The content and role of formal contracts in high-tech alliances

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ABSTRACT
In this study we investigate the governance structure of innovation processes in high-tech alliances, focusing on the content and role of formal contracts. The design of a formal agreement is one of the most important strategic decisions for alliance partners. Drawing upon transaction cost arguments and social exchange theory, we study the determinants of contractual detail of collaborative agreements in the Dutch high tech industry. The findings confirm important roles for transactional and relational characteristics. We also show that contracts have multiple functions: they are important to safeguard risks but are also used to co-ordinate alliance activities and show commitment; or to safeguard external contingencies. Each of these different dimensions has unique antecedents.

Keywords: contract clauses, contract functions, trust, high-tech alliances

1. INTRODUCTION
This study investigates the governance of high-tech alliances. The governance of high-tech alliances, through legal, private, and relational ordering, is a challenge as it needs to balance between realizing benefits and safeguarding risks (Dodgson et al. 2008; Dodgson 2000; Nooteboom 2004). Our focus is on the role of legal ordering, or formal contracts, in this process. Formal contracts are written, legally binding agreements between two or more parties (Lyons & Metha 1997). They are important instruments for the governance of exchange relations between economic actors because they represent promises or obligations to perform particular actions in the future (Mayer & Argyles 2004). However, empirical research on interfirm contracts is sparse because they are often subject to confidentiality and therefore rarely published. This hampers the understanding of the content and role of alliance contracts.

In this article, we report an in-depth study of 391 contracts of Dutch high-tech alliances. By doing so, we intend to fill the aforementioned research gap.

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 (Lyons 1996). Transaction cost theory (Williamson 1985) 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 (Brousseau & Glachant 2002). Various alliance scholars (e.g.
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Ariño & Reuer 2004; Parkhe 1993; Crocker & Reynolds 1993) provide evidence that complex formal contracts or contracts with many clauses that are strictly specified allow mitigating the risk of opportunistic behaviour. Nevertheless, there are also empirical contradictions (David & Han 2004) and theoretical limitations to transaction cost economics (Dodgson 1993; Nooteboom 1996).

Most importantly, the available evidence suggests that the level of detail of alliance contracts varies greatly. Very simple contracts seem to be able to regulate very complex collaborations. Empirical research of economists on contract clauses in innovation alliances show that in stead of entering into details about future activities, contracts tend to focus on a few core issues (Grandori 2006). This brings many questions. Which provisions do high-tech alliance partners specify in their contract? Does the number of clauses in formal contracts of high-tech collaboration vary and if so, why? What is the role or function of a contract? The key objective of this paper is to answer these questions.

Our research concerning the antecedents of contract details aligns with transaction cost economics but complements this with insights that derive from social exchange theory. We argue that the behavioural assumption of opportunism is one of the theoretical limitations in transaction cost economics that may explain the empirical anomalies (cf. Nooteboom 2002). More in particular, we suggest that fear of opportunistic behaviour by a potential or actual partner and a willingness to trust and reciprocate may be mutually considered by those designing and implementing contracts to manage interfirm alliances.

The study of contracts seems to ignore the human aspects of economic transactions, in particular the development of trust (Dodgson 1992, 1993). Hence, we argue that for a thorough understanding of the content and role of contracts in high-tech alliances we need to account for the development of trust as well as for the safeguarding of positions.

The cooperative nature of the interfirm relationships under study presents an interesting arena for the study of contracts. Contract studies often focus on vertical relationships such as procurement relationships where prices, quantities and qualities can be established and agreed upon (Crocker & Reynolds 2006; Anderson & Dekker 2005).

There have been few studies of contracts in high-tech cooperative relationships, where parties have no hierarchical relationship and outcomes cannot be predetermined (notable exceptions are Robinson & Stuart 2004; Ryall & Sampson 2006). 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 with other contract studies, can encourage new insights into the study 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 draw upon transaction cost economics and social exchange theory to identify key theoretical drivers of the choices that firms make when they design their interfirm agreement. A discussion of the research methodology and our empirical results will follow. We conclude with implications for managers and suggest avenues for future research.

2. THEORETICAL FOUNDATIONS

2.1 Dedicated assets

Dedicated assets is our first antecedent for the level of contractual detail. Dedicated assets are crucially important for the governance of strategic alliances (Poppo & Zenger 2002; Reuer & Ariño 2007; Joskow 1988). Transaction cost economics argues that particularly in conditions of asset specificity, alliance parties should safeguard to the maximum, but at the same time it acknowledges that this might be impossible due to bounded rationality and uncertainty (Williamson 1985). Dedicated assets are the result of dedicated investments and
are required to support the focal alliance. They have, in contrast to general purpose assets, little or no salvage value outside the relationship. That is, when asset specificity is low, resources can be easy deployed to other relationships and continuity of the alliance is therefore not important.

