The Dynamics of Interorganizational Relations in Contemporary Manufacturing: Nested Negotiations in Value Networks[1]

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Abstract

This chapter addresses the dynamics in interorganizational relations. We probe the value networks so prevalent within contemporary manufacturing to put forward that their basic cooperation/competition duality manifests itself in practical terms as capability, appropriation, and governance paradoxes. We conducted a longitudinal ethnographic study aimed at capturing the process by which interorganizational collaboration in manufacturing value networks is enacted. Our study finds that interorganizational relations are 'nested' in that a relationship plays out over an interpersonal network where the interorganizational relationships are a framework for action, while simultaneously interpersonal interactions affect how the interorganizational relationships take shape and evolve. Furthermore we found that interorganizational dynamics essentially is a stratified process. Solving particular and concrete problems at the surface level with regard to specific collaboration issues between organizations simultaneously shapes truces with regard to the underlying capability, appropriation and governance paradoxes.

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The concept of interorganizational relations is both obvious and elusive. Interorganizational relations are obvious in that organizations interact with other organizations on a regular basis and therefore need to foster relationships. Interorganizational relations are elusive in that it is not clear what exactly constitutes a relationship and how these relationships are developed, changed, and maintained over time. We label this maintaining, changing and developing of relationships between organizations as the *dynamics of interorganizational relations*. We also concur with Sztompka (1991) that the social world exists by way of activity. For interorganizational relations, this means that the interactions that happen between organizations define what the interorganizational relationship is. Put simply, *interorganizational relations are what interorganizational relations do*.

With regard to what interorganizational relationships do, they are often associated with cooperation and referred to as interorganizational collaboration (Dyer & Singh, 1998; Majchrzak, Jarvenpaa, & Bagherzadeh, 2015; Ring & Van de Ven, 1994). Conventionally, interorganizational relationships are viewed as a means by which organizations realize something that they are not able to achieve on their own, like pooling resources for co-exploitation, or co-exploration and joint knowledge creation (Parmigiani & Rivera-Santos, 2011; Phelps, Heidl, & Wadhwa, 2012; Provan, Fish, & Sydow, 2007). Simultaneously, individual organizations are seen to have interests of their own, which they seek to pursue

at the expense of the organizations with which they cooperate (Provan et al., 2007; Zaheer, Gäzübüyük, & Milanov, 2010). It is therefore not surprising that interorganizational relations have to accommodate contradicting demands (de Rond & Bouchiki, 2004; Sydow, Schüssler, & Müller-Seitz, 2016).

Interorganizational relationships are also an ongoing social process (Hardy, Phillips, & Lawrence, 2003; Sydow & Windeler, 1998). Prior research on the dynamics of interorganizational relations mostly has focused on how a cooperative relationship between two organizations is established (Majchrzak et al., 2015; Ring & Van de Ven, 1994). Moreover, research into interorganizational relationships tends to take the organization as a unitary actor; largely ignoring the role of individual organization members who actually enact the relationship (Marchington & Vincent, 2004; Olk & Earley, 1996), the larger process of continuity and change of a network of relationships (Ahuja, Soda, & Zaheer, 2012), or the wider institutionalized context within which relationships take shape (Marchington & Vincent, 2004). The process becomes truly social if a dyad is considered within the context of a network where multiple relationships have a bearing on each other (Gulati, 1995; Sydow, 1992). Besides, prior research that studied the larger network over time or that went into the detail of individual-level interactions found the process to be largely non-linear, playing out at multiple levels, with organizations participating for multiple reasons, and indeed riddled with contradictions (Berends, van Burg, & van Raaij, 2011; Deken, Berends, Gemser, & Lauche, 2018; Sminia, 2003).

The multi-facetted nature of a network of interorganizational relations also adds complexity. The network itself can be described in terms of size, diversity and density, while the relationships can vary in terms of being uniplex or

multiplex, or tightly or loosely coupled, and the nodes can vary with regard to centrality and role, and whether these would be organizations, sub-units or individual people (Ahuja et al., 2012; Sydow et al., 2016). Design parameters like which organization members from the various partners are to be involved, how they are connected to each other and to other members of their respective organizations, and whether the relationship will take shape as an organization in its own right, with devolved decision-making and dedicated people, all have a bearing on the process (Albers, Wohlgezogen, & Zajac, 2016). Ideally, research into the dynamics of interorganizational relations should reflect the continuity and change of all these facets. Given the endemic contradictions associated with interorganizational relations (de Rond & Bouchiki, 2004; Sydow et al., 2016), we ask: 'How are interorganizational relationships developed and sustained?' More specifically, we will focus on the actual interactions between people representing the organizations involved, by which interorganizational relationships are enacted. One way to address this question is by investigating the extent to which contradictions appear during interpersonal interactions, how these contradictions are dealt with, and how solutions appear as interorganizational relations evolve (Poole & Van de Ven, 1989; Smith & Lewis, 2011).

Contemporary Manufacturing

Contemporary manufacturing offers an ideal site to investigate the dynamics of interorganizational relations. Manufacturing encompasses design, make, deliver and service elements. Increasingly, offering product/service bundles of complex functionality to a system-of-use involves several different firms. Notable examples

are automobiles and electronic gadgets (Linden, Kraemer, & Dedrick, 2009; Sturgeon, Van Biesebroeck, & Gereffi, 2008). This observation is at the heart of a range of developments that come under the labels of 'high value manufacturing', 'advanced manufacturing', and 'industry 4.0' (Liao, Deschamps, de Freitas Rocha Loures, & Pierin Ramos, 2017; MacBryde, Paton, & Clegg, 2013).

