Fostering Incremental and Radical Innovation through Performance-Based Contracting in Inter-Organizational Relationships

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Abstract

In addition to internal innovation, inter-organizational relationships (IOR) have become an increasingly important source of innovation. Such IORs are usually governed by contracts that provide safeguards to opportunistic behavior and failures, yet the majority of contracts are not conducive to innovation. Nevertheless, anecdotal evidence suggests that innovation in IORs can be fostered by applying performance-based contracts (PBCs); yet, to date, our understanding of the underlying mechanisms is limited. This study combines transaction cost economics and agency theory to develop a theoretical model that explains how and under what conditions PBCs lead to innovation. More specifically, we investigate how the two main features of PBCs—low term specificity and rewards that are tied to performance—affect incremental and radical innovation using data on 106 IORs from the Dutch maintenance industry. We find that term specificity has an inverse-U-shaped effect on incremental innovation and a negative effect on radical innovation. Furthermore, pay-for-performance has a stronger positive effect on radical innovation than on incremental innovation. Finally, contrary to our expectations, we find a positive moderation effect of the partner's degree of risk-aversion on the relationship between pay-for-performance and both types of innovation. We also found that this moderation effect is stronger for radical than for incremental innovation.

Keywords: Innovation, incremental innovation, radical innovation, inter-organizational relationship, contract, performance-based contract, term specificity, pay-for-performance

INTRODUCTION

Innovation (both radical and incremental) in products and services is critical for firms to gain and sustain competitive advantage and hence crucial for the long-term survival of an organization (Brown and Eisenhardt, 1995; Faems et al., 2005; Hecker and Ganter, 2013; Hollen et al., 2013). Organizations may engage in internal innovation through for example internal development and R&D. However, a focus on internal innovative capabilities may limit the organization in dealing with change since e.g., organizations may not have all the resources that are necessary to succeed in complex environments (Chesbrough, 2006; Vanhaverbeke et al., 2008). As a consequence, external partners, such as suppliers have become an increasingly important source of innovative solutions, ideas, and technologies (Chesbrough et al., 2008), and are believed to enhance or even drive innovation (Faems et al., 2005; Goes and Park, 1997; Hamel, 1991; Teece et al., 1997).

In spite of these positive effects of partnering with external organizations, inter-organizational relationships (IORs) may also suffer from opportunistic behavior or coordination failures that impede the efforts of even well-intentioned parties (Gulati et al., 2005; Malhotra and Lumineau, 2011; Walker and Weber, 1984; Williamson, 1985). These hazards might inhibit innovation if they are not governed properly, and organizations therefore turn to governance mechanisms (i.e., formal governance such as contracts, and relational governance such as trust) to safeguard the inter-organizational collaboration from opportunistic behavior and failures. However, compared to studies into relational governance which has extensively studied the performance effects of relational governance, research on how contracts affect performance is limited (Schepker et al., 2014), especially in relation to innovation, a fundamental yet under-researched element of the value-creating potential of inter-organizational relationships (IORs) (Faems, Van Looy, and Debackere, 2005; Wang,

Yeung, and Zhang, 2011). The research that does exist is largely inconclusive: while some authors claim that contracts positively affect innovation (Johnson and Medcof, 2007; Wang et al., 2011), others have found no evidence for this effect (Gopal and Koka, 2010).

We therefore study the effects of contracts on innovation[1], more specifically, the effects of Performance-Based Contracts (PBCs). PBCs, which are predominantly used in the context of partnering with organizations that deliver services, are contracts that arrange for the *outcome* of the transaction rather than prescribing how to perform the transaction or what resources to use (Kim, Cohen, and Netessine, 2007; Randall. Pohlen, and Hanna, 2010). PBCs are characterized by low term specificity and the partner's[2] rewards that are to a large extent linked to the degree in which outcomes are achieved. The first refers to the extent to which contractual clauses related to obligations and behavior are specified in detail (Arino and Reuer, 2004; Furlotti, 2007; Luo, 2002). The second refers to the extent to the degree to which payment of the partner is dependent on partner performance, and relates to the incentives structures incorporated in the contract. Our motivations for focusing on PBCs are twofold. First, PBCs have been claimed to positively affect innovation (Kim et al., 2007; Martin, 2002; Ng and Nudurupati, 2010)[3], but this claim lacks empirical validation. Second, as PBCs are increasingly being adopted by practitioners (Hypko, Tilebein, and Gleich, 2010; Martin, 2002) with varying degrees of success, an empirical investigation of their effects is needed to guide effective contracting behavior.

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[1]Note that our focus on contracts does not entail that we argue that relational governance is not important in IORs. Given the large amount of research that has already been conducted on the performance effects of relational governance, we take a different view by studying if and how contractual governance affects performance outcome.

[2]An IOR can take many forms, such as joint ventures, joint production, contracted RandD, and a long term buyer-seller relationship. In this paper, we address our research question from an intra-IOR perspective. Thus: 'focal firm' refers to an organization within the IOR (e.g., a buyer), and 'partner' refers to the partner of that focal firm (e.g., a seller). Finally, the phrase 'parties' refers to the two organizations that are part of the IOR (e.g., the buyer and the seller that form the IOR).

[3] Note that we focus here on (performance-based) contracts in general, where contracted activities or performance (e.g., delivery, quality) may or may not be accompanied by innovations. This as opposed to innovation contracts (Beneito, 2006; Gilson, Sabel, and Scott, 2009), where innovation is the sole performance outcome.

Our analysis of PBCs is informed by the literature on incomplete contracting. Like any contract, PBCs are usually incomplete in that they do not include contractual terms for all possible future events (Saussier, 2000; Williamson, 2008), simply because these events cannot be foreseen or efficiently described (Hart and Moore, 1999; Mayer and Argyres, 2004). Relative to more complete contracts, incomplete contracts (such as PBCs) have two elements that offer important benefits. First, they are more flexible in the sense that they allow for contingency adaptability (i.e., they allow the partner to make changes deemed necessary to deal with unforeseen circumstances) (Bernheim and Whinston, 1998; Luo, 2002). Second, they provide the partner with more freedom to organize the processes surrounding the transactions in the way it thinks best (i.e., low degrees of term specificity) (Bernheim and Whinston, 1998; Luo, 2002).

However, the problem with incomplete contracts is that they do not sufficiently address the transaction characteristics that may result in opportunistic behavior (Williamson, 1985). From a TCE perspective, this partner opportunism[4] should be countered by opting for a more complete contract. This however may negatively affect innovation, because more contractual detail restricts the partner's freedom to identify new solutions. Alternatively, AT suggests that the problem of opportunistic behavior may be solved by implementing incentive structures through e.g., linking the partner's rewards to its performance (Eisenhardt, 1989). Thus, these two theories provide different solutions for curbing opportunism, with differing consequences for innovation. We thus need to consider these theories collectively rather than separately to understand the effects of (incomplete) contracts on innovation. Interestingly, the

[4] Note that we consider opportunism to be those activities that relate to maximizing the partner's profit and may or may not be disadvantageous for the focal firm or the IOR.

typical characteristics of PBCs (i.e., low term specificity and rewards that are linked to performance) allow for the interdependent application of both solutions.

We thus draw on TCE and AT to characterize the features of PBCs and hypothesize how these features affect innovation. We make a distinction between incremental and radical innovation as various authors have asserted that organizational antecedents that are favorable for one type of innovation may be unfavorable for the other (de Brentani, 2001; Koberg, Detienne, and Heppard, 2003). Nevertheless, empirical studies have provided mixed results (Jansen, Van Den Bosch, and Volberda, 2006), leaving us with inconclusive evidence on the impact of formal governance on different types of innovation. Whereas radical innovation entails developing a new product/service or making a fundamental change in the configuration of existing products/services, incremental innovation involves minor improvements or adjustments in existing products/services (Azadegan et al., 2008; Dash and Joshi, 2007; Dewar and Dutton, 1986; Roy, Sivakumar, and Wilkinson, 2004). We expect that formal governance has differing impacts on the degrees to which incremental and radical innovation are achieved. We thus consider both types of innovation to be continuous variables. We test our hypotheses using a survey-based research approach, in which we collect data on 106 IORs from the Dutch maintenance industry, in which owners of capital assets (e.g., buildings, infrastructure, production equipment) increasingly outsource the maintenance and management of these assets to specialist maintenance providers.

Our study makes several theoretical contributions. First, our focus on innovation as a performance outcome (Anderson and Dekker, 2005), and the distinction between incremental and radical innovation, constitute contributions to the innovation literature. Second, by studying how contracts affect positive IOR outcome, we address a gap identified in previous studies (i.e., a scarcity of research that focuses on performance implications of contracts)

(Anderson and Dekker, 2005; Schepker et al., 2014; Vandaele, Rangarajan, Gemmel, and Lievens, 2007). Moreover, our study adds to the limited number of studies on the use and effects of PBCs (Hypko et al., 2010; Martin, 2002). Finally, whereas previous research has drawn on either TCE or AT to understand the effects of governance on outcomes (Anderson and Dekker, 2005; Johnson and Medcof, 2007; Wang et al., 2011), our empirical study uses them collectively to understand the performance implications of (incomplete) contracts.