However, when a firm makes transaction-specific investments, it creates dedicated assets, which increase its switching costs and makes the focal firm more dependent. The more dependent the focal firm, the more difficult it is to replace the alliance partner and the more vulnerable it will be to opportunistic behaviour. An alliance manager will find it beneficial to negotiate a more detailed contract when the potential value of loss due to hold-up behaviour exceeds the costs of negotiating safeguards. Therefore we suggest:

**Hypothesis 1:** Asset specificity will result in a more detailed alliance contract.

### 2.2 Spill-over risks

Our second antecedent concerns the risk of spill-over (Inkpen 2000). 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 competencies and resources as it complements the firm’s own specialist knowledge and know-how (Nooteboom 2004). 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. In the setting of high-tech alliances contracts are designed to govern 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 detailed alliance contract.

### 2.3 Trust

By bringing trust into the equation of contracting behaviour, we align our research with the ongoing discussion concerning formal and relational governance (Lane & Bachman 1998; 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 (Nooteboom 1996): it facilitates joint action, reduces the need for hierarchical control, and is a key condition for the development of new knowledge within and between organizations.

In this study we focus on interorganizational trust (Dyer & Chu 2003; De Jong & Klein Woolthuis 2008) defined as a positive perception of the partner’s behaviour, that is, the perception by the respondent of the focal firm that a partner organization will not engage in opportunistic behaviour even in the face of opportunities and incentives to do so. We can expect this confidence or perception (trust) where the partner firm: a) shows forbearance from opportunism, and 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.

Trust and contracts are generally viewed as substitutes (Poppo & Zenger 2002; Reuer et al. 2003). There are two important arguments why trust and formal contracts can be considered as substitutes. First, trust economizes on costly contracts. Alliance managers who trust each other have less inclinations and need to impose control on others. Trust reduces the need to negotiate and specify e.g. tasks, investments, responsibilities, planned outcomes and accountability. Second, it has been argued that detailed contracts may destroy trust, for example by creating suspicion. Fehr and Schmidt (2002), for
instance, argue that contracts should remain less
detailed because this is closer to the implicit and
explicit norms and values of human interaction,
represented by their behavioural preferences. We
therefore expect the following:

Hypothesis 3: Interorganizational trust will result
in a less detailed alliance contract.

2.4 Control variables
We included four control variables in our analysis
concerning the antecedents of alliance contract
details. We include focal firm size as a variable in
our model to control for extraneous factors such as
bargaining power and resource base (Ariño &
Reuer 2004).

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.
Secondly, we assess the strategic importance of
the interfirm project (Reuer et al. 2003). Compa-
nies will design more detailed contracts for
alliances that involve strategically important proj-
ects because they are more exposed to the hazards
of the interfirm alliance.

A similar argument applies to the complexity of
interfirm projects. IT literature suggests that con-
tracts are more detailed according to an increasing
complexity of projects because of a need to avoid
ambiguity and a need for coordination among
alliance partners (Anderson & Dekker 2005).

Our final control variable is risk avoidance,
that is, the willingness to take risks differs among
firms and this is reflected by the level of detail of
formal contracts (Nooteboom 1996).

3. METHODS

3.1 Data collection and sample
This study focuses on business relationships
between two or more firms and/or research insti-
tutes that operate in high-tech industries (biotech-
nology, new material development, information
technology, maritime technologies and environ-
mental technology). The lifecycle of R&D in these
industries is usually very short. Much of the new
technological knowledge quickly becomes outdat-
ed, often even before it has been incorporated in
new products and/or services. Hence, in the high-
tech industries in particular, we find many collabo-
ration 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
25 semi-structured interviews with consultants of
the Dutch Ministry of Economic Affairs that
were involved in policy programmes to stimulate
interfirm collaboration on innovation. Addition-
ally, the consultants selected 20 cases (ten success-
ful 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 inno-
vation 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 con-
tracts 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 maga-
zines concerning the collaborations were collected.

To enable comparison between the cases and to
ensure the quality of the case analysis, a case proto-
col was written (Yin 2003), to describe the alliance’s
history, development and outcome. The interviews
with the consultants were transcribed into interview
reports and send back for verification and agreement. Hence, all this allowed us to reconstruct the development of high-tech alliances and to 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 & Zenger 2002; Subramani & 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 & Organ 1986). When self-reported two or more variables are collected from the same source at one time, correlations among them may be systemically contaminated.

However, for the aim of this study, reliance on key informants such as our respondents seems to be the only realistic and feasible way to obtain the required information (cf. Huber & Power 1985). 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 & 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 simi-
lar 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.

### 3.2 Measures

Table 1 provides an overview of the items that we used to measure the constructs of our theoretical model.

