

# **The Impact of Trust and Formal Control on Interfirm Knowledge Transfer: An Exploration of the Micro-Level Foundations**

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## **ABSTRACT**

Whereas previous alliance research has mainly focused on examining the macro-level relationships between trust, formal control and knowledge transfer, this study explores how micro-level interactions intermediate the impact of trust and formal control on interfirm knowledge transfer success. Based on a case study of two corporate investment relationships that are embedded in the same technological setting, we observe that (i) different combinations of organizational trust and formal control give rise to different kinds of micro-level interactions (i.e. structured versus unstructured technological knowledge exchange; positive versus negative managerial gatekeeping; extensive versus limited joint sensemaking); and (ii) these different micro-level interactions lead to different levels of knowledge transfer success. In addition, we find strong indications that these micro-level interactions also contribute to positive and/or negative trust and control dynamics. In this way, our study contributes to the emergence of a multi-level perspective on knowledge governance in which macro-level variables and micro-level interactions are linked to each other.

# **The Impact of Trust and Formal Control on Interfirm Knowledge Transfer: An Exploration of the Micro-Level Foundations**

## **INTRODUCTION**

During the past two decades, alliances have become an increasingly popular strategy for organizations to get access to and learn about external knowledge (Doz & Hamel, 1998; Hamel, 1991; Kogut, 1988; Vanhaverbeke, Gilsing, Beerkens & Duysters, 2009). Following its widespread dispersion in practice, academic research on knowledge transfer – i.e. an event through which one organization learns from the experience of another (Easterby-Smith, Lyles & Tsang, 2008: 677) - in alliances has also been proliferating. In this literature, trust – i.e. a psychological state comprising the intention to accept vulnerability based on positive expectation of the intentions or behavior of another (Rousseau, Sitkin, Burt & Camerer, 1998) - and formal control – i.e. contractual obligations and formal organizational mechanisms for cooperation (Dekker, 2003: 12) - have been recognized as important organizational antecedents of interfirm knowledge transfer (e.g. Becerra, Lunnan & Huemer, 2008; Chen, 2004; Faems, Janssens & Van Looy, 2007; Lui, 2009; Nielsen & Nielsen, 2009; Van Wijk, Jansen & Lyles, 2008).

In line with the broader organizational and knowledge management research, existing alliance studies on the connections between trust, formal control and knowledge transfer have mainly conceptualized these variables on the firm-level and examined the direct relationships between them. Foss (2007), however, recently criticized such ‘macro-level’ studies. In particular, he argued that it is quite unlikely that firm-level concepts are directly linked to each other. Instead, it is much more plausible that micro-level interactions of individuals within and between firms intermediate the relationship between firm-level concepts (Foss, 2007). For example, a formal contract between two firms for R&D exchange will not directly lead to knowledge transfer. Instead, the signing of the formal contract will set employ-

ees into motion to start interacting. Knowledge is then exchanged between employees of the different partners, which then aggregates to firm-level knowledge transfer.

The purpose of this paper is therefore to explore how micro-level interactions intermediate the relationships between trust, formal contracts and knowledge transfer. In order to do so, we conduct an inductive multiple case study of two strategic alliances. These alliances were so called “corporate investment” relationships, wherein a large incumbent firm invested a minority equity stake in a high-tech SME in order to learn about the technology of this latter firm (Schildt, Maula & Keil, 2005; Wadwha & Kotha, 2006). Both corporate investment relationships had the same incumbent partner: Alloy, a large West-European technology firm. The high-tech SME partners were Cord and Plane, which were both situated in the US. For this study, data were collected in a retrospective way, using both interviews and archival documents as data sources.

Based on an iterative cycle of within and across case analyses, we develop a process model for both cases showing that (i) the initial levels of organizational trust and formal control jointly influence the nature of knowledge exchange processes between engineers; (ii) the nature of operational knowledge exchange processes influences managerial gatekeeping behavior; (iii) managerial gatekeeping behavior influences the level of joint sensemaking about the technology; and (iv) the level of joint sensemaking about the technology impacts the successfulness of knowledge transfer. In addition, we provide first indications that the identified micro-level interactions also contribute to changing levels of trust and formal control.

These findings contribute to the emergence of a multi-level perspective on inter-firm knowledge transfer, illuminating how micro-level interactions during the operation stage of corporate investment relationships intermediate the relationship between macro-level variables such as organizational trust, formal control and knowledge transfer. In addition,

whereas previous research mainly focused on the individual impact of trust and formal control on knowledge transfer, our findings point to the relevance of examining their joint impact.

The remainder of this paper is structured in five sections. First, we position our research in the existing alliance governance literature. Second, we discuss the methodology of this study. Third, we provide an in-depth discussion of the two observed cases. Fourth, we present for each case a process model, illuminating how micro-level interaction patterns intermediated the relationship between trust, formal control and knowledge transfer. Finally, we discuss the main implications of our study, point to its main limitations, and suggest interesting avenues for future research.

## **THEORETICAL BACKGROUND**

### **Formal Control and Trust as Organizational Antecedents to Knowledge Transfer**

Alliances have been recognized as important learning mechanisms that allow access to external knowledge sources (Doz, 1996; Hamel, 1991; Kogut, 1988). As a result, the concept of knowledge transfer has also received a lot of attention in the alliance literature. Interfirm knowledge transfer is a process that consists of two critical steps (Easterby-Smith, Lyles & Tsang, 2008; Faems et al., 2007; Larsson, Bengtsson, Henriksson & Sparks, 1998). First, knowledge needs to be disclosed by the expert partner or the firm that possesses the knowledge. As a second step, the disclosed knowledge needs to be acquired and assimilated by the novice partner. Once knowledge is successfully transferred, the novice partner can start internally exploiting the disclosed knowledge for new markets, products and businesses (Hamel, 1991; Zahra & George, 2002), resulting in increased organizational performance and innovativeness (Van Wijk et al., 2008).

At the same time, it has been stressed that managing knowledge transfer processes in alliances is not a straightforward task. In particular, it has been argued that interfirm knowl-

edge transfer processes often fail because of (i) the limited willingness of the expert partner to disclose knowledge; and (ii) the limited ability of the novice partner to acquire and assimilate knowledge. Numerous researchers have therefore started examining the antecedents of interfirm knowledge transfer processes (for an overview of this research, see Van Wijk et al., 2008). Among others, formal control and trust have been recognized as two important antecedents of knowledge transfer processes in alliance settings.

