INSIDE THE TERTIUS GAUDENS: THE CASE OF ASML

IRENE LAMMERS ; ARD-PIETER DE MAN ; MARIANN JELINEK

VRIJE UNIVERSITEIT / SCHOOL OF BUSINESS AND EINDHOVEN UNIVERSITY OF TECHNOLOGY

ABSTRACT

This paper studies the network orchestration practices of a tertius gaudens, i.e. the central company in a structural holes network. Extant literature has pointed towards the benefits and drawbacks of a structural holes strategy in comparison to a closure strategy. Although the roles and activities of the central company in a closure network, the tertius iungens, have been described in detail, the practices of tertius gaudens network orchestrators have not been studied in detail. We advance a number of propositions regarding these practices. Next, we show the plausibility of our proposition by means of an in-depth analysis of a tertius gaudens, the high tech company ASML. Our analysis shows that the tertius gaudens follows different policies than the tertius iungens. These policies include consciously separating partners instead of connecting them, avoiding a network strategy based on group based competition and continuously increasing the number of network partners. We conclude with discussing the benefits of a tertius gaudens approach and the need for future research to include firm agency and contextual factors as important drivers in explaining actual network orchestration regimes.

KEY WORDS: network governance, tertius iungens, tertius gaudens, structural holes, brokerage

INTRODUCTION

Networked innovation is becoming increasingly important for firms' efforts to respond to rapidly changing environments by acquiring and integrating interdependent and complex bundles of knowledge and capabilities (Baden-Fuller & Grant, 2004; Kogut, 1991; Powell, Koput, & Smith-Doerr, 1996). Contemporary innovation practices have moved increasingly towards "open innovation" and strategically networked systems of complementary resources (Chesbrough, Vanhaverbeke, & West, 2006; Chesbrough, 2003; Harryson, Dudkowski & Stern, 2008). Furthermore, deliberate networks that are consciously designed and governed by a lead-organization or "hub firm" (Dhanaraj & Parkhe, 2006; Doz, Olk, & Ring, 2000; Jarillo, 1988; Lorenzoni & Baden-Fuller, 1995; Sydow & Windeler, 1998) achieve higher levels of performance – either in terms of individual firm performance, cost effectiveness of the entire network (e.g., (Dyer & Nobeoka, 2000), network-level learning (e.g., (Knight & Pye, 2005; Kraatz, 1998) or product design cf., (Chesbrough, 2006). The hub firm may be defined as the most prominent and powerful firm, centrally located in the network structure, such that its prominence and power enable the firm to pull together the dispersed resources and capabilities of network members (Dhanaraj & Parkhe, 2006):659.

In the literature two types of hub firms have been identified: the tertius gaudens and the tertius iungens (Burt, 2000; Obstfeld, 2005; Simmel, 1950). Much literature on organizational networks centers on a debate between those ascribing superior performance to companies bridging structural holes (brokerage) (Burt, 1992, 1997, 2000) and those claiming companies who prefer tighter network relations process (closure) gain a competitive advantage (Coleman, 1988). According to the closure perspective the tertius iungens gains from long-term intimate relations, because such relations stimulate knowledge exchange between the partners. The high level of trust in a closure network stimulates companies to share their skills and know-how. Hence companies in a closure network obtain important benefits. In a structural holes network on the other hand the tertius gaudens creates rents through brokerage, by positioning itself between two unconnected firms it has access to two different unrelated sources of knowledge. Consequently the tertius gaudens is better informed than other companies, which gives it a competitive edge.

The literature provides numerous large scale studies into the question under which conditions either the closure or the structural holes perspective is most effective (Gilsing et al. 2008; Lemmens, 2003; Obstfeld 2005; Rowley et al. 2000). Despite a wealth of network-related studies during the last network, contributions focusing on process and managerial issues are relatively scarce (Grabher & Powell 2004; Provan et al 2007; Vanhaverbeke, Gilsing, Beerkens and Duysters 2009). An exception to this is the Toyota case, which has been subjected to detailed analysis as an example of a tertius iungens positioning (Cusumano, 1985; Cusumano & Takeishi 1991; Dyer and Nobeoka, 2000). In fact, the Toyota case has been held up as an example to such an extent that any deviation from Toyota's model is described as being a corrupted application of the Japanese car maker's tertius iungens approach (Ro, Liker & Fixson, 2008), suggesting that all goal-oriented networks benefit from similar network design and orchestration practice. Other fine grained studies of the management processes that enable the tertius gaudens approach are lacking.

The aim of this research is to fill this gap by analyzing the management practices of a tertius gaudens. We will pursue our goal by first developing propositions about a tertius gaudens mode of network orchestration, based on current insight from the literature. Second, we will present the results of a case study into the network orchestration practices employed by ASML.

Our argument is presented as follows. In the next section, we will briefly summarize the two contrasting approaches of tertius iungens and tertius gaudens. We subsequently compare the two different modes of network governance, leading to a number of propositions about key network orchestration practices employed by a tertius gaudens. As a next step, we illustrate and further develop insights with a discussion of the network orchestration practices of ASML. Our case study confirms many, but not all propositions, and points towards contextual factors that have influenced ASML's network orchestration approach. We end with a discussion concerning the implications of our findings, including a discussion of the benefits of a tertius gaudens approach and the need for future research to include firm agency and contextual factors as important drivers in explaining actual network orchestration regimes.

CONTRASTING BROKERAGE STRATEGIES IN NETWORKS

Networks in which a lead organization plays a central role may have either a dense or a sparse social network structure. A sparse network is a network with structural holes, defined as the absence of connections among nodes in the network (Burt, 1992). Dense networks are networks were most nodes in the network have ties with most other nodes in the network (Coleman, 1990). Both types of networks have featured in a longstanding debate on the different merits of two different conceptualizations of social capital.

According to structural holes theory, rare ties to others beyond the focal group provide superior access to information and greater opportunities to exercise control, generate good ideas and creativity (Burt, 2004, 2005). Sparse networks expose an actor to novel communities, diverse experiences, unique resources, varying preferences and multiple thought worlds. Burt drew on the concept of *tertius gaudens* (Simmel, 1950) to explain the social activity that occurs around structural holes, where an actor positioned between two disconnected parties can manipulate or exploit those parties to the actor's benefit. Similar dynamics are visible at the firm level: the product design firm IDEO exploits a technology brokering role in order to develop innovative products by reusing partial solutions from distant settings (Hargadon & Fanelli, 2002; Hargadon & Sutton, 1997). Although networks with an abundance of structural holes create opportunities for the novel combination and recombination of ideas, they pose a problem for acting on such ideas. This difficulty arises because people found around structural holes are disconnected, dispersed, and thus inherently more difficult to mobilize or coordinate, especially around new ideas. Thus, while structural holes may lead to good ideas, implementation may be problematic (Burt, 2004; Obstfeld, 2005).

A contrasting position ascribes social capital benefits to a closed, dense or cohesive network (Coleman, 1988, 1990), where repeated interaction and idea exchange help create trusting, long-term relations that can only come into being in relatively tight knit groups (Ahuja, 2000). Obstfeld (2005) has focused on the behavior orientation of focal actors in these dense networks. He defines *a tertius iungens* ('the third who joins') orientation as the strategic, behavioral orientation toward connecting people in one's social network by either introducing disconnected individuals or facilitation new coordination between connected individuals. This orientation contrasts with the strategic separation among parties emphasized in Simmel's (1950) and Burt's (1992/2000) concept of the *tertius gaudens* as described above. By creating

dense networks, the tertius iungens aims to create dense networks in which mobilized action is conducive, because interests and perspectives are prealigned or normatively constrained, while the language and trust necessary to rally those interests are more readily available (Granovetter, 2005). A disadvantage of dense networks are the possible constraints they pose on idea generation and readiness for change, because of the redundancy of information circulating within the network, and the potential problems they have for absorpting new knowledge. In table 1 we summarize the key differences between these two kinds of strategies.
<< INSERT TABLE 1 ABOUT HERE >>

CONTRASTING STRATEGIES FOR NETWORK GOVERNANCE

How will network governance conducted by a *tertius gaudens* differ from network governance by a *tertius iungens*? We consider network governance to be a combination of network design and network orchestration activities by a hub firm. Network design activities include member recruitment, network structuring, and firm positioning within the network determine the architecture of the network. Network orchestration practices consist of a focus on knowledge mobility within the network, the appropriability of knowledge, and the ensurance of the stability of the network (c.f. Dhanaraj & Parkhe 2006). While some aspects of good network orchestration will be shared by the tertius gaudens and the tertius iungens, there are several important differences between the tertius gaudens and the tertius iungens mode of network governance. In table 2 an overview of the key differences is presented. Below we develop the propositions that capture these distinctions.