Contemporary manufacturing has been elaborated as a 'global commodity chain' with product/service bundles coming together as a consequence of a network of input-output relationships, geographically expanded depending on where inputs can be sourced best (Gereffi, 1996). While the 'chain' metaphor is of some use, the term 'supply network' suggests a more realistic representation of the complexities of contemporary manufacturing that infers firm interactions across multiple relationships (Cox, Watson, Lonsdale, & Sanderson, 2004; Lamming, Johnsen, Zheng, & Harland, 2000). Supply networks require management in that the various activities and relationships need to be organized to facilitate and coordinate the flow of material, money and information (Pilbeam, Alvarez, & Wilson, 2012; Russell & Taylor, 2008; Sridharan, Caines, & Patterson, 2005).

From a strategy point of view, the notion of supply network extends the construct of the firm level value chain (Porter, 1985) into a value network (Raedels, 1995), with competition increasingly happening on the basis of 'value network versus value network' rather than 'firm versus firm' (Shi & Yu, 2013). Consequently, core capability as an explanation for performance became attached to the value network rather than the individual firm (Boyer & Hult, 2005; Ketchen Jr & Hult, 2007). For value networks, competitiveness is then found in a

combination of speed, quality, flexibility and cost efficiency rather than just simple transaction costs (Morrow, Sirmon, Hitt, & Holcomb, 2007).

In addition to competition between networks, firms within value networks still compete with each other for margin (Coff, 2010; Porter, 1980). For example, Cox et al. (2004) argue that the purpose of positioning a firm within a value network is for the the appropriation of value. Value appropriation is then facilitated by the firm being in control of those core capabilities (Barney, 1991; Coff, 2010) that matter most for the complex functionality of the product/service bundle. However, others caution against this form of rivalry. They argue that competitive advantage associated with the value network is not easily attributable to firm specific contributions (Adner, 2017; Jacobides, Cennamo, & Gawer, 2018; Lamming, 2000; Lamming et al., 2000). These arguments notwithstanding, firm-level strategy is still about positioning a firm among other firms. In the context of contemporary manufacturing, consideration then needs to be given to the contributions that a firm's capabilities can make to the collective (Jacobides et al., 2018; Noke & Hughes, 2010; Peppard & Rylander, 2006). Yet firms in contemporary manufacturing remain eager to develop their capabilities to reposition themselves not just to appropriate more value but to also remain an indispensible participant (Edwards, Battisti, & Neely, 2004; Noke & Hughes, 2010).

The simultaneous occurrence of cooperation and competition has been elaborated as co-opetition. Brandenburger and Nalebuff (1996) explain that co-opetition is a consequence of competitors, buyers, and suppliers also being complementors in that a focal firm needs them to realize better overall value. They argue that the contradiction in co-opetition is that cooperation is needed for

creating value while there is competition with regard to dividing it up. More generally Bengtsson and Kock (2000) recognize that competition and cooperation are based on contradicting logics of interaction, with competition informed by self-interest and cooperation based on mutual interest. They restrict co-opetition to the relationship between competitors who simultaneously cooperate, arguing that such a relationship can vary with regard to whether it is mostly cooperative or mostly competitive. They add that cooperation in particular means that firms participate in collective action, which implies that some form of governance is required by which these firms are steered towards realizing a collective outcome.

Co-opetition can therefore be seen as a duality or a dialectic that is imperative for the interorganizational relationships in contemporary manufacturing value networks to both exist and change (Farjoun, 2010), but which then generates more specific practical problems or paradoxes that need to be accommodated (Farjoun, 2017). As a consequence of the cooperation/competition duality, we argue that interorganizational relationships in contemporary manufacturing feature three fundamental but interrelated paradoxes. We call these the capability paradox, the appropriation paradox, and the governance paradox (see Figure 1).

Insert Figure 1 about here

The capability paradox refers to the various capabilities associated with different firms, which are all needed to realize the required complex functionality (Dyer & Singh, 1998; Ketchen Jr & Hult, 2007; Shi & Yu, 2013). With contemporary manufacturing, there is a division of labor in the value network (Jacobides,

Knudsen, & Augier, 2006), with firms complementing each other to realize the complex functionality that is required (Adner, 2017). Simultaneously, firms would have, or could, develop alternative or similar capabilities and are therefore jostling with each other about who will contribute what (Edwards et al., 2004; Noke & Hughes, 2010), even to the extent that it requires time and effort for it to become clear what capabilities are needed as firms innovate and new offerings are developed (Deken et al., 2018).

The capability paradox feeds into the second paradox; the issue related to appropriation. The appropriation paradox plays out because each firm in the value network competes with other network members on the basis of their capabilities to appropriate value while simultaneously the whole value network of firms has to maximize value in order to compete with rival value networks (Cox et al., 2004; Linden et al., 2009; Peppard & Rylander, 2006). Put differently, firms that constitute a value network have to balance the maximization of their self-interest within the network with the maximization of their mutual interest that keeps their value network competitive vis-à-vis other value networks. The appropriation paradox is especially acute with innovation, where there is always a question how much of the additional added value can be appropriated by the innovator (Coff, 2010; Jacobides et al., 2006; Teece, 1986).