The remainder of this paper is organized as follows. First, we review the literature on innovation and (performance-based) contracts to build a preliminary framework that outlines how the features of an incomplete contract, such as PBCs, affect innovation. Then, we describe our research methodology, analyses, and results. We end with concluding remarks and a discussion of the scientific contributions and managerial implications, as well as the limitations and promising avenues for future research.

THEORETICAL BACKGROUND

Performance-Based Contracts and Innovation

PBCs are increasingly used for the effective and cost-efficient (out)sourcing of business services (Datta and Roy, 2011; Cohen, Agrawal, and Agrawal, 2006; Kim et al., 2007). While traditional contracts, such as fixed-price or cost-plus contracts, focus on inputs and processes, PBCs reward the partner based on the outputs and outcomes, i.e., the performance to be delivered by the partner (Kim et al., 2007; Mirzahosseinian and Piplani, 2011). For example, under a PBC, the partner providing maintenance of an airplane's turbine engine is not rewarded according to the materials used (e.g., spare parts) or the activities conducted but for the uptime of the engine (i.e., also known as Rolls-Royce's "power by the hour") (Kim et al., 2007; Ng, Maull, and Yip, 2009). Thus, the contract explicitly identifies the performance that

should be delivered by the partner (e.g., the uptime percentage), rather than describing how to achieve this performance: the partner decides how the targeted performance may best be attained. The partner has the autonomy to engage in new and improved ways of delivering the service. Such performance-based incentive structures are also emerging in other sectors such as logistics: the partner's compensation is tied to cost savings and/or revenue-growth targets set by the focal organization (Doerr, Lewis, and Eaton, 2005; Randall et al., 2010). This shift from more traditional contracting practices toward contracting performance is a trend that can be identified in both the manufacturing and service industries and in both the private and public sectors (Hypko et al., 2010; Kim et al., 2007).

Because PBCs focus on outcomes, they contain less contractual detail regarding the specification of processes, behaviors, and inputs. Consequently, PBCs are relatively more incomplete than other contract types, such as fixed-price and cost-plus contracts. E.g., PBCs have a lower degree of term specificity than a fixed-price contract. Whereas the prescribing nature of more complete contracts may inhibit innovation (Hart, 1989; Wang et al., 2011), it is the open nature of incomplete contracts that is expected to foster innovation. Nevertheless, such contracts do not sufficiently address the transaction characteristics that may result in opportunistic behavior (Williamson, 1985). TCE proposes that the IOR can be protected by the degree of contractual completeness, and AT focuses on the way the partner is rewarded. PBCs can be characterized in terms of these two solutions to partner opportunism: *low term specificity* and *the partner's rewards that are linked to performance (i.e., pay-for-performance)* (Hypko et al., 2010; Martin, 2002; Ng and Nudurupati, 2010) which may foster innovation, as we will explain later. Note that even though, *compared to other contract types*, PBCs are characterized by lower term specificity and rewards that are to a large extent linked to performance, within PBCs one can observe different degrees of these characteristics.

Drawing on contracting literature, in which innovation refers to all partner-initiated, proactive undertakings that result in new (i.e., radical) or improved (i.e., incremental) ways of delivering transactions, we define innovation as an activity to be conducted *by the partner* (Johnson and Medcof, 2007) either in collaboration with, but in any case for, a focal organization. The key premise of this definition is that the focal organization taps into the partner's entrepreneurial ideas (Shimizu, 2012). Both parties may benefit from the innovation: for example, when innovation results in a better service for the focal organization and in more efficient delivery of the transaction for the partner.

Direct Effect of Term Specificity on Incremental and Radical Innovation

Although a low level of term specificity is a key characteristic of a PBC, PBCs may still differ in this regard. For example, a maintenance PBC which specifies the use of specific parts or lubricants to be used in addition to a certain desired performance to be delivered has higher term specificity than one that only specifies the performance.

Term specificity has been considered in both TCE and AT studies on contracting and innovation. From a TCE perspective, Wang et al. (2011) argue that very detailed contracts may hamper existing knowledge exchange and innovation because of the clear contractual specification of what is and is not allowed. Similarly but from an AT perspective, Johnson and Medcof (2007) argue that specifying only the desired outcomes, as is the case in PBCs, allows the partner room for innovation. Thus, both perspectives suggest that there is a relationship between term specificity and innovation and, more specifically, that relatively low levels of term specificity should foster innovation. The key argument is that low term specificity gives the partner both the autonomy to decide how to attain the agreed performance goals and the control over the processes and procedures of its work (Bailyn,

1985; Das and Joshi, 2007; Raelin, 1989). The larger autonomy enables the partner to approach problems and performance metrics in a way that makes the most of its expertise and creative thinking (Amabile, 1998; Liao, Liu, and Loi, 2010; Woodman, Sawyer, and Griffin, 1993).

With regard to incremental innovation, low term specificity gives the partner the autonomy to exploit existing knowledge. The partner will pursue profit maximization by leveraging existing strengths and identifying new opportunities within existing knowledge domains. However, there is a caveat: incremental innovation also requires a certain basis (e.g., existing knowledge and processes) that specifies the baseline about how to achieve the desired performance output. Thus, although autonomy is beneficial for incremental innovation, a certain degree of term specificity is necessary for incremental innovation to occur because it is aimed at reducing deviation from the existing way of conducting business through incremental improvements in processes and outputs (Jansen et al., 2006). For example, a certain degree of term specificity facilitates the generation of ideas to improve existing ways of conducting business (Jansen et al., 2006) by using known knowledge domains. By incorporating contractual rules and procedures, best practices are codified to make them more efficient to exploit, easier to apply and to accelerate their implementation (Jansen et al., 2006). Wang et al., (2011) for example find that insufficient contractual detail negatively affects innovation in general. We have similar expectations for incremental innovation. We therefore expect an inverted-U-shaped relationship between term specificity and incremental innovation where neither too low nor too high degrees of term specificity are beneficial for incremental innovation.

With regard to radical innovation, low levels of term specificity should not stall the output of innovations. Low term specificity enables the partner to exchange and generate new

knowledge (Wang et al., 2011). Radical innovation draws on new knowledge, the development of which is promoted by high autonomy (Choo and Bontis, 2002; Lumpkin and Dess, 1996; Nonaka, Toyama, and Konno, 2000). We therefore argue that low term specificity grants the partner the autonomy to engage in and support new ideas, demonstrate creativity experimentation, and take actions free of contractual constraints. Underlying this is the notion that the partner will develop new ideas if it feels free to do so. In such circumstances, the partner is able to abandon established ways of working and to experiment with new ideas. Moreover, high autonomy fosters creativity and provides a basis for exploratory learning. Hence, the parties in the IOR should have sufficient autonomy to exchange new knowledge that may lead to radical innovation (Popadiuk and Choo, 2006). Conversely, detailed contractual rules and obligations constrain radical innovation (Jansen et al., 2006). Reliance on contractual rules and procedures hampers experimentation and ad-hoc problem-solving efforts. It reduces the likelihood that the partner deviates from structured behavior, and it hinders deviation from a partner's variation-seeking behavior (Jansen et al., 2006). Accordingly, higher degrees of term specificity constrain radical innovation.

In sum: whereas incremental innovation requires a certain degree of term specificity (i.e., it should not be too high or too low), radical innovation benefits from low term specificity only. We therefore hypothesize:

Hypothesis 1A: *There is an inverted-U-shaped relationship between term specificity and incremental innovation.*

Hypothesis 1B: *There is a negative relationship between term specificity and radical innovation.*

Direct Effect of Pay-for-Performance and Incremental and Radical Innovation

The second characteristic of PBCs is related to incentive structures, i.e., the partner's rewards that are to a large extent linked to its performance. According to AT, linking rewards to performance is an example of an incentive based pay that can align the interests of the two parties in the IOR and reduce the potential for opportunistic behavior created by incomplete contracts[5] (Devers et al., 2007; Eisenhardt, 1989; Makri, Lane, and Gomez-Mejia, 2006; Shimizu, 2012). Through these incentive schemes, the contract rewards the partner based on outcomes that are closely related to its efforts by means of incentives to meet performance goals (Argyres and Mayer, 2007; Lyons, 1996). If the rewards are linked to behavior or the resources used, the partner will be discouraged from engaging in activities, such as incremental and radical innovation, that will not be rewarded (Deckop, Mangel, and Cirka, 1999; Eisenhardt, 1989). In these cases, the partner limits itself to perform only those activities and behaviors that are specified in the contract and for which it is being paid. In the most extreme case, any new initiative (incremental or radical) would be a breach of contract (Johnson and Medcof, 2007).