<< INSERT TABLE 2 ABOUT HERE >>

Network Design and Stability

The key difference between a tertius iungens orientation and a tertius gaudens orientation can be found in the role the hub firm ascribes to its network. The tertius iungens aims to increase the competitive advantage of the network as a whole versus that of other networks, entering into group based competition in stead of individual competition (Gomes-Casseres 1994). It therefore seeks to limit network size, strengthen the ties in the network, enhances the number of avenues within the network, furthers network identity and welfare and ensures partners' long term commitment to the network to create network stability. By contrast, the tertius gaudens seeks to strengthen its own competitive position *a vis* its competitors and its power in and over the network and sees its network as a resource it can draw upon to further its own goals. It therefore expands the number of partners in its network to access new knowledge or to complement current network resources, weakens its network ties to enable maneuvering, create new structural holes to capture the benefits of new control and information rents, is not interested in promoting network identity or autonomy and seeks to create network stability by ensuring the adaptability of the network to changing circumstances. We will discuss these differences in more detail below.

Network size

While a tertius iungens seeks to restrict the number of partners in the network as a necessary precondition for the emergence of trust, identity and mutual learning in the network (Jones, Hesterly & Borgatti 1997), the tertius gaudens contrasts this approach by seeking to expand the size of its network with new partners, possibly also initiated by network partners. By enlarging the network, benefits such as complementary network resources (Ahuja 2000) and the access of new knowledge for the network (Grant & Baden-Fuller 2004) may be reached (Doz, Santos, & Williamson, 2001; Doz & Hamel, 1998; Hagel_III et al., 2009). Ties external to the existing network have been noted in high technology networks as a source of "productive friction" akin to diversity renewal (Hagel_III & Brown, 2005b; Hagel_III & Brown, 2005a). Lastly, enlarging the network also brings the benefits of new structural holes, which offer new opportunities for new ideas and control of network resources (Burt 1999). Thus, our proposition is:

> *Proposition 1a. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy, will expand the number of partners in the network*

Tie strength

Tie strength has been related by Granovetter (1973) to the amount of time invested in a partner, the emotional intensity of the relationship, intimacy or mutual confiding and the reciprocal services the partners deliver. Strong ties are pursued by hub firms acting from a tertius iungens

orientation, as they bring the benefit of stable, long-term relationships, long-term investment horizons, while at the same time reducing the cost of new partner search and selection. For instance, Dyer & Nobeoka (2000) describe how Toyota invests considerable amounts of time and effort in their network partners, by offering free consultancy advice and sharing its production know-how and enhances tie strength by taking equity positions in suppliers firms. The tertius gaudens however follows a different logic. As a tertius gaudens needs a certain degree of freedom to maneuver and to pursue the benefits of working with new partners, it does seek to be as independent as possible from its existing partners. In terms of tie-strength, the tertius gaudens will find it less desirable to have many strong ties, as a strong tie comes with a number of disadvantages. These disadvantages include high sunk costs through time invested in the partner, a complex set of reciprocal services that makes it more difficult to dissolve a bond with another company, and emotional intensity and intimacy. For a tertius gaudens, a strong tie is therefore something that should be avoided or weakened as far as possible. Thus, our proposition is:

> *Proposition 1b. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy will seek to weaken its ties as far as possible.*

Network density

Enhancing network density has traditionally been associated with innovation networks (Powell and all 1996, Dyer & Nobeoka 2000). A tertius iungens will stimulate the number of ties within the network, for instance by setting up meetings, initiating new forms of collaborations. By stimulating multiplexity in the network – defined as "two or more types of relationships occurring together" (Kenis & Knoke, 2002) - the number of conduits for knowledge exchanges in the network is multiplied, enhancing network level learning processes as well as the formation of a network identity (Dyer & Nobeoka 2000). However, for a tertius gaudens it is essential to keep structural holes into existence and possibly to create new ones in order to maintain network centrality, information benefits, benefits due to knowledge differences between parties and power over the network. We therefore don't expect network orchestration efforts to bring network partners together to create new conduits for knowledge flows and to create a shared network identity, but expect to find efforts to keep partners separate instead. Our proposition is therefore:

> *Proposition 1c. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy will not actively stimulate, or will actively prevent, socializing, learning or collaboration between partners in the network beyond those that lead to direct benefits for the lead firm*

Network identity and autonomy

As the tertius iungens relies on group based competition, it pursues network closure as well as the creation of a shared network identity. Thus, the tertius iungens may actively invest in the welfare of its supply network for instance by funding a supplier organization and support interorganizational socialization, group learning processes and efforts to create/emphasize the network identity (Dyer & Nobeoka 2000). We don't expect a tertius gaudens network orchestrator to pursue any activity for the benefit of the network, outside its own benefit. For the tertius gaudens, separating the network from its environment limits its own possibilities for network expansion and network adaptation, and is therefore undesirable. We therefore propose:

> *Proposition 1d. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy will not invest in creating group welfare beyond its own profitability*

Network stability

Network stability can be defined as the enhancement of network survival in the long run. Network stability is enhanced where the network is profitable, the network-of-choice for all partners, where the reputation of the lead firm or its key brand is superior. The prospect of future benefits – "lengthening the shadow of the future" – is also crucial for network stability (Dhanaraj & Parkhe, 2006), but also a key means of strengthening network goals and norms (Hagel_III, Brown, & Jelinek, 2009). Although these recommendations are held to be true for all types of goal oriented networks, a tertius gaudens and a tertius iungens employ different tactics for ensuring the survival of the network in the long run in addition to this.

According to the 'network closure' perspective pursued by a tertius iungens, network stability may best be enhanced by minimalizing the changes in network membership, size and tie strength within the network. As structural holes are believed to be unstable (Burt, 1999),

network stability may be enhanced by closing structural holes in the network and by building multiplexity in the network. Furthermore, as the erosion of network ties are assumed to undermines network benefits (Lorenzoni & Lipparini, 1999) network stability is also enhanced by developing the strength of ties within the network.

By contrast, a tertius gaudens relies for the long term survival of its network on the ability of its network to adapt itself to changing circumstances. Thus, a tertius gaudens will actively monitor the network environment and adjust network configurations to accommodate changes in technology, competitive positioning and economic tide.

Proposition 1e. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy will change its network to accommodate environmental change

Knowledge management

The coordination of knowledge exchange across the network is widely recognized as a crucial network task. Firms have the natural tendency to protect know-how viewed as proprietary, but an innovation network cannot be productive if 'the specialized knowledge of each network member stays mostly locked within its organizational boundaries' (Dhanaraj & Parkhe 2006). Knowledge management in network orchestration may be geared towards stimulating and enabling interorganizational learning processes, capability enhancement of network partners and the accessing of new knowledge outside the network (Dhaneraj & Parkhe 2006). Stimulating interorganizational learning process may take the form of organizing supplier site visits and supply chain conferences (Dyer & Nobeoka 2000) but also by engaging in early supplier involvement – the high level of involvement of suppliers in the design phase of innovation processes (Clark & Fujimoto 1991).