The appropriation paradox feeds into the third paradox that we have labeled the governance paradox. The governance paradox arises because the value activities of firms in the value network need to be coordinated in order to be able to realize the overall value (Jacobides et al., 2018; Pilbeam et al., 2012; Sturgeon et al., 2008). However, firms also require autonomy to exploit and develop their capabilities to position themselves in competition with other firms in the value

network (Lamming, 2000; Lamming et al., 2000; Noke & Hughes, 2010). This becomes especially problematic if innovation can only be developed through collective action (Sydow, Windeler, Schubert, & Möllering, 2012). With regard to governance, there are a variety of different arrangements, including spot market exchanges governed by market forces, longer-term relationships governed by contracts, and more immersive relationships governed by a lead organization or an over-arching administrative body (Provan & Kenis, 2008). This also completes the circle (Figure 1) in that the method of governance may inform how capability is arranged between firms and subsequently allocated to the overall network. There effect could also flow in the opposite direction where the governance arrangements drive value appropriation, and value appropriation informs capability considerations. Overall, the ongoing interorganizational dynamics are a consequence of the paradoxes and the associated problem solving.

Contemporary manufacturing indeed is a good example where contradiction is endemic in interorganizational relations. This basic contradiction appears as a duality that poses three interrelated paradoxes of capability, appropriation and governance in the value network. This not only allows us to investigate how these three paradoxes are accommodated within interorganizational relationships but also allows us to further explore how such an accommodation results in either the maintenance or change and development of interorganizational relations over time.

The Research Process

To investigate the dynamics in interorganizational relationships in a manufacturing value network, we looked at gas generators for mass spectrometers. A mass spectrometer offers complex functionality, where the system of use consists of various laboratories and research establishments that need to establish the chemical composition of samples of material. A mass spectrometer itself is a device that contains various components like a gas generator, a calibrant delivery system, an ion source, a syringe pump, a communications bulkhead, status LEDs, a gas and vacuum bulkhead, a roughing pump vacuum connection, a calibrant control system and an external control system. With mass spectrometers, Original Equipment Manufacturers (OEMs) source and integrate these various hardware components and add the proprietary control software that is required for the chromatography mass spectroscopy analysis.

We had access to a manufacturer who supplies gas generators to mass spectrometry OEMs. We were able to establish the network of firms and relationships that are involved in manufacturing and servicing gas generators for mass spectrometers, and track changes in some of the relationships. The pseudonym GenMan will refer to the UK-based gas generator manufacturer in question. The relationships that we will focus on are between GenMan and two OEMs: Alpha and Bravo.

Our research methodology combined synchronic and diachronic approaches (Barley, 1990; Langley & Tsoukas, 2010). The diachronic approach allowed us to track the course of the network process over a period of time. The

synchronic approach allowed us to assess the extent of order and organization in a network process at a given point in time.

For the synchronic analysis, we interviewed 7 key managers at GenMan and asked about how their firm functioned in the larger environment that it operated in. This included the Chief Executive as well the Directors of Sales, Human Resources, Operations, Engineering, and Manufacturing Engineering. This allowed us to draw the network of relationships between the various firms and other organizations that are involved in manufacturing, servicing, and using gas generators for mass spectrometry. These interviews lasted between 45 and 70 minutes. The interviews were recorded, transcribed and subsequently coded for agents/nodes and relationships. We have not conducted any interviews with respondents outside GenMan, as we feel that that we were able to assess the network of interorganizational relationships by asking GenMan managers with which organizations they have established relationships. However, we were able to observe and interact with non-GenMan participants as and when they appeared in the diachronic part of the analysis and we are confident that we have been able to capture their contributions and considerations in that way.

For the diachronic part we followed two product development episodes that were taking place involving GenMan. Each product development effort was initiated by and involved cooperation with an OEM, yet there were also conflicts of interest. This meant that both episodes represent prime opportunities to investigate the enactment of a relationship over time and to track the continuity and change. The second author was embedded in GenMan for eight months and was able to observe what was going on with both episodes on a daily basis. In the course of this, a research dairy was kept to record all notable events as well as

periodic reflections on what was being observed. The observer was allowed to attend and sit through multiple meetings that were held as part of these product development processes, many of which were audio recorded and transcribed. A total of 84 meetings were observed in this way, which on a number of occasions involved participation by representatives of outside organizations. Besides, the observer regularly engaged people at GenMan in conversations, of which 64 were recorded and transcribed. Additionally, documentation pertaining to the two episodes was made available, while our observer was issued with a GenMan email address and he was cc-ed into emails that were exchanged in the course of the two product development episodes.

There were two stages to the diachronic analysis. The first stage employed a narrative strategy (Langley, 1999). It was aimed at sorting out the course of events over time to eventually arrive at two narratives that described in detail what had been happening in the course of each of these two product development episodes. The second phase then took these two narratives and scrutinized them for who had been involved and what interactions had been taking place within and across the firms and other types of organizations that were involved in each episode. This then yielded a fine-grained assessment of the network of relationships, how they were enacted, and also allowed us to identify when and how the three paradoxes appeared to play up and how and whether they were settled. This then culminated in what can best be described as some abductive creative thinking (Klag & Langley, 2013; Van de Ven, 2007) where we combined existing insights and theoretical terminology with what emerged from the data.

Interorganizational Relations in Mass Spectrometer Manufacturing

The findings show us that interorganizational relationships are developed, changed and maintained by way of ongoing problem solving involving interpersonal interactions between members of each of the firms. Despite some open negotiation, most of this problem solving activity contains covert and almost unnoticeable negotiations with regard to the capability, appropriation and governance paradoxes. As a result of the ongoing problem solving activity, solutions are developed that take the form of temporary truces with regard to the paradoxes. These truces perpetuate, challenge, or change the current interorganizational relationships.