**Impact of Formal Control on Knowledge Transfer.** In the alliance literature, formal control has been emphasized as an important instrument for managing interfirm relationships. Formal control consists of contractual obligations and formal organizational mechanisms for cooperation (Dekker, 2003; Faems, Janssens, Bouwen & Van Looy, 2006). Researchers, applying a transaction cost framework, have stressed that formal control allows mitigating the perceived risk of opportunistic behavior. In formal contracts, for instance, the expected behaviors and/or outcomes of the different partners can be codified (Das & Teng, 2001; Klein Woolthuis et al., 2005). Through specifying what is and what is not allowed, detection of opportunistic actions is facilitated, reducing the opportunity for opportunistic behavior (Lui & Ngo, 2004). In addition, well specified formal contracts can reduce the incentive for opportunistic behavior through inflicting penalties for the omission of cooperative behaviors or commission of violative behaviors (Parkhe, 1993). The cost of self-interested activities subsequently increases, curbing partners' willingness to act opportunistically (Dyer & Singh, 1998). In sum, formal control allows for the monitoring and punishment of undesirable behavior and/or outcomes (Das & Teng, 2001), reducing the perceived risk of opportunistic behavior.

Relying on these insights, several scholars have emphasized the positive impact of formal control on knowledge transfer. Conducting a case study of three interfirm relationships, Faems et al. (2007), for instance, observed that the presence of specific contractual

clauses, providing a legal framework for the exchange of knowledge, substantially increased the willingness of one partner's engineers to disclose information to the engineers of the other alliance partner, stimulating the initiation of knowledge transfer. In a similar vein, Vlaar, van den Bosch and Volberda (2006) argue that formal contracting reduces biases, forces articulation, and focuses attention. As a result, joint sensemaking is improved, which in-turn fosters knowledge transfer. The recent study of Lui (2009) provides further empirical evidence for the importance of formal control on knowledge transfer. Studying 126 buyer-supplier relationships, he observed that formal control has a positive impact on knowledge acquisition.

**Impact of Trust on Knowledge Transfer.** Numerous scholars, relying on a relational governance perspective, have argued that alliance partners can not only apply formal control but can also rely on trust to govern alliances (Joshi & Campbell, 2003; Poppo & Zenger, 2002). Trust refers to a psychological state comprising the intention to accept vulnerability based on positive expectation of the intentions or behavior of another (Rousseau et al., 1998). Looking from a social exchange perspective (e.g. Blau, 1964), several scholars (e.g. Das & Teng, 1998, 2001; Dyer & Singh, 1998; Inkpen & Currall, 2004; Jones & George, 1998; Ring & Van de Ven, 1994) argued that the presence of trust influences how partners work together in alliances. In particular, they reasoned that, under conditions of trust, 'shared values underlying trust provide individuals with the assurance that knowledge and information will be used for the greater good and that one need not exercise power to protect one's own interests' (Jones & George, 1998: 542). In other words, when trust is present, the perception of opportunistic hazards is likely to be reduced<sup>1</sup>.

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<sup>1</sup> This does not mean that the objective risk of opportunistic actions is reduced. Granovetter (1985) has referred to the paradox of trust in this respect. In specific, he argued that, although trust establishes norms and expectations about appropriate behavior, lowering the perception of risk in the exchange, it provides the opportunity for abuse through opportunistic actions.

In line with these arguments, it has been argued that trust facilitates knowledge transfer. In particular, the theoretical argument is that trust tends to decrease the perceived risk of opportunism, encouraging members of the expert partner to engage in wide-ranging, continuous and intense contact with members of the novice partner (Kale, Singh & Perlmutter, 2000; Muthusamy & White, 2005). Empirical studies have provided substantial evidence for the positive impact of trust on knowledge transfer (Van Wijk et al., 2008). Chen (2004) and Nielsen and Nielsen (2009), for instance, reported a positive relationship between trust and the effectiveness of interfirm knowledge acquisition. In addition, Muthusamy and White (2005) and Lui (2009) both report a positive relationship between competence-based trust (i.e. positive expectations about the competencies of the other partner) and knowledge accessing in interfirm relationships. Finally, Faems et al. (2007) observed that the presence of positive expectations about the long-term character of the interfirm relationship had a positive impact on the initiation of interfirm knowledge transfer processes.

### **Need for Micro-Level Perspective on Interfirm Knowledge Transfer**

Although existing studies have provided valuable insights in the impact of formal control and trust on knowledge transfer, it needs to be stressed that these studies have mainly conceptualized these concepts as firm-level variables and examined the direct relationships between them (see arrow 4 in Figure 1). Foss (2007: 33), however, recently criticized such ‘macro-level studies’ as they suppress the level of individual action and interaction. In particular, he argued that it is quite unlikely that firm-level concepts are directly linked to each other. Instead, it is much more plausible that micro-level interactions of individuals within and between firms intermediate the relationship between firm-level constructs (see arrow 1, 2, and 3 in Figure 1). Foss (2007) therefore emphasizes the need for ‘micro level studies’, illuminating the impact of individuals’ actions and interactions on the relationship between macro-level concepts such as formal control, trust and knowledge transfer.

----- Insert Figure 1 about here -----

Recent case study research on the relationship between trust and formal control seems to confirm the relevance of such a micro-level perspective. Klein Woolthuis et al. (2005), for instance, observed that the formulation of different contract roles resulted in different kinds of interactions between members of the alliance partners, leading to different kinds of trust dynamics. Faems, Janssens, Madhok and Van Looy (2008), exploring two sequential R&D alliances between the same pair of firms, observed that a different nature of contractual formalization (i.e. narrow versus broad contractual interface structures) triggered different kinds of joint sensemaking dynamics at the operational level, which in-turn generated different trust dynamics. Based on these observations Faems et al. (2008: 1072), pointed to ‘relational processes at the operational level as important intermediary processes between contract design and trust dynamics.’ In a similar vein, we expect that micro-level processes might substantially intermediate the impact of trust and formal control on interfirm knowledge transfer. In the next section, we present the methodology that we applied to explore such micro-level processes.

## **METHODOLOGY**

### **Research Design**

The purpose of this study was to explore the micro-level foundations of the relationship between trust, contractual control and knowledge transfer. In order to do so, we relied on a case study design as it allows to (i) answer how questions about a contemporary set of events over which the investigators had little or no control (Yin, 2003), and (ii) draw in the significance of various interconnected levels of analysis (Hall, 2006; Pettigrew, 1990). In particular, we conducted an embedded case study (Faems et al., 2007; Yin, 2003) of two corporate investment relationships (i.e. Cord venture relationship and Plane venture relationship) that were part of the same technological trajectory (see Table 1). Corporate investment relationships

represent a particular kind of strategic alliance, wherein a large incumbent firm invests a minority equity stake in a high-tech SME (Schildt et al., 2005; Wadwha & Kotha, 2006). Both corporate investment relationships had the same incumbent partner: Alloy, a large European technology firm. The SME partners were Cord and Plane, both situated in the US. Cord and Plane were not related to each other.