On the other hand, pay-for-performance induces the partner to behave in the interest of the focal firm and to engage in improved or new activities that improve performance. Paying the partner based on its performance creates an incentive for the partner because the increased net profits will, at least partly, accrue to the partner. The partner is therefore inclined to invest in innovative activities with the aim to e.g., lower costs or increase quality, while maintaining performance (Randall et al., 2010). Therefore, the partner will invest in performance improvement via innovative activities, anticipating that the incentive payment

[5]Note that AT proposes alternative mechanisms to curb opportunistic behavior (e.g. monitoring) in addition to the use of reward schemes. Nevertheless, given our focus on the elements of PBCs (i.e., pay-for-performance) and not on how organizations could curb opportunistic behavior with all possible mechanisms, we only focus on reward schemes.

will offset the investment (Heinrich and C hoi, 2007). Incentive structures are critical to encourage the partner to engage in innovative activities that can lower or avoid costs to improve profit potential (Randall et al., 2011). Indeed, financial incentives have been demonstrated to be positively related to incremental and radical innovation (Abbey and Dickson, 1983; Johnson and Medcof, 2007; Shepherd and DeTienne, 2005).

However, compared to incremental innovation, radical innovation involves higher uncertainty, complexity, and unpredictability (Cabrales, Medina, Lavado, and Cabrera, 2008). Radical innovation is associated with higher variability in outcomes and a higher probability of failure. Hence, radical innovation is inherently more risky than incremental innovation. However, higher net profits compensate for this high risk. One cannot have high returns without substantial risk (Sanders and Hambrick, 2007). The higher risk inherent to radical innovation is mitigated by higher returns (Bloom and Milkovich, 1998), as higher returns offset higher risk. Since the net profits will be higher for radical innovation, we expect the positive effect of pay-for-performance to be stronger here than for incremental innovation. We thus hypothesize:

Hypothesis 2A: *There is a positive relationship between paying the partner based on its performance and incremental innovation*

Hypothesis 2B: *There is a positive relationship between paying the partner based on its performance and radical innovation.*

Hypothesis 2C: *The positive effect of pay-for-performance is stronger for radical than for incremental innovation.*

Moderation Effect of Risk-Aversion on Incremental and Radical Innovation

AT further suggests that the optimal reward scheme depends on the partner's (i.e., the agent's) degree of risk-aversion (Eisenhardt, 1989; Levinthal, 1988). When the partner's rewards are to a large extent linked to its performance, rather than the processes or resources used, its liability increases (Gates et al., 2004). The partner is confronted with increased responsibilities and bears more risk because its income stream is uncertain (Gates et al., 2004; Gruneberg, Hughes, and Ancell, 2007; Guajardo, Cohen, Kim, and Netessine, 2012; Kim, Cohen, Netessine, and Veeraraghavan, 2010; Ng and Nudurupati, 2010). Among these risks are the possibility of defects, the possibility of failure to meet completion deadlines, and financial risk. Since attitudes toward risk differ among organizations, we argue that the effect of rewarding partners for their performance by means of incentive schemes on incremental and radical innovation is lower for risk-averse partners. Previous research has shown that risk-averse organizations sacrifice some of their expected returns to minimize risk (March and Shapira, 1987; Singh, 1986). They will opt for status-maintaining decisions, and they will favor solutions that have been proven to work well over higher-risk options (Ederer and Manso, 2013). Therefore, when a risk-averse partner's payment is linked to its performance, the partner may make conservative decisions and establish greater cost control at the expense of creative freedom. This may result in fewer resources being devoted to innovative activities, since both types of innovation are inherently risky (Bloom and Milkovich, 1998; Makri et al., 2006).

Exploiting existing knowledge domains for incremental innovation or exploring new domains for radical innovation can be expensive and involves commitment of the partner's assets (Das and Joshi, 2007). Moreover, it requires organizations to take risk as innovation may not contribute to the targeted performance. This is especially true for radical innovation

because it involves a greater risk than incremental innovation does. Thus, we suggest that the partner's degree of risk-aversion has a stronger negative moderation effect on radical than on incremental innovation. Accordingly, we propose:

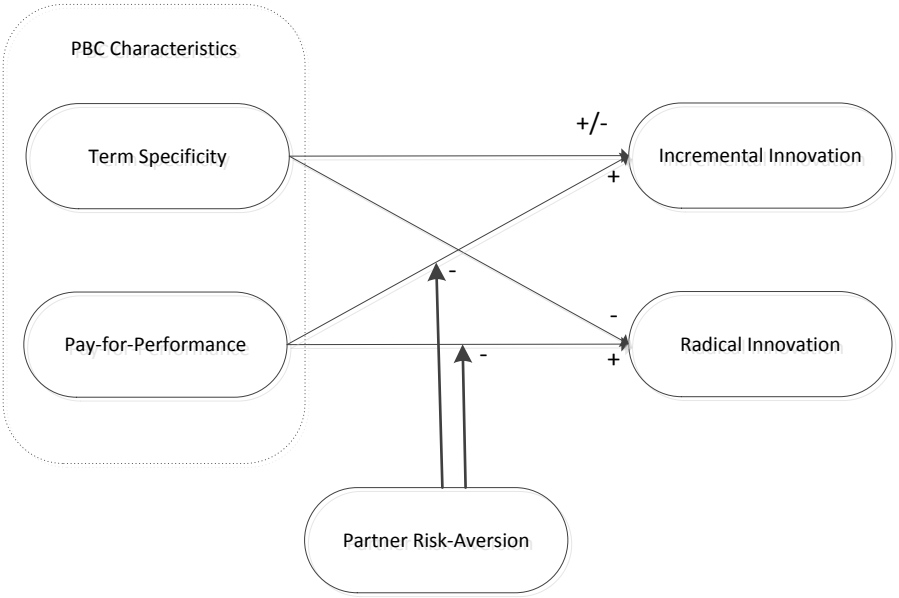
Hypothesis 3A: *There is a negative moderation effect of the partner's degree of risk-aversion on the relationship between pay-for-performance and incremental innovation.*

Hypothesis 3B: *There is a negative moderation effect of the partner's degree of risk-aversion on the relationship between pay-for-performance and radical innovation.*

Hypothesis 3C: *The negative moderation effect of the partner's degree of risk-aversion is stronger for radical than for incremental innovation.*

Figure 1 summarizes the hypothesized relationships. We posit an inverse-U relationship between term specificity and innovation. In addition, we hypothesize that pay-for-performance positively affects both types of innovation. This effect is theorized to be stronger for radical innovation. Finally, we expect a negative moderation effect of risk-aversion on the positive relationship between pay-for-performance and both types of innovation. We posit that this moderation effect is stronger for radical than for incremental innovation.

FIGURE 1: Conceptual Model: Relationship between PBC Characteristics and Innovation



RESEARCH METHODS

Sample Selection and Data Collection

The data for this study originated from a survey of buyer-seller relationships in the Dutch maintenance industry. We selected IORs involving a buying and a supplying firm as our unit of analysis, because such IORs are well known for the use of contractual governance (Aghion and Holden. 2011). We chose to gather our data in the maintenance sector because of the importance and frequent use of PBCs in this sector (Hypko et al., 2010); this increased the likelihood that our dataset would contain data on PBCs as well. The fact that such contracts are suggested to positively affect innovation (Kim et al., 2007; Martin, 2002; Ng and Nudurupati, 2010) leads us to expect the growing use of this type of contract to coincide with more frequent innovation in this sector. In the context of maintenance, innovation may concern minor changes that lead to a more efficient maintenance process (e.g., a performance dashboard that diagnoses specific problems in advance of the supplier's site visit) or more major changes that increase the effectiveness of the maintenance process (e.g., changing certain components to reduce the overall maintenance activities). The data collection was not limited to PBCs, because our analysis requires variation in our independent variables. To ensure this variation, we incorporated two other frequently used contract types: fixed-price and cost-plus contracts[6]. For example, term specificity will be lower for a PBC than for a cost-plus contract.

[6] Given that PBCs are not often used in the private sector and we are looking at the elements of contracts (i.e., term specificity and pay-for-performance) which are present in all contract types with different degrees, we did not only look at PBCs in our empirical model. We used three contract types to guide the respondents. Even though we argue that within PBCs, term specificity and pay-for-performance are present in different degrees, these variations are small and would perhaps not be sufficient to find significant effects on our dependent variables (i.e., incremental and radical innovation). Hence, we incorporated other contract types as well to ensure that the variation within our independent variables (i.e., term specificity and pay-for-performance) is large enough.

We collected our data in 2013 from the members of the Dutch Association for Maintenance Services (in Dutch: Nederlandse Vereniging voor Doelmatig Onderhoud, NVDO), using an online survey administered through a dedicated website. The 1227 member organizations are either asset owners (i.e., buyers of maintenance services) (430), providers of maintenance services (430), or consultants (367), operating in one of six different maintenance sectors (i.e., real estate, infrastructure, fleet (excluding passenger cars), process industry, manufacturing, and food, beverage, and pharmaceuticals). Given our focus on the use of formal governance in IORs, we surveyed the 860 asset owners and providers of maintenance services, because both are knowledgeable about the contract underlying the IOR.

We contacted the board members of NVDO to obtain their approval and support, and we subsequently presented the research as a joint effort, with the goal of maximizing the response rate. A letter announcing the survey and when it would be distributed was sent out to all members. We sent the questionnaire accompanied by an introductory letter explaining the intent of the study, assuring confidentiality, and indicating the preferred survey respondent (i.e., a manager knowledgeable about the content of the contract and the collaboration). The respondents were asked to indicate whether they were an asset owner, a maintenance provider, or a consultant. Consultant responses were excluded from the analysis.