<table>
<thead>
<tr>
<th>Constructs, items and scales</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contract Details</strong></td>
</tr>
<tr>
<td>Please indicate whether one or more of the following arrangements are present in the contract with your partner.</td>
</tr>
<tr>
<td>1. Relationship goal and outcome</td>
</tr>
<tr>
<td>2. Relationship duration</td>
</tr>
<tr>
<td>3. Project plan of the relationship</td>
</tr>
<tr>
<td>4. Investments by all alliance parties (knowledge, material, human- and financial resources)</td>
</tr>
<tr>
<td>5. Risk allocation (internally as well as external to possible customers)</td>
</tr>
<tr>
<td>6. Project’s management: which partner has project leadership, when and how do parties inform each other, how do they communicate, and how is the project monitored</td>
</tr>
<tr>
<td>7. Pledge of secrecy: protection of know-how and sanctions in case of monopolizing knowledge and/or breach of the agreement</td>
</tr>
<tr>
<td>8. Ownership of the final product or technology</td>
</tr>
<tr>
<td>9. Ownership of the final method</td>
</tr>
<tr>
<td>10. Licence agreement concerning the exploitation of all alliance results</td>
</tr>
<tr>
<td>11. Patent rights of all alliance results</td>
</tr>
<tr>
<td>12. Relationship adjustments and/or termination arrangements under unforeseen circumstances such as disappointing market potential</td>
</tr>
<tr>
<td>13. Arrangements how parties will deal in case there are conflicting interests in the future</td>
</tr>
<tr>
<td>(1 = no arrangement indicated, 13 = all arrangements indicated)</td>
</tr>
</tbody>
</table>

**Asset Specificity, alpha = 0.81**

1. For the project with our partner, we need custom made machinery and instruments.
2. We can also use this specific machinery for projects with other partners.
(1 = strongly disagree, 5 = strongly agree)

**Spillover Risks, alpha = 0.97**

1. In our industry it is no problem if another firm observes the things we are working on.
2. Because our knowledge is difficult to protect, we are very careful in the exchange of knowledge with our partner.
(1 = strongly disagree, 5 = strongly agree)
The dependent construct is contract detail. The business relations that we analyse are characterised 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 and spillover (ownership of knowledge, products or methods, pledge of secrecy, sanctions on spillover); clauses determining the management of complex relationships (relationship duration, project management, investments, communication); and clauses relating to future contingencies (environmental uncertainty, relationship adjustments, liability ‘in the event of’) (Klein Woolthuis et al. 2005).

In our questionnaire we specified thirteen clauses that address these issues. We verified these clauses in the exploratory case studies and the document analysis of the high-tech alliance contracts. Hence, we applied this categorisation 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.

We used two items to measure dedicated assets in terms of partner specific machinery and instruments. Spill-over risks are also 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).

<table>
<thead>
<tr>
<th>Constructs, items and scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interorganizational Trust, alpha = 0.78</td>
</tr>
<tr>
<td>1. We did not feel that we constantly had to keep an eye on [name partner]</td>
</tr>
<tr>
<td>2. During the relationship, [name partner] treated our problems constructively and with care</td>
</tr>
<tr>
<td>3. I never had the feeling of being misled by [name partner]</td>
</tr>
<tr>
<td>4. [Name partner] tried to reap disproportional gains from the cooperation relative to its input</td>
</tr>
<tr>
<td>5. [Name partner] withhold important information from us</td>
</tr>
<tr>
<td>(1 = strongly disagree, 5 = strongly agree)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size Focal Firm, alpha = 0.82</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the number of employees in your firm? (1 = 0 - 10; 3 = 100 - 250; 5 &gt; 1000)</td>
</tr>
<tr>
<td>2. What is the annual sales revenue of your firm? (1 &lt; 500.000; 3 = 1 - 10M; 5 &gt; 50M)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strategic Importance of the Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. [Name partner] supplied us with important information on new technologies.</td>
</tr>
<tr>
<td>(1 = strongly disagree, 5 = strongly agree)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To what extent did this project cover basic or applied research?</td>
</tr>
<tr>
<td>(1 = very applied research; 5 = very basic research)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Avoidance Focal Firm, alpha = 0.59</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In an alliance we [name own company] try to cover everything in a contract</td>
</tr>
<tr>
<td>2. In an alliance with another company we strictly maintain and use the procedures and legal rules that apply in our own company</td>
</tr>
<tr>
<td>(1 = of very little importance; 5 = of very high importance)</td>
</tr>
</tbody>
</table>
Two items were used to measure the size of the focal firm, i.e. the number of employees and annual turnover. The complexity and strategic importance of the project were measured by one item that directly relate to the particular construct. We used two items to measure risk avoidance by the focal firm: the inclination to use a detailed formal contract as well as to align with procedures and legal rules in an interfirm alliance.

