Between trust and control in interorganizational collaboration – Rethinking formal and informal governance in R&D alliances

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Abstract

Purpose: Trust and control through contracting have been juxtaposed in many studies addressing interorganizational collaboration and knowledge exchange. In this study, we move from the opposite ends of a continuum between trust as an attitude and control exercised through formal contracts toward the center of the continuum where trust and contracting start to show similar features. We ask how trust in its analytical form, and control gained through establishing informal protection for knowledge assets affect the innovation and market performance of firms engaged in R&D alliances.

Design/methodology: We examine existing literature and conduct a quantitative empirical study to answer our research question.

Findings: We find, first, that controlling an organization's own knowledge assets in R&D alliances with informal means of protection can be more effective than a strategy of controlling the alliance through formal contracts. Second, we find that an analytical audit of partner trustworthiness, and especially partner capabilities and goodwill, can be more effective than trust as an attitude.

Implications: Our findings support softening the sharp distinction between trust and control and provide evidence on the relevance of highlighting the firm point of view in knowledge management in R&D alliance governance.

Originality: Our study adds to the existing understanding of trust and control in R&D alliance governance. Specifically, we turn the focus from interorganizational governance to intra-organizational knowledge management measures, and particularly toward how a focal actor can take an analytical approach to evaluating partner trustworthiness and use informal control in protecting its own knowledge assets. Consequently, this study also provides a plausible explanation for the contradictory findings in studies that examine the relationship between trust and control. Our study indicates that depending on the specific nature of trust and control, they can be either a complement or a supplement factors: the extreme forms of trust and control are notably different from those forms that share similar features.

Keywords: analytical trust, informal control, knowledge protection mechanisms, (knowledge) governance, R&D, innovation

Introduction

It is well established that interorganizational collaboration can improve innovation and market performance. Collaboration may provide access to complementary knowledge and enhance innovative output. It may also provide access to distribution channels and marketing capabilities, promoting market performance in the form of increased sales and value added (Belderbos et al., 2004; Hite and Hesterley, 2001; Lööf and Broström, 2008). Likewise, it is widely acknowledged that formal and informal governance are relevant to benefiting from outcomes in interorganizational collaboration; that is, trust and control play a notable role (e.g., Brattström et al., 2012; Cianci et al., 2018; De Man and Roijakkers, 2009; Dhanaraj and Parkhe, 2006; Galati and Bigliardi, 2019; Long and Sitkin, 2018; Lui and Ngo, 2004; Jiang et al., 2013; Möllering and Sydow, 2018; Poppo and Zenger, 2002; Zhang et al. 2018).

The challenge arising from these earlier studies is that they have very specific views on the relationship between trust and control, seeing them as a complement or a supplement (Blomqvist et al., 2005), or focusing on finding the balance between the two by adjusting the amount of formal and informal governance to different levels (Möllering and Sydow, 2018), for example. Moreover, on their own, control and trust seem to be approached in specific ways.

First, past research on formal governance (especially in connection to informal governance) has emphasized the role of contracts (formal, legally binding contracts, and relational governance) in regulating relationships between the collaborating organizations as a relevant issue (see, e.g., Olander et al., 2010). Approaching control as contracting directs attention to the rights and obligations of the actors involved, and the activity in the collaboration (e.g., Arranzand de Arroyabe, 2012; Blomqvist et al., 2005; Cao and Lumineau, 2015; Cullen, 2000; Faems et al., 2008; Frankel et al., 1996; Edelenbos and Eshuis, 2012; Powell et al. 1996; Yli-Renko et al., 2001). While useful as such, this view is of limited use in fully

capturing the motivation and strategies of individual actors. In fact, recent knowledge management literature suggests that the understanding of both the knowledge creating conditions and knowledge protection related to securing organizational performance remains scant, especially in the context of interorganizational collaboration (Manhart and Thalman, 2015; Durst and Zieba, 2018; Durst, 2019; Durst, Aggestam, and Aisenberg Ferenhof, 2015; Abubakar, Elrehail, Alatailat and Elci, 2019).

We argue that past research may have overlooked the role of internal, firm-specific mechanisms to apply knowledge governance in the context of inter-firm collaboration. What if a firm could best invest in R&D alliance governance by focusing in its own actions, not by trying to control anything and everything through contracts? Instead of considering the formal governance of the alliances or the behavior of the partners per se (e.g., Das and Teng, 1998), we examine how firms govern their own knowledge assets and actions in R&D alliances. We are especially interested in seeing how they exercise control through the use of informal knowledge protection mechanisms (see e.g., Gallié and Legros, 2012; Hurmelinna-Laukkanen and Puumalainen, 2007), that we believe match well with trust as the form of governance residing at the other end of the continuum of governance modes.

Second, as in the case of control, it seems that discussion on trust has taken specific paths in the context of interorganizational collaboration. While trust building is a central aspect enhancing knowledge exchange in R&D activities, there is a large body of research on trust that does not differentiate trust (in the relationship) from the trustworthiness of partners (see Barney and Hansen, 1994). Seminal articles on trust in inter-firm alliances still conceptualize trust as a collectively held attitude or orientation (Zaheer et al., 1998; Dyer and Chu, 2000). However, this view of trust as a passive, generalized attitude has been criticized (Currall and Inkpen, 2002; Li, 2007), and a more active approach to trust has been called for (Möllering, 2005; Blomqvist, 2014; Poppo et al., 2015). Likewise, recent research acknowledges the

problem of paying attention to the amount of trust (too little vs. too much) instead of considering the type of trust in many studies (Möllering and Sydow, 2018).

Indeed, we might ask "What if trust could be "formalized" by taking a more analytical and active stance?" We respond to the need to look at the qualitative dimension, as well as to recent calls by researchers such as Dietz (2011) and Ashnai et al. (2016) for investigations into the actual use of trust in management. We focus especially on analytical trust that refers to the active and analytical auditing and evaluation of partner firm trustworthiness (instead of a generalized trusting attitude, or a level of trust in the relationship) (see Möllering and Child, 2003; Blomqvist 1997; 2005; Seppänen et al. 2006).

Summarizing the elements in the above discussion, we target discerning *how analytical trust and informal means of knowledge protection affect the innovation and market performance in R&D alliances.* Innovation performance here captures the level of innovativeness, renewal, and development, and market performance refers to profitability and market expansion types of outcomes as the desired outcomes of governance of R&D alliances.

We start by examining literature on informal knowledge protection as a form of control in R&D alliances, and also the role of trust in such arrangements. We conduct an empirical examination of multi-industry survey data from R&D-intensive Finnish firms to verify expectations and capture new insights. The discussion and conclusions section incorporating managerial implications, the limitations of this study, and suggestions for future research concludes the study.

Informal knowledge protection mechanisms in knowledge management: The firm perspective on controlling collaborative innovation

Interorganizational collaboration, and especially collaboration involving R&D activity most likely necessitates some form of control. Organizations operating R&D alliances can target

the control toward the alliance partners' behavior, or its own knowledge management practices. The former usually means drafting contracts that determine ownership of knowledge assets brought into the collaboration and created in it (Olander et al., 2010). The latter refers to proactive planning of how the organization will limit or prevent abuse of its knowledge assets, and protecting them with formal mechanisms (consider, e.g., intellectual property rights; IPRs) or informal ones. The range of informal knowledge protection mechanisms includes human resource management (HRM) practices, practical and technical concealment and secrecy, lead-time, and the tacit nature of knowledge (Gallié and Legros, 2012; Hurmelinna-Laukkanen and Puumalainen, 2007; Zobel et al., 2017).

In general, knowledge protection has been found to have positive effects on firms' performance (e.g., Escribano et al., 2009). However, knowledge protection may have both positive or negative effects on knowledge transfer and R&D collaboration (Autio et al., 2000; Czarnitzki et al., 2011; Dosi et al., 2006; Neuhäusler, 2012; Olander et al., 2010; Zobel et al., 2017). For example, partners might interpret the use of protective measures as a sign of self-interest or distrust on the part of the partner. Considering that informal mechanisms are not as visible to alliance partners as formal ones, reliance on those mechanisms could help avoid some of those challenges (see Olander et al., 2014).

In fact, first, HRM practices as a protection mechanism can be highly relevant to R&D alliances (Baughn et al., 1997; Norman, 2002; Hurmelinna-Laukkanen and Puumalainen, 2007; Olander et al., 2011; Porter Liebeskind, 1997), where knowledge is more readily observable by partners, and concerns related to misappropriation are greater than when knowledge is kept within the firm (Heiman and Nickerson, 2004; Ritala et al., 2018). When a contact person knows what to share and with whom, collaboration is more likely to yield the desired outcomes without damaging the relationship as such.

