance with the use of Harman's single factor test. The data reported distinct factors with Eigen values greater than one. Additionally, we used the following actions to address possible concerns of validity in stage three of our research.

Secondary data. Available data can be tested for convergence by triangulation with secondary data (Keats and Hitt, 1988). We compared the outcomes of the self-reported data in the questionnaire with the archival data on the 20 cooperative projects that we studied the first phase of the data-collection. The congruence of the data from the questionnaires and case studies supports the accuracy of the reported data.

Questionnaire structure. Via the sequence of our questions we aimed to minimize the effects of consistency artefacts. Whereas Salancik and Pfeffer (1977) suggest letting the independent variable follow, rather then precede, the independent variables, Podsakoff and Organ (1986) argue that correlations will be similar using either method. In our opinion, a life-cycle approach would best serve an accurate reflection of the interfirm collaboration. Hence, for the purpose of this study, we structured the questions in the survey from past interactions through partner selection, contract negotiations, contract execution and outcomes of the interfirm collaboration.

Non-response analysis. The non-response is low (31.5 percent) especially considering that only 10.5 percent actually refused to be interviewed. 20.1 percent could not be contacted within the 3 attempts that the interviewers used to try to get in touch with the respondent. To investigate whether the non-response incurs a bias, the non-cooperating respondents (10.5 percent) were asked for their reasons not to participate. The reasons for refusal were, on the one hand, a lack of time and interest, and, on the other hand, irritation because they had recently cooperated in another survey. Although these reasons can hide their true motive for not participating in the survey (such as an unsuccessful cooperation), the low non-response and the reasons for not participating do not raise serious doubts on the implications of non-response.

**2.2. Constructs and measures.** Table 1 provides an overview of the items that we used to measure the constructs of our theoretical model.

Table 1. Constructs, items and scales

| Constructs, items and scales | Factor loading |
|---|---|
| *Contract use*<br>1. The contract is, after it has been drawn up, actively used to manage the relationship with [name partner]<br>(1 = strongly disagree, 5 = strongly agree) | n.a. |
| *Contract design*<br>1. It was easy to design a contract with [name partner]. | n.a. |
| *Contract details*<br>Please indicate one or more of the following arrangements which are present in the contract with your partner<br>1. Relationship goal and outcome<br>2. Relationship duration<br>3. Project plan of the relationship<br>4. Investments by all alliance parties (knowledge, material, human and financial resources)<br>5. Risk allocation (internal as well as external to possible customers)<br>6. Project's management: which partner has project leadership, when and how do parties inform each other, how do they communicate, and is the project monitored<br>7. Pledge of secrecy: protection of know-how and sanctions in case of monopolizing knowledge and/or breach of the agreement<br>8. Ownership of the final project or technology<br>9. Ownership of the final method<br>10. License agreement concerning the exploitation of all alliance results<br>11. Patent rights of all alliance results<br>12. Relationship adjustments and/or termination arrangements under unforeseen circumstances such as disappointing market potential<br>13. Arrangements how parties will deal in case there are conflicting interests in future<br>(1 = no arrangement indicated, 13 = all arrangements indicated) | n.a. |
| *Dedicated assets, alpha = 0.81*<br>1. For the project with our partner, we need custom made machinery and instruments<br>2. We can also use specific machinery for the projects with other partners<br>(1 = strongly disagree, 5 = strongly agree) | 0.92<br>0.92 |
| *Spill-over risks, alpha = 0.97*<br>1. In our industry it is no problem if another firm observes the things we are working on<br>2. Because our knowledge is difficult to protect, we are very careful in the exchange of knowledge with our partner<br>(1 = strongly disagree, 5 = strongly agree) | 0.82<br>0.82 |