The Cord venture relationship and Plane venture relationship were similar in many aspects, allowing for the minimization of extraneous variation (Eisenhardt & Graebner, 2007). For instance, they were part of the same technological trajectory (i.e. thin-film coatings) at the same firm (i.e. Alloy). At the same time, the two relationships can be regarded as ‘contrasting cases’ (Pettigrew, 1990) in terms of knowledge transfer success. As a result, this embedded case study constituted an excellent setting to explore the mediating impact of micro-level interactions on the relationship between trust, contractual control and knowledge transfer (Eisenhardt, 1989).

----- Insert Table 1 about here -----

### **Research Setting**

Throughout the 1980’s Alloy, a large European technology company, developed competencies in thin-film coating technologies. This technology enabled Alloy to put very thin metal coatings on materials. Originally, this technology was meant to serve customers’ rising performance demands in one of Alloy’s existing business units. At the end of the 1990’s, Alloy started a project to search for substantial new business opportunities that could be linked to its thin-film coating technology. This project included ventures in a variety of fields of technology. All these ventures were aimed to apply Alloy’s thin film coating technology. Together, they formed a portfolio of thin-film coating manufacturing opportunities. In the 2000’s, two new potential applications of the thin-film technology were identified: a micro-electronics component, which was developed by Cord; and an advanced construction mate-

rial, which was developed by Plane. Market research indicated that both applications could become multi-billion dollar industries in the future. As Alloy's thin-film coating technology suitability allowed for mass production of such applications, both opportunities seemed to fit in with Alloy's existing portfolio of thin-film coating manufacturing activities. This perceived fit led to the creation of the Cord and Plane corporate venturing relationships.

### **Data Collection**

Data on the two corporate investment relationships were collected in a retrospective way between November 2008 and January 2009. At the moment of data collection, the corporate investment relationships still existed. However, in both cases, the corporate investment relationships had been transformed from a technology-focused relationship, in which Alloy's management saw the relationship as an important part of its thin-film coating technology portfolio, into a financially-focused relationship, in which Alloy's management only considered the relationship as a financial investment in a promising high-tech SME (see Table 1).

Our retrospective data collection approach allowed for a focused data-gathering process (Poole, Van de Ven, Dooley and Holmes, 2000). At the same time, unconsciously accepting respondent bias might occur in retrospective studies, leading to confusion about cause-and-effect relationships (Leonard-Barton, 1990). To improve the validity of the retrospective reports, we applied a number of strategies. First, we triangulated our data, applying two data sources (Eisenhardt, 1989; Yin, 2003): interviews and documents (see Table 2). Second, we asked informants to reflect on concrete events rather than past opinions or beliefs to reduce the risk of cognitive biases and impression management (Miller, Cardinal & Glick 1997). Finally, we attempted to verify individual reports by asking similar questions to multiple informants at Alloy.

----- Insert Table 2 about here -----

In total, three venturing managers, four R&D managers, one product-market manager, two market analysts and one legal advisor at Alloy were interviewed, for a total of thirteen interviews (see Table 2). The involved venture managers were more focused on the juridical, financial and strategic aspects of the corporate venture relationships, whereas the R&D managers were more focused on the technological issues. The interviews with the product-market manager, market analysts and legal advisor provided additional background information. Six interviewees had been involved in both the Plane and Cord venture relationship, whereas five interviewees had only been involved in one of the corporate investment relationships. Interviews were individual, face-to-face, and lasted between 30 and 150 minutes. The interviews were based on a protocol, representing the history of the corporate investment relationships. A first version of this protocol was based on the information from (i) a first explorative interview with one of the involved managers and (ii) a detailed analysis of the available documents. After each interview, this protocol was further refined. The interviews were performed in either the interviewee's mother tongue or primary work language. All interviews were recorded. The interviews were transcribed and sent back to the interviewees for verification and clarification purposes (Keil, McGrath & Tukiainen, 2009). As the corporate investment relationships were still ongoing and as Alloy was only one of many investors in the involved organizations, we did not get permission to also interview members of the entrepreneurial companies (i.e. Cord and Plane). We tried to reduce the consequences of this limitation, by explicitly asking interviewees whether their counterpart had different opinions, views and/or thoughts.

### **Data Analysis**

For each corporate investment relationship, a case study report was written with extensive use of citations from both the interviews and documents to achieve a high level of accuracy

(Langley, 1999). These reports were sent to one Alloy manager; his comments were collected via electronic mail, leading to the final case study reports.

Subsequently, we analyzed the case study reports through an inductive approach, relying on an iterative process that coupled within-unit analysis with between-unit analysis (Eisenhardt, 1989; Yin, 2003). We started by conducting a within-unit analysis for each corporate investment relationship, searching for micro-level interactions that influenced the relationship between trust, contractual control and knowledge transfer. After completing the within-case analyses, we compared the findings across the two cases. Based on the identification of similarities and differences across cases, new iterations of within-case and across-case analysis were subsequently initiated. This procedure was repeated until dominant findings emerged.

## **RESULTS**

In this section, we describe the two corporate investment relationships. In line with Das and Teng's (2002) conceptual model of alliance developments, we make an explicit distinction between the formation, operation and outcome stages.

### **Cord Venture Relationship**

**Formation stage.** Alloy learned about Cord through the NTO fund - a materials oriented venture capital fund in which Alloy participated. In 2001, NTO decided to invest in Cord as this American SME, which was founded in 2000, possessed a license of a particular micro electronics technology that had been invented at a government-funded research institute. The purpose of this investment was to financially support the creation of a prototype product at Cord. As a result of this investment, Alloy became an indirect investor in Cord.

In 2003, Cord faced the risk of running out of cash in two weeks time. At that moment, Alloy provided Cord with a 'bridge' loan (i.e. a loan to make the firm survive until the next investment round), to make sure that Cord could continue its activities on its potentially interesting technology:

‘At the moment that we were not a [direct] investor yet, we bridged. We had nothing to lose. Of course we were very interested in the business, because it was a potential strategic business to Alloy. We bridged because Cord may have gone broke otherwise.’ (Venturing Manager)

Alloy was very interested in Cord because Alloy believed that, by means of its own thin-film coating technology, it could become Cord’s partner for the large-scale manufacturing of the micro electronic application:

‘We communicated very clearly that Cord’s market is one where Alloy has no activities at all. We would only become a high-volume manufacturing partner. In the end, Cord must have the knowledge to translate the micro electronic component into applications, and develop the necessary electronics and knowledge to make the application usable. We would mostly focus on manufacturing good products at low-cost in high volumes.’ (Venturing Manager)

A schematic overview of this proposed strategic fit is provided in Figure 2.