The respondents were asked to fill out the questionnaire for a specific service contract with which they had considerable experience. This contract could be any of the three types mentioned: fixed-price, cost-plus, or PBC (Kim et al., 2007). In line with Luo (2002), we interviewed and pre-tested the survey with eight practitioners (who were excluded from the population from which we drew our sample) and management researchers to verify whether the wording was appropriate for business practitioners and to identify ambiguities in the

terms and concepts or other issues. We made minor changes to the wording based on the feedback received. In addition, as suggested by Van Teijlingen and Hundley (2002), we conducted a pilot study: in collaboration with the Dutch Association for Purchasing Management (NEVI), we surveyed seventy-four purchasing managers from various industries. We used the responses to evaluate the feasibility, the time taken, and any adverse events so that we could improve the study design prior to the actual data collection. We also used the pilot study to evaluate and validate our measurement items.

The members of NVDO were reminded three times to respond to the survey; after the third reminder, we called the members who had not yet responded. Eventually, 169 questionnaires were received, for an overall response rate of (169/860=) 19.7%, which compares favorably with existing questionnaire-based research in business and management (Huang et al., 2014; Im and Rai, 2008; Koberg et al., 2003). Of the 169 responses, 63 were discarded due to excessive missing information, resulting in a final usable dataset of 106 responses (i.e., effective response rate of 12.3%) of which 51 (51/430=11.9%) are asset owners and 55(55/430=12.8%) are maintenance providers. Note that these responses are non-dyadic data. On average, the respondents have 14 (SD=8.4) years of experience in managing relationships with external partners, and they managed 18 (SD=17) contracts in 2012. These figures suggest that the informants have a high level of competence, which indicates that the responses should be of sufficient quality. Table 1 shows the number of employees and average revenue of the firm respondents work for, the percentage of respondents representing the six maintenance sectors, and the roles most commonly held by respondents.

Table 1: Information about the Respondents

Information	Percentage / number
Number of employees	59% of the responding firms have more than 250 employees
Average revenue	1273 million (SD: 4567)
Maintenance industries	
Process industry	39.6%
Real estate	19.8%
Food, beverage & pharmaceuticals	13.2%
Infrastructure	11.3%
Manufacturing	8.5%
Fleet	5.7%
Roles of the respondents	
Contract manager	13.2%
Director / owners	13.2%
Advisor	12.3%
General manager	12.3%
Maintenance manager	6.6%
Operations / production manager	6.6%

To assess the potential respondent bias, we compared the early and late responses based on the assumption that the opinions of late respondents are representative of the responses of non-respondents (Armstrong and Overton, 1977). The final sample includes 32.1% of the responses in the first wave and 67.9% in the second wave after the first reminder. We compared characteristics such as the sector in which the respondent is active, the function of the respondent, the number of employees, and the number of contracts the respondent managed in 2012. We also compared the responses to all our independent and dependent variables. The results of the independent-sample T-tests showed no significant differences between these groups (p-values ≥ 0.05). In addition, the descriptive characteristics were also investigated for a group of respondents (56.5%) that only provided very few answers, assuming that these could be representative of non-respondents. We found no

significant differences between this group of respondents and the respondents in our dataset, suggesting that non-response bias is not a serious threat. Finally, the main reason for not completing the survey given by the non-respondents during the call-back sessions was lack of time. This also suggests that there are no differences between respondents and non-respondents.

Measures

We operationalized the variables using single- or multi-item reflective measures. Where possible, we relied on scales used in previous research. Since we collected our data in the maintenance sector, the survey questions are in the context of maintenance service transactions. The items were measured using either five-point or seven-point Likert scales ranging from 1 (*strongly disagree*) to 5 or 7 (*strongly agree*). See Appendix A for the items we used for our key variables.

Radical and Incremental Innovation. Innovation is a proactive undertaking that results in new or improved products/services and new or improved ways of delivering the service. We measure both service and product innovation within the service. Product innovation in a service context entails innovation in the physical goods involved in the use of the service (e.g., innovation in the machine/asset that is being maintained by the service provider). We derived our innovation items from the innovation scale used by other researchers in their study on the use of PBCs in the maintenance sector (Verbeeten, 2014). Verbeeten's (2014) incremental innovation scale was developed by adapting Jansen et al.'s (2006) scale of exploitative innovation to the sector being investigated and was found to work well in the study on maintenance PBCs. Incremental innovation was measured using a seven-item, five-point Likert scale. These items focus amongst others on minor changes in existing

services and products such as improvements to the efficiency of the maintenance process. Radical innovation was measured using a four-item, five-point Likert scale. The items for this construct were based on the work of Gallouj and Weinstein (1997) and Hertog (2000) and focus, amongst others, on the extent to which the maintenance provider has developed a new service and product/technology and/or a new way of interacting with the client.

Term Specificity. Term specificity is the extent to which the contractual clauses prescribe how the partner should deliver the service or which resources it should use. Based on Argyres, Bercovitz, and Mayer (2007), Mayer (2006), and Ryall and Sampson (2009), we captured term specificity in a three-item, seven-point Likert scale which e.g., states to what extent the contract prescribes how the partner should develop certain technologies and which specific resources should be contributed to the service delivery.

Pay-for-performance. Pay for performance was measured using a six-item, seven-point Likert scale that measures how the partner is rewarded. Specifically, we asked the respondents to what extent the partner's reward are linked to its performance. Examples are the extent to which the provider's rewards are linked to the outcome of the service and the extent to which the provider has sufficient financial incentives to improve the service. The items were adapted from Jaworski, Stathakopoulos, and Krishnan (1993).

Risk-aversion of the partner. Risk-aversion is the degree to which the partner is reluctant to take risks. Risk-aversion was evaluated using a single-item, seven-point Likert scale, investigating to what extent the partner prefers the "tried and true" paths. This item was derived from the items developed by Venkatraman (1989). We opted for this single-item measure for two reasons. First, in spite of its importance in AT, high-quality, validated reflective measures of organizational risk-aversion in an IOR context are virtually nonexistent. Second, the complete item set of risk-averseness in inter-firm relationships

developed by Venkatraman (1989) demonstrated weak validity in our pilot study (i.e., low and insignificant item loadings , weak composite reliability, and low Cronbach's alpha and average variance extracted). As a result, we followed existing research by using a single-item risk-preference measure that has worked well in existing economics and management research (Dohmen et al., 2011).

Control variables. To control for potentially confounding factors, we used several control variables. First, firm size can influence both types of innovation because firms of different sizes exhibit different organizational characteristics and resource deployment (Wang et al., 2011). Large firms may have slack resources that might positively affect innovation (Liu, Li, and Wei, 2009). Although firm size is most commonly evaluated in terms of revenues, the number of missing values for this question rendered us unable to use this as an indicator for firm size. Therefore, in line with existing research (Jansen et al., 2006; Koberg et al., 2003; Rothaermel and Deed, 2006; Zhou and Poppo, 2010), we used the number of employees as a proxy for firm size.

Second, trust is viewed as an important mechanism to stimulate incremental and radical innovation (Dovey, 2009; Nielsen and Nielsen, 2009; Wang et al., 2011). The interaction among parties who trust each other will be more informal, leading to the creation and sharing of existing and/or new knowledge that could result in innovation (Im and Rai, 2008; Wang et al., 2011). Based on validated items used in previous research, we measured trust using a nine-item, five-point Likert scale that captures contractual, goodwill, and competence trust (Aulakh, Kotabe, and Sahay, 1996; Green, 2003; Lui and Ngo, 2004). Contractual trust is the extent to which the parties in the IOR are true to the contract. Competence trust focuses on whether the parties are *able* to fulfill an agreed-upon obligation.

In contrast, goodwill trust refers to the trust one has in the partner's *intention* to fulfill its role in the collaboration (Das and Teng, 2001; Lui and Ngo, 2004; Nooteboom, 1996).

Third, we controlled for relationship length because enduring relationships may help parties build trust (Kramer, 1999; Malhotra and Lumineau, 2011), which may, in turn, affect innovation (Wang et al., 2011). The relationship length was measured as the number of years since the relationship formation. The average relationship length was 12 years (SD = 9) in our sample.

Fourth, since prior research has shown that the industry in which the firm operates and the complexity of the transaction may affect incremental and radical innovation (Damanpour, 1991; de Brentani, 2001), we controlled for these factors as well. The transaction complexity was measured using a single-item, five-point Likert scale asking respondents about the complexity of the products and services in the selected contract. In addition, we created dummy variables for the six maintenance sectors to control for industry effects. We pooled the data for the buyers and sellers because there is no theory to suggest that the effects of IOR governance differ on the two sides of the IOR (Jap and Anderson, 2003) (we test this assumption, which will be discussed in the following section). Nevertheless, we controlled for perception differences between buyers and suppliers by controlling for the type of organization the respondent represents (i.e., asset owner or provider of the maintenance service).