Both a tertius gaudens and a tertius iungens hub firm recognize the importance of building and exchanging knowledge in its network, but take a different approach in pursuing these. A tertius iungens has the tendency to close the network and pursues the competence enhancement of the entire network. A tertius gaudens however has the tendency to expand the network, predominantly by accessing partners with new knowledge for the entire network. A tertius gaudens is therefore not interested in the capability enhancement of network partners: if there are competence problems, there is always the possibility to approach a new partner. This lack of loyalty towards existing partners may also be visible in when interfirm learning processes are organized. Literature's prescription to enable interorganizational learning by promoting the free flow of knowledge throughout the network (e.g. Danaraj & Parkhe 2006; Dyer & Nobeoka 2000) suggests a tertius iungens perspective on network orchestration, which is partly contrasting the tertius gaudens approach. For a tertius gaudens orchestration mode of the network, the organization of interfirm learning processes is only beneficial when the brokerage position of the hub firm is not undermined. A tertius gaudens is therefore unlikely to adopt early supplier involvement in design, at this process may be experienced as posing a potential threat to its competence base. Furthermore, as the tertius gaudens has the tendency to 'open' the network, the risk of knowledge leakages is higher. Knowledge exchanges will therefore only take place when safe settings have been created. These settings will be local, for instance in the context of a certain project or interfirm alliance, as the entire network is not safe for free knowledge exchanges. This leads to the following propositions:

Proposition 2a. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy will be selective in the learning processes in the network that are enhanced or not.

Proposition 2b. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy will not invest in capability enhancement of its network partners.

Proposition 2c. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy, will not systematically use early supplier involvement in its innovation processes

Knowledge and Innovation Appropriability

Given network members' independent interests, managing knowledge appropriability in a network entails the implementation of structures, rules and behaviors that secure equitable distribution of value to network members. As hub firms, both the tertius iungens as the tertius

gaudens have the power to enforce a just knowledge innovation appropriation situation, however, there may be differences in the way these hub firms use their power.

The tertius iungens pursues a group based competition with its network. It will therefore decrease its power distance towards other members in the network to enable other network member to take initiatives, pursue the goals of the network and control themselves and other network partners ('concertive control' Barker 1993). The tertius iungens will seek to use a cultural mode of control, based on the development of network rules of behavior en the social enforcement thereof, to create the macro culture proposed by Jones, Hesterly & Borgatti 1997. Important elements of this cultural mode of control are trust, reputation and the self-monitoring of network partners to conform to network norms.

The tertius gaudens does not pursue a group based competition, but seeks to maximize its own profit, chances of survival and power over the network. For a tertius gaudens it does not make sense to give power in and over the network away to network partners, only to the extend that it makes its own life easier. It therefore maximizes power distance over its network partners. As a tertius gaudens does not expect trust to be present in the network – due to its own brokerage practices – it relies on formal modes of control to keep partners both at an arms length as well as to ensure knowledge appropriability. Formal modes of control may include contractual arrangements such as patent pooling and formal methods to monitor a partner's contribution to value creation. We expect that a tertius gaudens will use these formal control instruments extensively as a cultural control mode is virtually absent in the network. This leads to the following propositions:

Proposition 3a. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy will not rely on cultural modes of control to orchestrate its network.

Proposition 3b. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy, will use formal instruments to ensure innovation appropriability

Proposition 3c. A lead firm orchestrating its innovation network by employing a tertius gaudens strategy, will enlarge power distance between itself and its network partners

METHODOLOGY

In keeping with our aim of theory-building, we have followed a case study design to replicate our propositions. After defining the research question, we used theoretical sampling to select a case (Eisenhardt, 1989). Based on our interest in *tertius gaudens* we chose a company (ASML) that appeared to have many *tertius gaudens* characteristics (e.g. hub firm in a large network, policy of expanding the number of partners, no explicit pursuit of a network identity). We gained full access to ASML through the R&D director and a Supply Chain Director, who acted as our primary informants and confirmed our characterization of ASML's network orchestration philosophy.

We then studied the ASML network orchestration philosophy in general, studying company documents and reports and external sources on ASML's network, and conducting interviews with ASML managers on their network orchestration philosophy.

To gain insight into the day-to-day practices of network orchestration by ASML we subsequently looked at the practices surrounding the management of four ASML supplier relationships in more depth (thus creating an embedded case study design, c.f.Yin, 1981). The four relationships were picked to highlight contrasts: two of the relationships were considered (by ASML) to be optimal, 'as it should be', yielding successfully conducted joint innovation projects. The other two relationships were considered to be 'difficult', leading to innovation projects that encountered some important problems. By contrasting successful and unsuccessful relationships we hoped to see differences between 'the theory' and 'the practice' of ASML's mode of network orchestration. We will refer to the four partners involved in our study "Tooler", "High Gear", "Mechatron", and "Power Electronics" (the names are pseudonyms).

Data were gathered within the period June 2006 to February 2007. In this period, we conducted 27 semi-structured interviews in total, each lasting between 1 and 1.5 hours (see table 3 for an overview of our interview partners). All interviews were conducted by two ore more researchers to enhance reliability (Eisenhardt, 1989), and all were recorded and subsequently transcribed. For each network partner firm, we interviewed the ASML project leaders, project employees and direct responsible managers within ASML, as well as their counterparts at the supplier, to uncover differences in interpretation of key events and

dilemmas. Each supplier's perspective on their relation with ASML as well as key events in their innovation project was verified by the supplier.

A second source of information was on site presence. A research assistant spent six months on location in ASML in the purchasing department that managed the company's relationship with the four selected partners. In addition, the sites of the ASML partners were visited, which in particular increased our understanding of the technology involved and the management skills of the supplier. A third information source were ASML company documents, including purchasing manuals, internal and external company presentations, annual reports, contracts with the partners and the results of annual partner assessments. Finally, our fourth source of information consisted of external sources like press clippings, other ASML cases studies and analyst reports. This information provided the basis for a written case, which was presented to ASML and to the partners for comment and correction, resulting in minor factual changes. In the final phase we compared the propositions against the case results to reach our conclusions.

<< INSERT TABLE 3 ABOUT HERE >>

RESEARCH SETTING

ASML is a leading provider of advanced technology systems for the semiconductor industry. The company produces a portfolio of lithography systems, mainly for manufacturing complex integrated circuits ("semiconductors", "integrated circuits", "ICs" or "chips"). Chips made with lithography systems are found in numerous consumer products, such as phones, hand held mobile computers (PDAs), digital television, and DVD players. Headquartered in Veldhoven, The Netherlands, ASML delivers to most of the IC manufacturers in the United States, Asia and Europe[1]. In addition to its lithography systems, ASML also provides its customers with a range of support activities and products, including process and product software applications, manufacturing and design advice and service support.

At the time of the research[2], ASML was highly successful, enjoying a 2006 of € 3,6 billion with a net income of €625 million. ASML enjoyed a further increase in market share from 57% in 2005 to 65% in 2008 (Annual report ASML, 2008 based on independent research firms). These results can be added to a long list of impressive results from the company's founding in 1984 to the market leadership position its holds today. While the chip lithography market grew from €463 million in 1984 to €4,800 million in 2006 worldwide (ASML 2007), the number of competitors dropped from 8 to 3, and the market share of ASML's major competitors, Nikon and Canon, decreased from respectively 45% and 29% in 1995 to 24% and 11% in 2008. ASML's market share is rooted in technological mastery: It ranked 167th on the list of companies granted the most patents in 2005, and was the third most active in patents in The Netherlands following Philips and Unilever, firms many times ASML's size (IPO, 2005). ASML spent 13.84% of revenues on R&D in 2005, significantly more (in absolute terms as well as compared to the total number of sales) than its main competitors Nikon and Canon.