This finding supports an earlier suggestion that organizational processes are stratified (Sminia & de Rond, 2012) in that open and visible-on the surface activities are embarked upon for a particular purpose – like finding a solution for a particular problematic situation – while concurrently these activities contain more covert negotiations about the underlying institutionalized social order. This stratified process is particular apparent in the diachronic analysis, which shows the continuous problem solving that has been going on in each of the two episodes that we studied, and by solving these particular problems simultaneously arrangements with regard to the capability, appropriation, and governance paradoxes are confirmed or changed. This will be demonstrated in more detail in the two accounts below.

The synchronic analysis shows up the value network structure (see Figure 2) that poses as an underlying framework for action while the problem solving at the surface goes on. The description of relationships between the various firms and other types of organizations, which came out of the synchronic analysis

resemble what Feldman and Pentland (2003) have identified as the ostensive aspect of organizational process. The ostensive aspect of the network structure depicts how the value network is commonly understood to operate. It captures the abstracted and general idea of the network of interorganizational relationships. In this instance the network structure of nodes and linkages follows the design hierarchy (Clark, 1985) of the mass spectrometer with various firms contributing respective parts to the overall offering, yet in this case dominated by an OEM (Gereffi, 1996). The OEM manufactures the actual spectrometer. The generator and other hardware is bought in and added to the package. The generator is there to generate a flow of gas like nitrogen or hydrogen by which the chemical compound that needs to be assessed is transported into the spectrometer. A generator, in turn, requires a compressor and a membrane or a sieve to create a flow of pure nitrogen or hydrogen gas. Interestingly, what also came out was an ambition of GenMan to establish a relationship with mass spectrometer users by way of entering into generator service contracts with them (as indicated by the dashed link).

Insert Figure 2 about here

With the diachronic analysis we found the network structure to be nested. The overall mass spectrometer network structure as depicted in Figure 2 becomes more particular and also somewhat less settled when we zoom into the detail of the interpersonal interactions that are taking place. Firms and other types of organizations dissolve somewhat in that individuals make up the nodes, with a link between two firms becoming a network of relationships between individuals

itself (see Figures 3 and 4 below). We suggest that this is best understood in terms of networks nested within networks (cf. Holm, 1995) rather than distinguishing between network levels, as this better captures network dynamics. 'Nested' means that interorganizational relationships play out through an interpersonal networks where the interorganizational relationships are a framework for action for the interpersonal interactions. Simultaneously interactions at the interpersonal level affect how interorganizational relationships evolve and take shape. Understanding what goes on in a network then becomes a matter of zooming in into the detail to identify the interpersonal interactions and how they occur, and zooming out to get the overview, rather than having to account for how the different levels connect.

The diachronic analysis shows up the performative aspect (Feldman & Pentland, 2003) of interorganizational relations. It shows how the relationships are continuously performed with individual people acting and interacting on behalf of a firm or a subunit, solving concrete problems, and in doing so perpetuating or altering the relationship, as concurrently truces are negotiated and re-negotiated with regard to the capability, appropriation, and governance paradoxes, as part of this day-to-day problem solving. The two accounts below illustrate how we observed this happening.

Account 1: Changing requirements while GenMan develops a generator for Alpha

The specific problem solving here concerns a sudden change of requirements. As it turned out, it featured at the latter stages of this product development episode where GenMan was developing a generator for a new Alpha mass spectrometer.

Alpha is an OEM based in the USA. Earlier successive problems that were solved concerned settling Alpha's initial specifications, whether the generator would be based on the cheaper membrane or more expensive carbon molecular sieve technology, whether there would be a variant with and a variant without an internal compressor, whether the generator layout should be changed for easier servicing, and which of the two variants would be prioritized. Parallel to this, GenMan was changing compressor supplier because the compressors from the original supplier were starting to fail prematurely.

After all that was sorted, going for the cheaper membranes, two variants, and a new compressor supplier, Alpha was signaling it wanted to change the requirements. Alpha wanted a higher flow rate but was not clear about how much higher. The original specification asked for 4 liters per minute of at least 95% pure nitrogen. Word was that they now wanted 7 liters per minute at 95%. The current design had been tested and proved capable of providing 7 liters per minute at 98%. The GenMan Design Engineer wondered whether he should modify the design and test it at 8 liters per minute to provide a margin for error, and whether the generator would then still be capable of 95% purity? GenMan were notified while they were still in the midst of changing compressor supplier and they were yet to ascertain whether the compressor from the new supplier would be able to cope with the new requirements. They were sure that the old compressor would not. A change of specifications would require more testing and possibly a re-design. It would also cause delays in preparing the new generator for production and would require making changes to the work instructions and manufacturing procedures. The projected time line was already running late and the launch date of the new Alpha spectrometer was fast approaching.

In the value network as presented in Figure 2 above, the problem solving concerns the relationship between a generator manufacturer – in this case GenMan – and an OEM – in this case Alpha. GenMan supplies generators to Alpha but is also involved in developing new Alpha mass spectrometers. As an OEM, Alpha initially has the upper hand with regard to the capability paradox. At the beginning of the episode, GenMan acquiesces to Alpha with regard to delivering capability, as Alpha sets the generator's specifications. This is also the case with regard to the appropriation paradox, as GenMan is mostly concerned with meeting Alpha specifications at minimal costs, with Alpha setting the price. With regard to the governance paradox, as Alpha defines the terms by which GenMan will supply the generators to Alpha, Alpha is the dominant partner here as well. However, when we zoom in and look into the detail, we see that this relationship is a network that spans different people within GenMan and Alpha (see Figure 3). We also see that in the course of the subsequent problem solving with regard to developing this new generator, the overall relationship between Alpha and GenMan is altering, with solutions to the three paradoxes seeing change, as new settlements emerge. Solving the problem posed by the change in specifications will illustrate this further.