4. **Empirical Results**

4.1 **Contract characteristics**

The data from our sample show that companies aim for different levels of detail in the contract. About 10 per cent of the respondents used low detailed contracts with less than five clauses included in the arrangement; another 55 per cent used moderately detailed contracts with less than 10 clauses; and 35 per cent used highly detailed contracts with 11 or more clauses included in the contract, although only 13 per cent thereof reported to have all clauses covered in the formal contract. The latter aligns with a highly detailed contract.

Table 2 provides an overview of the relative importance of each contractual clause.

All contractual clauses were found in one of the contracts that we investigated. However, Table 2 shows that there is variation in the relative importance of the contractual clauses. The most important clauses concern those that address the investments of the alliance partners (present in 89.26 per cent of all contracts), the project plan (present in 86.45 per cent of all contracts), the duration (present in 85.17 per cent of all contracts) and the goal of the alliance (present in 84.91 per cent of all contracts). In less than half of all the contracts we find arrangements concerning patent rights, risk allocation, conflict resolution and licence agreements.

4.2 **Contract functions**

Before we present the regression results, we first determine whether ‘contractual detail’ is a unidimensional or a multidimensional construct. For this, we performed a two-stage factor analysis for the thirteen clauses that are included in our research (Jöreskog & Sörbom 1993, 1996). Table 3 reports the results for the exploratory factor analysis and Table 4 for the confirmatory factor analysis.

The exploratory factor analysis produced three factors with eigenvalues greater than one, which together accounted for 54.6 percent of the variance in the data. The confirmatory factor analysis supports these findings: all factor loadings for a particular construct exceed the threshold value of 0.50 and are significant (with t-values > 2). Thus,

<table>
<thead>
<tr>
<th>No.</th>
<th>Contract Clause</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relationship Adjustments and Termination</td>
<td>224</td>
<td>57.29</td>
</tr>
<tr>
<td>2</td>
<td>Ownership - Method</td>
<td>238</td>
<td>60.87</td>
</tr>
<tr>
<td>3</td>
<td>Ownership - Product/Technology</td>
<td>307</td>
<td>78.52</td>
</tr>
<tr>
<td>4</td>
<td>Investments</td>
<td>349</td>
<td>89.26</td>
</tr>
<tr>
<td>5</td>
<td>Risk Allocation</td>
<td>186</td>
<td>47.57</td>
</tr>
<tr>
<td>6</td>
<td>Project's Management</td>
<td>297</td>
<td>75.96</td>
</tr>
<tr>
<td>7</td>
<td>Pledge of Secrecy</td>
<td>318</td>
<td>81.33</td>
</tr>
<tr>
<td>8</td>
<td>Relationship Goal and Outcome</td>
<td>332</td>
<td>84.91</td>
</tr>
<tr>
<td>9</td>
<td>Relationship Duration</td>
<td>333</td>
<td>85.17</td>
</tr>
<tr>
<td>10</td>
<td>Licence Agreement</td>
<td>145</td>
<td>37.08</td>
</tr>
<tr>
<td>11</td>
<td>Patent Rights</td>
<td>191</td>
<td>48.85</td>
</tr>
<tr>
<td>12</td>
<td>Project’s Management</td>
<td>297</td>
<td>75.96</td>
</tr>
</tbody>
</table>

Table 2: Relative importance of clauses in Dutch high-tech alliance contracts.
our analysis provides three different factors or contract dimensions. Below, we offer an interpretation of these dimensions. The interpretation derives from carefully inspecting the content of the clauses that construct a particular dimension.

We interpret the first factor as the traditional safeguarding function of contracts for risks and spill-over. This function of the contract is mainly to limit the incentives towards and opportunities for opportunistic behaviour by one of the alliance partners. The fear of the incentives and opportunities for opportunistic behaviour leads to the design and inclusion of clauses that safeguard ownership and property rights. Hence, clauses with a high loading on this factor concern product or technology ownership, methods, licence agreements, patent rights and confidentiality. The standardized Cronbach’s alpha of this factor (0.77) is satisfactory.

We interpret the second factor as a combination of the coordination and the commitment function of a contract. This contract may be very detailed but will generally focus more on the positive (what we want to achieve and how) than on the negative (which legally enforceable measure we put in place to safeguard property or knowledge and how we take the case to court). Contractual clauses facilitating cooperation, which are interpreted as, for example, technical aids to relationship management – such as minutes from meetings, memoranda of agreements or outlines of the nature of alliances – do not necessarily increase the level of detail of a contract in terms of opportunism preemption. Clauses loading high on this factor concern the goal and outcome of the relationship, the project plan, and its project management. The results show that the coordination function serves to make arrangements that guide the day-to-day management of the interfirm alliance.