The R&D euros are spent to create new generations of microlithography equipment. The challenge in microlithography is to make chips as small as possible. The need for miniaturization in the industry follows a pattern, usually referred to as 'Moore's law', based on the observation of INTEL co-founder Gordon Moore who predicted as early as 1965 that the number of transistors on a chip would double every 18 months. What once was an observation now acts as an industry-wide technological roadmap: manufacturers like ASML take the lead in

[1] Of the 20 largest semiconductor manufacturers ranked by capital expenditure, 17 were customers of ASML in 2005 (ASML, 2006).

[2] In Q1 of 2009 the world-wide financial crisis has hit ASML as well. Sales have dropped from 919 million (based on 43 new/7 used machines) in Q1 of 2008, via 494 million (15 new/10 used) in Q4 2008 to the current (7 new/4 used) 184 million sales of the first quarter of 2009. Losses have been limited by anticipatory cost-cutting from December 2008 onwards in administrative and marketing areas, and by letting go a number of temporary workers. R&D investments in the new immersion and extreme ultraviolet (EUV) systems have remained at the usual levels, enabled by a substantive 200 million loan from the European Investment Bank. ASML expects a first recovery of its market technology investments in mid-2009.

making Moore's law a reality. Currently, ASML's latest lithography equipment (TWINSCAN XT1900i) sets the industry standards in terms of precision and accuracy: it is able to make patterns with a precision of 40 nanometers (0.0000040 mm) which are positioned layer-to-layer with a close control accuracy of 6 nanometers and reach a productivity of 2500 wafers a day. Lithography equipment is indeed as Chuma (2006: 395) puts it 'the ultimate precision tool in human history'. Today, ASML pursues EUV (extreme ultra violet) technology to take the next, possibly the last, step in its quest for miniaturization.

To achieve these innovation targets, ASML highly depends on its network, including customers, R&D institutes as well as suppliers. In our research we focus on ASML's relationship with its supplier network. ASML estimates that as much as 90% of the costs of a lithography system are being supplied by external partners. According to Chuma (2006), this high degree of outsourcing (compared to Nikon and Canon) has provided ASML a strategic advantage that has been crucial for ASML development into a market leader (Chuma 2006). To reach this high degree of outsourcing, ASML works with over 500 suppliers, about 300 from The Netherlands, 100 from the rest of Europe and another 100 suppliers outside the EU, mostly from the US (ASML, 2006). Within this network, ASML occupies a prominent and powerful position due to its capacity to generate business. Although ASML is a key player in the network, it shares its central position with a few other companies who possess crucial expertise for ASML, notably Carl Zeiss SMT. Zeiss, a specialist in precision optics and mechanics designs, produces the projection lens that is a crucial part of any lithography equipment. Within the network, ASML focuses on the design of lithography equipment from a system integration perspective. The task of actually making the components is, as far as possible, handed over to ASML's supplier base. However, the task of orchestrating the innovation efforts in the entire supply chain remains to be ASML's ultimately. And given ASML's dependence on its network, the governance of this supply network is of crucial importance for the firm's survival in the long run. We shall now discuss the way ASML governs its network, identifying the tertius gaudens features in their approach by following the hypothesis as identified above.

RESULTS: NETWORK GOVERNANCE BY A TERTIUS GAUDENS

How to manage supplier relations with over 500 external suppliers? ASML's answer to this question is predominantly determined by the nature of its task environment: its technology, the expectations of its customers and the demand volatility in the semiconductor industry. These specifics have been translated into a supply network orchestration approach, following the ASML procurement motto "What our customer expects us to perform is what we expect our suppliers to perform" (ASML/GWO procurement, 2004). ASML recognizes several customer expectations that guide the design of their supply chain management approach. The first most dominant one is meeting the technological challenges and timelines that arise from the *de facto* industry-wide technological roadmap derived from Moore's law. No less important is the focus on product quality, a reliable supply of parts, and cost control, as these have a huge impact on customer satisfaction. Lastly, given demand volatility, there is an emphasis on solutions that decrease the costs and risks of over- and underproduction in the supply network (ASML/GWO procurement, 2004).

ASML's supply chain management approach has not always been like this, but has evolved out of the semiconductor industry crisis in 2001. In that year, industry downturn caused ASML to cancel over 40 percent of its orders as customers cancelled theirs. This pushed several of ASML's high dependence suppliers into bankruptcy, endangering the survival of the entire supply chain. As explained by one of ASML's suppliers:

> It used to be a real Philips-company. Philips used to be one of the big guys, with a 'we are the king' attitude, and 'the client will get it when we are finished'. This also used to be the case for ASML. In the good old times, ASML gave away much time and commitment. For instance, in the supply chain, they allowed a lot of space. There used to be plenty of time for production, for keeping stock, everything was covered. It produced a culture of *laisser-fair*, leaning backwards, saying 'everything will be alright'. But things have changed over time. There has been a big culture change, also because we ourselves have entered new, more customer driven markets. And ASML has learned its lessons too; also for them the market determines their business. One of the things that have changed is the way they approach the supply chain. In the past, suppliers were brought in and nurtured a bit. There was a feeling of partnership and equality in the supply chain. Of course we all had to work hard, but then everyone

> prospered. But even since the experience of 2001, when everything fell apart, the feeling that power controls the chain has crept in. ASML constantly pressures its suppliers, which are smaller by definition, to take more of the risks. There is little room to say 'we're not able to do that' – then you immediately have the choice to participate, or not. After 2001, ASML continued to organize supplier days. But the tone of voice has become much more business-like. It now all centers on the awareness for 'this is our market, these are the demands of our market, this is what you (as supplier) has to participate in'. It's not that they don't recognize their supply chain, or don't value us. They just approach us very rational. As a small company, it's not always easy to cope with that. " (Account Manager High Gear, 21-09-2006*)*

We will now discuss the details of ASML's network orchestration approach in terms of the hypothesis developed above.

1a. Network expansion

There are two reasons for ASML to expand its supply network. The first reason is associated with ASML's strategy of technological leadership, and thus the desire to have or access to state-of-the-art knowledge in all areas that are relevant for the production of lithography machines. When a new area of knowledge emerges, a so-called make-or-buy decision is being made. An important consideration here is the question whether any given activity, and its underlying resources or capabilities, is crucial for ASML's competitive advantage. For these crucial areas of competence, tailor made constructions are being made to secure ASML's access to this knowledge such as equity exchanges (Zeiss) or acquisitions. For instance, in March 2007 ASML acquired Brion Technologies, Inc., a US firm that claims to be the technology leader in computational lithography, which encompasses design verification, reticle enhancement technologies and optical proximity correction. According to ASML CEO Eric Meurice this will increase the imaging quality and the yield of wafer manufacturing equipment (Meurice, 2007). The second reason is associated with ASML's desire to minimize its dependencies. ASML aims for a "dual sourcing of knowledge, globally, together with the suppliers, and a single, dual, or multiple sourcing of products, where possible or required" (Dijkhuis, 2006). Thus, despite the existence of long term relations with most suppliers, ASML is actively seeking to expand its supplier base and thus decreasing its dependence on a limited number of other organizations.

ASML's satisfaction with the supplier in question also plays a role. For a high performing supplier a position of 'preferred supplier' is also possible. Supplier may earn a position of preferred supplier, implying a long term commitment of ASML for mutual business, but it takes a lot of effort for suppliers to get there. The effort includes amongst other things the strategic alignment of suppliers' business plans with ASML's needs, the development of key competences and good reputation to be 'first in class' for all products the supplier supplies, a good performance in terms of quality, costs and logistics control and an active effort to identify and develop new markets in other segments to decrease their dependence on ASML.