Second, longer lead-time, that is, constantly moving forward (ahead of the competition),

improves the likelihood that others cannot capture the essence of the focal firm's innovation (Saviotti, 1998). Moreover, moving first improves the opportunities for customer lock-in, which, in turn, can generate further input for innovation (Lieberman, 2005). Gaining ancillary revenues from licensing and other such operations after prompt market entry may also promote incentives and resources for subsequent innovation (Hurmelinna-Laukkanen and Puumalainen, 2007), and therefore, there is opportunity for innovation and market performance to be enhanced. This applies to R&D collaboration, where, after the joint development work, there is often a need for differentiation.

Third, secrecy promotes the proprietary nature of knowledge and has the potential to generate monopoly rents (Arundel, 2001). Secrecy can be enforced through a range of practical and technical means, such as using password protection, holding meetings in a secure environment, limiting opportunities to move materials outside the firm, etcetera. The challenge of secrecy is that it prohibits knowledge sharing to facilitate new combinations of knowledge (Bohlmann et al., 2010; Crossan and Inkpen, 1995) and potentially harms the development of trust (Hannah and Robertson, 2016).

Fourth, tacit knowledge is inherently difficult to codify and transfer and is not easily visible even when observed (Nonaka and Takeuchi, 1995; Zander and Kogut, 1995). However, tacitness is not perfect and is connected to HRM in the sense that losing tacit knowledge when key employees leave is a pertinent risk (Boxall, 1998; Olander et al., 2011). Furthermore, tacitness at its strongest levels may hinder knowledge sharing (Martin and Salomon, 2003), which may become an issue, especially in the initial stages in R&D alliances (Wei et al., 2019).

In sum, we expect that despite some limitations, informal mechanisms to protect a firm's assets represent a form of control that focuses on the firm's own activity and opportunities to gain from R&D alliances and does so in a manner that is likely to also match the informal,

relational forms of governance. Therefore, we expect positive results from the use of these mechanisms with regard to innovation and market performance. For simplicity, we introduce only two hypotheses despite testing all mechanisms (HRM, secrecy, lead-time, and tacitness) individually.

Hypothesis 1a: Informal knowledge protection mechanisms are positively related to innovation performance.

*Hypothesis 1b**:** Informal knowledge protection mechanisms are positively related to market performance.*

Analytical Trust: Toward relational knowledge management to promote success in R&D alliances

Trust is often introduced as the counterpart of control in intra-organizational activities. While it has been broken down into different elements and viewed at various levels, research has tended to focus on investigating the notion of a trusting attitude (see, e.g., Varoutsa and Scapens, 2018) and the quantitative element of trust has also quite often been highlighted (Möllering and Sydow, 2018). In our study, we consider analytical trust, that is, the analytical audit of partner firm trustworthiness instead of a generalized trusting attitude, or a level of trust in the relationship. Möllering (2005; see also Child and Möllering, 2003) describes analytical trust as rational behavior, Adler (2001) and Sydow (2003) discuss reflective trust, and Hardin (1993) describes a trustor behaving analytically as an “instinctive Bayesian” updating the parameters of actor trustworthiness based on past experience. Much of the literature on trust has also examined the incremental development of trust through gradual investments (Lewicki and Bunker, 1995; Ring and Van de Ven, 1994; Ring, 2000; Van De Ven, 1976), where evaluation and learning also play a role. This implies that analytical trust

has been accounted for, although not necessarily explicitly.

In our research, we propose that while any actual trusting behavior (risk-taking decisions and disclosure of sensitive information, for example) should always be specific to the situation, task, and object of trust (Hardin, 1992; Lewicki and Bunker 1995; Brattström, 2012), the analytical approach itself is a firm-specific behavior. We suggest that for trust to create value in R&D alliances, a trustor must analytically evaluate and audit a specific trustee's trustworthiness along the dimensions of trust, specifically, competence, and goodwill (Blomqvist, 1997 & 2005). Accordingly, we focus on the trustor's point of view instead of trying to capture trust as an inter-firm, reciprocal phenomenon (cf., e.g., Brattström et al., 2012). The trustor does not rely solely on shared expectations based on broad social rules, but on a firm-specific analytical audit of trustworthiness. When we focus on analytical trust, with the emphasis on the firm's point of view, it is not essential to have an informant from the opposite side or to connect trust to a specific interaction situation.

Analytically evaluated trust in capabilities and goodwill should lead to benefits in terms of better-informed knowledge sharing for improved innovation performance and, if collaboration is continued through to the commercialization phases, to better access to markets and subsequent stronger market performance (see Blomqvist et al., 2005). Therefore, we expect, especially in the case of knowledge intensive R&D alliances, that:

Hypothesis 2a: Analytical trust is positively related to innovation performance.

Hypothesis 2b: Analytical trust is positively related to market performance.

Figure 1 below shows all the hypotheses and illustrates the framework of this study.

Insert Figure 1 about here

Data and methods

The data were collected from different industries in Finland. Differences in industry characteristics may lead to firms relying on different mechanisms, and therefore, studying multiple industries promotes a holistic view. Moreover, Finland, having a small economy and being a fairly homogenous country culturally and economically, should be a good setting in which to measure the central variables in this study. A homogenous culture reduces the likelihood of culturally interpreted variation in the perception of abstract constructs (Autio et al., 2000; Spender and Grant, 1996).[1] The data were collected with two web-based survey instruments during the years 2008–2009. One was dedicated to studying HR functions and one to R&D functions in respondent firms. We used the publicly available Amadeus database when selecting the initial sample. Firms with at least 100 employees at the end of 2007 were included in the search (1,035 firms). Second, because the survey was conducted as part of a research project focusing on R&D and innovation, ongoing R&D and innovation activity was a prerequisite. The process identified 570 eligible firms from which 205 responses to the HR questionnaire were gathered, along with 213 responses to the R&D questionnaire. Of the total responses, 83 were matched pairs from the same firm. Out of those 83, we picked only those responses that reported having alliances. Ultimately, we had 77 firms with alliances and which had two respondents from the same company. By collecting data from different informants in the same company for dependent and independent variables, we aimed to avoid common-method bias. Additionally, we mainly used well-established measures that have delivered construct validity through convergent and divergent validation (only the analytical trust construct is an exception to this, as it was developed based on qualitative research; Blomqvist, 2005). Therefore, we also conducted confirmatory factor analysis for all our measures with Lisrel. The measures were obtained from the answers to the two questionnaires

[1] Other features of Finnish culture of possible relevance are an adherence to "gentleman's contract" norm that indicate that different mechanisms are likely to be operating.

(i.e., knowledge protection mechanisms from the R&D questionnaire and trust from the HR questionnaire), or publicly available databases (e.g., size and industry). When measuring innovation performance (the dependent variable), answers from the HR and RD managers were used so as to mitigate potential overconfidence on the part of R&D managers in evaluating the outputs. The missing values in the rest of the data were sufficiently small to allow them to be input in accordance with the estimation maximum procedure, thus ensuring the applicability and completeness of the data for statistical testing (see, e.g., Dempster et al., 1977).

Measures

We identified four *informal knowledge protection mechanisms*: *HRM measures, secrecy, lead-time,* and *tacitness*. We adopted and modified measures for each mechanism following the example of the Community Innovation Surveys (CIS, see OECD Oslo Manual, 2005) and other similar surveys (Cohen et al., 2000; Hurmelinna-Laukkanen and Puumalainen, 2007; Levin et al. 1987). The respondents were asked to evaluate a set of practices and mechanisms in terms of how strongly they had protected against imitation. Table 1 reports the items used to measure informal knowledge protection mechanisms and the other constructs in this study.

Insert Table 1 about here

The measure of *analytical trust* was developed based on qualitative research by Blomqvist (2005) revealing that technology companies evaluated each other's trustworthiness based on competence, goodwill, and identity (see also Blomqvist, 2005, Seppänen et al., 2006). Our measure reflects an analytical audit of partner trustworthiness as consisting of an assessment of technological knowledge (competence), collaboration capability (goodwill), awareness of other organizations of their own strengths, goals, and modes of operation, and compatibility

of goals.[2] Respondents evaluated these factors with a 7-point Likert scale. Statements and statistical information related to measurement development are shown in Table 1.