Table 1 (cont.). Constructs, items and scales

| Constructs, items and scales | Factor loading |
|---|---|
| *Interorganizational trust, alpha = 0.78* | |
| 1. We did not feel that we constantly had to keep an eye on [name partner] | 0.76 |
| 2. During the relationship, [name partner] treated our problems constructively and with care | 0.76 |
| 3. I have never had the feeling of being misled by [name partner] | 0.77 |
| 4. [Name partner] tried to reap disproportional gains from the cooperation relative to its input | 0.71 |
| 5. [Name partner] withhold important information from us | 0.74 |
| (1 = strongly disagree, 5 = strongly agree) | |
| | |
| *Prior ties, alpha = 0.81* | |
| 1. Our current alliance is a continuation of a previous, long-term relationship | 0.92 |
| 2. We only knew each other for a short while but thought we could manage the alliance together | 0.87 |
| 3. Before this alliance a friendly relationship had already been established | 0.77 |
| (1 = strongly disagree, 5 = strongly agree) | |
| | |
| *Size focal firm, alpha = 0.82* | |
| 1. What is the number of employees in your firm? (1 = 0-10; 3 = 100-250; 5 > 1000) | 0.92 |
| 2. What is the annual sales revenue of your firm? (1 < 500.000; 3 = 1-10M; 5 > 50M) | 0.92 |
| | |
| *Risk avoidance, alpha = 0.59* | |
| 1. In an alliance we [name own company] try to cover everything in a contract | 0.81 |
| 2. In an alliance with another company we strictly maintain and use the procedures and legal rules that apply in our own company | 0.81 |
| (1 = of very little importance; 5 = of very high importance) | |
| | |
| *Strategic importance of the partner* | |
| 1. [Name partner] supplied us with important information on new technologies | n.a. |
| (1 = strongly disagree, 5 = strongly agree) | |
| | |
| *Relative importance of the contract* | |
| 1. Informal norms and values were in our relationship more important than the formal contract | n.a. |
| (1 = strongly disagree, 5 = strongly agree) | |

The dependent variable "contract use" was measured by one item that directly relates to this construct[1]. We also used a single-item measure for our variable concerning "contract design" that also directly relates to this construct. "Spill-over risks" are measured by two items: one item measures these risks for the industry and one for the focal company in relation to a partner firm. We used five items to measure "interorganizational trust". Our definition characterizes interorganizational trust as a multi-component construct based on three related components: forbearance from opportunism (measured by two items), care and concern (measured by two items) and lack of monitoring (measured by one item). We used three items to measure the existence and nature of prior ties between the alliance partners. Apart from a neutral statement, this includes two items that capture the possible affective nature of the past relationship.

**2.3. Control variables.** We included seven control variables that are recognized as having an influence on the active use of alliance contracts (see Table 1). First, we include "focal firm size" as a variable to control for extraneous factors such as bargaining power and resource base (Reuer and Ariño, 2007). These factors may influence the governance because large firms have more legal resources, experience and staff, and may be more successful in directly extracting hostages than smaller firms. Therefore, they will be less dependent on bilateral governance mechanisms such as contracts to protect their confidential, proprietary knowledge and their business interests. Two items were used to measure the size of the focal firm, i.e., the number of employees and annual turnover. Second, we include "risk avoidance" as

[1] Depending on the nature of the construct that is measured and the potential ambiguity from the perspective of the respondents, single-item measures may or may not be appropriate. Wanous and Hudy (2001) offer three conditions suggesting the use of such items; namely, when the construct of interest is a) unidimensional rather than multidimensional, b) clear to the respondents, and c) sufficiently narrow. The constructs measured in this study meet these criteria.