Although ASML aims to broaden its supply base, this process is still underway as it has appeared to be difficult to find additional suppliers with the required (specialized) knowledge and the willingness and ability to participate in high-velocity innovation trajectories. However, as ASML is firmly determined to expand its supply base it takes a tertius gaudens position in this aspect of its network orchestration strategy.

1b. Tie weakening

> "ASML is a pleasant customer. But they've changed. Within a time period of 4 to 5 years, they've transformed from an open into a closed organization, for us. Many rules, too many rules I think" Account manager at Tooler (26-11-2006)

It is not surprising that suppliers such as Tooler experience the process of tie weakening embarked upon by ASML as a transformation from an open into a closed organization. The strength of the tie ASML has with its suppliers depends on the uniqueness of the product or expertise that the supplier brings to the relation. The reason for a strong, high-trust relation with supplier 'Power Electronics' is being described by ASML as follows:

> "We trust Power electronics to such a degree that we consider them to be an equal partner in our conversations. They think with us in our product generation processes from the very first sketches onwards. Why? Because they have the knowledge and skills to do so, as well as a proven ability to meet quality and supply chain control

> demands. Moreover, in previous development trajectories the engineers of Power electronics have demonstrated their ability to perform in our product generation processes. Even in terms of meeting the pressure of a time-to-market trajectory. They've demonstrated that they are able to perform in both respects again and again, and that makes them unique compared to possible other partners". [Supply chain manager ASML for Power Electronics, 19-01-2007]

For routine products that could be supplied by multiple suppliers, ASML maintains a distant transactional relationship. For suppliers with crucial and relevant expertise, ASML seeks to develop long term relationships. However, these relationships should not get too close. ASML seeks to limit suppliers' dependency on ASML to 25% of revenue at maximum, in order to secure supply chain survival in case of an industry downturn. In the cases we have studied however ASML grants suppliers much more business than this, in cases even over 50% of the business volume of a supplier. ASML considers this to be undesirable and takes several actions to minimize its dependencies of its suppliers. First, if and when possible, ASML seeks additional suppliers of the same product family to share business over multiple partners in stead of one. Second, with suppliers with a high degree of dependence, ASML initiates strategic conversations with the board of the supplier to assist in developing new markets for the supplier and thus decrease the dependence of the supplier from ASML. Thirdly, the degree of dependence of ASML and its supplier is monitored and subject to periodic evaluations of the relation between ASML and each supplier.

1c. Multiplexity and 1d. Network identity creation

Especially in the Dutch part of the network, the ASML supply network resembles a 'small world' with many different kinds of relations and a shared historical and cultural background. Suppliers said that before the industry crisis in 2002, ASML periodically organized supplier conferences where knowledge was exchanged and the possibility to socializing occurred. Today, supplier gatherings are organized as well. However, tensions occur around the invitation lists for these events, as ASML does not invite direct competitors so many suppliers are not allowed to attend. Moreover, we also found an indication that ASML actively prevents knowledge exchanges between suppliers. When we suggested at ASML to report the findings of our research back to the suppliers in one general meeting, ASML explained that they didn't want the suppliers to meet to prevent them from exchanging crucial information that would weaken their negotiation position. So the enhancement of multiple avenues within the network – beyond those that are directly necessary to realize the next innovation trajectory, is not actively enhanced.

No interviewee at any of the four suppliers for ASML that we visited considered himself to be part of a social group of ASML suppliers. Supplying to ASML is business, mostly highly challenging and rewarding financially as well as technologically, but there are no warm feelings towards this network as a social group to be found. A network identity is lacking. Considering these observations, we consider the propositions 1c and 1d to be true for ASML.

Knowledge management

2a. Selective use of interfirm learning processes

Most suppliers in the network have their own technological expertise and have little to gain in exchanging their technological competences with other network partners. This may explain the absence of any institutionalized form of knowledge exchange in the ASML network. However, in the context of specific innovation projects, occasionally partners are brought together to solve a technological or logistic problem at hand. For instance, in one of our less-successful projects called 'moving diaphragm' the technological complexity of the project was of such a nature, that neither ASML engineers nor the engineers of the responsible supplier 'Mechatron' were able to solve it. When the project threatened to damage the release of the entire new type of lithography system, ASML took the lead in erecting a so-called 'tiger team'. In this team, a number of specialists – also drawn from other suppliers in the network – worked together to solve the technological and production problems at hand. However, on a network level there is no exchange of management best practices between suppliers. Many suppliers have planning or project management challenges. Knowledge exchange between suppliers about these issues is not facilitated by ASML. Here ASML behaves different from Toyota that does facilitate knowledge exchange about management best practice among the partners in its network. Thus

(confirming proposition 2a): while interfirm learning is not facilitated in general in the ASML network, effective knowledge integration efforts are undertaken on a bilateral level to solve the problems at hand.

2b. No capability enhancement of network partners
For ASML, the technological competence of its network partners is of crucial importance in the realization of its innovative ambitions. For key suppliers, it is not sufficient to have unique technological competences. In order to be able to develop the next generation of lithography equipment, suppliers have to stretch their technological capabilities in every new project they do with and for ASML. In addition, and also due to the increasing emphasis on time and cost control in the network, suppliers are also expected to develop their managerial competences – for instance in securing the part supply or controlling for quality in their own supply chain. ASML monitors the capability enhancement of its suppliers and periodically evaluates whether the supplier is 'on the right track'. However, ASML gives surprisingly little assistance to suppliers in these respects. The competence enhancement of suppliers is considered to be their own responsibility. When network partners are repeatedly not able to meet the performance criteria, ASML starts the search for another supplier. Also in this aspect ASML demonstrates a tertius gaudens positioning.

Knowledge and Innovation Appropriability
3a + 3b. mode of control in the network
In the ASML network, we found value appropriation not to be a crucial issue – neither for ASML as for its suppliers. This is being ascribed to the extensive use of contracts concerning deliverables and timelines, intellectual property and the organizational performance of suppliers in the network. These contracts make it very clear for all involved which knowledge and products should be supplied by which partner and who should benefit from efforts. Of course, especially in the Dutch cases we studied, no supplier would want to run the risk of loosing its ASML business and getting reputation damage in the local high tech community, by 'running off' with ideas. The use of contracts is not only beneficial for securing innovation appropriability; they are also helpful for guaranteeing the realization of the right kind of deliverable at the agreed costs and within the agreed timeline. In fact, in one of the unsuccessful cases we studied (the qualification tool project at 'Tooler') the excessive delay of the project was being ascribed to a lack of clarity in the contractual agreements – very unusual in the ASML network. Thus the proposition that a tertius gaudens uses a formal mode of control can be confirmed based on the ASML evidence.

DISCUSSION AND IMPLICATIONS

Table 4 summarizes our findings from the ASML case. The findings largely confirm our propositions. Therefore our first contribution is to show empirically that the management practices of the tertius gaudens differ sharply from those of the tertius iungens in the areas of network design, knowledge management and value appropriation. The only minor difference relates to hypothesis 1C. ASML does not stimulate socializing among its partners and in some cases it actually prevents it. However in a limited set of cases it stimulates socializing among suppliers. This may suggest that a pure tertius gaudens is strategy is not feasible: maybe each network requires a minimum form of socializing among its members, even if it is only on specific issues.