----- Insert Figure 2 about here -----

At the beginning of 2004, Alloy provided a second bridge loan to Cord. In addition, Alloy also decided to set apart a significant amount of money to participate in Cord’s next investment round. This decision was accompanied by a due diligence procedure and negotiations on the nature of Alloy’s investment in Cord.

Alloy interviewees stressed that, given the absence of competitive risks between the partners, the level of trust was high. As a result, due diligence and negotiation processes proceeded quite smoothly:

‘At the very start our due diligence at Cord was very easy. At Cord we were allowed to come in and inspect everything that happened. (...) It went fast because we would not become a competitor.’ (Venturing Manager)

In June 2004, the new investment round was completed. At this stage, Alloy became a minority shareholder (i.e. 20%) of Cord. Alloy consequently received a seat on the board of Cord, which was held by an Alloy Venturing Manager. On this person’s insistence, a second Alloy Venturing Manager was allowed as unofficial board observer. At this stage, Alloy clearly communicated that it was their intention to become a technology partner of Cord,

supporting the large-scale manufacturing of micro electronics applications. However, contractual clauses that described in detail the exchange of technological knowledge between the partners remained absent. Instead, Alloy interviewees referred to the presence of a ‘gentleman’s agreement’ with respect to the technological part of the collaborative relationship:

‘First there was what Cord called a “gentlemen’s agreement” between Alloy and Cord.’ (R&D Manager)

‘We verbally agreed on it... It was a verbal agreement. Nothing was put on paper or signed.’ (Venturing Manager)

According to Alloy interviewees, the advantage of that gentlemen’s agreement was that they avoided making irreversible commitments to Cord:

‘We had agreed with our executives not to accept any liabilities. We will not make promises or take liabilities. We would not contractually agree with them that ‘we will do the [mass-scale coating] manufacturing for you’, because that is a liability under American law. You are then obliged to deliver.’ (Venturing Manager)

At the same time, the absence of explicit contractual clauses reduced the need at Cord to codify technological issues that still faced substantial amounts of technological uncertainty.

**Operation stage.** The initial technological interactions between Alloy and Cord were focused on two issues. First, Alloy wanted to provide support to Cord in order to speed up the development activities. Second, Alloy wanted to learn about Cord’s technology in order to be able to become a large-scale manufacturer of its applications:

‘At the start, the focus was on technical support for Cord, since we have a lot of coating-technology knowledge available. (...) The other goal we had early on was to become Cord’s manufacturing partner. (...) We wanted to learn which knowledge they had developed. Because it makes little sense to start [mass-scale coating] manufacturing activities if you don’t have the knowledge to improve the manufacturing process.’ (R&D Manager)

Alloy interviewees stressed that, at the start of the relationship, the knowledge exchange between engineers of Cord and Alloy proceeded in an open manner:

‘We noticed quickly that, in the technological field, we had an open communication with many experts at Cord. (...) For example, Cord explained in extremely high detail how certain measurement procedures had to be successfully executed. (...) They even provided manufacturing equipment, so we could fabricate materials in-house.’ (R&D Manager)

‘At the start we thought ‘Cord is easy going’.’ (R&D Manager)

At the same time, interviewees indicated that this knowledge exchange took place in an unstructured manner:

‘The information exchange was not in a very coordinated manner. They were ad hoc contacts between engineers on either side.’ (R&D Manager)

‘A schedule [for knowledge exchange] had been written, but it was not detailed. It was something like ‘first year [do] this, second year [do] that’. That is very vague.’ (R&D Manager)

‘The gentlemen’s agreement was not properly formalized. It that was not clear to everyone what needed to happen and to what extend that needed to happen.’ (R&D Manager)

Alloy R&D personnel sensed that Cord’s management quickly started feeling threatened by this open but unstructured knowledge exchange between Cord and Alloy engineers:

‘Quite quickly Cord became more and more critical of Alloy’s internal activities. We particularly sensed that Cord’s management feared that too much knowledge was being disclosed to Alloy. Despite the fact that we always said that we viewed ourselves as Cord’s manufacturing partner, Cord’s management started fearing that, if too much knowledge was disclosed, Alloy would initiate its own development, independent of Cord.’ (R&D Manager)

As a result, the management of Cord started actively intervening in technology-related interaction between the partners. In particular, Cord’s management started actively attending the knowledge exchange meetings to make sure that sensitive information would not be disclosed toward the Alloy people:

‘At Cord the management became actively involved. It became very difficult to bypass them. It would have been more efficient if we had [bypassed management]. With the R&D personnel you can come up with and discard ideas without trouble. You can do so much more, there is more freedom. (...) Because Cord’s management always at-

tended, certain statements always were interpreted strategically. You had to weigh your words very carefully.’ (R&D Manager)

‘Their CEO would usually be the one speaking, and answering difficult questions (...) He did not answer the questions to satisfaction.’ (R&D Manager)

Because of these active management interventions, it turned out to be very difficult for Cord and Alloy engineers to develop a common understanding of the main technological challenges at hand:

‘I was missing detailed information for each process step, which we would have needed to setup a new generation [mass-scale] manufacturing. You have to understand why their process is setup like that, and what the critical issues are. We asked for that explicitly at the start, and that request has been explicitly denied.’ (R&D Manager)

‘The technological progress in that project halted because we got too little technical information from them. It was trial and error. I also think that they had problems with their own system.’ (R&D Manager)

‘There only was a working prototype [at Cord]. Certain layers were too thick, making them crack. They did not know how to solve that. ... Alloy could have helped solving the problem. [However], the flow of information from them to us was too limited.’ (Venturing Manager)

In 2007, Alloy and Cord also signed a joint development agreement that was much more extensive than the previous gentlemen’s agreement. By means of this contract, Alloy’s management hoped to revitalize the knowledge exchange between the partner. However, this contract did not have an immediate impact on the quality of knowledge exchange:

‘The joint development agreement was important to remain ‘on speaking terms’... After the joint development agreement was signed, we had a monthly conference call, and regular face-to-face contact. (...) But I did not sense that the quality [of the knowledge exchange] improved. Cord still was very careful about what they told, and the contact still was mostly via their management. The relationship did not improve as we had hoped. The information exchange still was very difficult.’ (R&D Manager)