Previous studies have employed many measures of *innovation performance*. We used a subjective measure for an organization's overall innovation performance based on the work of Alegre and Chiva (2006; 2008) because we believe that it captures the organizational level of innovation performance in a holistic way, and separates innovativeness in terms of development and renewal from financial aspects better than the measures used in the CIS questionnaires (i.e., share of turnover from new products or services). Respondents were asked how they would compare their organization's performance on a set of areas over the last three years to that of other organizations operating in the same sector. Again, the items were rated using a 7-point Likert scale (see Table 1 for the wording of individual items).

Market performance was measured based on the work of Delaney and Huselid (1996). The respondents were asked how they would compare their organization's performance over the last three years to that of other organizations operating in the same sector in relation to the following aspects: growth in sales; marketing, market share; profitability; and market growth.

We also used control variables in the linear regression analyses, including *firm age* (in years, information collated from publicly available data) and *firm size* (number of employees as reported in publicly available data). We used logarithmic transformations to ensure the normality of the distribution of these two control variables. Additionally, we included industry dummies in our analyses. In the database, the 77 companies are categorized into *industry* sectors: manufacturing (27 firms, 35.1 %); machinery (16 firms, 20.8%); ICT (8 firms, 10.4%); trade (8 firms, 10.4 %); construction (5 firms, 6.5%); and services (13 firms, 16.9%).

[2] That is, the construct captures different dimensions of trust and also addresses the problem of the dark side of trust (cf. Neu, 1991).

Analyses and Results

There were three steps to the statistical analysis testing our hypotheses. First, a correlation analysis was conducted to identify statistically significant measures. Table 2 displays the correlation matrix for the variables. Second, we conducted a confirmatory factor analysis (CFA) with Lisrel examining the construct and discriminant validity of the proposed constructs. We decided to drop items from all measures apart from lead-time owing to their high standardized residuals (over 3) and low loadings (see Table 1). After dropping the items, the model measurement fit produced fairly strong results in relation to the scales in the study. The *t*-values associated with each of the item loadings in relation to the examined variables were: HRM 5.579, secrecy 5.006, lead-time 5.145–6.782, tacitness 7.878–11.898, analytical trust 7.198–7.375, market performance 6.542.–6.613, and innovation performance 6.365–6.818. The chi-square (maximum likelihood ratio) helps to determine whether the factor model gives a reasonable estimation of the population or theoretical model. The chi-square/*df* value is 0.96 ~1 (161.94/168) and being close to 1, could be considered reasonably good. The chi-square *p*-value is non-significant, indicating good model fit (Cuttance, 1987, Hair et al., 1995). The RMSEA of 0.00 is also acceptable as it is below the 0.05 threshold, thus indicating good model fit. The comparative fit indexes CFI, IFI, NFI, and NNFI also exhibited favorable fit statistics of 0.979, 0.979, 0.873, and 0.973 respectively, and values over 0.9 indicate a good fit with the data (Kelloway, 1998). The CFA model on informal knowledge protection mechanisms, analytical trust, and market and innovation performance thus showed good fit to the collected data.

Finally, as the third step, linear regression analyses were used to assess the link between informal knowledge protection mechanisms, and market and innovation performance, as well as the link between analytical trust, and market and innovation performance (H1a, H1b, H2a, and H2b). Table 2 reports the eventual scales used in the linear regression model, and Tables

3 and 4 present the results of the regression analyses.

Insert Tables 2-4 about here

Hypotheses H1a and H2a are concerned with informal knowledge protection mechanisms and analytical trust, and whether they are positively related to innovation performance. The results reported in Model 2 in Table 3 lend support to H2a and partial support to H1a. More specifically, analytical trust, HRM, and lead-time are positively related to innovation performance, but tacitness and secrecy are not.

Furthermore, HRM as a knowledge protection mechanism is positively related to market performance, but lead-time, tacitness, and secrecy are not, thereby only partly supporting hypothesis H1b (see Table 4, model 2). H2b predicted a positive relationship between analytical trust and market performance: The relationship was not significant (see Table 4, model 2), and therefore, H2b is rejected.

In addition to the hypothesized relationships, we also decided to examine the role of analytical trust as opposed to generalized trust, and informal forms of protection against contracts and formal protection, in order to see if the extreme forms at the end of continuum differ from those located in the center. For this purpose, we relied on larger, but separate data sets with the aspect on trust evaluated based on all the usable responses retrieved from HR managers (114 responses), and protection mechanisms examined based on full data from R&D managers (114 responses). We used linear regression analyses in this *post hoc* examination to test (1) if contracts, or formal mechanisms of knowledge protection (employment legislation and IPRs) explain market and innovation performance better than the informal (HRM, lead-time, secrecy, and tacitness) mechanisms addressed in the main study, (2) if generalized trust explains market and innovation performance better than analytical trust, and (3) if contracts, and formal and informal mechanisms of protection relate to a company's collaboration with

alliance partners, and if the existence of analytical and generalized trust connects to the perceptions of alliances.

To measure the effect of *contracts* and *employment legislation*, and *IPRs*, we asked the respondents to evaluate via a 7-point Likert scale how well different means protected innovations against imitation. The items for contracts (alpha=0.774) covered *long-term collaboration contracts* and *non-disclosure/confidentiality agreements*. Employment legislation (alpha =0.838) included *inter-firm contracts on not recruiting personnel from each other*, *employees' non-competition agreements*, and *the legal loyalty obligation of employees*, and the items for IPRs (alpha= 0.729) were *patents*, *copyright*, and *trademark*. *Generalized trust* (alpha= 0.832) was measured with two items also on a 7-point Likert scale: *We think that most people in the business world can be trusted*; and, *We try to trust our partners without continual monitoring*.

The company's collaboration with alliance partners, especially *value-creation benefit* (alpha = 0.864), was evaluated by asking the respondents to estimate how they would characterize the results of their company's collaboration with alliance partners. The items included statements such as: *We get information from our partners that is valuable to our business*; *We get useful ideas for the development of business from our partners; In our alliances we take full advantage of both parties' expertise;* and, *A close collaboration relationship fosters new creative solutions*. *Overall alliance performance* (alpha = 0.90) was measured by asking respondents to describe their alliances, following the example of Kale and Singh (2007). The items cover aspects such as: *Our alliances are characterized by strong and harmonious relationships between partners; Our company has achieved its primary objectives in forming alliances;* and, *The company's competitive position has been greatly enhanced due to alliances.*

The results of the post hoc examination are reported in Tables 5–10 below. Since the data for

the post hoc analyses were limited to a single respondent per firm, we used Harmon's one-factor test to check for common-method variance (see Podsakoff and Organ, 1986). No problems emerged.

Insert Tables 5-10 about here

The post hoc examination provided the following findings: (1) HRM and secrecy explain innovation performance. HRM is as in the main study, but without trust being controlled for, secrecy has a negative impact, which is not completely surprising considering that it can be seen as a deliberate blocking activity with negative effects on (reciprocal) knowledge sharing. Contracts are not relevant (the sign is negative). Additionally, employment legislation and HRM explain market performance, with HRM having a positive, and employment legislation a negative, effect. Contracts do not play a significant role (although, again, the sign is negative). This suggests that informal mechanisms may indeed be more useful than contracts or formal mechanisms, although the effects vary and a cautious approach to interpretation is therefore recommended. We were also able to establish (2) that while analytical trust explains market performance and innovation performance, generalized trust does not. This suggests that trust needs to be more than just an attitude. Finally, we found that (3) lead-time relates positively to the respondents' perception of the overall alliance performance. Analytical trust relates positively to how the respondents characterize the value-creation benefit of collaboration. Therefore, both informal mechanisms, that come closer to trust than strict contracting, for example, and analytical trust, that is closer to formal governance than a general positive attitude, can have a positive association with alliance performance.

Discussion

Our findings have implications for the current theorization on managing R&D alliances. Of

the informal mechanisms, HRM seems to be positively related to market performance and innovation performance in firms engaged in R&D alliances. It may be quite essential for the generation of innovation as the contact persons at the interfaces of organizations participating in R&D collaboration act both as recipients and gatekeepers of core knowledge (Baughn et al., 1997; Chesbrough, 2003; Olander et al., 2014). With regard to market performance, HRM is relevant as marketing and other such functions could jeopardize or dilute the uniqueness of the offerings if care is not taken to keep certain aspects secret while publicly promoting others (see Hannah et al., 2015).