Additionally, the clauses that concern the investments of the alliance partners as well as the duration of the relationship also support this factor. These two terms are related to the commitment function of a contract: partners may also use the contract as a tangible expression of their

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**Table 3: Contracts – exploratory factor analysis results**

<table>
<thead>
<tr>
<th>No.</th>
<th>Contract Clause</th>
<th>Safeguarding Risks and Spill-over Contract (Factor 1)</th>
<th>Co-ordination and Commitment Contract (Factor 2)</th>
<th>Safeguarding External Contingencies Contract (Factor 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relationship Goal and Outcome</td>
<td>0.110</td>
<td>0.660</td>
<td>0.220</td>
</tr>
<tr>
<td>2</td>
<td>Relationship Duration</td>
<td>0.096</td>
<td>0.668</td>
<td>0.114</td>
</tr>
<tr>
<td>3</td>
<td>Project Plan</td>
<td>0.096</td>
<td>0.710</td>
<td>-0.042</td>
</tr>
<tr>
<td>4</td>
<td>Investments</td>
<td>0.136</td>
<td>0.696</td>
<td>0.055</td>
</tr>
<tr>
<td>5</td>
<td>Risk Allocation</td>
<td>0.129</td>
<td>0.226</td>
<td><strong>0.727</strong></td>
</tr>
<tr>
<td>6</td>
<td>Project’s Management</td>
<td>0.112</td>
<td>0.668</td>
<td>0.158</td>
</tr>
<tr>
<td>7</td>
<td>Pledge of Secrecy</td>
<td><strong>0.636</strong></td>
<td>0.242</td>
<td>0.248</td>
</tr>
<tr>
<td>8</td>
<td>Ownership - Product/Technology</td>
<td>0.739</td>
<td>0.293</td>
<td>0.106</td>
</tr>
<tr>
<td>9</td>
<td>Ownership - Method</td>
<td>0.735</td>
<td>0.172</td>
<td>0.053</td>
</tr>
<tr>
<td>10</td>
<td>Licence Agreement</td>
<td>0.620</td>
<td>-0.001</td>
<td>0.244</td>
</tr>
<tr>
<td>11</td>
<td>Patent Rights</td>
<td>0.685</td>
<td>-0.002</td>
<td>0.299</td>
</tr>
<tr>
<td>12</td>
<td>Relationship Adjustments and Termination</td>
<td>0.293</td>
<td>0.111</td>
<td><strong>0.726</strong></td>
</tr>
<tr>
<td>13</td>
<td>Conflict Resolution</td>
<td>0.281</td>
<td>0.071</td>
<td><strong>0.762</strong></td>
</tr>
</tbody>
</table>

*Cronbach’s Alpha*: 0.77 | 0.74 | 0.71

*Principal component analysis with varimax rotation and eigen values greater than one (n = 391). Factor-loadings that exceed the threshold value (factor-loadings > 0.50) are indicated in bold.*
trust in each other and their intention to be loyal partners with high levels of dedicated investments and long-term commitments. The contribution of each partner in terms of knowledge, financial and human resources as well as the duration of the relationship are discussed and determined.

Apparently, coordination and commitment go hand-in-hand as our respondents do not differentiate the clauses into separate factors. For that reason we interpret this factor as the ‘coordination and commitment’ function of a contract. The standardized Cronbach’s alpha (0.74) is satisfactory.

We interpret the third factor as the ‘external contingency’ function of a contract. When parties engage in a long-term and complex relationship, parties may put a detailed contract into place to have a framework for how to (re)act if unforeseeable contingencies arise. Time is a crucial aspect in this function, as over time events may transpire beyond the control of the alliance partners but for which they need to be prepared, such as radical new innovations or the hostile takeover of one of the partners. Such issues may be harmful but unlike opportunism do not have this purpose.

External contingency clauses do not take the inclination towards or possibilities for opportunism as their point of departure. In other words, managers are not actively concerned by their counterparts’ opportunistic behaviour at the moment these clauses are designed. However, they are not naive and also acknowledge that unforeseen circumstances affecting the relationship’s conditions or context may arise which could change the parties’ interests and the particularities of the relationship. Clauses loading high on this factor concern the future risk allocation, relationship adjustment and termination arrangements, and conflict mediation. These clauses deal with issues that may arise from within or outside the relationship. The standard-

### Table 4: Contracts – Confirmatory Factor Analysis Results*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relationship Goal and Outcome</td>
<td>0.78 (17.80)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Relationship Duration</td>
<td>0.76 (17.09)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Project Plan</td>
<td>0.79 (17.86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Investments</td>
<td>0.83 (19.26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Risk Allocation</td>
<td></td>
<td></td>
<td>0.74 (15.91)</td>
</tr>
<tr>
<td>6</td>
<td>Project’s Management</td>
<td>0.79 (18.13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pledge of Secrecy</td>
<td>0.92 (22.56)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ownership - Product/Technology</td>
<td>0.92 (23.14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ownership - Method</td>
<td>0.86 (20.39)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Licence Agreement</td>
<td>0.62 (13.29)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Patent Rights</td>
<td>0.71 (16.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Relationship Adjustments and Termination</td>
<td></td>
<td>0.82 (18.15)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Conflict Resolution</td>
<td></td>
<td>0.88 (19.67)</td>
<td></td>
</tr>
</tbody>
</table>