**Outcome Stage.** In late 2008, Alloy’s management decided to shut down its internal research concerning thin-film manufacturing activities. As a result of this decision, the Cord

investment relationship was transformed from a technology-oriented partnership into a pure financial investment. At that point in time, knowledge transfer between Cord and Alloy was described as unsuccessful. In particular, it was stressed that Alloy engineers have never managed to fully replicate the technology of Cord and/or make substantial improvements to it:

‘I have never seen a working Alloy [micro-electronic] component.’ (Venturing Manager)

‘We did certain process developments and could prove some minor advantages. However, we did not improve their process or help directly.’ (R&D Manager)

Alloy interviewees also stressed that the level of trust has notably dropped over time. Whereas trust was described as high at the start, the level of trust at the end of the technological collaboration was described as poor:

‘[On a scale of 1 to 10 of trust] the relationship with Cord was a 3.’ (R&D Manager)

### **Plane Venture Relationship**

**Formation Stage.** In 2004, Plane - an American high-tech SME company that was founded in 1989 – was searching for outside investors to financially support the development of a particular technology that allowed for the production of advanced construction applications. Alloy learned about Plane through Innotia, a Venture Capital fund in which Alloy was a limited partner. Innotia informed Alloy about Plane. Innotia was not interested in investing itself, as it considered Plane to be too ‘early stage’. However, Alloy’s management was interested in Plane because Alloy already commercialized a particular advanced construction application and Plane’s technology seemed to offer significant advantages in terms of financial costs, environmental costs and end-user comfort.

During the first contacts, Plane allowed Alloy little access, fearing that Alloy would run of with Plane’s knowledge and abuse the knowledge for competitive reasons. According to the Alloy interviewees, they had to be careful not to scare of Plane, since there was little trust originally:

‘At Plane it took very long before we could at last see it [= Plane’s technology] for real (...) Trust was hanging by a silk thread. You only have to say something wrong and it can be [ruined] completely. (...) They were very fearful that we would walk off with their technology; that our R&D personnel would go to an external academic institute right away; that we would show this institute how Plane produces its product; that all their knowledge, all their value would be gone. (...) Originally, Plane was much more fearful than Cord.’ (Venturing Manager)

‘We were a potential competitor, because we would produce a product that is an alternative to theirs.’ (Venturing Manager)

In 2004, Alloy proposed a Technology Evaluation Agreement (TEA) to Plane. This type of agreement would provide Alloy with access to Plane’s technology, but with no legal rights to exploit the knowledge gained from that access:

‘Fairly quickly, we sent Plane our proposal: ‘you are developing technology on your substrate. We would like to evaluate if that technology is also applicable to Alloy’s substrate. (...) We would like a Technology Evaluation Agreement, so we gain access but no exploitation rights on your technology for a predefined period of time.’ (Venturing Manager)

In this TEA agreement, a clear distinction in the target markets of Plane and Alloy was made:

‘We split the market. Plane had all rights regarding their substrate, we had all the rights for our substrate.’ (R&D Manager)

This was important, because Alloy’s product could become an alternative for Plane’s product. Plane would continue developing for the ‘OEM’ market, where the advanced construction materials was treated during the manufacturing stage, before on-site installation. This was typical in Plane’s target market. Alloy would develop an application for the ‘retrofit’ market, where the construction material would be treated after it was already installed. This was typical for Alloy’s existing market. A schematic overview of the proposed strategic fit is provided in Figure 3.

----- Insert Figure 3 about here -----

Plane and its existing investors responded favorably to Alloy's TEA offer, but demanded a financial commitment of Alloy to tie Alloy's interests to Plane's. Alloy agreed to this term:

'Plane had a positive attitude toward the TEA offer, and only demanded one condition that we agreed to. They said 'we would like the TEA, but we want to ensure you are bound to us, more than just contractually. If we agree on the TEA, we would like a financial participation from Alloy in Plane to show commitment, as a tie between Alloy and Plane'.' (Venturing Manager)

Alloy thus participated in investment round A, along with a consortium of angel investors and one other strategic investor. The actual investment transaction happened in early 2005. It was a relatively small participation. The financial investment was linked to signing the TEA:

'The investment and the Technology Evaluation Agreement were signed on the same day. We would only invest money if the TEA was signed at the same time.' (Venturing Manager)

**Operation Stage.** As agreed on in the TEA, Alloy started trying to replicate Plane's technology. In order to achieve this goal, extensive knowledge exchange between the engineers of both partners needed to be initiated. In line with the TEA agreement, this knowledge exchange was very well structured, based on clear arrangements on how to exchange knowledge:

'From 2005 onwards there were good agreements with Plane on which steps to take in technology transfer. (...) It was very specifically defined. For example, we first discussed the equipment, methodology and so on. We took two months to do that. The next step was the first layer [of the coating]: what is it made of and how do we get it right. That was very specifically defined.' (R&D Manager)

'Plane really took the lead in 'how do we do the transfer'. That was logical, because they knew the subject and what needed to be transferred. So at the start of the cooperation, when we had little expertise, they pointed out 'try to realize that, and we will discuss the results'. And that was a few weeks', a month's job.' (R&D Manager)

In addition, the involved Alloy personnel, who received access to Plane's technology, was limited and known to Plane. Their files and other work-related material were kept strictly separated from other Alloy activities.

According to the Alloy interviewees, the knowledge exchange proceeded in a very open, but focused manner:

'The Plane project meetings were always very positive. Very focused towards the technological results, and taking them to the next level.' (R&D Manager)

In contrast to the Cord relationship, interviewees have provided no evidence of hampering intervention by Plane's management. Actually, Alloy interviewees referred to Plane's CEO as a knowledgeable person, who often provided interesting input in technological discussions.

As knowledge exchange continued to be extensive, Alloy's R&D employees started to get a very good understanding of Plane's technology, triggering new interactions between the engineers of both partners, which had not been formally planned:

'We had good people working at our place. So they fairly quickly started taking initiative. At a certain point we started discussing with Plane 'what is the next step'. We would then execute that step and discuss the results. That is how the ball kept rolling. That had not been formalized.' (R&D Manager)

As a result, a joint understanding of the possibilities and limitations of Plane's technology started to emerge:

'Plane people were impressed by the technological progress that we made. As a result, we [= Plane and Alloy people] started jointly discussing the possibilities of the technology in other markets such as automotive and transportation.' (R&D manager)

**Outcome Stage.** Knowledge transfer from Plane to Alloy had been very successful. The adoption of Plane's technology went well, as Alloy successfully replicated it within a year:

'I thought it was unbelievable how quick we adopted Plane's technology. It got done in only half a year's time.' (Venturing Manager)

‘The transfer of Plane’s technology had succeeded, so that was very successful.’  
(R&D Manager)

As the relationship evolved, trust also substantially increased:

‘[On a scale of 1 to 10 of trust] the relationship with Plane was an 8 or 9. Several people went to their plant for several weeks. They worked and cooperated on the production floor. They could see everything, talk to the personnel. Total freedom.’  
(R&D Manager)

At the same time, indications were present that the level of formal control gradually became lower. After a while, for instance, the engineers of both partners started to jointly work on using Alloy’s substrate for an OEM product, which was Plane’s core activity. This collaborative activity clearly fell outside the scope of the initial TEA agreement. A new contractual agreement (i.e. joint development agreement), legally framing these new collaborative activities, was therefore necessary. During the negotiation of this new joint development agreement, however, engineers of both partners already heavily engaged in joint interaction on this new application. In other words, the need for a formal framework that structured the collaborative activities seemed to have become much lower than at the beginning of their relationship<sup>2</sup>.