a control variable because the willingness to take risks differs among firms and is reflected by the use of formal contracts (Nooteboom, 2002). Firms that are high in uncertainty avoidance need predictability and uniformity; they have a strong preference for codification and the establishment of and the inclination to actively use formal rules (Steensma et al., 2006). We used two items to measure risk avoidance: the inclination to use a detailed formal contract as well as to align with procedures and legal rules in an interfirm alliance. Third, we include the relative importance of an alliance contract over relational governance. By definition, alliance partners might disregard the value of a contract. Our data concerns high-tech alliances between Dutch companies. The trusting and contracting behavior will, thus, reflect the Dutch (or broader continental European) culture in which 'voice' is the prevalent option for solving problems (Bachmann, 1998). We measure "relative importance of the contract" by one item that directly relates to this construct. Fourth, we also assess the "strategic importance of the alliance partner" (Reuer et al., 2006). More specifically, we include the value that the focal firm places on the knowledge that the partner firm has to offer. Companies will be more inclined to actively use the contract for alliances that involve valuable partners because they are more exposed to the hazards of the interfirm alliance. We measure "strategic importance of the partner" by one item that directly relates to this construct. Fifth, we include the level of dedicated assets. In circumstances with dedicated assets, firms become more dependent and, thus, more vulnerable to opportunistic behavior and parties may, therefore, sooner resort to active use of contracts. We used two items to measure "dedicated assets" in terms of partner specific machinery and instruments. Sixth, we control for the existence of "prior ties" between alliance partners. A shared past may reduce the inclination to actively use a contract because prior ties may lead to the development of routines and habituation, independent of trust (Zollo et al., 2002). The final control variable is "contract details". It is possible that the *ex post* use of the contract is determined by the *ex ante* level of detail. The business relations that we analyze are characterized by high uncertainty or complexity, entail substantial alliance-specific investments, and require intensive knowledge transfer. Empirical studies suggest that for these circumstances, alliance contracts typically include clauses safeguarding (intellectual) property rights, determining the management of complex relationships, and clauses relating to future contingencies (Lui and Ngo, 2004; Klein Woolthuis et al., 2005). In our questionnaire we specified thirteen of these clauses. We applied this categorization of contractual clauses because it was tailor-made to our research context. We take the sum of the clauses included in the contract as a measure for the level of contractual detail.

**2.4. Factor analysis and ordered probit analysis.** We performed a two-stage factor analysis for the multi-dimensional constructs (Jöreskog and Sörbom, 1993; 1996). All items for a specific construct meet the regular requirements. The constructs displayed statistically significant item loadings (t-values > 2) that exceeded the threshold value for CFA (factor-loadings > 0.50). The composite reliability for each construct is above the critical value of 0.60 (Bagozzi and Yi, 1988) – except for 'risk avoidance' that reports a Cronbach alpha of 0.59. However, given the satisfactory EFA and CFA results we maintain this construct in our analysis. The Likert-scale questionnaire item that was the source of the dependent variable allowed us to distinguish among ordered outcomes. The ordered logit regression model, derived from the binomial logit model, is appropriate for such dependent variables (McCulagh, 1980; Peterson and Harrell, 1990). We standardized the explanatory variables before entering them into the regression model. The general specification of the ordered logit regression model is:

$$Pr(outcome_j = i) = Pr(k_{i-1} < B_1X_{1j} + B_2X_{2j} + B_kX_{kj} + u_j \leq = k_i),$$

where $u_j$ is assumed to be logistically distributed. The coefficients $B_k$ are estimated, along with the threshold values $K_i$, where $_i$ is the number of possible outcomes. In our research context, the interpretation of the results relates to the likelihood of contract use. A positive and significant coefficient, for instance, indicates that the variable is positively correlated with a greater likelihood that a formal contract will be actively used to manage the interfirm alliance.

## 3. Empirical results

The means, standard deviations and correlations among composite indicators are shown in Table 2. The findings for the relationships between the antecedents and the use of a formal contract are reported in Table 3.

Table 2. Descriptive statistics and correlations [a]

| Construct | Mean | S.d. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Contract use | 2.21 | 1.63 | 1.00 | | | | | | | | | | |
| 2. Contract design | 4.21 | 1.24 | -0.21 ** | 1.00 | | | | | | | | | |
| 3. Contract details | 8.81 | 3.22 | 0.27 ** | -0.15 ** | 1.00 | | | | | | | | |
| 4. Dedicated assets | 4.70 | 3.04 | 0.07 | -0.03 | -0.00 | 1.00 | | | | | | | |
| 5. Spill-over risks | 12.28 | 2.52 | 0.13 ** | 0.06 | 0.16 ** | 0.09 * | 1.00 | | | | | | |
| 6. Interorganizational trust | 22.38 | 3.67 | -0.25 ** | 0.28 ** | -0.05 | -0.03 | 0.01 | 1.00 | | | | | |
| 7. Prior ties | 11.17 | 3.98 | -0.13 ** | 0.12 ** | -0.05 | -0.00 | -0.05 | 0.13 ** | 1.00 | | | | |
| 8. Size focal firm | 6.71 | 2.29 | -0.01 | -0.07 | 0.13 ** | 0.06 | -0.11 * | 0.02 | 0.03 | 1.00 | | | |
| 9. Risk avoidance | 6.09 | 2.48 | 0.16 ** | 0.00 | 0.21 ** | 0.02 | 0.07 | -0.01 | -0.06 | 0.03 | 1.00 | | |
| 10. Strategic importance partner | 3.80 | 1.39 | 0.12 ** | 0.00 | 0.08 | 0.01 | 0.06 | 0.14 ** | 0.02 | 0.09 * | -0.07 | 1.00 | |
| 11. Relative importance contract | 4.15 | 1.20 | -0.17 ** | 0.18 ** | -0.07 | 0.04 | 0.00 | 0.20 ** | 0.14 ** | 0.06 | -0.10 * | 0.04 | 1.00 |