RESULTS

To estimate the measurement and structural models, we opted for partial least squares (PLS), which has been widely adopted in business research (Peng and Lai, 2012; Hair et al., 2011; Rosenzweig, 2009). Despite the increasing interest in using PLS (Hair, 2010), researchers

have questioned the usefulness of PLS over other techniques (Rönkko and Evermann, 2013). We acknowledge these critiques and address them by e.g., having a sufficient sample size (for PLS) and conducting extra robustness checks of our results. Our motivation to opt for PLS is twofold. First, compared to covariance-based structural equation modeling (CBSEM), PLS is a more appropriate tool for analyzing hypotheses at an early stage of model development (Peng and Lai, 2012), as is the case with our model on the effects of contractual characteristics on innovation. Second, our research model is complex, due to the inverse-U and moderation effect in a single model, with two dependent variables. In the presence of model complexity, CBSEM increases the total number of parameter estimates, possibly leading to model identification and convergence issues (Peng and Lai, 2012). Model complexity may even increase the required sample size in CBSEM since, e.g., for a moderation effect a new construct is computed by multiplying the items of each construct. PLS, on the other hand, uses an iterative algorithm to separately calculate parts of the measurement model, and it subsequently estimates the structural path coefficients (Peng and Lai, 2012). This leads to a successful estimate of the factor loadings and structural paths subset by subset (Peng and Lai, 2012). PLS thus readily accommodates complex relationships in the structural model, and it does so effectively with a relatively small sample size (Hair, 2010; Im and Rai, 2008; Pulles, Veldman, Schiele, and Sierksma, 2014; Rosenzweig, 2009).

We first used expectation maximization (EM) to replace a small number of missing values (Tsikriktsis, 2005). We then used a bootstrapping sample of 5000 and ran 300 cases per resampling to estimate the standard errors and statistical significance of the structural paths. A large bootstrapping sample (of 500 or more) is recommended because it reduces the effect of random sampling error (Hair et al., 2011; 2014; Peng and Lai, 2012). As a recommended standard practice (Ahuja, Galletta, and Carley, 2003), we replicated the

analyses with three additional iterations (bootstrapping samples of 200, 500 and 1000) to assess the stability of the significance of the path coefficients. The results are consistent across the bootstrap samples.

Subsequently, we tested the assertion that the effects of IOR governance do not differ on either side of the IOR by conducting a Chow-test to determine whether there are significant differences in the models for buyers and sellers (Lee, 2008). The results show that there are no significant differences between the buyer and the seller models (i.e., $F_{incremental}=1.63 < 1.81$, $\alpha = 0.05$; $F_{radical}=0.95 < 1.81$, $\alpha = .05$), and hence, the two datasets may be pooled.

Measurement Model

We employed confirmatory factor analysis (CFA) to assess the unidimensionality, convergent validity, and discriminant validity of our multi-item constructs. In line with previous research, we followed Gefen and Straub's (2005) guidelines to validate our reflective measures by using standard factorial validity for PLS (Im and Rai, 2008).

Table 2 presents the descriptive statistics and the bivariate correlations among the variables. Because some variables are significantly correlated, we checked for multicollinearity problems. The variance inflation factors (VIFs) of all the variables (control- and main variables, quadratic and cross terms included) range from 1.13 to 1.89, diminishing this concern as the VIF levels are well below the rule-of-thumb cut-off of 10 (O'Brien, 2007). All the indicators load high (>0.5) on their respective constructs and are significant at a 1% significance level, providing evidence for unidimensionality and convergent validity. The composite reliabilities (CRs) exceed the 0.70 threshold for acceptable reliability (Bagozzi and Yi, 1988) and the Cronbach's alpha ranges between .68 and .93. The average variance

Table 2: Descriptive Statistics and Correlation Matrix

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Radical innovation	3.12	0.92	1														
2. Incremental innovation	3.38	0.88	.497**	1													
3. Specificity level	3.43	1.53	.239*	.489**	1												
4. Pay-for-performance	3.67	1.45	.368**	.190	.349**	1											
5. Risk-Aversion	4.97	1.25	-.103	-.184	-0.023	0.062	1										
6.Transactional complexity	3.50	0.89	.149	.205*	.249**	.209*	-.019	1									
7. Trust	3.93	0.64	.152	.319*	.320**	.013	.025	.196*	1								
8. Relationship length	11.49	8.43	-.033	.106	-.009	-.020	.068	.057	.153	1							
9. Firm size	5.91	2.39	-.060	-.199*	-.119	.077	.031	.058	-.183	-.065	1						
10. Industry: Infrastructure	0.11	0.32	.020	.052	-.105	-.099	-.014	.000	-.134	-.113	.152	1					
11. Industry: Fleet	0.06	0.23	.114	.115	.100	.179	-.124	.046	.078	.068	.164	-.088	1				
12. Industry: Process	0.40	0.49	.059	.135	.184	.002	.130	-.021	-.006	.121	-.025	-.289**	-.198*	1			
13.Industry: Manufacturing	0.08	0.28	-.053	-.065	-.027	.094	.198*	.096	.114	.087	-.045	-.109	-.075	-.247*	1		
14.Industry: Food, Beverage, Pharma	0.13	0.34	-.180	-.289**	-.214*	-.080	-.079	-.031	-.121	-.038	-.055	-.139	-.096	-.316**	-.119	1	
15. Perspective focal firm/ partner	0.52	0.50	.269**	.530**	.278**	-0.48	-.154	.031	.095	.104	-.141	.046	.154	.047	-.045	-.126	1
Cronbach's Alpha	-	-	0.85	0.929	0.683	.865	-	-	.901	-	-	-	-	-	-	-	-
Composite Reliability	-	-	0.898	0.943	0.824	.898	-	-	.918	-	-	-	-	-	-	-	-
Average Variance Extracted-(AVE)		-	0.688	0.703	0.611	.597	-	-	.557	-	-	-	-	-	-	-	-

N_Total= 106. N_Buyers = 51. N_Suppliers = 55

**Significance level: $p < 0.01$ (2-tailed).

*Significance level: $p < 0.05$ (2-tailed).

extracted (AVE) values exceed the 0.50 threshold for all constructs. The discriminant validity was assessed by comparing the AVE with the squared correlation between construct pairs (Fornell and Larcker, 1981). The AVEs exceed the squared correlations between constructs, indicating that each construct explains more within-construct than across-construct variance. In addition, our data does not contain cross-loadings (Hair, 2010). These results provide evidence of discriminant validity among the theoretical constructs.

To minimize the possibility of common-method bias, we took several preventive measures (Podsakoff, MacKenzie, Lee, and Podsakoff, 2003). First, the pre-test we conducted before the survey minimized the item ambiguity and any comprehension problems for the respondents. Second, we guaranteed respondent anonymity, which reduces respondents' tendency to provide socially desirable answers (Smets, Langerak, and Rijsdijk, 2013). Finally, we included items that needed to be reverse coded, and used both 5 and 7-point Likert scales to reduce the potential effects of pattern responses (Dillman, Smyth and Christian, 2009; Hinkin, 1995). To identify whether our preventive measures were effective, we looked at the path coefficients of the models and Harman's post-hoc one-factor test (Podsakoff et al., 2003). The path coefficients show different levels of significance across the models, indicating the reduced likelihood of common-method bias. In addition, principal component analysis for Harman's post hoc-one factor test showed that the first factor accounts for only 26.9% of the variance, suggesting that the observed variance cannot be explained by one underlying factor (Im and Rai, 2008). Collectively, these tests indicate that there is a reduced likelihood of common-method bias in our data.

Hypothesis Tests

Because we tested our hypotheses using PLS, we were able to combine all the dependent variables and the independent and control variables into one model. To enhance the interpretability of the outcomes of the hypothesis tests, we mean-centered and standardized the variables term specificity, pay-for-performance, and risk-aversion prior to creating the cross products and interaction terms. Standardization and mean centering improves the robustness of the analyses without lowering the quality of the data (Rothaermel and Deeds, 2006). Table 3 examines the relationship between the contractual characteristics and incremental and radical innovation.

We tested the relationships with three separate models, each simultaneously measuring the effects of the independent variables on both dependent variables. Model 1 is the baseline model; it tests only the control variables[7]. Each subsequent model provides an improvement over the baseline model. Model 2 evaluates the impact of the direct effects of the independent variables (including the cross-product variable of term specificity) on the dependent variables. Finally, model 3 includes the effect of the moderation variable on incremental and radical innovation. This model corresponds to the complete model from Figure 1 and exhibits adequate predictive power (R^2), since it explains 55% of the variance in incremental innovation and 34% in radical innovation. These outcomes compare favorably with the values obtained in other IOR and innovation studies (e.g., Im and Rai, 2008; Koberg et al., 2003; Lui and Ngo, 2004; Luo, 2002). As an additional model quality indicator, we

[7] Note that we did not insert the contract types as control variables because first, there might be multicollinearity issues with the contractual elements and contract types. Second, during our interviews we realized that managers have differing definitions of contract types. As a result, some of the contracts they qualify as PBCs are not PBCs according to our definition. Hence, categorizing contract types would not be correct. Nevertheless, in a separate analysis we did insert the contract types as control variables as a robustness check; our model remained the same (in terms of direction and significance). In addition, we have also performed an ANOVA test on the descriptive variables (e.g., number of employees and contract length) for each of the three contract types: the results suggest that there are no significant differences between IORs that use different contract types.