In 2006, after successfully replicating Plane’s technology, Alloy turned its attention to developing the coating on Alloy’s substrate for its retrofit market. This step turned out to be extremely difficult from a technological point of view, triggering huge questions within Alloy about the commercial feasibility of applying Plane’s technology in its existing retrofit market.

‘It turned out very quickly that the technical hurdles were extremely difficult.’ (Venturing Manager)

‘In [2006] we gave more attention to commercializing the product. We had found that a [retrofit] product would take years. Our people actively went looking ‘can we work in such a way to realize business activities quickly. So we would not only com-

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<sup>2</sup> The Joint Development Agreement has never been officially signed because, in 2008, Alloy’s management decided to stop all R&D activities on thin-film coatings, making the agreement obsolete.

municate the message ‘have 10 years of patience and we will have something’ to the executives, but we would get something proven and operational earlier.’ (R&D Manager)

Subsequently, Alloy started looking for other business opportunities in which it could use Plane’s technology. However, none of these alternatives was found to be commercially feasible. In 2008, when Alloy’s management decided to shut down its internal research concerning thin-film manufacturing activities, also the activities that were related to Plane’s technology were stopped. As a result, the technological collaboration between Plane and Alloy came to a hold. However, Alloy still kept its equity share in Plane, and continued selling materials to Plane as a supplier.

### **MICRO-LEVEL PROCESS MODELS**

Drawing on the findings above, we developed for each observed corporate investment relationship a process model, illuminating the intermediary impact of micro-level interactions on the relationship between formal control, trust and knowledge transfer. Figure 4 presents these two models. In this section, we systematically discuss these two process models.

----- Insert Figure 4 about here -----

#### **Impact of Trust and Formal control on Nature of Technological Knowledge Exchange**

Comparing the Cord and Plane venture relationships, we notice substantial differences concerning their initial trust and formal control levels. In the Cord venture relationship, high trust levels and limited formal control (i.e. only gentlemen’s agreement) were present at the formation stage. In contrast, the Plane venture relationship was characterized by low levels of initial trust and extensive formal control (i.e. technology evaluation agreement that contained specific clauses on how the exchanged knowledge could be used). These different combinations of initial trust and initial formal control contributed to different kinds of technological knowledge exchange. In the Cord venture relationship, the combination of high trust and limited formal control lead to unstructured technological knowledge exchange between engi-

neers of the two partners. In the Plane venture relationship, the combination of low trust and extensive formal control triggered much more structured knowledge exchange, based on specific rules, procedures and guidelines. Based on these observations, we propose that:

***Proposition 1:*** In the setting of corporate investment relationships, the presence of high (low) initial trust and low (high) initial formal control is likely to trigger unstructured (structured) technological knowledge exchange.

### **Micro-Level Interaction between Knowledge Exchange, Gatekeeping, and Sensemaking**

Our data suggest that these different kinds of knowledge exchange processes triggered different kinds of ‘gatekeeping behavior’ (i.e. decisions about which information will go forward, and which will not; Lewin, 1947) at the management of the entrepreneurial partner. In the Cord venture relationship, the unstructured knowledge exchange between engineers of Cord and Alloy led to increased concerns for unintended knowledge spillovers at Cord’s management. As a result, this management started to engage in negative gatekeeping behavior or actively filtering and blocking information exchange toward Alloy engineers. In the Plane venture relationship, the management of the entrepreneurial partner did not have concerns that knowledge exchange would result in unintended knowledge spillovers because, in this case, knowledge exchange proceeded in a very structured manner. Instead, the Plane management facilitated knowledge exchange by engaging in positive gatekeeping behavior or providing valuable technological input during technological meetings. We therefore propose that:

***Proposition 2:*** In the setting of corporate investment relationships, unstructured (structured) technological knowledge exchange increases the probability of negative (positive) gatekeeping behavior at the management of the entrepreneurial partner.

The gatekeeping behavior of the entrepreneurial partner turned out to substantially influence the level of joint sensemaking between the engineers of both partners. In the Cord venture relationship, the negative gatekeeping of Cord’s management hampered the ability of the partner’s engineers to come to a joint understanding of the technological challenges at hand. Instead, they were forced to focus on their own activities with limited knowledge about

what the other partner was doing. In the Plane venture relationship, the positive gatekeeping of Plane's management allowed for the further increase of technological knowledge exchange, which in-turn contributed to extensive joint sensemaking about the technological problems that engineers of both partners were facing. These observations result in the following proposition:

***Proposition 3:*** In the setting of corporate investment relationships, negative (positive) managerial gatekeeping is likely to hamper (facilitate) joint sensemaking between the engineers of both partners.

### **Impact of Micro-Level Interactions on Knowledge Transfer, Trust, and Formal Control**

Comparing the Cord and Plane venture relationships, we come to the conclusion that different micro-level interactions are likely to result in different levels of knowledge transfer success. In particular, we found strong indications that the level of joint sensemaking between engineers of both partners substantially influenced Alloy's ability to replicate the technology of the high-tech SME partner. In the Cord venture relationship, the lack of joint sensemaking severely hampered the ability of Alloy engineers to replicate Cord's technology. In contrast, the extensive joint sensemaking between Plane and Alloy engineers in the Plane venture relationship lead to successful knowledge transfer, represented by the swift replication of Plane's technology at Alloy. We therefore propose:

***Proposition 4:*** In the setting of corporate investment relationships, limited (extensive) joint sensemaking between the engineers of both partners increases the likelihood of unsuccessful (successful) knowledge transfer.