----------Insert table 4----------

The reason for the different approach of the tertius gaudens may be found in the business environment. Differences in task environmental conditions very likely affect what works in network orchestration orientation: ASML exists in a vastly more uncertain technological environment than, say, Toyota, with its mature manufacturing processes. The *tertius iungens* approach of creating dense, tightly linked network described for Toyota (Dyer and Nobeoka, 2000; Womack and Jones, 1994; Womack, Jones and Roos, 1990) is associated with relative low levels of demand and technological uncertainty, and moderate levels of innovation speed

characteristic of a mature industry.[3] By contrast, the *tertius gaudens* approach is associated with high levels of demand uncertainty, technological uncertainty and innovation speed that characterize "high velocity" environments (Bourgeois & Eisenhardt, 1988; Eisenhardt, 1993; Jones et al., 1997). The elements of Tables 1 and 2 map nicely onto ASML's network behaviors: ASML structures its network, seeking out new technological partners at need. The central logic of its demands upon suppliers – surge and subsidence capability; superior quality and reliability; "preferred" status and strategic alignment – are closely integrated with the demand environment that ASML (and its supplier network) face. ASML seems curiously disinterested in enhancing the capability of its supply net *per se,* except by adding partners; there is relatively little effort to collaboratively develop suppliers' capabilities – a characteristic others note in innovation networks (Hagel_III et al., 2009) – although ASML does work to solve immediate supplier problems.

Contexts will surely affect network governance modes, yet attention for the application domain for recommendations is remarkably absent from the current literature on network governance. Furthermore, although lead firm networks are recognized as different from decentralized networks, the implications of other differences (knowledge exploitation versus knowledge exploration; goal oriented networks versus serendipitous networks; dense versus sparse networks) have received scant attention. Solutions applicable in one type of network may be inappropriate in others. For instance, while a focus on knowledge management is probably useful in innovation networks, the enhancement of knowledge mobility – the free flow of knowledge throughout the network – may be more useful in networks consisting of partners with similar knowledge assets, but less useful in networks where several highly specialized knowledge domains are combined. Here, modular approaches to the innovation process, interface management or knowledge integration, may be better suited to the needs of these types of innovation networks.

ASML emphasizes quality, response to technological demands and volatility that are historically absent in Toyota's environment. Our second contribution to the literature is to demonstrate that "the Toyota model" for network orchestration is contingent on the nature of the industry, described in terms of environmental uncertainty and environmental pressure for innovation. This calls for additional research into other environmental contingency factors that may be at stake.

A further insight of this case is that ASML has a deliberate networking strategy. Most of the literature concerns emergent networks. The ASML case shows networks can be managed to a much larger extent than was previously thought. Networks appear to be more malleable than the existing literature suggests. Further research might address the question whether this is only true for the tertius gaudens approach or whether other types of networks can be directed by a central firm as well. The extent of and conditions supporting deliberate networking strategies still need to be addressed.

It is also noteworthy that the partners of the tertius gaudens benefit from their relationship as well. Even though the tertius gaudens may benefit more than its partners, partners do have reasons to strike up a relationship with a tertius gaudens. Extant literature tends to look from the position of the central firm and does not address the position of the partners. Why would they join a tertius gaudens' network? In the case of ASML the partners profit from the fact that being an ASML partner significantly enhances their reputation. In addition, the continuous pressure ASML puts on partners helps them to improve and thus contributes to their competitiveness. Further research may shift the focus away from the tertius gaudens towards looking at its partners and their strategies and interests.

Another intriguing observation is that although ASML does not encourage its partners to collaborate amongst them, it does actively encourage its partners to look for partnering opportunities outside the ASML network. The tertius gaudens encourages its partners to act as a tertius gaudens as well. There is an interesting parallel here with the Toyota network, where Toyota as a tertius iungens stimulates its partners to become tertius iungens too. These two examples seem to suggest that networks are recursive systems: parts act in a similar way as the whole. An interesting avenue for further research may be to study whether more networks are recursive and what the implications of such a recursive nature could be. Does it ease the

[3] The current (Jan. 2009) environment of dramatic demand declines and potential technological change in response to historically high oil prices constitute a very different pattern; even Toyota has seen demand drop by more than 30% in the worst declines since the Great Depression.

management of the network? Is it a precondition for stable networks to arise? Does recursivety occur beyond the first tier partners and does it extend into the second or even third tier as well?

This case study may also shed light on the limits of the tertius iungens versus the tertius gaudens strategy. The literature only defines the limits on a broad strategic level. We can now some managerial limitations. First of all tertius gaudens thinking has become embedded widely in ASML and in its network. All management behavior is rooted in it. Even areas where a tertius gaudens approach may be less logical are managed via tertius gaudens routines. For example, many ASML partners have insufficient project management skills. By educating these partners on project management and have them exchange experiences around project management, the overall network would become more robust. Such an approach would not undermine the basic tertius gaudens approach as it only relates to a non-core issue. ASML however does not think about this. This raises an interesting question for further research: to what extent can the tertius gaudens approach be combined with a tertius iungens approach? Are they mutually exclusive because they require completely different behavior, different people, norms and values? Or is it possible to have elements of both strategies in one network? And can companies shift from a tertius gaudens to a tertius iungens approach and vice versa? Or is this a change in management routines that this is unlikely to happen?

This last question may be of particular relevance when the business environment changes. With the economic conditions worsening in 2008 and 2009 a tertius gaudens approach may be more effective in dealing with the economic crisis. A tertius gaudens can change partners faster, has more access to different knowledge bases and hence may be able to make radical changes quickly without high switching costs. The tertius iungens' network may be harder to change radically. The long-term relations in the network and the trust built up in it represent a switching cost that may act as a barrier to change and a source of inertia. Whereas a tertius iungens network may be more effective in dealing with incremental changes, a tertius gaudens may be more effective in a radically changing business environment.

REFERENCES

ASML (2004) Reflect & Imagine, 20 years of ASML. Veldhoven: ASML N.V.

ASML/GWO Procurement (2004) Procurement strategy and objectives 2005, Veldhoven: ASML N.V.

ASML (2006) Annual Report 2006. Veldhoven: ASML N.V.

Ahuja, G. 2000. Collaboration networks, structural holes, and innovation: A longitudinal study. ***Administrative Science Quarterly*** 45(4): 425-455.

Allen, T.J. (1977) *Managing the flow of technology: technology transfer and the dissemination of technological information within the R&D organization.* Cambridge, Mass: MIT Press

Andersen, P. H. & Drejer, I. 2006. Systemic innovation in a distributed network: Paradox or pinnacle? In D. W. Paper (Ed.), ***Aalberg, Denmark***, Vol. No. 06-13. Danish Research Unit for Industrial Dynamics (DRUID): May 22, 2006.

Baden-Fuller, C. & Grant, R. M. 2004. A knowledge accessing theory of strategic alliances. ***Journal of Management Studies***, 41(1): 61-84.

Baker, W.E. and D. Obstfeld (1999) Social capital by design: structures, strategies and institutional context. In: R.T. Leenders and S.M. Gabbay (eds) ***Corporate Social Capital and Liability***: 89 - 105

Baum, J.A.C. Calabrese, T., and B.S. Silverman (2000) Don't go it alone: alliance network composition and Startups performance in canadian biotechnology. ***Strategic Management Journal*** 21 (special issue): 267 - 94

Bourgeois, L. J. & Eisenhardt, K. M. 1988. Strategic decision processes in high velocity environments: Four cases in the microcomputer industry. ***Management Science***, 34/7 (July): 816-835.

Brown, J.D. & P. Duguid (1991) Organizational learning and communities-of-practice: towards a unified wiew of working, learning and innovation. ***Organizational Science*** vol 2/1: 40 - 57

Burt, R. S. 1992. ***Structural holes: The social structure of competition***. Cambridge, MA: Harvard University Press.

Burt, R. S. 1997. The contingent value of social capital. ***Administrative Science Quarterly***, 42(2): 339-365.

Burt, R. S. 2000. The network structure of social capital. ***Research in Organizational Behavior***, 22(2000): 345-423.

Burt, R. S. 2004. Structural holes and good ideas. ***American Journal of Sociology***, 110(2): 349-399.