Table 3: Results of Hypothesis Tests Using PLS

	Model 1: Impact on		Model 2: Impact on		Model 3: Impact on	
	Incremental innovation	Radical innovation	Incremental innovation	Radical innovation	Incremental innovation	Radical innovation
Controls						
Firm size	-0.13*** (0.04)	-0.03 (0.04)	-0.13*** (0.04)	-0.04 (0.04)	-0.12*** (0.04)	0.00 (0.03)
Trust	0.23*** (0.05)	0.12* (0.06)	0.19*** (0.04)	0.13** (0.05)	0.22*** (0.05)	0.19** (0.05)
Relationship duration	0.01 (0.02)	-0.10* (0.06)	0.05 (0.03)	-0.08 (0.05)	0.03 (0.03)	-0.10* (0.05)
Transactional complexity	0.15***(0.05)	0.13** (0.06)	0.08* (0.04)	0.04 (0.04)	0.09* (0.04)	0.06 (0.05)
Industry: Infrastructure	0.06 (0.05)	0.00 (0.04)	0.11** (0.05)	0.04 (0.04)	0.09* (0.03)	-0.02 (0.04)
Industry: Fleet	0.04 (0.03)	0.06* (0.03)	-0.01 (0.02)	-0.01 (0.02)	0.00 (0.02)	-0.02 (0.03)
Industry: Process	0.05 (0.05)	0.03 (0.05)	0.06 (0.04)	0.01 (0.04)	0.07 (0.04)	0.01 (0.04)
Industry: Manufacturing	-0.09 (0.07)	-0.07 (0.06)	-0.07 (0.05)	-0.08 (0.06)	-0.07 (0.04)	-0.11* (0.06)
Industry: Food, Beverage, Pharma	-0.19*** (0.06)	-0.13** (0.07)	-0.14*** (0.05)	-0.13** (0.05)	-0.14** (0.04)	-0.12** (0.05)
Perspective focal firm /partner	0.46*** (0.04)	0.24*** (0.05)	0.36*** (0.05)	0.26*** (0.05)	0.35*** (0.04)	0.24*** (0.05)
Direct effects						
Specificity level			0.23*** (0.06)	-0.06 (0.05)	0.20*** (0.06)	-0.09* (0.05)
Specificity level^2			-0.10** (0.05)	0.06 (0.05)	-0.11** (0.04)	0.05 (0.04)
Pay-for-performance			0.11** (0.05)	0.42*** (0.05)	0.10* (0.04)	0.38*** (0.05)
Risk-aversion			-0.13*** (0.04)	-0.08* (0.05)	-0.13*** (0.04)	-0.08** (0.04)
Moderation effect						
PfP x RA					0.13*** (0.08)	0.27*** (0.05)
R^2	0.45	0.15	0.54	0.28	0.55	0.34
ΔR^2			0.09	0.13	0.01	0.06

Notes. PfP: Pay-for-performance; RA: Risk-aversion. Standardized coefficients are shown, with standard errors in parentheses.
Two-tailed tests. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Dummy variable industry, baseline category: Real estate sector
Dummy variable perspective: 0= focal firm, 1=partner

also evaluated how well our estimated model reconstructs our empirical data (i.e., predictive relevance) using Stone–Geisser's Q^2 (Geisser, 1975; Stone, 1974) by means of blindfolding in SmartPLS. For the final model, Q^2 is greater than zero for incremental and radical innovation, indicating acceptable predictive relevance (Peng and Lai, 2012).

Hypothesis 1A states that the relationship between term specificity and incremental innovation is inversely U-shaped. The results obtained in model 3 support Hypothesis 1A since the linear term of term specificity is positive and significant (β=0.20, p<0.01), while the squared term of term specificity is negative and significant (β=-0.11, p<0.05)[8]. This means that there is an optimal level of term specificity that maximizes incremental innovation: neither contracts with a (very) high degree of term specificity, nor contracts with a (very) low degree of term specificity are conducive for such innovation[9]. On the other hand, Hypothesis 1B states that the higher the degree of term specificity in a contract, the less likely that the partner will engage in radical innovation. The results show that this hypothesis is supported (β=-0.09, p<0.1).

Hypotheses 2A and 2B state that the extent to which the partner's rewards are linked to its performance has a positive effect on incremental and radical innovation. The results in Table 3 show that Hypotheses 2A (β=0.10, p<0.1) and 2B (β=0.38, p<0.01) are supported. The beta coefficient for radical innovation is almost four times larger than for radical innovation. This lends empirical support for hypothesis 2C. This means that incentive

[8] The tipping point of the inverse-U relationship between term specificity and incremental innovation is within the observed variable range (i.e., 4.82).

[9] Given the importance of relational governance mechanisms in IORs and that trust is a significant control variable with large effect sizes in our models, we ran extra models to confirm that our inverse-U relationship remains significant. In the models, we included interaction terms of term specificity and trust and also ran an extra model with a non-linear term of trust (i.e., trust*trust). In all the models, the inverse-U relationship between term-specificity and incremental innovation remains significant.

structures by paying the partner based on its performance seems to have stronger effect on radical than on incremental innovation.

Hypotheses 3A and 3B postulate that the partner's degree of risk-aversion negatively moderates the relationship between pay-for-performance and incremental and radical innovation. For accurate results, we also tested the direct effect of the moderation variable on the dependent variables. As can be seen in Table 3, hypothesis 3A is rejected; there is a significant *positive* moderation effect of risk-aversion on the relationship between pay-for-performance and incremental innovation (β=0.13, p<0.01). This means that pay-for-performance has a stronger positive effect on incremental innovation when the partner is risk-averse.

To better understand the form of the moderation effect, Figure 2a plots the relationship between pay-for-performance and incremental innovation for low (one SD below the mean) and high (one SD above the mean) values of the partner's degree of risk-averseness. Consistent with the positive interaction term, the plot shows a positive relationship between pay-for-performance and incremental innovation when the partner's degree of risk-aversion is high. Moreover, this figure reveals that for providers who are less risk-averse, the slope is negative. Table 3 further shows that there is a positive moderation effect of risk-aversion on the relationship between pay-for-performance and radical innovation, thus leading us to reject hypothesis 3B. The interaction term is positive and significant (β=0.27, p<0.01), meaning that the positive relationship between pay-for-performance and radical innovation is stronger when the partner has a high degree of risk-aversion. Consistent with the positive interaction term, the plot in Figure 2b shows that there is a positive effect of pay-for-performance on radical innovation for providers with a high degree of risk-aversion. Finally, the beta coefficient of the moderation effect of radical

innovation is more than two times higher than for incremental innovation. This suggests a stronger moderation effect for radical innovation, but this effect is positive. Hence, hypothesis 3C is also rejected. Table 4 summarizes our findings.

FIGURE 2A: Plot of the Moderating Effect of Risk-Aversion on Incremental Innovation

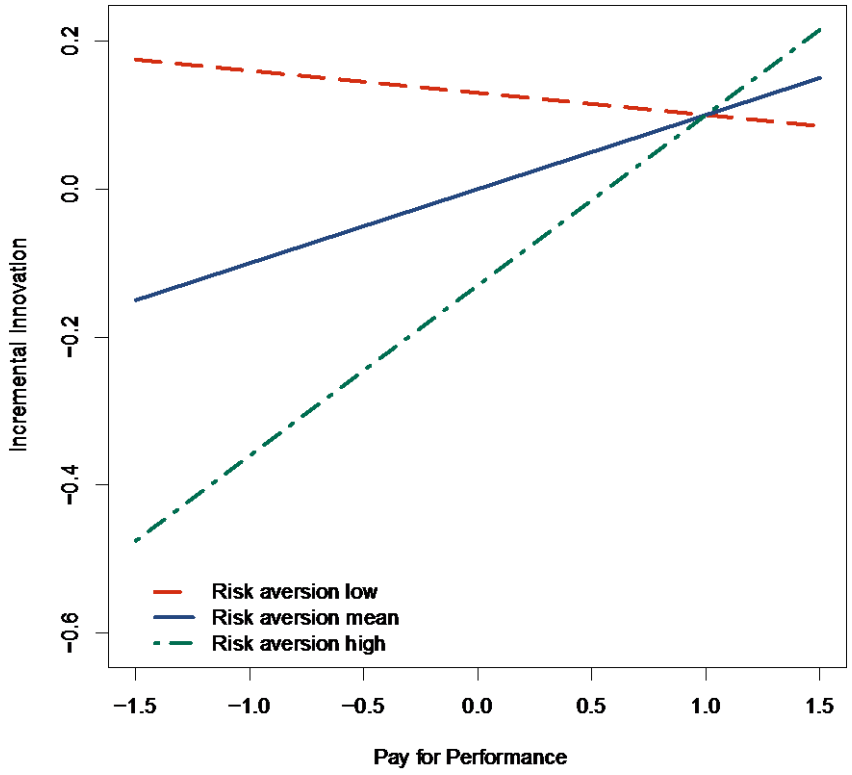


FIGURE 2B: Plot of the Moderating Effect of Risk-Aversion Propensity on Radical Innovation