The identified micro-level interactions did not only influence knowledge transfer success, but also had an impact of the evolution of trust and formal control. In the Cord relationship, the combination of unstructured technological knowledge exchange, negative managerial gatekeeping and limited joint sensemaking contributed to negative trust dynamics. At the same time, these micro-level interactions led to an increase in formal control. In particular, a Joint Development Agreement was negotiated and signed, which contained specific contrac-

tual obligations on the technological activities in the Cord venture relationship. In the Plane relationship, the combination of structured technological knowledge exchange, positive managerial gatekeeping and extensive joint sensemaking triggered positive trust dynamics. Whereas, at the beginning of the Plane venture relationship, serious concerns about the partner's good intentions had been present, much more positive expectations emerged as the relationship evolved over time. At the same time, the level of formal control gradually decreased. Whereas, at the beginning of the Plane venture relationship, technological activities had been heavily formalized by numerous contractual obligations, guidelines and procedural restrictions, engineers of the different partners did not have to wait for a new joint development agreement to start interacting about new collaborative activities that expanded the boundaries of the original contractual agreement. Based on these observations, the following proposition is put forward:

***Proposition 5:*** A combination of unstructured (structured) knowledge exchange, negative (positive) managerial gatekeeping and limited (extensive) joint sensemaking is likely to contribute to negative (positive) trust dynamics and increased (decreased) formal control.

## **DISCUSSION AND CONCLUSION**

In this section, we reflect on the theoretical implications, the study's main limitations and various promising avenues for future research.

### **Toward a Micro-Level Perspective on Knowledge Governance**

This paper contributes to the emergence of a multi-level perspective on knowledge governance (Foss, 2007), illuminating the importance of micro-level interactions as intermediary factors in the relationship between macro-level antecedents (i.e. organizational trust and formal control) and macro-level outcomes (i.e. knowledge transfer success). It shows that initial conditions and organizational outcomes are not directly linked to each other, but rather are indirectly connected via a complex set of micro-level interactions. Moreover, we find first indications that these complex micro-level interactions might trigger counterintuitive out-

comes. Relational governance scholars (e.g. Dyer and Singh, 1998; Zaheer, McEvily & Perone, 1998; Ring & Van de Ven, 1994), for instance, have referred to high trust and low formal control as being very favorable initial conditions for the governance of alliances. In particular, it is argued that, when high levels of trust and low levels of formal control are present, negotiation and monitoring costs are likely to be low, whereas alliance flexibility is likely to be high, maximizing the opportunity to realize value in interfirm settings. At the beginning of the Cord venture relationship, this particular set of initial conditions was present. However, we observed that, in this corporate venture relationship, this combination of high trust and low formal control triggered particular micro-level interactions (i.e. unstructured knowledge exchange, negative gatekeeping, limited joint sensemaking), which resulted in negative knowledge transfer outcomes. At the same time, the Plane venture relationship indicates that low initial trust and high initial formal control can result in positive knowledge transfer outcomes by means of complex micro-level interactions.

Previous research has mainly focused on examining the *individual* impact of trust and formal control on interfirm knowledge transfer. Nielsen (2005) already criticized this approach as it tends to ignore the simultaneous effects of such conditions on the creation of knowledge synergies. Our findings provide additional evidence, emphasizing the need to examine the joint impact of initial conditions such as trust and formal control on knowledge transfer. In particular, we observed that different *combinations* of trust and formal control gave rise to different kinds of technological knowledge exchange processes between engineers of the different partners, which in the end contributed to differences in knowledge transfer success.

### **Limitations and Future Research**

Next to its merits, this study has several limitations. A first main limitation is that we could only interview Alloy people. Although we tried to minimize the negative impact of this limi-

tation by (i) triangulating our interview data with archival data and (ii) explicitly asking Alloy interviewees whether their counterpart had different opinions, views and/or thoughts; we recognize that our corporate investment relationship descriptions are mainly Alloy's reproduction of the history of the corporate investment relationships. In addition, we acknowledge that interviewing members of the other firms would have provided more opportunities to check for issues such as the presence of trust asymmetries (Graebner, 2009), the presence of different opinions on why low/high levels of formalization were present, and the presence of different views on the micro-level interactions. We therefore stress the need for future research that collects data at all involved partner organizations.

Second, we focused on one particular type of alliance (i.e. corporate investment relationships) in one particular setting (i.e. thin-film coating trajectory at Alloy). Although such a research design minimized the confounding effects of extraneous variation, it remains unclear whether our findings can be generalized to other alliance types and organizational settings. To develop a more general theory on the intermediary effect of micro-level interactions on the relationship between trust, control and interfirm knowledge transfer, additional case study research in other contexts is therefore necessary.

Third, it needs to be stressed that we focused on two particular antecedents of knowledge transfer in this study (i.e. trust and formal control). However, previous knowledge transfer research has identified other organizational antecedents such as cultural distance between the partners, level of absorptive capacity at the novice partner, and the presence of a shared vision (van Wijk et al., 2008). In our study, we decided not to focus on these antecedents in order to reduce the complexity of our analyses. Instead we decided to select cases in which these additional antecedents were kept constant (i.e. cultural distance, level of absorptive capacity at Alloy, and level of shared vision were very similar in the Cord and Plane venture relationships). However, it might be interesting to examine how differences in these addi-

tional antecedents across cases impact micro-level factors such as technological knowledge exchange, managerial gatekeeping and joint sensemaking.

Several other avenues for future research prevail. Existing research (e.g. Faems et al., 2007; Hamel, 1991; Inkpen & Wang, 2006) has provided interesting insights in the initiation and evolution of knowledge transfer processes between firms. However, much less is known about revitalization of knowledge transfer processes. In our data, we found first indications that revitalizing knowledge exchange between partners is not a straightforward task. In the Cord venture relationship, for instance, Alloy tried to revitalize knowledge exchange through pushing for of a more complex contract (i.e. Joint Development Agreement) that would provide a formal framework for the technological activities. However, Alloy interviewees admitted that knowledge exchange did not revitalize after this contract was signed. We therefore encourage future research on the revitalization of knowledge exchange processes.

A second promising avenue for future research concerns alternative combinations of trust and formal control. In our study, high (low) levels of trust were always combined with low (high) levels of formal control. At first sight, these observations seem to support the existence of a substitutive relationship (e.g., Lyons & Mehta, 1997; Macaulay, 1963; Malhorta & Murnighan, 2002) between trust and formal control. However, in line with other alliance governance scholars (e.g. Faems et al., 2008; Klein Woolthuis et al., 2005), we argue that a substitutive relationship does not always need to be present. In the Cord venture relationship, for instance, the low level of formal control was not an immediate consequence of the high level of trust between the partners. Instead, Alloy interviewees referred to the extensive technological uncertainty, making it (i) unfavorable to make explicit commitments and (ii) difficult to codify technological activities ex-ante, as the most important factor, explaining the absence of detailed contractual specifications. We therefore expect that combinations of low (high) trust and low (high) formal control can also be present in alliances. An examination of

the micro-level interactions that emerge in the presence of such alternative combinations of trust and formal control would be a very interesting avenue for future research.