Note: [a] n = 391, * p < .05, ** p < .01.

Table 3. Antecedents of *ex post* contract use in high-tech alliances [a]

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| **Main effects** | | | | |
| Contracting process | | -0.35 *** | -0.37 *** | -0.27 ** |
| | | (0.10) | (0.11) | (0.11) |
| Spill-over risks | | | 0.19 * | 0.21 * |
| | | | (0.12) | (0.12) |
| Interorganizational trust | | | | -0.44 *** |
| | | | | (0.11) |
| **Control variables** | | | | |
| Contract details | 0.57 *** | 0.52*** | 0.49*** | 0.52*** |
| | (0.13) | (0.13) | (0.13) | (0.14) |
| Dedicated assets | 0.22 ** | 0.21 ** | 0.20 * | 0.19 ** |
| | (0.10) | (0.11) | (0.11) | (0.11) |
| Size focal firm | -0.09 | -0.11 | -0.08 | -0.06 |
| | (0.11) | (0.11) | (0.11) | (0.11) |
| Risk avoidance | 0.27 ** | 0.31*** | 0.30*** | 0.30*** |
| | (0.11) | (0.11) | (0.11) | (0.11) |
| Relative importance contract | -0.34 *** | -0.27 *** | -0.28 *** | -0.22 ** |
| | (0.10) | (0.11) | (0.11) | (0.11) |
| Strategic impotance partner | 0.21 * | 0.23 ** | 0.23 ** | 0.28 ** |
| | (0.11) | (0.11) | (0.11) | (0.11) |
| **Model fit** | | | | |
| -2 (log-likelihood) | 891.43 | 828.94 | 826.36 | 810.13 |
| Chi-square | 54.29 *** | 65.26 *** | 67.85 *** | 84.08 *** |
| Cox Snell pseudo-R2 | 0.14 | 0.16 | 0.17 | 0.20 |
| Nagelkerke pseudo-R2 | 0.15 | 0.18 | 0.18 | 0.22 |

Note: [a] n = 391. Standard errors appear in parentheses. * p < .10, ** p < .05, *** p < .01.

Table 3 presents the results of the hierarchical ordered logistic regression analysis. We estimated four models. In addition to the control variables (Model 1), we subsequently added contracting design (Model 2), safeguarding spill-over risks (Model 3) and interorganizational trust (Model 4) to the first model in order to assess the unique contribution of each in predicting contract use. The hierarchical ordered logistic regressions reveal that all antecedents have an independent effect on the active use of alliance contracts when introduced in steps as groups. The addition of the various antecedents leads to a significant improvement of the model fit (changes in Chi-square are 10.97, 2.59, and 16.23 with $p < 0.01$ for Models 2, 3 and 4, respectively). In what follows, we discuss our findings with respect to the results for the final Model 4.

Our empirical results provide convincing evidence for the impact of *ex ante* contract design on *ex post* contract use. The parameter estimate for contract design is positive and significant. Hypothesis 1 is, thus, confirmed ($p < 0.01$). We also find significant support for the safeguarding perspective. Table 3 shows that spill-over risks induce an *ex post* active use of contracts as we expected ($p < 0.10$). Nonetheless, not all knowledge shares the same amount of spill-over risk and this may explain the somewhat modest support (Nooteboom, 2004). The tacitness of knowledge, for example, may decrease these risks. The greater the tacitness of knowledge, the greater the causal ambiguity and hence, the less likely it is that outside firms will understand the 'production process' of that knowledge. It also depends on the absorptive capacity of the recipient firm whether or not it can imitate it to their advantage. In exploration much knowledge is new and tacit and, hence, difficult to absorb. Taken together, this may explain the modest significant support. Our empirical results provide strong support for the substituting effect of interorganizational trust and the active use of contracts. This confirms Hypothesis 3 ($p < 0.01$) and indicates that in the setting of high-tech alliances business agreements are influenced by the social characteristics of the relationship. It supports the

prevailing idea in the sociological literature on interfirm alliances that trust can substitute for contracts and become a superior governance mechanism due to the positive side effects such as constructively solving conflicts and loyalty (Shapiro, 1987).