Innovation performance can also be promoted through the reliance on lead-time. By acting first, the firm has the opportunity to acquire higher profits, lock in customers, and—with the help of feedback, income gains, and new knowledge assets—constantly move on to new areas, making it harder for imitators (or previous partners) to capture the essence of its innovations (Hurmelinna-Laukkanen and Nätti, 2012; Saviotti, 1998; Stanko et al., 2013). Market performance may not be affected as much, if opportunist action by followers and similar issues diminish the market related benefits, for example (Kerin et al., 1992).

In sum, it seems that controlling the knowledge transfer strategically from within the firm is relevant—more so than is a reliance on contracting for control. With regard to HRM mechanisms and lead-time, success is built on the company doing everything it can to profit from its innovations instead of employing protective means to preserve uniqueness, which is unlikely to be the most productive approach in R&D alliances (cf. Martin and Salomon 2003; Zobel et al., 2017).

This idea is bolstered by the strong positive relationship of analytical trust with innovation performance. Analytical trust captures how a firm assesses another company’s technological knowledge, collaboration capability, goals, and goodwill, and how well the partner knows its strengths, goals, and how well it is able to operate. These qualitative aspects (cf. Möllering

and Sydow, 2018) are especially relevant in R&D collaboration when parties develop new products and services together, replace old services, and access new target groups. Prior research has indicated that goodwill and capability trust are relevant, but both an under-emphasis and an over-emphasis on trust is risky, or at least inefficient (e.g., Bidault and Castello, 2010; Bunduchi, 2013; Goel and Karri, 2006, Wicks et al. 1999). This is in line with our findings: When the capabilities and goodwill of the alliance partners are carefully analyzed, under- and over-investment is easier to avoid, making it more likely that relevant ideas can be efficiently combined and that problems will not arise over abuse of the knowledge assets of the participants. This provides fertile ground for the emergence of innovations. The weak linkage of analytical trust to market performance measured in terms of market share, market growth, and profitability is less evident from both practical and theoretical points of view. This may be due to innovation creation being a collaborative, and commercialization being more an individual, activity (see Ritala and Hurmelinna-Laukkanen, 2009). In that case, trust issues may not be as decisive.

To summarize, this study indicates that there might be tools available in what might be termed the golden middle between the strict control in R&D alliances, and the generalized forms of trust where feelings or a laissez-faire approach dominate analytical approaches.

Theoretical contribution

In this study we asked how analytical trust and informal knowledge protection mechanisms affect the innovation and market performance of firms engaged in R&D alliances. Our study contributes to existing knowledge, first, by complementing studies that take the governance of an alliance as the focal issue (e.g., Das and Teng, 1998; Yang et al., 2011). Instead, we take an approach that concentrates on the firm's self-governance activities, especially with regard to knowledge management. We find that the focal firm can rely on a set of informal, organizational mechanisms that protect its firm-critical knowledge assets, and that it can take

an analytical approach toward trust, making an effort to evaluate the trustworthiness of its partners.

Second, our findings indicate that it might well be possible—and even warranted—to soften the relatively sharp distinction between trust and (contractual) control. Analytical trust, that in its proactive and evaluative character comes closer to control mechanisms, and informal knowledge protection mechanisms that serve similar purposes to contracts and IPRs but perhaps fit better with the evolution of trust, seem to be relevant for innovation and market performance, as well as alliance performance. Considering using informal knowledge protection mechanisms in relation to firm-specific knowledge instead of formal, contractual means to control the partner behavior (Edelenbos and Eshuis, 2012) adds to existing knowledge on interorganizational collaboration governance. Introducing analytical trust instead of trust in general (e.g., Bidault and Castello, 2010; Bunduchi, 2013; Goel and Karri, 2006; Möllering, 2011; Wicks et al., 1999) may extend the contribution: Analytical trust has the potential to meaningfully capture different dimensions of trust (see Castaldo et al., 2010; Gargiulo and Ertug, 2006; Poppo et al, 2015; Schilke and Cook, 2015), and the firm perspective removes or at least reduces some measurement-related problems.

Finally, addressing knowledge protection and analytical trust simultaneously during the empirical examination offers a way to augment existing knowledge. This leads us to suggest that, in a collaboration, focusing on governing oneself can be beneficial. Furthermore, our study indicates that whether control and trust are complement or supplement factors to each other may be a question of degree rather than a clear-cut alternative. The current research therefore adds to the discussion on the duality of trust and control (see Möllering, 2005; Möllering and Sydow, 2018) The entangled nature of trust and control generates contradictions or alignment depending on the nature of control and trust.

Managerial implications

This study serves as a reminder that there are at least two parties to interorganizational collaboration, and that sometimes it is useful to start with a review of ones own perspectives when seeking to govern joint activities. Our findings indicate that managers should be careful neither to adopt an overly trusting attitude in alliances, nor put too much emphasis on controlling the collaboration as such. Here, for example, introducing joint training for lawyers and R&D managers, or at least improving the communication within the organization among these actors can be beneficial in helping to build a shared language and common ground. In particular, considering the importance of HRM in knowledge management, this activity can be considered relevant. Firms could also benefit from developing intelligent routines and structures for promoting the analytical audit of partner trustworthiness as part of their alliance capability tools (see Heimeriks, 2008). Trust could be evaluated continuously as part of an assessment of the collaboration quality (Blomqvist & Levy, 2006), and a tool could be developed for that as well. Further trust building for R&D alliances should be a continuous investment requiring management time at both strategic and operative levels (see Knudsen and Nielsen, 2010; Schilke and Goerzen, 2010). Similarly, while in practice, it would be very difficult to use informal knowledge protection mechanisms to completely replace formal ones, the former can be used efficiently to complement the latter in R&D and innovation collaboration (Blomqvist et al. 2005, Zobel et al., 2017). Therefore, a strategic approach with an appropriate knowledge protection policy is worth considering.

Limitations and future research

Our study is obviously limited in terms of the size of the data set available. Although other studies (e.g., Brattström et al., 2012) have utilized similarly small data sets, a larger data set would allow the simultaneous inclusion of diverse types of protection mechanisms and forms of trust in the analysis in a reliable manner, or closer scrutiny of interactions or curvilinear

relationships. On the other hand, the two-respondent setting, for example, improves the quality of the analyzed data. Another issue worth noting is the context: As a Nordic country, Finland has been assessed to be a low bribery and high-trust country (Rothstein & Ek, 2009; Transparency International 2014). Therefore, our sample of Finnish firms may have been adjusted to collaborate with a trusting attitude instead of analytical trust, and the same study parameters applied to other contexts might show different results. The age of the data is also an issue to consider. While the studied phenomena are relatively stable and the relationships between the central constructs are not critically vulnerable to any fast-changing trends, with the increase of open innovation (and acknowledging its downsides), collecting and analyzing new data could potentially reveal more nuances of this topic. Our hope is that the findings and limitations, taken together, provide a starting point for future research.

References

Abubakar, A. M., Elrehail, H., Alatailat, M. A., & Elçi, A. (2017). Knowledge management, decision-making style and organizational performance. *Journal of Innovation & Knowledge*. 4(2), 104-114.

Adler, P. (2001). Market, Hierarchy, and Trust: The Knowledge Economy and the Future of Capitalism. *Organization Science,* 12, 215-234. Doi: 10.1287/orsc.12.2.215.10117

Alegre, J. Lapiedra, R., & Chiva, R. (2006). A measurement scale for product innovation performance. *European Journal of Innovation Management***,** 9, 333-346. Doi: org/10.1108/14601060610707812

Alegre, J., & Chiva, R. (2008). Assessing the impact of organizational learning capability on product innovation performance: An empirical test. *Technovation***,** 28, 315-326. Doi: org/10.1108/dlo.2009.08123bad.006

Arranz, N., de Arroyabe, J., & Fdez, C. (2012). Effect of Formal Contracts, Relational Norm

and Trust on Performance of Joint Research and Development Projects. *British Journal of Management,* 23, 575–588. Doi: 10.1111/j.1467-8551.2011.00791.x

Arundel, A. (2001). The relative effectiveness of patents and secrecy for appropriation. *Research Policy,* 30, 611 – 624. Doi: 10.1016/S0048-7333(00)00100-1

Ashnai, B., Henneberg, S. C., Naudé, P., & Francescucci, A. (2016). Inter-personal and inter organizational trust in business relationships: An attitude–behavior–outcome model. I*ndustrial Marketing Management*, 52, 128-139. Doi.org/10.1016/j.indmarman.2015.05.020

Autio, E., Sapienza, H., & Almeida, J.G. (2000). Effects of age at entry, knowledge intensity and imitability on international growth. *Academy of Management Journal,* 43, 909-924. Doi*:*10.2307/1556419

Baughn, C.C., Stevens, J.H., Denekamp, J.G., & Osborn, R.N. (1997). Protecting intellectual capital in international alliances. *Journal of World Business*, 32, 103-117.