Burt, R. S. 2005. ***Brokerage and closure: An introduction to social capital***. Oxford, UK and New York: Oxford University Press.
Chesbrough, H. 2006. ***Open business models; how to thrive in the new innovation landscape***. Boston, MA: Harvard Business School Press.
Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). 2006. ***Open innovation: Researching a new paradigm***. Oxford, UK: Oxford University Press.
Chesbrough, H. W. 2003. ***Open innovation: The new imperative for creating and profiting from technology***. Boston, MA: Harvard Business School Press.
Chuma, H. 2006. Increasing complexity and limits of organization in the microlithography industry: Implications for science-based industries. ***Research Policy***, 35(3): 394-411.
Cohen, W. M. & Levinthal, D. A. 1990. Absorptive capacity: A new perspective on learning and innovation. ***Administrative Science Quarterly***, 35(1): 128-152.
Coleman, J. S. 1988. Social capital in the creation of human capital. ***American Journal of Sociology***, 94(S): S95-S120.
Coleman, J. S. 1990. ***Foundations of social theory***. Cambridge, MA: Harvard University Press.
Cusumano. M.A. & A. Takeishi (1991) Supplier relations and management: a survey of Japanese, Japanese transplant and US auto plants. ***Strategic Management Journal*** 12/8: 563 – 588
Cusumano, M.A. (1985) ***The Japanese automobile indistry: technology and management at Nissan and Toyota***. Cambridge, MA: Harvard University Press
Dhanaraj, C. & Parkhe, A. 2006. Orchestrating innovation networks. ***Academy of Management Review***, 31: 659-669.
Dijkhuis, H. (2006) Value sourcing: QLTC performance in each phase of the life cycle. *Kennisbank Inkoop en Logistiek*
Doz, Y., Santos, J., & Williamson, P. 2001. ***From global to metanational: How companies win in the knowledge economy***. Boston, MA: Harvard Business School Press.
Doz, Y. L. & Hamel, G. 1998. ***The alliance advantage***. Boston, MA: Harvard Business School Press.
Doz, Y. L., Olk, P. M., & Ring, P. S. 2000. Formation processes of r&d consortia: Which path to take? Where does it lead? ***Strategic Management Journal***, 21(3): 239 – 266
Dyer, J. H. & Nobeoka, K. 2000. Creating and managing a high-performance knowledge-sharing network: The Toyota case. ***Strategic Management Journal***, 21(1): 345-367.
Dyer, J. H. & Chu, W. 2003. The role of trustworthiness in reducing transaction costs and improving performance: Empirical evidence from the United States, Japan, and Korea. ***Organization Science***, 14(1): 57-68.
Eisenhardt, K. M. 1989. Building theories from case study research. ***Academy of Management Review***, 14: 532-550.
Eisenhardt, K. M. 1993. High reliability organizations meet high velocity environments: Common dilemmas in nuclear power plants, aircraft carriers and microcomputer firms. In K. Roberts (Ed.), ***New challenges to understanding organizations***: 117-135. New York: Macmillan.
Fleming, L. and D.M. Waguespack (2007) Brokerage, boundary spanning, and leadership in open innovation communities. ***Organization Science*** 18(2):165 - 180
Grabher, G. & Powell, W. W. 2004. Introduction. In G. Grabher & W. W. Powell (Eds.), ***Networks***: x-xxxi. Cheltenham, UK: Edward Elgar.
Granovetter, M. 2005. The impact of social structure on economic outcomes. ***Journal of Economic Perspectives***, 19(1): 33-50.
Gulati, R. 1998. Alliances and networks. ***Strategic Management Journal***, 19(4): 293-317.
Gulati, R. & Gargiulo, M. 1999. Where do interorganizational networks come from? ***American Journal of Sociology***, 104(5): 1439-1493.
Hagel_III, J. & Brown, J. S. 2005a. ***The only sustainable edge: Why business strategy depends on productive friction and dynamic specialization*** Boston: Harvard Business School Press.
Hagel_III, J. & Brown, J. S. 2005b. Productive friction: How difficult business partnerships can accelerate innovation. ***Harvard Business Review***, 83(2): 82-91.
Hagel_III, J., Brown, J. S., & Jelinek, M. 2009. Relational networks, strategic advantage: New challenges for collaborative control. In S. B. Sitkin & L. B. Cardinal & K. Bijlsma-Frankema (Eds.), ***Control in organizations: New directions in theory and research***. Cambridge, UK: Cambridge Universty Press.

Gilsing, V. , B. Nooteboom, W. Vanhaverbeke, G. Duysters and A. van den Oord, 2008, Network embeddedness and the exploration of novel technologies: Technological distance, betweenness centrality and density, ***Research Policy***, 37, 10, 1717-1731.
Hagel_III, J. & Brown, J. S. Forthcoming. Creation networks: Harnessing the potential of open innovation. ***Journal of Service Science***.
Hargadon, A. (2002) Brokering knowledge: linking learning and innovation. ***Research in Organizational Behavior*** 24: 41 - 85
Hargadon, A. & Sutton, R. I. 1997. Technology brokering and innovation in a product development firm. ***Administrative Science Quarterly*** 42(4): 716-749.
Hargadon, A. & Fanelli, A. 2002. Action and possibility: Reconciling dual perspectives of knowledge in organizations. ***Organization Science***, 13(3): 290-302.
Harryson, S. J., Dudkowski, R., & Stern, A. 2008. Transformation networks in innovation alliances, the development of Volvo C70. ***Journal of Management Studies***, 45(4): 745-773.
IPO (2005) Top 300 Organizations granted patents in 2005, Washington: IPO
Jarillo, J. 1988. On strategic networks. ***Strategic Management Journal***, 9(1): 31-41.
Jones, C., Hesterly, W. S., & Borgatti, S. P. 1997. A general theory of network governance: Exchange conditions and social mechanisms. ***Academy of Management Review***, 22(4): 911-945.
Kenis, P. & Knoke, D. 2002. How organizational field networks shape interorganizational tie-formation rates. ***Academy of Management Review*** 27: 275-293.
Kilduff, M. & Tsai, W. 2003. ***Social networks and organizations***. London and Thousand Oaks, CA: Sage.
Kogut, B. & Zander, U. 1992. Knowledge of the firm, combinative capabilities and the replication of technology. ***Organization Science***, 3(3): 383-397.
Kraatz, M. S. 1998. Learning by association? Interorganizational networks and adaptation to environmental change. ***Academy of Management Journal***, 41(6): 621-643.
Lemmens, C, 2003, ***Network Dynamics and Innovation***, PhD thesis, Eindhoven, Technische Universiteit Eindhoven.
Lorenzoni, G. & Baden-Fuller, C. 1995. Creating a strategic center to manage a web of partners. ***California Management Review***, 37(3): 146-163.
Lorenzoni, G. & Lipparini, A. 1999. The leveraging of interfirm relationships as a districtive organizational capability: A longitudinal study. ***Strategic Management Journal*** 20(4): 317 - 338.
Lammers, I.S. H. Berends, A.P. de Man and A. van Weele (2008) 'Best practices, key lessons from the cases'. In: Man, A.P. de (ed.) (2008) ***Knowledge Management and Innovation in Networks.*** Edward Elgar, p. 174 – 196
Meurice, E. (2007) 'Wow' (Comments on ASML annual results over 2006), Financieele Dagblad, January 18th (in dutch)
Obstfeld, D. 2005. Social networks, the tertius iungens orientation, and involvement in innovation. ***Administration Science Quarterly***, 50(1): 100-130.
Ozcan, P. and K.M. Eisenhardt (2009) Origin of alliance portfolios: entrepreneurs, network strategies and firm performance. ***Academy of Management Journal,*** 52(2): 246 - 279
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(1): 116-146.
Provan, K. G. & Milward, H. B. 1995. A preliminary theory of interorganizational network effectiveness: A comparative study of four community mental health systems. ***Administrative Science Quarterly***, 40(1): 1-33.
Provan, K. G., Fish, A., & Sydow, J. 2007. Interorganizational networks at the network level: A review of the empirical literature on whole networks. ***Journal of Management***, 33: 479-516.
Ro, Y. K., Liker, J. K., & Fixson, S. K. 2008. Evolving models of supplier involvement in design: The deterioration of the japanese model in U.S. Auto. ***IEEE Transactions in Engineering Management***, 55(2): 359-377.
Rowley, T., Behrens, D., & Krackhardt, D. 2000. Redundant goverance structures: An analysis of structural and relational embeddedness in the steel and semiconductor industries. ***Strategic Management Journal***, 21(2): 369-386.
Simmel, G. 1950. ***The sociology of Georg Simmel*** (K. H. Wolff, Trans.). Glencoe, IL: Free Press.
Sydow, J. & Windeler, A. 1998. Organizing and evaluating interfirm networks: A structurationist perspective on network processes and effectiveness. ***Organization Science***, 9(3): 265-284.