As for the control variables, our results suggest that many of them have a significant impact on contract use in line with our expectations. In particular, the level of contract detail ($p < .01$), dedicated assets ($p < .10$), risk avoidance ($p < .01$), and the strategic importance of the partner ($p < .05$) will increase the likelihood of *ex post* contract use. The relative importance of the contract versus relational governance decreases the likelihood of *ex post* contract use ($p < .01$) and confirms that this variable offers a benchmark for formal governance per se. Table 3 shows that a shared past between the alliance partners decreases the likelihood of contract use as expected but the effect is non-significant. Apparently, the effects of a shared past do not directly materialize in the active use of a contract. Prior ties may serve to develop trust and, therefore, only indirectly lead to a reduced need for formal governance. The results also indicate that larger firms are less likely to actively use a contract to manage an alliance albeit this effect is non-significant. In summary, we found support for our main effects, while controling for a substantial firm- and relational characteristics. By doing so, we eliminated potentially spurious relationships as well as alternative explanations for *ex post* contract use.

## Summary and conclusion

In this paper, we present a first attempt to explain whether and how alliance partners actively use a formal contract to manage a high-tech alliance. In so doing, we shifted the attention from the *ex ante* content to the *ex post* use of a formal contract. We believe the latter is interesting in its own right: a firm's governance decision does not need to be a once-and-for-all proposition that takes place at the alliance design phase. The antecedents for the *ex ante* content of alliance contracts are increasingly identified in the governance literature (Furlotti, 2007; De Jong and Klein Woolthuis, 2009). The determinants for the *ex post* use of a contract remain relatively unknown. The point of departure in this paper is that the underlying causal structure for the content and the use of a formal agreement is different. Both sets need to be disentangled in order to fully understand the role of a contract in high-tech alliances. Hence, our paper aims to combine initial alliance conditions with post-formation alliance dynamics in order to understand how innovation processes between independent companies are managed.

Explaining the active use of a contract is critical in a global knowledge economy where high-tech alliances remain crucially important in order to survive and obtain sustained competitive advantages. However, many of these high-tech alliances fail, because of, among other things, ambiguity on agreements. The dominant perspective considers contracts to be a necessary but rather inefficient instrument to manage interfirm agreements. As Lyons (1996: 31) states, 'The written word has apparent objectivity, and would be the prime source of evidence in the event of litigation. However, numerous contracts are written … but … might never be invoked even in the event of a dispute.' It has been suggested that an active use of the contract (e.g., by monitoring activities, threat or litigation) may evoke conflict, opportunism and defensive behavior (Goshal and Moran, 1996). Even mentioning the word 'contract' would have reputation effects and harm the relationship. Our study intends to show alliance managers that contracts are important governance instruments not only when things go wrong, but also in the development and management of the relationship. The active use of a contract after the start of an alliance not only entails constraining of behavior but also the enabling and guiding of interfirm cooperation.

Traditionally, contract studies have considered a contract as a static, legal document and have, therefore, paid little or no attention to the active role contracts may play in interorganizational alliances (David and Han, 2004). Transaction cost theory has contributed greatly to the study of interorganizational exchange because it specifies in detail the nature and extent of risk in transactions and provides indications that allow the construction of schemes for 'governing' transactions in such a way that risks are reduced. According to this perspective, contracts, particularly very detailed contracts, are important instruments to mitigate contemporaneous and future risks. Nevertheless, there are empirical contradictions and theoretical limitations to transaction cost economics (Nooteboom, 2004). Not all firms write detailed contracts when they are involved in bilateral exchange. Empirical evidence shows that firms often design limited formal agreements, even in highly uncertain and volatile circumstances, notwithstanding the other studies that confirm the role of contracts in line with the predictions of transaction cost economics.