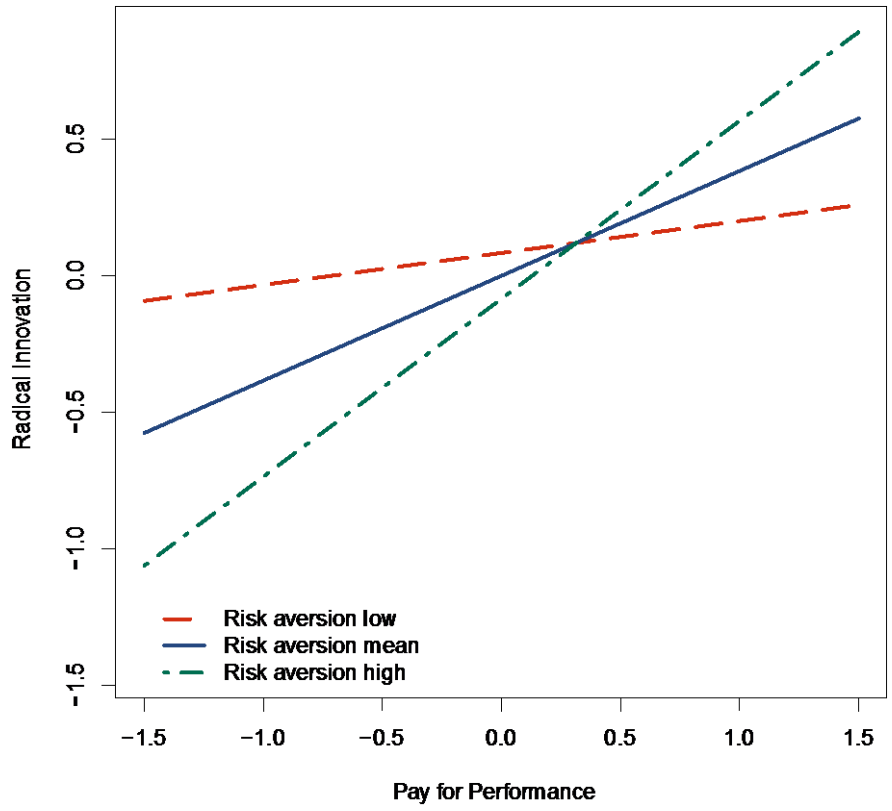


Table 4: Summary Results for the Hypothesis Tests

Hypothesis		Result
H1a	There is an inverted-U-shaped relationship between term specificity and incremental innovation	Supported
H1b	There is a negative relationship between term specificity and radical innovation	Supported
H2a	There is a positive relationship between paying the partner based on its performance and incremental innovation	Supported
H2b	There is a positive relationship between paying the partner based on its performance and radical innovation	Supported
H2c	The positive effect of pay-for-performance is stronger for radical than for incremental innovation	Supported
H3a	The degree of the partner's risk-aversion positively moderates the relationship between pay-for-performance and incremental innovation	Not Supported
H3b	The degree of the partner's risk-aversion positively moderates the relationship between pay-for-performance and radical innovation	Not Supported
H3c	The positive moderation effect of the partner's degree of risk-aversion is stronger for radical than for incremental innovation	Not Supported

DISCUSSION

Despite the large amount of research that has been conducted on the determinants of contractual governance, research focusing on its performance implications is limited (Anderson and Dekker, 2005; Schepker et al., 2014), especially in relation to innovation. We address this gap by considering two important contractual characteristics: the level of term specificity and the extent to which rewards are linked to performance. The first characteristic is derived from TCE, which suggests increased term specificity as the solution against supplier opportunism. However, innovation benefits from more open contracts, i.e., contracts with lower term specificity. To counter the opportunism that open contracts may bring, AT suggests the use of contractual incentive schemes. Together, these variables constitute two interdependent solutions for dealing with opportunism in IORs. Interestingly, it is in PBCs,

the one type of contract which has been argued to be conducive for innovation (Kim et al., 2007), that these solutions can be applied interdependently. Yet, the increased use of PBCs in practice, under the assumption that these provide innovation benefits, warrants a further investigation of the relationships between the features of these contracts and innovation.

We found that term specificity is inverse-U related to incremental innovation, meaning that if term specificity is too high or too low the maximum possible level of innovation will not be achieved. This observation reinforces existing findings in within-firm settings that indicate that a certain degree of term specificity leads to incremental improvements in processes and outputs (Benner and Tushman, 2003; Daft and Lengel, 1986; Jansen et al., 2006). Capturing a certain degree of rules and obligations in contracts makes existing knowledge and skills explicit, enabling more efficient exploitation and faster implementation of incremental changes (Jansen et al., 2006).

Radical innovation was found to be negatively affected by term specificity. This is in contrast with several existing studies in intra-firm settings, which suggest that rules and obligations are not detrimental to radical innovation (Jansen et al., 2006; Zollo and Winter, 2002). Based on our findings, we argue that in an inter-organizational setting, a higher degree of term specificity, and thus less autonomy, produces inertial forces and makes the partner focus on incremental improvements rather than on exploring new knowledge domains. Hence, the characteristics of the setting (i.e., whether it is in intra-firm or inter-firm setting) seem to have an influence on how formal governance affects radical innovation. Overall, term specificity has different effects on the two types of innovation.

Second, we found that the extent to which the partner's rewards are linked to its performance positively affects incremental and radical innovation. The effect seems to be stronger for radical than for incremental innovation.

Taken together, these empirical results demonstrate the (different) effects of the two PBC characteristics on (incremental and radical) innovation. More specifically, the importance of using TCE and AT collectively rather than separately when trying to explain innovation in contractual IORs is demonstrated by the clear interdependency between the two mechanisms. Incremental innovation requires a higher degree of term specificity than radical innovation; the latter in contrast benefits from a contract that is free of rules and obligations. The opportunism that might arise from too low term specificity should be offset by linking rewards to performance; this is less urgent for incremental innovation. More in general: altering term specificity influences the extent to which pay-for-performance is a required protection mechanism against partner opportunism, whereas adopting pay-for-performance allows lower term specificity.

Third, we found that the partner's degree of risk-aversion *positively* rather than negatively moderates the positive relationship between pay-for-performance and incremental and radical innovation. This means that under pay-for-performance conditions, risk-averse partners will engage more strongly in incremental and radical innovation. A plausible explanation for this finding is the pressure that the partner experiences. As Haubrich (1994) states, at first glance, risk-averse partners value insurance and therefore avoid performance-based pay (unless they get an appropriate risk-premium). However, in some situations, the partner may be forced to accept such reward schemes, for example because the focal organization is an important customer or the focal firm has more power and can force the partner to accept such reward schemes. In such cases, pay-for-performance schemes may cause risk-averse partners to feel pressured to succeed, as the financial consequences of not meeting performance targets are substantial. Such pressure drives organizations to place a greater value on creative ideas and, thus, to act on the outcomes of a creative climate (Hunter,

Bedell, and Mumford, 2007; Janssen, Vliert, and West, 2004). The resulting pressure may elicit creative thinking and persistence in deriving solutions (e.g., Anderson, De Dreu, and Nijstad, 2004; Nicol and Long, 1996) that lead to the desired performance. Although the consequences of not meeting performance targets may be equally severe for both risk-averse and non risk-averse partners, the latter will experience less pressure since they are more familiar with such situations and more open to taking risks. We also found that the moderation effect seems to be stronger for radical than for incremental innovation. This can potentially be explained by the fact that radical innovation usually involves higher pressure than incremental innovation. The pressure increases as the result of higher uncertainty and a higher probability of failure.

Our study makes a number of theoretical contributions. First, it adds to the limited stream of research on the (positive) performance implications of (performance-based) contracts (Anderson and Dekker, 2005; Hypko et al., 2010; Schepker et al., 2014), specifically innovation performance. Our findings furthermore provide additional evidence for the assertion that the antecedents have different effects on incremental and radical innovation (Jansen et al., 2006). Another important research contribution is our finding that the use of incomplete contracts should not be limited to IORs involving non risk-averse partners. Rather, our findings suggest that contracts based on reward schemes that are to a large extent linked to performance, may be more successful when the partner is risk-averse. Whether it is the increased pressure resulting from the pay-for-performance clause inherent in PBCs that positively affects risk-averse partners creativity and persistence is a question in need of further investigation.

Our results have several implications for practitioners. First, the finding that the relationship between term specificity and incremental innovation appears to have an optimum

suggests an interesting tension. Finding the optimal degree of term specificity requires significant managerial skills. Managers must understand the risks associated with giving the partner too much freedom and the limitations imposed by an overly detailed contract. The resulting level of term specificity may however not be low enough to give an optimal level of radical innovation. For radical innovation, organizations must think carefully about incentivizing the partner via incentive structures (i.e., paying the partner for its performance). Finally, when pursuing innovation, organizations should preferably engage in outcome-based reward schemes with risk-averse partners, since under conditions of high pay-for-performance schemes, risk-averse partners tend to achieve higher levels of both incremental and radical innovation. PBCs may thus effectively be used for both types of innovation, although not simultaneously. Organizations need to think about the type of innovation they wish to pursue, to determine the appropriate level of term specificity, and to consequently develop appropriate financial incentive structures.