Belderbos, R., Carree, M., & Lokshin B. (2004). Cooperative R&D and firm performance. *Research Policy*, 33, 1477-1492. Doi: org/10.1016/j.respol.2004.07.003

Bidault F., & Castello A. (2010). Why too much trust is death to innovation. *MIT Sloan Management Review***,** 51, 33-38.

Blomqvist, K. (1997). The Many Faces of Trust. *Scandinavian Journal of Management*, 13, 271-286. Doi: org/10.1016/S0956-5221(97)84644-1

Blomqvist K., Hurmelinna P., & Seppänen R. (2005). Playing the Collaboration Game Right – Balancing Trust and Contracting. *Technovation***,** 25, 497-504. Doi*:10.1016/j.*technovation*.2004.09.001*

Blomqvist K. (2005). Trust in a Dynamic Environment - Fast Trust as a Threshold Condition for Asymmetric Technology Partnership Formation in the ICT Sector. In K. Bijlsma Frankema & R.K. Woolthuis (Eds), *Trust in Pressure, Investigations of Trust and Trust*

Building in Uncertain Circumstances (127-147). Edward Elgar Publishing, Inc.

Blomqvist K., and Levy J. (2006) Collaboration Capability – A Focal Concept in Collaborative Knowledge Creation and Innovation in Networks. International Journal of Management Concepts and Philosophy, 2(1), 31-48. DOI: 10.1504/IJMCP.2006.009645

Blomqvist, K. (2014). Building sustainable organizational trust in radical change–interplay of organizational trust and mindfulness. In G. Becke (Ed), *Mindful Change in Times of Permanent Reorganization* **(**131-145). Springer Berlin, Heidelberg.

Bohlmann, J.D., Calantone, R.J., & Zhao, M. (2010). The effects of market network heterogeneity on innovation diffusion: an agent-based modeling approach. *Journal of Product Innovation Management*, 27, 741–760. Doi: 10.1111/j.1540-5885.2010.00748.x

Brattsröm, A., Löfsten, H. & Richtnér, A. (2012). Creativity, trust and systematic processes in product development. *Research Policy*, 41, 743-755. Doi: 10.1016/j.respol.2011.12.003

Bunduchi, R. (2013). Trust, partner selection and innovation outcome in collaborative new product development. *Production Planning & Control*, 24, 145–157. Doi: org/10.1080/09537287.2011.647868

Cao, Z., & Lumineau, F. (2015). Revisiting the interplay between contractual and relational governance: A qualitative and meta-analytic investigation. *Journal of Operations Management,* 33, 15-42. Doi: org/10.1016/j.jom.2014.09.009

Castaldo, S., Premazzi, K., & Zerbini, F. (2010). The Meaning(s) of Trust. A Content Analysis on the Diverse Conceptualizations of Trust in Scholarly Research on Business Relationships. *Journal of Business Ethics*, 96, 657-668. Doi: org/10.1007/s10551-010-0491-4

Chesbrough, H. (2003). The logic of open innovation: Managing intellectual property. *California Management Review*, 45, 33-58. Doi: org/10.2307/41166175

Child J. & Möllering, G. (2003). Contextual Confidence and Active Trust Development in the Chinese Business Environment. *Organization Science,* 14, 69-80. Doi:

org/10.1287/orsc.14.1.69.12813

Cianci, A., Reichert, B. E., Sedatole, K., & Tsakumis, G. T. (2018). *Trusting behavior following a violation of trust: The immunization effect of control system transparency*. Available at SSRN 3022154.

Cohen, W.M., Nelson, R.R., & Walsh, J.P. (2000). Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not). National Bureau of Economic Research, Working Paper 7552.

Crossan, M.M., & Inkpen, A.C. (1995). The Subtle Art of Learning through Alliances. *Business Quarterly,* 60, 68 – 78.

Cullen, P.A. (2000). Contracting, co-operative relations and extended enterprises. *Technovation***,** 20, 363–372. Doi: 10.1016/S0166-4972(99)00172-8

Currall, S.C., & Inkpen, A.C. (2002). A multilevel approach to trust in joint ventures. *Journal of International Business Studies,* 33, 479-495. Doi: org/10.1057/palgrave.jibs.8491027

Czarnitzki, D., Hussinger, K., & Schneider, C. (2011). R&D Collaboration with Uncertain Intellectual Property Rights SSRN working paper 1786402.

Das, T. K., & Teng, B.S. (1998). Between trust and control: Developing confidence in partner cooperation in alliances. *Academy of Management Review*, 23, 491-512. Doi: 10.5465/AMR.1998.926623

De Man, A. P., & Roijakkers, N. (2009). Alliance governance: balancing control and trust in dealing with risk. *Long Range Planning***,** 42, 75-95. Doi:10.1016/j.lrp.2008.10.006

Delaney, J.T., & Huselid, M.A. (1996). The impact of human resource practices on perceptions of organizational performance. *Academy of Management Journal*, 39, 949-969. Doi: 10.2307/256718

Dempster, A. P. Laird, N.M. & Rubin, DB. (1977). Maximum likelihood from incomplete

data via the EM algorithm. Journal of the Royal Statistical Society, Series B (Methodological), 39, 1-38.

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review*, 31, 659-669. Doi: 10.5465/AMR.2006.21318923

Dietz, G. (2011). Going back to the source: Why do people trust each other? *Journal of Trust Research*, 1, 215-222. Doi: org/10.1080/21515581.2011.603514

Durst, S. (2019). How far have we come with the study of knowledge risks?. *VINE Journal of Information and Knowledge Management Systems, 49(1), 21-34.*

Durst, S., Aggestam, L. and Aisenberg Ferenhof, H. (2015). Understanding knowledge leakage: a review of previous studies, *VINE*, 45, 4, 568-586, https://doi.org/10.1108/VINE-01-2015-0009

Durst, S. & Zieba, M. (2018). Mapping knowledge risks: towards a better understanding of knowledge management in *Journal of Knowledge Management Research & Practic*e 17(1), 1-13.

Dyer, J.H., & Chu, W. (2000). The Determinants of trust in supplier-automaker relations in the US, Japan, and Korea. *Journal of International Business Studies*, 42, 28-34. Doi: 10.1057/palgrave.jibs.8490905

Edelenbos, J., & Eshuis, J. (2012). The Interplay Between Trust and Control in Governance Processes A Conceptual and Empirical Investigation. *Administration & Society*, 44, 647-674. Doi: org/10.1177/0095399711413876

Escribano, A., Fosfuri, A., & Tribó, J.A. (2009). Managing external knowledge flows: The moderating role of absorptive capacity. *Research Policy*, 38, 96-105. Doi: 10.1016/j.respol.2008.10.022

Faems, D., Janssens, M., Madhok, A., & Van Looy, B. (2008). Toward an integrative perspective on alliance governance: connecting contract design, trust dynamics, and contract application. *Academy of Management Journal*, 51, 1053–1078. Doi:

10.5465/AMJ.2008.35732527

Frankel, R., Smitz Whipple, J., & Frayer, D. J. (1996). Formal versus informal contracts: achieving alliance success. *International Journal of Physical Distribution & Logistics Management,* 26, 47-63. Doi: org/10.1108/09600039610114992

Galati, F., & Bigliardi, B. (2019). Redesigning the model of the initiation and evolution of inter-firm knowledge transfer in R&D relationships. *Journal of Knowledge Management*. Doi: 10.1108/JKM-05-2018-0326/full/html

Gallié, E-P., & Legros, D. (2012). French firms' strategies for protecting their intellectual property. *Research Policy,* 41, 780 – 794. Doi:10.1016/j.respol.2011.12.008

Gargiulo, M., & Ertug, G. (2006). The dark side of trust. In R. Bachmann, A. Zaheer, A. (Eds), *Handbook of Trust Research* (165-186). Edward Elgar, Cheltenham.

Goel, S., & Karri, R. (2006). Entrepreneurs, effectual logic, and over-trust. *Entrepreneurship Theory and Practice,* July 1, 477-493. Doi: 10.1111/j.1540-6520.2006.00131.x

Hannah, D. R., & Robertson, K. (2015). Why and how do employees break and bend confidential information protection rules? *Journal of Management Studies,* 52(3), 381-413.