Model Fit
- Goodness of fit index (GFI) 0.98 0.96
- Adjusted goodness of fit index (AGFI) 0.91 0.89
- Normed fit index (NFI) 0.99 0.97
- Non-normed fit index (NNFI) 0.97 0.94

* The estimates derive from LISREL based on the matrix of polychoric correlation coefficients of the binary scales that measure the contract clauses (t-values in brackets, n = 391).
ized Cronbach’s alpha for the items that construct this factor (0.71) is satisfactory.

To summarize, formal contracts between high-tech alliance partners may serve different functions. In our setting of Dutch innovative collaboration we show that contracts may have the function to safeguard positions and spill-over risks; to coordinate alliance activities and to show commitment; or to safeguard external contingencies.

4.3 Antecedents of contract detail and contract functions

Because our items have different scales, we used PRELIS to calculate the matrix of (polychoric, polyserial or Pearson) correlation coefficients and LISREL to estimate the effects of the antecedents and control variables on contract detail and the three different contract functions (Jöreskog & Sörbom 1993, 1996). The descriptive statistics are in Table 5 and the regression results in Table 6 which also provides partial evidence for the transaction cost explanation of detailed contracts.

Our first hypothesis predicted that contractual detail will be greater for alliances involving greater transaction-specific assets. Table 6, however, shows that dedicated assets do not determine the level of detail of an alliance contract (β = 0.01, n.s.). Hypothesis 1 therefore needs to be rejected. But we do find that spill-over risks have a positive and significant effect on contractual detail (β = 0.15, p < 0.01). The greater the risks of spill-over, the greater the number of contractual provisions built into the alliance contract. This confirms Hypothesis 2.

Our third hypothesis suggested that interorganizational trust can substitute for detailed alliance contracts. Table 6 shows that interorganizational trust does reduce the need to specify many details but the effect is not significant (β = -0.06, n.s.). Hypothesis 3 is thus rejected. As for the control variables, our results suggest that large firms strive for more detailed contracts (β = 0.14, p < 0.01). The same applies to the complexity of the interfirm projects: the more complex the interfirm project, the more detailed the interfirm contract (β = 0.19, p < 0.01).

We cannot find significant evidence for the strategic importance of the project to the focal firm and alliance contract detail (β = 0.06, n.s.). However, risk aversion of the focal firm is an important antecedent because it makes the alliance contract more detailed (β = 0.18, p < 0.01). Hence, these results confirm valuable insights from transaction costs economics for the governance of high-tech alliances. More detailed contracts are needed to safeguard positions not so much due to dedicated assets but more because valuable knowledge is at stake and spill-over risks need to be reduced. The results cannot confirm that in the setting of high-tech alliances, business agreements are influenced by the social characteristics of the relationship.

We continue our analyses and determine whether our antecedents have significant relationships with the different contract functions. Three findings are worthwhile highlighting. First of all, Table 6 shows that the overall construct for alliance contracts masks the true influence of dedi-

Table 5: Descriptive statistics and correlations*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Mean</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dedicated Assets</td>
<td>4.70</td>
<td>3.04</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Spill-Over Risks</td>
<td>12.28</td>
<td>2.52</td>
<td>.10 *</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Intergroupizational Trust</td>
<td>22.38</td>
<td>3.67</td>
<td>-.04</td>
<td>.02</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Size Focal Firm</td>
<td>6.71</td>
<td>2.29</td>
<td>.07</td>
<td>-.06</td>
<td>.02</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Complexity Project</td>
<td>3.51</td>
<td>1.22</td>
<td>.04</td>
<td>.01</td>
<td>-.05</td>
<td>-.03</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Strategic Importance Project</td>
<td>4.07</td>
<td>1.12</td>
<td>.05</td>
<td>.27 *</td>
<td>-.07</td>
<td>-.18 *</td>
<td>-.03</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Risk Aversion</td>
<td>6.09</td>
<td>2.48</td>
<td>.02</td>
<td>.06</td>
<td>-.01</td>
<td>.03</td>
<td>-.06</td>
<td>.02</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>8. Contract Completeness</td>
<td>8.81</td>
<td>3.22</td>
<td>.01</td>
<td>.17 *</td>
<td>-.04</td>
<td>.13 *</td>
<td>-.21 *</td>
<td>.09</td>
<td>.20 *</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*n = 391; * p < 0.05; ** p < 0.01
TABLE 6: ANTECEDENTS OF CONTRACT DETAILS AND CONTRACT FUNCTIONS*