The behavioral assumption of opportunism is one of the theoretical limitations in transaction cost economics that may explain the empirical anomalies. That is, we suggest that fear of opportunistic behav-

ior by a potential or actual partner and a willingness to trust and reciprocate may both be considered by those designing and implementing contracts to manage interfirm alliances. The assumption that actors have an intrinsic tendency to keep promises is as true as their likelihood to behave opportunistically (Chen, 2000; De Jong and Klein Woolthuis, 2008). Thus, we recommend a more detailed and finely nuanced analysis of formal contracts in studies of high-tech alliances (cf. Das and Teng, 2001). We, therefore, proposed a model that provides a stepping stone for investigating in detail core determinants of *ex post* contract use. We draw attention to, first, the design of the contract. The process of contract negotiation cannot be ignored if one wants to understand the use of a formal contract. Second, we draw attention to the safeguarding of spill-over risks. High-tech alliances may bring substantial benefits to the participating parties but may likewise seriously hamper the economic performance of the organization if positions are misused. Finally, we draw attention to relational governance because alliance partners may have developed (interorganizational) trust.

In the analysis of the *ex post* use of contracts, this article presents unique data. Empirical research on alliance contracts is sparse because they are often subject to confidentiality and, therefore, rarely published. Our study is based on primary data collection from business managers directly responsible for the interfirm relationship and the design of the interfirm contract. The sample included small, medium and large companies. The data enabled us to develop good insight into both factual information and subjective interpretations of the alliance contract. By doing so, our empirical work complements other contract studies, where data derive from, e.g., very large, and, hence, unique, multinationals (Ryall and Sampson, 2009; Robinson and Stuart, 2007), from panel data (Crocker and Reynolds, 2006), game theoretical experiments (Bernheim and Whinston, 1998) or case studies (Klein Woolthuis et al., 2005; Roxenhall and Ghauri, 2004).

Overall, we believe that our approach to the study of contract use is promising. This is supported by the significant empirical findings of our work. We contribute to the understanding whether and how alliance managers actively use a contract to manage interfirm innovation activities. Contracts that are easy to design and interorganizational trust foster a cooperative atmosphere and reduce a need for *ex post* contractual governance. With interorganizational trust we take into account that personal relationships may end, whereas the interfirm alliance continues. This particularly applies to high tech industries, at least in the Netherlands, where the average turn-over of managers and specialized personnel is much higher than in other sectors of the economy. As a result, many different persons have been involved in high-tech innovation between organizations over the years. For that reason, the interfirm context becomes important and the partner organization the object of reference. Spill-over risks induce alliance managers to more actively use the contract after the start of the alliance in order to safeguard their positions. Hence, in line with the key findings of our study we suggest that the process of collaboration plays a central role in the active use of a formal contract. It is not the mere presence or the absence of contracts, or their eventual level of detail that are the only issues. Instead, the focus should be on the active use of the contract, the embeddedness in trustful relationships and the atmosphere in which it is designed.

Of course, given the novel focus on contract use our study cannot be but a first step. In future research we intend to develop the theoretical framework and empirical work. For example, we interviewed one respondent for each interfirm collaboration. Although our respondents were the best-informed parties because they were the managers of the business relationship, it would also be interesting to explore other angles of the alliance from the perspective of the focal firm or the partner firm. In relation to this, our study focused on high-tech alliances in the Netherlands. In due time, samples from other nations such as the United States or Japan as well as other industries would allow a cross-validation of the results presented in this paper and provide the opportunity for analyzing the effects of institutions on the creation and functioning of formal contracts. This new sample may also include different measures, e.g., the content of the contract clauses. Our study does not account for demographic characteristics such as firm tenure and age of the alliance manager or characteristics of the top management team (Finkelstein and Hambrick, 1996). These may also determine the active use of formal contracts to manage an interfirm alliance. A final limitation concerns the dynamic nature of interfirm alliances versus the analysis thereof using cross-sectional databases. Our work is grounded in detailed case-studies that we used to reconstruct the contracting process and to design the survey research. Nonetheless, our cross-sectional sample may or may not provide a substantial picture of a substantive process. A dynamic approach towards the use of contracts is interesting by itself. Given the robust empirical results, our model offers an important point of departure for this.

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