Hannah, D. R., McCarthy, I. P., & Kietzmann, J. (2015). We're leaking, and everything's fine: How and why companies deliberately leak secrets. *Business Horizons,* 58(6), 659-667.

Hardin, R. (1992). The Street-Level Epistemology on Trust. *Analyse & Kritik,* 14, 152-176. Doi: org/10.1515/auk-1992-0204

Heiman, B.A., & Nickerson, J.A. (2004). Empirical evidence regarding the tension between knowledge sharing and knowledge expropriation in collaborations. *Managerial and Decision Economics,* 25, 401 – 420. Doi: 10.1002/mde.1198

Heimeriks, K. (2008). Developing Alliance Capabilities, Palgrave Macmillan, New York.

Hite, J.M., & Hesterly, W.S. (2001). The evolution of firm networks: From emergence to early growth of the firm. *Strategic Management Journal*, 22, 275–286. Doi: 10.1002/smj.156

Hurmelinna-Laukkanen, P., & Nätti, S. (2012). Network orchestration for knowledge mobility – The case of an international innovation community. *Journal of Business Market Management*, 5, 244-264.

Hurmelinna-Laukkanen, P., & Puumalainen, K. (2007). The nature and dynamics of appropriability – Strategies for appropriating returns on innovation. *R&D Management*, 37, 95-112. Doi: 10.1111/j.1467-9310.2007.00460.x

Jiang, X., Li, M., Gao, S., Bao, Y., & Jian, F. (2013). Managing knowledge leakage in strategic alliances: the effects of trust and formal contracts. *Industrial Marketing Management,* 42, 983-991. Doi: 10.1016/j.indmarman.2013.03.013

Kerin, R.A., Varadarajan, P.R., & Peterson, R.A. (1992). First-mover advantage: A synthesis, conceptual framework, and research propositions. *Journal of Marketing,* 56, 33-52. Doi: 10.2307/1251985

Knudsen, L.G., Nielsen, B.B. (2010). Collaborative capability in R&D alliances: exploring the link between organisational- and individual-level factors. *International Journal of Knowledge Management Studies,* 4, 152-175. Doi: 10.1504/IJKMS.2010.030790

Levin, R.C., Klevorick, Alvin, K., Nelson, R.R., & Winter, S.G. (1987). Appropriating the returns from industrial research and development. *Brookings Papers on Economic Activity*, 18, 783-831.

Lewicki, R. J., & Bunker, B. B. (1995). Trust in Relationships: A Model of Development and Decline. In B. B. Bunker & J. Z. Rubin (Eds.). *Conflict, Cooperation, and Justice: Essays Inspired by the Work of Morton Deutsch* (133-173). San Francisco: Jossey-Bass.

Li, P. (2007). Toward an interdisciplinary conceptualization of trust: a typological approach. *Management and Organization Review,* 3, 421-445. Doi: 10.1111/j.1740-8784.2007.00081.x

Lieberman, M. (2005). Did first-mover advantage survive the dot-com crash? Working paper, UCLA, (downloaded on 1 Nov 2013 from http:// www.anderson.ucla.edu/ faculty/marvin.lieberman/ working_papers/InternetFMA.pdf.)

Liebeskind, J. (1997). Keeping organizational secrets: Protective institutional mechanisms and their costs. *Industrial and Corporate Change*, 6, 623-663. Doi: org/10.1093/icc/6.3.623

Long, C. P., & Sitkin, S. B. (2018). Control–trust dynamics in organizations: identifying shared perspectives and charting conceptual fault lines. *Academy of Management Annals*, 12(2), 725-751. Doi: org/10.5465/annals.2016.0055

Lui, S.S., & Ngo, H-Y. (2004). The role of trust and contractual safeguards on cooperation in non-equity alliances. *Journal of Management*, 30, 471-485. Doi:org/10.1016/j.jm.2004.02.002

Lööf, H., & Broström, A. (2008). Does knowledge diffusion between university and industry increase innovativeness? *The Journal of Technology Transfer*, 33, 73–90.

Manhart, M., & Thalman, S. (2015). Protecting organizational knowledge: a structured literature review, *Journal of Knowledge Management*, 19(2), 190-211, Doi.org/10.1108/JKM-05-2014-0198

Martin, X., & Salomon, R. (2003). Knowledge transfer capacity and its implications for the theory of the multinational corporation. *Journal of International Business Studies*, 34, 356-373. Doi: 10.1057/palgrave.jibs.8400037

Möllering, G. (2005). Rational, Institutional and Active Trust: Just Do It!? In K. Bijlsma Frankema & R. Klein Woolthuis, R. (Eds.). *Trust under Pressure: Empirical Investigations of Trust and Trust Building in Uncertain Circumstances* (17-36). Cheltenham: Edward Elgar.

Möllering G. (2011). Conceptual openness and actor focus in research on international business relationships. In S. Schmid, (Ed), *Internationale Unternehmungen und das Management ausländischer Tochtergesellschaften* (333-353). Wiesbaden: Gabler.

Möllering, G., & Sydow, J. (2018). Trust trap? Self-reinforcing processes in the constitution of interorganizational trust. In: Sasaki, M. (Ed.) *Trust in Contemporary Society*. Leiden: Brill.

Neu, D. (1991). Trust, contracting and the prospectus process. *Accounting Organizations and Society*. 16, 243–256.

Neuhäusler, P. (2012). The use of patents and informal appropriation mechanisms – Differences between sectors and among companies. *Technovation*, 32, 681 – 693. Doi: 10.1016/j.technovation.2012.07.004

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company*. Oxford University Press, New York.

Norman, P. (2002). Protecting knowledge in strategic alliances. Resource and relational characteristics. *Journal of High Technology Management Research*, 13, 177 – 202. Doi: 10.1016/S1047-8310(02)00050-0

OECD, (2005). The Measurement of Scientific and Technological Activities. Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data. 3rd Edition, OECD, EUROSTAT. OECD Publishing.

Olander, H., Hurmelinna-Laukkanen, P., Blomqvist, K., & Ritala, P. (2010). The dynamics of relational and contractual governance mechanisms in knowledge sharing of collaborative R&D projects. *Knowledge and Process Management*, 17, 188-204. Doi: 10.1002/kpm.356

Olander, H., Hurmelinna-Laukkanen, P., & Heilmann, P. (2011). Do SMEs benefit from HRM-related knowledge protection in innovation management? *International Journal of Innovation Management*, 15, 593-616. Doi: org/10.1142/S1363919611003453

Olander, H., Hurmelinna-Laukkanen, P., & Vanhala, M. (2014). Mission: Possible but sensitive—Knowledge protection mechanisms serving different purposes. *International Journal of Innovation Management*, 18(06), 1440012.

Podsakoff, P.M., & Organ, D.W. (1986). Self-reports in organizational research: problems and prospects. *Journal of Management,* 12, 531-544. Doi: org/10.1177/014920638601200408

Podsakoff, P. M. MacKenzie, S. B. Lee, J-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology,* 88, 879-903. Doi: 10.1037/0021-9010.88.5.879

Poppo, L., & Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal,* 23, 707–725. Doi: 10.1002/smj.249

Poppo, L., Zhou, K. Z., & Li, J. J. (2015). When can you trust "trust"? Calculative trust, relational trust, and supplier performance. *Strategic Management Journal.* 37, 724-741. Doi: 10.1002/smj.2374

Powell, W.W., Koput, K.W., & Smith-Doerr, L. (1996). Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. *Administrative Science Quarterly***,** 41, 116-145. Doi: 10.2307/2393988

Ring, P.S., &Van de Ven, A. (1994). Developmental processes of cooperative interorganizational relationships. *The Academy of Management Review,* 19, 90–118. Doi: 10.5465/AMR.1994.9410122009

Ring, P.S. (2000). The three T's of alliance creation: task, team and time. *European Management Journal*, 18, 152-163.

Ring, P.S., & Van de Ven, A.H. (2006). Relying on trust in cooperative interorganizational relationships. In R. Bachmann & A. Zaheer (Eds). *Handbook of Trust Research* (144-163). Northhampton, MA: Edward Elgar.