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Antecedents</th>
<th>Control Variables</th>
<th>adjusted $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alliance Details (Model 1)</td>
<td>Contract Functions</td>
<td>(Model 2)</td>
</tr>
<tr>
<td></td>
<td>Dedicated Assets</td>
<td>0.01 (0.71)</td>
<td>0.16 ** (3.19)</td>
</tr>
<tr>
<td></td>
<td>Spill-Over Risks</td>
<td>0.15 ** (3.09)</td>
<td>0.16 ** (3.21)</td>
</tr>
<tr>
<td></td>
<td>Interorganizational Trust</td>
<td>-0.06 (-1.12)</td>
<td>0.03 (0.67)</td>
</tr>
<tr>
<td></td>
<td>Size Focal Firm</td>
<td>0.14 ** (2.84)</td>
<td>0.21 ** (4.32)</td>
</tr>
<tr>
<td></td>
<td>Complexity of Project</td>
<td>0.19 ** (3.98)</td>
<td>0.07 (1.49)</td>
</tr>
<tr>
<td></td>
<td>Strategic Importance Project</td>
<td>0.06 (1.19)</td>
<td>0.09 * (1.71)</td>
</tr>
<tr>
<td></td>
<td>Risk Aversion</td>
<td>0.18 ** (3.71)</td>
<td>0.07 (1.46)</td>
</tr>
</tbody>
</table>

* n = 391; t-values in brackets; * p < 0.05; ** p < 0.01

...cated assets. Dedicated assets is an important determinant for safeguarding contracts (Model 2; $\beta = 0.18, p <0.01$). The disaggregate analysis thus suggests that firms use more safeguarding provisions in their contract as asset specificity increases.

The presence of dedicated assets has no impact on use of the contract for the coordination of the alliance activities or for the safeguarding of external contingencies. Likewise, Table 6 reports that spill-over risks increase the number of safeguarding clauses in an alliance contract (Model 2; $\beta = 0.16, p <0.01$) as well as the number of clauses that address external contingencies (Model 4; $\beta = 0.17, p <0.01$). In other words, the greater the risks of spill-over, the more the alliance partners discuss and agree upon clauses that aim to reduce these risks.

Secondly, the disaggregate analysis identifies an important and significant role for interorganizational trust. Specifically, interorganizational trust between alliance partners lead them to specify fewer provisions relating to the coordination of the alliance and showing commitment (Model 3; $\beta = -0.11, p < 0.01$). Trust has no impact on the number of safeguarding provisions that firms include in the contract. This is an interesting finding and partly confirms Williamson's (1985) view on the limits of trust for interfirm organization. It replaces ‘weaker’ provisions but not the safeguarding clauses. Interorganizational trust helps alliance partners to e.g. improve the understanding of each others’ business cultures and habits and to improve mutual communication but, surprisingly, this does not materialize in the management of risks. In other words, interfirm governance of high-tech innovation activities may benefit from trust but cannot do without formal agreements.

Thirdly, Table 6 shows that each group of contract clauses has unique determinants.

When we group the significant antecedents we find explanations for each peculiar function of a
contract. In a first situation, represented by Model 2, we find that a high-tech alliance with a large firm that executes a strategically important project – including substantial dedicated assets and spill-over risks – will discuss and subsequently include many safeguarding provisions in the formal agreement. In a second situation, represented by Model 3, we find that a high-tech alliance with a large firm that is risk-averse and that operates a complex project will review and include co-ordination and commitment provisions. At the same time, these alliances will benefit from interorganizational trust. In a third situation, represented by Model 4, we find that a high-tech alliance with a large and risk-averse firm that operates a complex and strategically important project – including spill-over risks – will have many debates on unforeseeable contingencies. They include these provisions in the contract.

5. Appraisal

5.1 Implications for managers

The present study has important implications for alliance managers who are, or soon will be, involved in a strategic (high-tech) alliance. First, our study informs alliance managers on the content of an interfirm contract. 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.

However, many of these high-tech alliances fail, because of, among other things, ambiguity on agreements. That is, disappointing alliance performance is often not only due to the lack of crystal clear agreements on e.g. goals, investments and communication, but also because these agreements are not specified in a formal contract. Oftentimes alliance managers are informed by their company lawyers who tend to focus on safeguarding risks and spill-over.

Our clauses provide an overview of alliance issues that go beyond that. These clauses derive from business practice. Our study confirms the relative importance of each of these in a large scale sample of 391 high-tech alliances and by doing so, offers a best-practice situation. This is helpful for large companies that either have contract expertise in-house or have the financial resources to hire outside legal support. Our clauses offer an opportunity to crossvalidate the content of their (standard) contracts. For small and medium sized enterprises they offer a point of departure should they not have contract expertise and/or a benchmark opportunity for existing contracts.