Tushman, M.L. (1977) Special boundary roles in the innovation process. ***Administrative Science Quarterly*** 22/4: 587 - 605

Vanhaverbeke, W., V. Gilsing, B. Beerkens and G. Duysters (2009) The Role of Alliance Network Redundancy in the creation of core and non-core technologies. ***Journal of Management Studies*** 46/2: 215 - 244

Womack, J. P., Jones, D. T., & Roos, D. 1990. ***The machine that changed the world***. New York: Rawson Associates.

Womack, J. P. & Jones, D. T. 1994. From lean production to lean enterprise. ***Harvard Business Review***, 72(2): 93-103.Yin, R. K. 1981. The case study as a serious research strategy. ***Knowledge***, 3: 97-114.

TABLE 1.
Tertius Iungens versus Tertius Gaudens (compiled by the authors; the tertius iungens perspective is based on Obstfeld 2005)

Orchestrating strategy	**Tertius Iungens** ('the third who joins')	**Tertius gaudens** ('the third who enjoys')
Key behavioral orientation	Connecting people	Separating people
Key activities	Creation/preservation of group unity, through: - Introducing disconnected parties - Introducing new forms of coordination between connected parties - arbitrage of conflicts	Active separation of two parties by - Knowledge mobilization; - Introduction of new parties; - Information control and manipulation
Assumed benefits	- Long term relationships facilitate trust, tacit knowledge and language alignment - Clear goal alignment between partners - Multiple pathways in network enables efficient knowledge sharing - Normative constraints on behavior prevents opportunistic behavior - Mobilization of actors for specific efforts is comparatively easy	- Superior access to information - Rich variety of communities, experiences, resources and preferences enhances likelihood of creative ideas - Greater opportunities to exercise control - Manipulation and exploitation of third parties for own benefits - Flexibility
Assumed drawbacks	Lack of new ideas Inertia problems – inward-focus, no need for change Problems with recognizing and absorption new external knowledge	Low trust levels hamper coordination and knowledge sharing Mobilization and coordination of dispersed partners is difficult
Key authors	Obstfeld (2005) Baker and Obstfeld (1999)	Simmel (1950) Burt (1992, 2000)
Associated other theories	Research suggesting the benefits of dense networks for innovation, such as: - Strong ties (Granovetter 2005) - Communities of practice (Brown & Duguid 1991)	Research suggesting the benefits of - Gatekeepers (Allen 1977; Tushman 1977) - Boundary spanning (Fleming and Waguespack 2007) - Technology brokering (Hargadon and Sutton 1997; Hargadon 2002;)
Associated network type	Both dense as well as structural holes network (this strategy is independent of network type)	Structural holes network

TABLE 2.
Tertius Iungens versus Tertius Gaudens approach to Network Orchestration

	Tertius Iungens has the tendency ...	***Tertius Gaudens has the tendency...***
Network design and stability		
Network size	to limit number of partners within the network	to expand number of partners within the network
Tie strength	to strengthen interdependencies	to weaken interdependencies
Network density	to enhance multiplexity in the network	to limit multiplexity in the network
Network autonomy	to enhance network identity and welfare	not to enhance network identity and welfare
Network stability	to create long-term commitments with existing partners	to ensure the changeability of the network to new circumstances
Knowledge management		
Network level learning processes	to enhance all learning with and between network partners	to be selective in the learning processes in the network that are enhanced
Capability enhancement of network partners	to enhance the capability of network partners	not to invest in capability enhancement of network partners
Accessing new knowledge outside network	not to access new knowledge outside the network.	to access knowledge outside the network
Use of power		
Preferred control modus in use to ensure coordination and equitable innovation appropriation	… to use a cultural mode of control	to use contractual and bureaucratic modes of control
Power distance	.. to schrink power distance between network partners	.. to enlarge power distance in the network

TABLE 3.
List of Interviewees

Date	Organization	Position	Key focus
15-6-2006	ASML	Director Electrical Procurement	Network orchestration philosophy
06-07-2006	ASML	Design Engineer	'Qualification Tool'
06-07-2006	ASML	Procurement Account Manager	'Qualification Tool'
26-09-2006	'Tooler'	Commercial director	'Qualification Tool'
06-07-2006	ASML	Procurement Account Manager	'Qualification Tool'
26-09-2006	'Tooler'	Design Engineer	'Qualification Tool'
28-08-2006	ASML	Project leader	'Qualification Tool'
19-09-2006	ASML	Design Engineer	'Qualification Tool'
28-06-2006	AMSL	Procurement Account Manager	'Precision motor 3'
21-09-2006	'High Gear'	Development	'Precision motor 3'
21-09-2006	'High Gear'	ASML account manager/ procurement manager	'Precision motor 3'
21-09-2006	'High Gear'	Logistics	'Precision motor 3'
10-08-2006	ASML	New Product Logistics Engineer	'Precision motor 3'
10-08-2006	ASML	Supply Chain Engineer	'Precision motor 3'
10-08-2006	ASML	Design Engineer	'Precision motor 3'
06-07-2006	AMSL	Director Mechanical Procurement	'Moving diaphragm'
02-10-2006	'Mechatron'	Project leader	'Moving diaphragm'
16-08-2006	ASML	Procurement Account Manager	'Moving diaphragm'
16-08-2006	AMSL	Project leader	'Moving diaphragm'
02-10-2006	'Mechatron'	Logistics	'Moving diaphragm'
29-01-2007	ASML	Director Procurement	'Power amplifier'
19-01-2007	ASML	Procurement Account Manager	'Power amplifier'
01-02-2007	'Power Electronics'	Account Manager	'Power amplifier'
15-01-2007	ASML	Project leader	'Power amplifier'
15-01-2007	ASML	Design Engineer	'Power amplifier'
08-02-2007	'Power Electronics'	Technology Manager	'Power amplifier'
01-02-2007	'Power Electronics'	Managing director	'Power amplifier'
08-02-2007	'Power Electronics'	Manager business unit	'Power amplifier'

TABLE 4
Summary of case findings

Hypothesis	ASML
1A Size	Grows the network depending on technological developments
1B Strength	Actively seeks to decrease the partner's dependency on ASML
1C Density	Some elements to stimulate density, but also efforts to keep suppliers separate; limit invitations to supplier meetings
1D Autonomy	No network identity is built up and no group based competition exists
2A Selective learning	Only around specific issues and via tiger teams No sharing of management best practices on a network level
2B Capability enhancement	Suppliers 100% responsible for their own capability development
3A Appropriation	No build up of network identity, network culture, informal personal relationships
3B Control mode	Largely contractual, but some reputation effect is present *"Having ASML as a client requires much know-how, and as a supplier you learn a lot about new developments and techniques. But for us, we don't use this additional knowledge to create new business. With ASML, you work on a high technological level, so you have a good reference to use out there. If you are an ASML supplier, your in the game. That's probably the more important additional benefit of working for ASML, not the development of any*

	new product. (Account Manager High Gear, 21-09-2006)