Ritala, P. & Hurmelinna-Laukkanen, P. (2009). What´s in it for me? Creating and appropriating value in innovation-related coopetition. *Technovation,* 29, 818-827. Doi: 10.1016/j.technovation.2009.07.002

Ritala, P., Husted, K., Olander, H., & Michailova, S. (2018). External knowledge sharing and radical innovation: the downsides of uncontrolled openness. *Journal of Knowledge Management,* 22(5), 1104-1123

Rothstein, B., & Eek, D. (2009). Political corruption and social trust an experimental approach. *Rationality and Society*, 21, 81–112. Doi: 10.1177/1043463108099349

Saviotti, P.P. (1998). On the dynamics of appropriability, of tacit and of codified knowledge. *Research Policy,* 26, 843-856. Doi: 10.1016/S0048-7333(97)00066-8

Schilke, O., & Goerzen, A. (2010). Alliance management capability: An investigation of the construct and its measurement. *Journal of Management,* 36, 1192-1219. Doi: 10.1002/smj.2208

Schilke, O., & Cook, K. S. (2015). Sources of alliance partner trustworthiness: Integrating calculative and relational perspectives. *Strategic Management Journal*, 36, 276-297. Doi: 10.1002/smj.2208

Seppänen R., Blomqvist, K., & Sundqvist S. (2007). Measuring Interorganizational Trust – Critical Review of the Empirical Research in 1990-2003. *Industrial Marketing Management,* 36, 249-265. Doi: 10.1016/j.indmarman.2005.09.003

Spender, J-C., & Grant, R. M. (1996). Knowledge and the firm: Overview. *Strategic Management Journal,* 17, 5-9. Doi: 10.1002/smj.425017110

Stanko, M.A., Bohlmann, J.D., & Molina-Castillo, F-J. (2013). Demand-side inertia factors and their benefits for innovativeness, *Journal of the Academy of Marketing Science*, 41, 649-668. Doi: 10.1007/s11747-013-0332-y

Transparency International (2014). *Corruption perception index 2014.* Berlin: Transparency International.

Van de Ven, A. H. (1976). On the Nature, Formation and Maintenance of Relations among Organizations. *The Academy of Management Review*, 1, 24-36. Doi:

10.5465/AMR.1976.4396447

Varoutsa, E., & Scapens, R. W. (2018). Trust and control in evolving inter-organisational relationships: Evidence from the aerospace industry. *Accounting, Auditing & Accountability Journal*, 31(1), 112-140. Doi: 10.1108/AAAJ-02-2013-1218

Wei, Q., Zhang, Q., Yan, R., & Wu, X. (2019). A Theoretical Framework for the Interorganizational Knowledge Collaboration of Knowledge Network. In: International Conference on Management Science and Engineering Management (pp. 772-782). Springer, Cham.

Wicks, A.C., Berman, S.L., & Jones, T.M. (1999). The Structure of Optimal Trust: Moral and Strategic Implications. *The Academy of Management Review,* 24, 99-116. Doi: 10.2307/259039

Yang, Z., Zhou, C., & Jiang, L. (2011). When do formal control and trust matter? A context based analysis of the effects on marketing channel relationships in China. *Industrial Marketing Management***,** 40, 86-96. Doi: 10.1016/j.indmarman.2010.09.013

Yli-Renko, H., Sapienza, H., & Hay, M. (2001). The role of contractual governance flexibility in realizing the outcomes of key customer relationships. *Journal of Business Venturing***,** 16, 529–555. Doi: 10.1016/S0883-9026(99)00062-2

Zaheer, A., McEvily B., & Perrone V. (1998). Does trust matter? Exploring the effects of interorganizational and interpersonal trust on performance. *Organization Science,* 9, 141 159. Doi: org/10.1287/orsc.9.2.141

Zander, U., & Kogut, B. (1995). Knowledge and the speed of transfer and imitation of organizational capabilities: an empirical test. *Organization Science,* 6, 76-92. Doi: org/10.1287/orsc.6.1.76

Zhang, L., Huang, S., & Peng, Y. (2018). Collaboration in Integrated Project Delivery: The Effects of Trust and Formal Contracts. Engineering Management Journal, 30(4), 262-273. Doi: /10.1080/10429247.2018.1498259

Zobel, A. K., Lokshin, B., & Hagedoorn, J. (2017). Formal and informal appropriation mechanisms: The role of openness and innovativeness. *Technovation*, 59, 44-54. Doi: 10.1016/j.technovation.2016.10.001

FIGURE 1.
The study framework

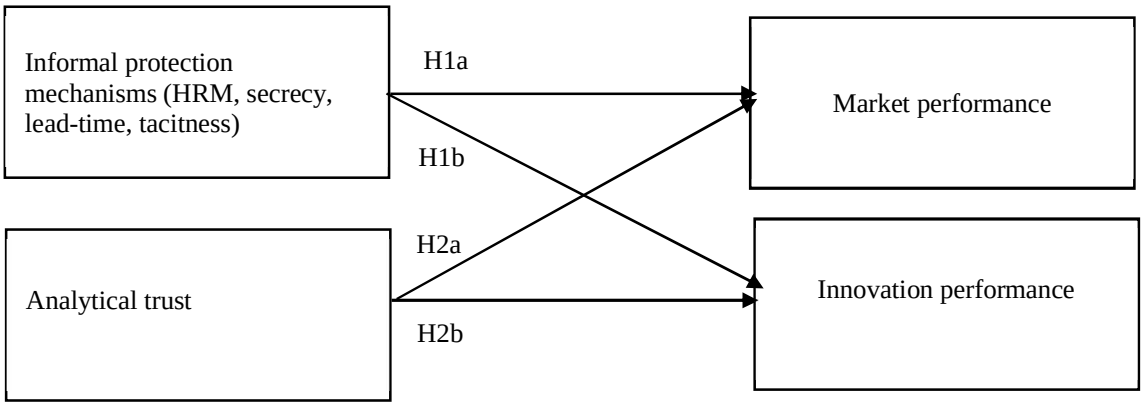

TABLE 1.

Measurement items and results of confirmatory factor analysis

Concept	*Item*	*Mean*	*SD*	*Factor loading*	*CR*	*α*
HRM	Educating personnel	4.21	1.48	0.74 [a]	0.65	0.65
	Making personnel committed to the firm (e.g., by offering perks)			0.68***		
	Low personnel turnover/minimizing it			(item dropped)		
Secrecy	Sharing information with just a few	4.05	1.64	(item dropped)	0.62	0.79
	Using passwords			0.82 [a]		
	Restricting access to meetings and the firm's premises			0.80		
Lead-time	Getting to the markets first with a new product or service	4.77	1.22	0.73 [a]	0.8	0.78
	Continuous improvements in products/ services/processes			0.63***		
	Keeping ahead of competitors			0.88***		
Tacitness	Complexity of the product/service/process	3.97	1.70	0.85 [a]	0.93	0.9
	The fact that it is very hard to teach knowledge related to the product/service/process			0.95***		
	The fact that it is very hard to understand the features of the product/service/process by observing/examining it			0.94***		
	The fact that knowledge related to the product/service/process may not be usable in other environments.			0.75***		
	The fact that it is not possible to document knowledge related to the product/service/process			(item dropped)		
	The fact that core knowledge related to the product/service/process is embedded in routines			(item dropped)		
Analytical trust	We assess whether the company has technological knowledge	5.57	0.803	0.74 [a]	0.86	0,85
	We assess whether the company has the necessary business knowledge			(item dropped)		
	We assess whether the company is collaborative			0.84***		
	We assess whether the company targets collaboration that is also beneficial to us			0.82***		
	We assess whether the company knows its strengths, how it operates and its goals			0.67***		
	We use agreed upon tools and processes to assess partners and collaboration opportunities			(item dropped)		
	We assess whether the partner is reliable			(item dropped)		
Innovation	Replacement of products being phased out	4.75	1.13	(item dropped)	0.82	0,81

Concept	*Item*	*Mean*	*SD*	*Factor loading*	*CR*	*α*
performance	Replacement of services being phased out			0.82 [a]		
	Extension of product/service range within main market			0.72***		
	Extension of product/services range outside main market			(item dropped)		
	Development of environment-friendly products/services			(item dropped)		
	Opening of new markets abroad			(item dropped)		
	Opening of new domestic target groups			0.77		
Market	Growth in sales	5.26	0.96	0.74 [a]	0.84	0,84
performance	Profitability			(item dropped)		
	Market share			0.81***		
	Market growth			0.83***		
	Marketing			(item dropped)		

[a] Significance level is not available, because the coefficient is fixed at 1. *** Statistically significant at 0.01 significance level.