Second, our study shows alliance managers that contracts are important not only when things go wrong, but also in the development and management of the relationship. Managers need to be aware of the different functions of a contract. It is not just a legal document that others can take care off. On the contrary, it is one of the most essential parts of the relationship, with different stages and, similar like trust, one that can make or break the interfirm alliance. The three functions that we identified in this study can be envisaged as a reflection of the process of negotiation and the stages of commitment that the parties go through. The concerns of safeguarding risks and spill-over may play a particularly prominent role when entering an agreement. The coordination and commitment function is not concerned with opportunism but is designed to coordinate the often complex tasks undertaken in interorganizational alliances and to show loyalty to the alliance. The final function of safeguarding external contingencies is also unconcerned with any direct fear of opportunism.

Although not implemented naively, its function is to safeguard the parties from that which might occur if the relationship or its context changes over time. Thus, in line with the findings of our study we suggest that the process of collaboration plays a central role in the design and implementation of a formal contract. It is not the mere presence or the absence of contracts, or their eventual detail that are the only issues. Instead, the focus should be on the aim and content of the contract and the atmosphere in which it is set out.
Third, we suggest that alliance managers self rather than company or outside lawyers need to design and manage the interfirm contract. Lawyers are not the most appropriate parties for alliance contracts because they have a biased focus – i.e. only safeguarding positions – and often perceive alliance contracts as one-shot documents designed at the start of the relationship (note that alliance managers need to avoid this pitfall themselves as well).

Lawyers and alliance managers can break trust by putting too much emphasis on the wrong issues at the wrong time. Alliance managers of an interfirm collaboration can make contracts subject of discussion by emphasizing that different phases of the relationship require different items to be dealt with. Thus, the meaning of a contract generally changes over time (cf. Nooteboom 2002). If we consider the development of a relationship as a process in which positive and negative behaviour can change the relationship atmosphere – as suggested in the literature by Zand (1972) and Deutsch (1973) – the writing and signing of a contract should also be envisaged as a step in this development. Contracts can, just like trust, be seen as both a cause and result of cooperation. Negotiating the contract can be seen as a process of getting to know and understand each other. Signing the contract can be seen as an act of commitment.

Alliance managers can monitor this ongoing process of contracting by, for instance, categorizing and timely discussing particular sets of clauses so that they are addressed in the appropriate negotiating atmosphere.

5.2 Limitations and future research

We emphasize that improvements could and should be made in future empirical research that aims to understand the role and content of contracts behaviour in the management of (high tech) interfirm alliances. Some of the limitations of our research are generic, and have also been identified in other, related organization research. We collected cross-sectional data from business relationships in high-tech alliances in the Netherlands. The data concern alliances between Dutch companies. Their contracting behaviour will thus reflect the Dutch (or broader continental European) culture in which ‘voice’ is the prevalent option for solving problems and cases are seldom taken to court (cf. Bachmann 1998). This choice limits the ability to generalize from our results. Also, 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, this means we did not explore other angles of the relationship from the perspective of the focal firm or the partner firm. A final limitation concerns the dynamic nature of contracting behaviour versus the analysis thereof using cross-sectional databases.

Taking these limitations into account, we envisage the following opportunities for future research into alliance contracts. First, given the lack of empirical research on contracts, any new sample would add to our understanding of this important phenomenon. A cross-validation of our key findings with data from Anglo-Saxon countries such as the United Kingdom or the United States would provide opportunities for analysing the effects of institutions on the role and content of formal contracts. New data from Dutch high-tech alliances would allow to test whether contract functions in the same sector and country change over time. In line with this, future research may also analyse whether and under what conditions contracts are actually used to manage interfirm alliances.

Second, we challenge the general validity of the ‘self-interest’ assumption in transaction costs and contract theory. Following Das & Teng (2001), a key premise of our research is that economic exchange also incorporates social elements that are built on personal foundations in which reciprocity and affection as well as self-interest play a role.

Recent empirical studies confirm this by showing that about half of the people are completely selfish, whereas the other half exhibit egalitarian or even altruistic preferences. In other words, the assumption that actors have an intrinsic tendency to keep promises is as true as their likelihood to
behave opportunistically (Chen 2000). We plead for future research that looks at how the study of interorganizational governance (contract, control, trust) changes if these different assumptions of human behaviour are taken as point of departure.

Third, we believe that our results have implications for the ongoing trust–control discussion (Ryall & Sampson 2006). In many studies trust and formal contracts are often seen in contradiction – economists advocate the superiority of formal control mechanisms and social scientists maintain the crucial importance of trust and social capital in governing relationships. Our research methods could open a new path that allows a combination of these two perspectives.

Future research may also account for demographic characteristics such as firm tenure and age as well as contract management skills of the alliance manager or characteristics of the top management team (Finkelstein & Hambrick 1996). These may also determine the role and content of contracts in (high-tech) alliances.

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References


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