Insert Figure 3 about here

With regard to the specification change problem, Alpha appears as four nodes with three of them linking up with nodes in GenMan. GenMan features eight nodes with four of these linking up with Alpha. GenMan by way of the GenMan Design Engineer also links with a certification agency, which in turn links up with

the European Union, as in the course of solving this problem the generator needs to be newly certified according to EU requirements. GenMan also links up with a metalwork supplier who manufactures the chassis and casing of the generators, which also need to be modified while GenMan redesigns the generator. Furthermore, GenMan itself contains nodes representing the sales, manufacturing, and engineering departments as well as senior management. The relationships where the problem solving is concentrated concerns the triangle between the GenMan Product Manager, the GenMan USA Sales Manager, and the Alpha Product Manager, yet there are linkages between the Alpha Product Manager and the GenMan Product manager that go through Alpha and GenMan senior management. What will become clear is that the problem solving simultaneously started to modify the interpersonal network that makes up the Alpha-PP link, which then opens up the possibility for change in the GenMan–Alpha relationship.

The GenMan person who took the lead in solving this problem was the GenMan Product Manager who had overall responsibility for the development of the new generator and as such was in touch with the Alpha product manager responsible for the new mass spectrometer. She acted as a gatekeeper in this episode for the GenMan Design Engineering Department who were developing the new generator and GenMan's Manufacturing Engineering department, who were responsible for putting the new generator into production. For this she liaised with a GenMan Product Engineer and with two GenMan Manufacturing Engineers (ME-one and ME-two working on a variant each), as well as with the Senior Manufacturing Engineer. Her problem, as she saw it, had two aspects. First, she wanted to get clarity on Alpha's new requirements in order to see if these could

be accommodated in the generator design. The issue that the generator had to incorporate a new type of compressor further complicated this aspect. And second she wanted to assess how quickly each variant of the re-design could be put into production. Part of this was also whether Alpha would order the generators in batches, as they had always done, or whether they would be supplied on demand. Furthermore, GenMan was eager to be allowed to sell service contracts directly to Alpha customers.

In enacting her role as gatekeeper and problem solver, she also had to deal with the GenMan USA Sales Manager. The GenMan USA sales manager was made responsible for the eventual pricing and product planning of the new generators and so he was, simultaneously, holding separate conversations with the Alpha Product Manager. Furthermore, the Alpha Product Manager had a habit, when pressed for details, of referring back to 'senior management'. To solve the problem of getting clarity about Alpha's new requirements, she had to get herself more firmly established as gatekeeper.

After the GenMan Design Engineer had done some testing on a re-designed generator and found it was capable of delivering 10 liters per minute at 96.2%, she organized a telephone conference between herself, the GenMan Design Engineer, and the Alpha Product Manager to present the test results, bypassing the GenMan USA Sales Manager. In this meeting, the Alpha Product Manager relayed that Alpha R&D was happy with the test results of the new design, confirmed that Alpha was going to go ahead with this design, and also agreed to push back the launch date to allow GenMan enough time to make it ready for production. The Alpha Product Manager also linked up the GenMan Product Manager with the Alpha Procurement Department to allow her to settle how the

ordering of the new generators by Alpha was going to be organized. The GenMan Product Manager took this opportunity to push for a new arrangement where GenMan will be delivering the new generators on a supply on demand basis rather than batch order. This supply arrangement also allowed GenMan to increase the price.

So with regard to the interpersonal network that constitutes the link between GenMan and Alpha, the GenMan Product Manager has become more central at the expense of the GenMan USA Sales Manager. She also managed to by-pass the route through senior management. The GenMan Product Manager becoming more central sets the stage for subsequent problem solving, which involves preparing the generators for manufacturing on a supply on demand basis while the production department still has to balance this with other demands, and having Alpha agree to a servicing regime for the generators, where GenMan is allowed to develop direct links with Alpha customers.

Moving away from the detail of the Alpha–GenMan interpersonal network of relationships and looking at the evolving overall link between Alpha and GenMan, this specific problem-solving episode was part of a sequence of solved problems, which saw GenMan interpreting Alpha's specifications such that the new generators were designed using the cheaper membrane technology, as well as for easy servicing. In this way, the relationship was effectively re-negotiated in the course of the whole episode, altering the state of affairs with regard to the capability, appropriation, and governance paradoxes. With regard to capability and appropriation, GenMan was able to utilize a cheaper technology and subsequently raise its margin. With regard to governance and appropriation, a new ordering regime allowed GenMan to raise the price. Furthermore, it opened

up the possibility for GenMan to develop relationships with Alpha customers by selling service contracts for the generators.

Account 2: Certification and pricing while GenMan upgrades a generator for Bravo

This episode concerns upgrading the generator for a mass spectrometer manufactured by Bravo. In this instance the relationship and the capability, appropriation and governance arrangements remained largely unaltered, despite these being challenged by GenMan. Again the process involved a sequence of problem solving, mostly around Bravo changing the requirements while they were developing an upgrade for their spectrometer system, with GenMan trying to keep up by re-designing and re-testing their setup while also trying to adhere to the planned and very tight launch date of the new system, also specified by Bravo. The specifications were about gas purity and flow rates. Furthermore, the generator for the original product had three outputs with one delivering nitrogen and the other two delivering air. Bravo was also uncertain about whether this configuration would be maintained or whether this would change to three outputs delivering nitrogen. Additionally Bravo wanted the generator to be less noisy.