TABLE 2.
Descriptive statistics and correlations (n= 77)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age	1														
2. Personnel	.137	1													
3. Manufacturing	-.100	-.047	1												
4. Machinery	-.052	-.111	-.376***	1											
5. ICT	.063	.037	-.250*	-.174	1										
6. Trade	.039	.067	-.250*	-.174	-.116	1									
7. Construction	.002	-.045	-.194	-.135	-.090	-.090	1								
8. Services	.098	.124	-.331**	-.231*	-.153	-.153	-.119	1							
9. HRM	-.170	-.036	.244*	-.085	.066	-.064	-.038	-.195	1						
10. Secrecy	-.262*	.074	.046	-.083	-.049	-.153	.203	.062	.426**	1					
11. Lead-time	-.113	.057	.097	-.086	.007	.054	.065	-.123	.605**	.356**	1				
12. Tacitness	-.020	-.060	.187	.199	-.239*	-.289*	.215	-.165	.313**	.266*	.250*	1			
13. Analytical trust	.038	-.040	-.066	.004	.023	-.111	.092	.090	-.054	.209	.036	-.069	1		
14. Innovation performance	.046	-.100	-.016	-.011	-.051	.150	.027	-.065	.479**	.332**	.553**	.064	.228*	1	
15. Market performance	.054	-.088	.082	-.208	.128	.025	.019	-.016	.588**	.256*	.381**	.106	.005	.473**	1

***P<0.01* *P<0.05

TABLE 3.
The effect of the informal protection mechanisms and analytical trust on innovation performance – the results of the regression analyses (N=77)

	Dependent variable Innovation performance			
Variable	β	T	β	T
Age	.061	.512	.190	1.977
Personnel	-.112	-.926	-.150	-1.612
Manufacturing	.051	.303	-.041	-.298
Machinery	.036	.226	.074	.586
ICT	-.007	-.048	-.091	-.819
Trade	.178	1.256	.147	1.300
Construction	.052	.382	-.005	-.050
HRM			.296	2.322*
Secrecy			.156	1.377
Lead-time			.380	3.269**
Tacitness			-.143	-1.271
Analytical trust			.191	2.005*
F		0.424		5.093**
Adjusted R^2		-.056		.393

** significant at the 0.01 level (2-tailed)
* significant at the 0.05 level (2-tailed)

TABLE 4.
The effect of the informal protection mechanisms and analytical trust on market performance – the results of the regression analyses (N=77)

	Dependent variable Market performance			
Variable	β	T	β	T
Age	.058	.495	.163	1.592
Personnel	-.117	-.986	-.125	-1.265
Manufacturing	.061	.364	-.135	-.930
Machinery	-.167	-1.064	-.204	-1.510
ICT	.120	.861	.004	.032
Trade	.032	.227	-.012	-.096
Construction	.017	.125	-.022	-.190
HRM			.596	4.394**
Secrecy			.041	.343
Lead-time			.037	.303
Tacitness			-.037	-.309
Analytical trust			.006	.063
F		0.737		3.898**
Adjusted R^2		-.025		.314

** significant at the 0.01 level (2-tailed)
* significant at the 0.05 level (2-tailed)

TABLE 5.
The effects of labor legislation, IPRs, contracts, HRM, secrecy, tacitness, and lead-time on innovation performance–the results of the *post hoc* regression analyses (N=114, R&D questionnaire)

	Dependent variable: Innovation performance			
Variable	β	T	β	T
Age	-.074	-.772	-.109	-1.128
Personnel	.217	2.280*	.193	1.923*
Manufacturing	.039	.271	.062	.424
Machinery	.148	1.097	.169	1.265
ICT	.071	.544	.083	.646
Trade	.069	.575	.065	.546
Construction	.035	.303	.055	.478
HRM			.270	2.468**
Secrecy			-.194	-1.803*
Lead-time			.165	1.533
Tacitness			.082	.757
Employment legislation			.040	.365
IPRs			-.020	-.174
Contracts			-.096	-.891
F		0.009		0.097
Adjusted R^2		1.149		1.869*

** significant at the 0.01 level (2-tailed)
* significant at the 0.05 level (2-tailed)

TABLE 6.
The effects of labor legislation, IPRs, contracts, HRM, secrecy, tacitness, and lead-time on market performance–the results of the *post hoc* regression analyses (N=114, R&D questionnaire)

	Dependent variable: Market performance			
Variable	β	T	β	T
Age	-.109	-1.156	-.146	-1.523
Personnel	.282	3.002**	.273	2.742**
Manufacturing	.003	.021	.053	.368
Machinery	-.019	-.143	.039	.298
ICT	.095	.743	.155	1.225
Trade	.021	.175	.034	.288
Construction	.064	.560	.091	.796
HRM			.219	2.023*
Secrecy			-.146	-1.369
Lead-time			.147	1.370
Tacitness			.016	.152
Employment legislation			-.079	-.729*
IPRs			.145	1.271
Contracts			-.223	-2.075
F		1.650		2.026*
Adjusted R^2		0.039		0,113

** significant at the 0.01 level (2-tailed)
* significant at the 0.05 level (2-tailed)

TABLE 7.
The effects of generalized and analytical trust on innovation performance–the results of the *post hoc* regression analyses (N=114, HR questionnaire)

	Dependent variable: Innovation performance			
Variable	β	T	β	T
Age	.145	1.450	.101	1.110
Personnel	.135	1.389	.051	.572
Manufacturing	-.042	-.299	-.174	-1.305
Machinery	.035	.305	-.073	-.687
ICT	-.018	-.141	-.116	-.982
Trade	-.053	-.365	-.131	-.988
Construction	.078	.629	-.026	-.230
Generalized trust			-.061	-.668
Analytical trust			.468	4.995**
F		0.724		3.542**
Adjusted R^2		-0.016		0.168

** significant at the 0.01 level (2-tailed)
* significant at the 0.05 level (2-tailed)

TABLE 8.
The effects of generalized and analytical trust on market performance–the results of the post hoc regression analyses (N=114, HR questionnaire)

	Dependent variable: Market performance			
Variable	β	T	β	T
Age	.178	1.801*	.162	1.719
Personnel	.121	1.260	.052	.560
Manufacturing	-.195	-1.395	-.245	-1.785*
Machinery	.020	.179	-.041	-.370
ICT	-.090	-.714	-.129	-1.055
Trade	-.112	-.782	-.141	-1.034
Construction	-.089	-.722	-.147	-1.244
Generalized trust			.116	1.232
Analytical trust			.312	3.234**
F		1.097		2.673**
Adjusted R^2		0.006		0.118

** significant at the 0.01 level (2-tailed)
* significant at the 0.05 level (2-tailed)

TABLE 9.
The effects of labor legislation, IPRs, contracts, HRM, secrecy, tacitness, and lead-time on overall alliance performance–the results of the *post hoc* regression analyses (N=114, R&D questionnaire)

	Dependent variable: Overall alliance performance			
Variable	β	T	β	T
Age	,051	0,431	0,074	0,496
Personnel	,122	1,342	0,137	1,138
Manufacturing	-,227	-0,665	-0,016	-0,037
Machinery	-,289	-0,805	-0,077	-0,172
ICT	-,453	-1,196	-0,516	-1,097
Trade	,399	0,937	0,511	0,819
Construction	,039	0,084	0,51	0,864
HRM			0,173	1,385
Secrecy			-0,235	-2,164
Lead-time			0,314	2,643**
Tacitness			0,113	1,05
Employment legislation			-0,022	-0,202
IPRs			-0,084	-0,839
Contracts			0,015	0,146
F		1.052		2.228*
Adjusted R^2		0.003		0.175

** significant at the 0.01 level (2-tailed)
* significant at the 0.05 level (2-tailed)

TABLE 10.
The effects of generalized and analytical trust on value-creation benefit–the results of the *post hoc* regression analyses (N=114, HR questionnaire)

	Dependent variable: Value-creation benefit			
Variable	β	T	β	T
Age	,177	2,082	,155	2,076
Personnel	-,044	-,560	-,126	-1,792
Manufacturing	,472	1,915	,335	1,507
Machinery	,297	,907	,037	,127
ICT	,341	1,213	,207	,827
Trade	,474	1,882	,393	1,771
Construction	,203	,700	-,001	-,003
Generalized trust			,114	1,673
Analytical trust			,457	5,087**
F		1.623		5.699**
Adjusted R^2		0.037		0.272

** significant at the 0.01 level (2-tailed)
* significant at the 0.05 level (2-tailed)