## **Conclusion**

This research has enriched existing interfirm knowledge transfer research through illuminating how micro-level interactions intermediate the relationship between macro-level antecedents and knowledge transfer outcomes. We hope that our findings inspire scholars to further examine the micro-level foundations of knowledge transfer in alternative organizational settings.

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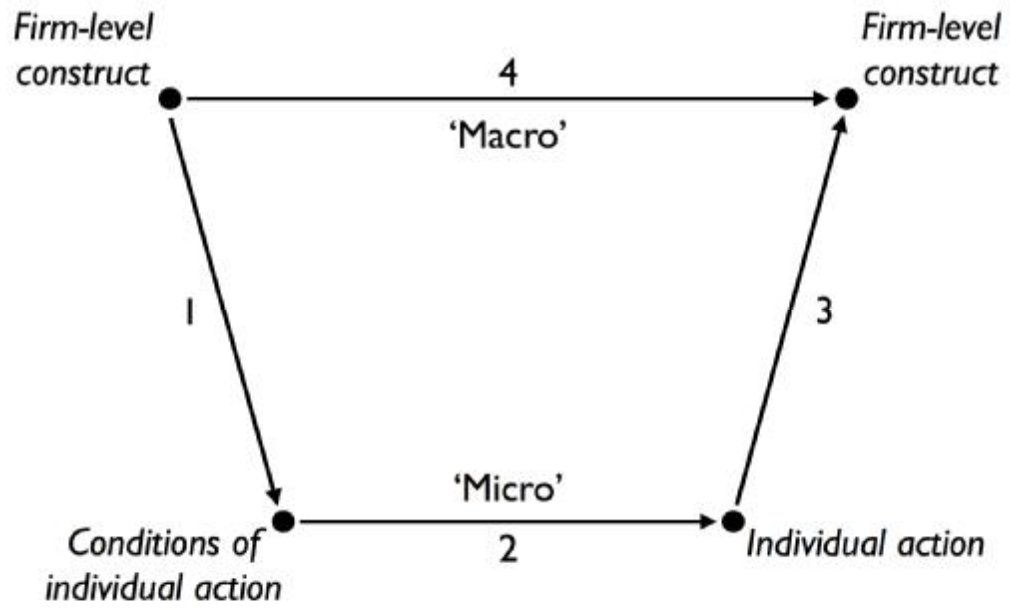
**TABLE 1: Overview of Venture Relationships**

| <i>Characteristics</i>                                  | CORD venture relationship   | PLANE venture relationship  |
|---|---|---|
| <i>Description of Partners</i>                          | Large West-European technology firm with thin-film coating competencies.                                    | <b>ALLOY:</b><br>Advanced construction material company, based in the US, founded in 1989.  |
| <i>Initiation (Alloy's first equity investment)</i>     | Late 2004   | Early 2005  |
| <i>Initial strategic objective of relationship</i>      | Transfer of CORD technology to ALLOY, to explore the viability of ALLOY as CORD's mass production supplier. | Transfer of PLANE technology to ALLOY, to explore the viability of using PLANE's technology under license in an existing business of ALLOY. |
| <i>Ending (shift from strategic to financial focus)</i> | Late 2008   | Late 2008   |

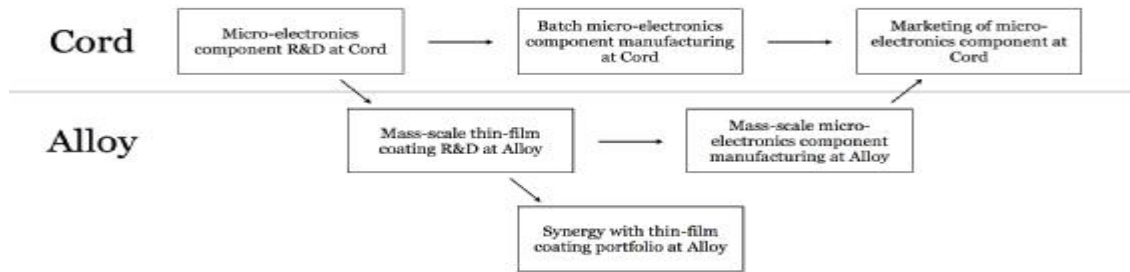
**TABLE 2: Overview of Data Collection**

| <b>Interviews</b>       |                        |                      |
|-------------------------|------------------------|----------------------|
| Function of interviewee | Number of interviewees | Number of interviews |
| Venturing Manager       | 3                      | 4                    |
| R&D Manager             | 4                      | 5                    |
| Product-Market Manager  | 1                      | 1                    |
| Market Analyst          | 2                      | 2                    |
| Legal Advisor           | 1                      | 1                    |
| <b>Archival Data</b>    |                        |                      |
| Type                    | Number                 | Total pages          |
| Presentations           | 19                     | 547                  |
| Text Documents          | 3                      | 6                    |

FIGURE 1: Macro versus Micro Level Relationships (Based on Foss, 2007)



**FIGURE 2: Strategic Fit in Cord Venture Relationship**



**FIGURE 3: Strategic Fit in Plane Venture Relationship**

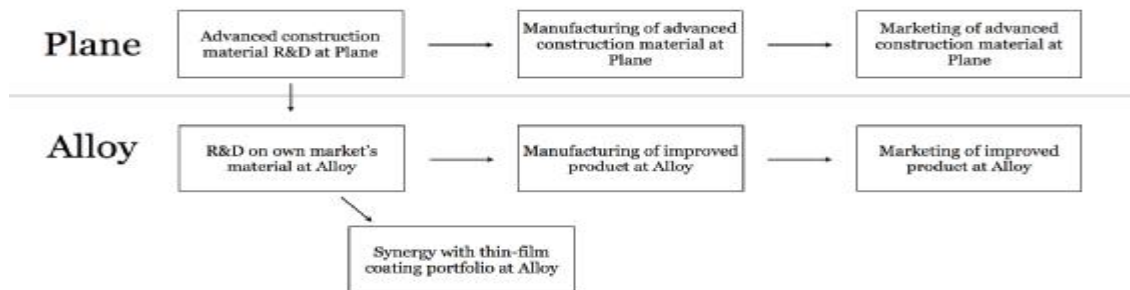


Figure 4: Micro Level Process Models