A complication with this upgrade was the requirement for the generator set-up to be certified by the Canadian Standards Association (CSA). The GenMan product in this application consisted of three main parts: a generator for the nitrogen output, a generator for the two air outputs, and what was referred to as a 'table' which contained auxiliary equipment like the compressor and a cooling fan. The air generator and the table are CSA certified but would not require re-certification if the same names were retained, although components within these

two parts could be exchanged and upgraded. The nitrogen generator does not need CSA certification. Bravo and GenMan with them, wanted to avoid re-certification because it would add six weeks to the developmental process and would be costly, which Bravo wanted to avoid.

The product development process progressed to the point where GenMan had upgraded all three parts to meet Bravo specifications while the names used for these parts had remained the same to avoid re-certification. The technological strand in this episode was more or less finalized but GenMan costs had increased. GenMan therefore needed Bravo to agree on a higher price to offset the increased component and manufacturing costs. GenMan was looking for a $300 increase, while Bravo was actually seeking for a price reduction. This problem was to be solved by the GenMan Sales Director.

The interpersonal network that makes up the relationship between GenMan and Bravo at this point is depicted in Figure 4. Bravo appears as four nodes while GenMan features eight nodes. Both have links to CSA to enable them to comply with the certification requirements. There are two channels between Bravo and GenMan. One channel works over the link between the GenMan sales director and a Bravo senior manager. The other channel is between the GenMan Design Engineer and the Bravo Service & Support Manager. These two nodes are gatekeepers between the GenMan Engineering team involved in upgrading the generator and the Bravo Technical Team who are redesigning the mass spectrometer. The GenMan engineering team consisted of three Manufacturing Engineers (ME-1, ME-2, ME-3) who were each responsible for preparing one of the three generator parts for production, overseen by a Senior Manufacturing Engineer, who liaised with the Design Engineer who was developing the generator

upgrade. The problem solving with regard to the repeated specification changes and Bravo's dithering mostly went through this channel. With regard to the capability paradox, Bravo had the upper hand, as they had been dictating specification changes to GenMan, which GenMan was trying to comply with within the limited timeframe that was available, while also complying with the CSA regulatory framework. This was how this aspect of the GenMan - Bravo interorganizational relationship was performed.

Enacting the other channel, the GenMan Sales Director entered negotiations with a Bravo senior manager, making the case that the increased cost for sourcing components for and the manufacturing of the upgraded generator needed to be translated into a higher price. The Bravo manager argued that as the product retained the original names for the three constituent parts, the Bravo Purchasing Department would not agree to a price increase for what they would consider to be the same product. The Bravo manager suggested that if GenMan could differentiate between the old variant and the new variant, it could be possible to agree on a higher price for the new upgraded model. However, the technical teams from both Bravo and GenMan objected to this because it would mean that the new variant had to be re-certified. Nevertheless, they agreed to look into this and see what could be done within the time left for the planned product launch date.

Insert Figure 4 about here

For GenMan, distinguishing between an old and a new variant meant that all the manufacturing design had to be done a second time as two sets of

manufacturing instructions and arrangements were needed to take the two variants in production, while for compliance reasons, the components that make up each variant had to be referred to by the same name. This would complicate the manufacturing process in that there would be different paperwork and work instructions while the production department would be assembling identical generators. To be able to distinguish between the two variants, GenMan proposed using different names for the nitrogen generator because it is the only component that does not require certification. However, Bravo came back and notified GenMan that for compliance reasons they could only agree to the new variant and consider adapting the price upwards if GenMan would provide a declaration that the new nitrogen generator is identical to the nitrogen generator in the original pre-upgraded system. This is of course not the case because it had to be changed to fulfill the requirements for the upgraded mass spectrometer that Bravo had been developing.

Eventually after all this chicanery, GenMan had to accept that they were going to supply an upgraded generator that was more expensive to produce, at the same price as the original generator. However, there was an expectation that the volume of generators would increase because the upgraded mass spectrometer was aimed at the medical market (where Bravo was seeking to expand into), which would then add to the installed base that at some point could be targeted by GenMan with service contracts.

With regard to the capability paradox, Bravo was – as they had always done – dictating to GenMan what they wanted GenMan to supply them with. This is how this aspect of the relationship continued to be performed throughout all the problem solving. With regard to the appropriation paradox, GenMan eventually

became worse off. Although, GenMan challenged the situation by asking for an increased price, they had to accept the same price while the increased costs meant a lower margin per individual generator. However, the upgraded mass spectrometer would deliver better functionality in the medical market and this could mean increased volumes. To cater for the increased volume, the governance paradox did see a change in the arrangement in that GenMan agreed to a standing order arrangement. With the old model, orders had been placed one at a time. The new arrangement would mean that GenMan would have to stock generators to be able to deliver as soon as Bravo needed to be supplied with one.

This episode showed some open negotiation with regard to the appropriation paradox when the GenMan Sales Director interacted with a Bravo senior manager and asked for a price increase. But this was couched in more covert negotiations about price across other interpersonal relations as a solution with regard to compliance and manufacturing were sought. In this instance, the problem solving yielded solutions that made the truce with regard to the three paradoxes less favorable for GenMan.

Both accounts show that the links were enacted through ongoing problem solving that played out over a network of interpersonal relationships, and this problem solving concurrently generated continuity and change in the interorganizational relationship. With regard to the GenMan–Alpha link, the interorganizational relationship saw change in regard to the capability paradox. GenMan was given some leeway that allowed them to opt for the cheaper membrane technology, which in turn changed the settlement with regard to the appropriation paradox in their favor because it improved their margin. The leeway also allowed them to design the generator for easy maintenance, which set

them up better for developing links with Alpha customers through service contracts. With regard to the governance paradox, a change in the way the generators were to be ordered by Alpha opened up the opportunity to negotiate a price increase, adding to the change in the settlement of the appropriation paradox in GenMan's favor here too.