LIMITATIONS AND FUTURE RESEARCH

Our study has several limitations. First, our study uses perceptual data only. Although such measures are reliable and valid, and are used most appropriately when traits being measured are salient and when multi-item scales are used (Ketokivi and Schroeder, 2004), as is the case in this study, future research should draw on both perceptual and objective data. This implies complementing the respondents' self-reports with objective data, such as measures of term specificity derived from the *actual* content of the contracts and objectively measuring innovation as perceptions may differ as to whether something can be considered an innovation. An in-depth contractual analysis would fit with the call for more research based on contractual content (Chen and Bharadwaj, 2009; Faems, Janssens, Madhok, and Looy,

2008) Moreover, we have defined and measured innovation as a static outcome rather than a dynamic process that unfolds between the parties with multiple stages consisting of idea generation, idea development and idea implementation (Garud et al., 2013). We expect that earlier stages of the innovation process (i.e., idea generation and development) require lower degrees of term specificity as autonomy is important for the partner to generate and develop new ideas. On the other hand, the last stage (i.e., idea implementation) would benefit from higher degrees of term specificity as clearly specifying the objectives is important in accelerating their implementation (Jansen et al., 2006). Hence, future research could test whether our independent variables have different effects on different stages of the innovation process. Third, although we did not find response bias in our data, the response rate is rather low. As has been observed before (Im and Rai, 2008), despite the association's support of this research, it was difficult to increase the response rate. We therefore suggest that a larger sample should be studied in future research to increase the external validity. Moreover, the sample is drawn from firms in the Dutch maintenance sector and therefore can be generalized only to this population. Future research should seek to extend this domain to other industries and geographical areas. More generally, additional research on the relationship between contracts and innovation is required, particularly in conjunction with contingency variables such as the partner's characteristics or the external environment (e.g., market uncertainty) and the internal environment (climate for innovation) (Das and Joshi, 2007; Wang et al., 2011). Finally, since common-method bias cannot be completely eliminated in single-respondent studies, caution must be exercised in interpreting the results. This bias may make the results of the hypothesized relationships stronger or weaker (Das and Joshi, 2007; Parkhe, 1993). Therefore, future research should preferably be based on mixed-method and multi-respondent approaches. Moreover, studies of IORs benefit from dyadic data collection as multi-

respondent data may influence the findings by affecting for example the scores on the control-variable 'trust' of which both parties can experience it differently. However, trust was measured as a bidirectional relationship construct (i.e., "neither party withholds information that is needed to perform well") as opposed to a unidirectional trait (i.e., "we do not withhold information that is needed to perform well"). We therefore expect that this influence is not of high concern. Future research, however, should explore two-sided data collection.

There are several interesting avenues for future research. First, in contrast to recent studies in intra-firm settings, which found that contractual detail might not be as detrimental for radical innovation as previously thought (Jansen et al., 2006; Zollo and Winter, 2002), we have found that term specificity does have a negative effect on radical innovation. Future work could continue this line of research by studying why contractual term specificity affects radical innovation differently in inter- versus intra-firm settings. Second, future studies could investigate the effects of different financial incentive structures, such as bonuses and innovation incentives, on innovation. In an intra-firm setting, reward schemes, such as stock ownership and stock options, have been shown to affect either short-term goals (incremental innovation) or long-term goals (radical innovation) (Sanders, 2001); similar studies could be conducted in an inter-firm setting. Third, future research could focus on the conditions under which risk-aversion is an advantage rather than a disadvantage. Existing research has shown that pressure may foster creativity when it arises from workload or intellectually challenging situations (Amabile and Gryskiewicz, 1987; Amabile, 1988; Bunce and West, 1994); but other types of pressure (e.g., stress resulting from time pressure) may have the opposite effect. It seems worthwhile to study how organizations can create and maintain "healthy" pressure for their risk-averse partners. Furthermore, in this study we have argued that risk-aversion moderates the relationship between pay-for-performance and innovation. However,

risk-averseness may also directly moderate the relationship between term specificity and both types of innovation, since low term specificity increases the partner's responsibility for the design of the transaction. Axelsson and Wynstra (2002) argue that under incompleteness, the partner must be willing to deal with the risk that comes with increased responsibility. Finally, we only tested the effect of formal control on innovation; we did not address the effects of relational governance. IORs governed by contracts that are prone to opportunistic behavior require other governance methods such as the relationship (Al-Najjar, 1995). By keeping the contract open, organizations demonstrate that they trust their partners to deliver the service as agreed. Relational aspects such as trust, communication, and commitment therefore become important (Mohr and Spekman, 1994; Schmoltzi and Wallenburg, 2012). These relational attributes could also affect innovation. For example, parties that interact closely share know-how, which can positively affect innovation (Im and Rai, 2008). Future research could therefore study the interaction between (performance-based) contracts and relational governance elements, rather than testing their effects independently in separate studies.

As more and more organizations adopt contracts that are intentionally left incomplete to govern their inter-organizational relationships, an enhanced understanding of how to design, implement, manage, and control such contracts is critical. The future research opportunities are abundant, and we expect the emerging body of literature on the use and effects of incomplete contracts in general, and PBCs in particular, to grow substantially. Our study is one such contribution; it has increased our understanding of how incomplete contracts affect innovation.

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APPENDIX

Appendix A: Scale items asked to the buyer (and the supplier between brackets), Standardized Loadings (SL), and T-values (t)

	SL	t
Incremental Innovation (Likert-scale = 1 to 5) *To what extent do you agree with the statements below regarding the activities that have been carried out by the partner (your company) within this maintenance contract?*		
1. The partner/(we) continuously improves the maintenance processes	0.809	37.602
2. The partner/(we) often refines the delivery of existing products and services	0.863	52.370
3. The partner/(we) regularly implements small adjustments to existing products and services	0.867	49.420
4. The partner/(we) improves the efficiency of the products and services that are delivered	0.918	88.802
5. The partner/(we) contributes to a higher degree of usage and effectiveness of the asset	0.790	28.209
6. The partner/(we) improves scope management	0.859	41.350
7. The partner/(we) achieves a higher productivity from the mechanics	0.752	22.358
Radical Innovation (Likert-scale = 1 to 5) *To what extent do you agree with the statements below regarding the activities that have been carried out by the partner/(your company) within this maintenance contract?*		
1. Creation of a new service within a particular market	0.839	45.547
2. New way of interacting with the client who receives the service	0.863	50.180
3. Changed internal organizational arrangements with the supplier/(our company) to allow their/(our) employees to perform their job properly	0.814	27.786
4. Change in the tangible aspects of the transaction (e.g., new/changed technology)	0.801	23.826
Term Specificity (Likert-scale = 1 to 7) *To what extent are the following specifications outlined in this maintenance contract?*		
1. The specific persons to be assigned the management and monitoring tasks	0.736	21.020
2. The specific technologies to be contributed by the partner/(our company)	0.724	14.943
3. How the partner/(our company) should develop certain resources/technologies	0.876	66.003
Pay-for-performance (Likert-scale = 1 to 7) *To what extent do you agree with the following statements regarding the reward schemes applied in this contract?*		
1. The partner's/(our) rewards are linked to the outcomes of the service delivered	0.648	14.276
2. The partner/(we) has sufficient financial incentives to improve/develop the service	0.757	25.371
3. The partner/(we) is compensated for delivering better service quality	0.792	22.747
4. The partner's/(our) rewards are linked to the degree of improvement in its/(our) performance	0.835	25.460
5. We have agreed-upon performance bonuses on top of the regular payment schemes when performance levels exceed targets	0.775	25.278
6. The partner/(we) is financially rewarded for developing alternative/new ways of achieving the performance targets	0.815	32.283
Trust (Likert-scale = 1 to 5) *To what extent do you agree with the following statements regarding the degree of trust between your company and the partner?*		
1. Our relationship with this partner is characterized by high levels of trust	0.752	17.189
2.The parties generally trust that each will abide by and work within the terms of the contract	0.764	22.874

3. The parties are generally skeptical of the information provided by the other [R]	0.648	12.876
4. The parties trust each other to have the required resources (such as capital and labor)	0.781	27.593
5. The parties recognize and acknowledge each other's reputation and capabilities	0.698	16.164
6. The parties do whatever is necessary to ensure the success of the collaboration even if it involves performing tasks that they had not previously agreed on	0.769	25.231
7. Neither party withholds information that is needed to perform well	0.721	19.459
8. Neither party exploits to its advantage any (temporary) shortcomings of the other party	0.725	16.851
9. The parties work hard to help each other solve problems that may influence the success of the collaboration	0.842	32.731
Risk-Aversion of the Partner		
To what extent do you agree with the following statements regarding the partner's /(your companies) predisposition toward risk?		
1. The partner/(we) prefers the "tried and true" paths		
Transactional Complexity		
1. How would you evaluate the complexity of the products and services delivered by the partner/(your company) within this maintenance contract (from very low to very high)?		