The GenMan–Bravo link at some point saw some open negotiation with regard to the appropriation aspect, as GenMan tried to negotiate a higher prize for the upgraded generator. However, the problem solving that had gone on before concerning the changing specifications and the upgrading of the three parts that make up the generator while complying with CSA requirements, created an effect of covert negotiation by which Bravo was able to perpetuate the settlement with regard to the capability and appropriation paradoxes, and forced a change in the settlement of the governance paradox at the expense of GenMan margin.

Overall, the nested character of interorganizational relationships as being enacted through respective networks of interpersonal relationships, generating a stratified process as solving concrete problems with regard to generator requirements simultaneously shapes truces with regard to the capability, appropriation and governance paradoxes, provides an enhanced understanding of interorganizational dynamics as nested negotiations in interorganizational collaboration.

Discussion and Conclusion

The research reported on in this chapter set out to investigate how interorganizational relations are being developed and sustained; bearing in mind

these relationships feature contradiction and paradox. We focused on interorganizational relations in contemporary manufacturing because of the competition / cooperation duality in the value networks by which complex functionality for systems of use is being produced. This duality manifests itself as capability, appropriation, and governance paradoxes. Our findings make four contributions.

The first contribution is that we found that interorganizational relationships are nested (cf. Holm, 1995). We argue that the links between firms and other types of organizations as they exist in a network structure appear as networks themselves when examined at the detail level of interpersonal interactions. These networks feature individuals from the organizations concerned who enact specific interpersonal relationships. We suggest that rather than distinguishing between network levels, interorganizational relations are better understood as nested networks or networks within networks because this better captures network dynamics. Understanding what goes on in a network of interorganizational relations is then a matter of zooming in to identify the detail of the actual interpersonal interactions and how they occur, and zooming out to get the overview of the interorganizational relationships.

Nesting automatically accounts for how the interpersonal and the interorganizational connect in that the interorganizational is seen simultaneously as a framework for action for and as a product of action of the interpersonal level (Holm, 1995). Notwithstanding that by putting the emphasis on the separate existence of levels there is the possibility to argue that a relationship at – for instance – a personal level does not necessarily mean that a relationship exists at the organizational level, that relationships at each level can exist independently of

each other, and that relationships at each level can precede or follow on from each other over the course of time (cf. Berends et al., 2011), emphasizing that levels in an interorganizational relationship are nested makes it easier to capture the dynamics of the relationship because how the levels link up has been specified. Nesting means that we can understand interpersonal interactions as happening in the context of a particular interorganizational arrangement while these interactions simultaneously contribute to this interorganizational arrangement. More specifically with GenMan and its evolving interorganizational relations with Alpha and Bravo, it is how the problem solving through interpersonal interactions takes place in the context of a specific institutionalized context. This context here has taken shape through – in this case – the design hierarchy of a spectrometer and these being OEM-supplier relationships. It is through the solutions that eventually are arrived at as a consequence of these interpersonal interactions that the interorganizational relationship takes further shape and evolves. These solutions then add to the context for future problem solving. In a similar vein, the variability over time with regard to whether relationships at personal and at organizational level co-exist or not as found by Berends et al. (2011) also would be part of a changing context in an evolving relationship.

Second we illuminate the ostensive and the performative aspect of interorganizational relations (cf. Feldman & Pentland, 2003). Our synchronic analysis indicated the overall network structure at a particular moment in time, depicting how a network is commonly understood to operate. It provides a general and abstracted representation of the network. Our diachronic analysis indicates the performative aspect, referring to the specific interactions by which a link is enacted, and in doing so generates the continuity and change over time. It is

through performativity that the dynamics of interorganizational relations play out (Gond, Cabantous, Harding, & Learmonth, 2015).

Our third contribution is about specifying how this performativity is generated. It confirms an earlier suggestion that the network process is stratified (cf. Sminia & de Rond, 2012). At the surface, interactions are embarked upon for a particular purpose – like dealing with a particular problematic situation – while concurrently underneath, these interactions confirm or change the current arrangement with regard to the inherent paradoxes in the interorganizational relationships. In the case of the value networks of contemporary manufacturing, the paradoxes are about capability, appropriation, and governance. The mostly covert negotiations about these three paradoxes that happened concurrently with solving particular and concrete problems that appeared while a relationship is enacted are the way by which interorganizational relationships are maintained, changed, and developed.

The fourth contribution is about lending support to the social dimension of network dynamics as depicted by Sydow (1992) with the concept of strategic network. This concept refers to the phenomenon that when there are two or more links in a network, what happens in one link will have a bearing on what happens in another link. This became particularly apparent in the account dealing with the relationship between GenMan and Bravo. The interactions by which this link was enacted were constrained by the link that needed to be maintained with the Canadian Standards Agency. The requirement for certification helped Bravo to continue to dominate the relationship between Bravo and GenMan.

There is of course a question of transferability and whether what we found with regard to the value networks in contemporary manufacturing is of relevance

to other networks of interorganizational relations. We would not expect that every network would feature issues around capability, appropriation, and governance. We are confident that more research into the dynamics of organizational relations in other contexts will benefit from the idea that these relations feature inherent contradictions and paradoxes. We would also argue that accommodating them fuels the continuity and change. Furthermore, we put forward that interorganizational relations have an ostensive and performative aspect, and that the interactions by which relationships are enacted are stratified. In short: we maintain that interorganizational relations are what interorganizational relations do.

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Figure 1: Three Paradoxes in Contemporary Manufacturing

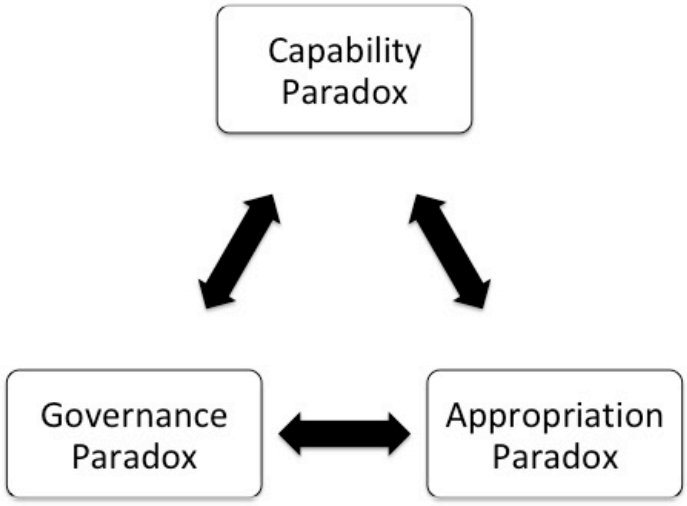

Figure 2: The Network of Gas Generators in Mass Spectrometers

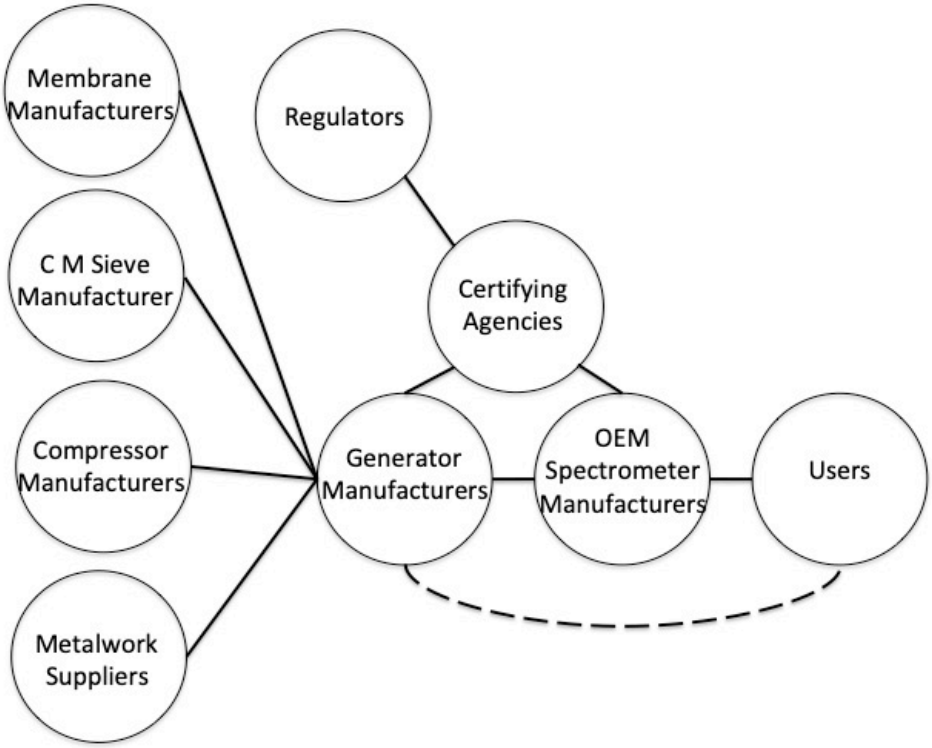

Figure 3: The GenMan − Alpha Relationship Network

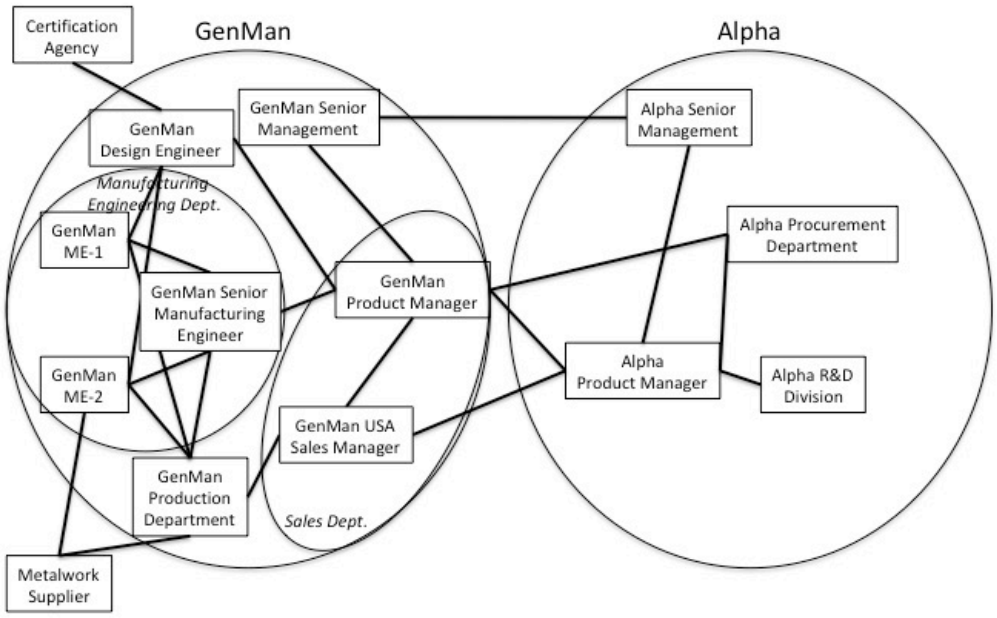

Figure 4: The GenMan − Bravo Relationship Network