Decoding network dynamics

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ABSTRACT

Business networks are fluid, yet decoding network dynamics provides a number of methodological challenges. This research illustrates how, by using a technology-bundled business net, the temporal fluidity of the network boundary and the associated processes and events that affect this can be understood. Abductive logic is applied in combination with the concepts of network positions and roles to analyze these processes and events. Empirical observations from a case study embedded in the optical recording media industry spanning the period 2001–2008 are used to illustrate the network dynamics resulting from technological change that drive the evolution of the focal net. The case illustrates that in order to decode network dynamics, a number of aspects need to be considered: how the network boundary is delimited, process, time, events and the conceptual lenses that can provide a basis for analyzing change.

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1. Introduction

Dynamics drive exchanges in a business network, yet capturing dynamics puts both the analytical tools and the way we use them under pressure (Håkansson & Waluszewski, 2004). Dynamics are manifest in the changes in the relationships that constitute the network. Methodologically, decoding network dynamics is challenging. A central issue is how the network boundary is delimited for research purposes (Easton, 1995). The challenge in delimiting the network boundary arises from the complexity of business interaction in networks (see Holmen, 2001). Actors being embedded in networks identify their respective scopes for strategic actions through relating their resources and activities to others in order to enhance their competitiveness (Gadde, Huemer, & Håkansson, 2003). The influences of these actions spread through interfirm relationships and are interpreted and responded to differently by their counterparts, resulting in dynamics in these interconnected relationships (Halinen, Salmi, & Havila, 1999; Ritter, 2000; Schurr, Hedaa, & Geersbro, 2008). Consequently, grasping the context and causality of network dynamics becomes difficult because of the connectedness and embeddedness of networks, in which firms (actors) prioritize their relationships based on their respective interaction histories and interpretations of their surroundings (Anderson, Håkansson, & Johanson, 1994; Ford & Håkansson, 2006; Uzzi, 1997). As a result, when researchers attempt to delimit a network boundary for their research, essential questions emerge, such as: what types of relationships to study and how many relationships (dyads) to include.

The challenge in delimiting the network boundary relates to which conceptual tools are appropriate for the analysis of empirical data that explicitly includes temporality in the process of business interaction. In particular this is needed to allow changes in a firm’s interfirm relationships to be analyzed. The available literature rarely addresses this issue. The work by Hedaa and Törnroos (2008) is an exception. Taking time, timing and events into consideration, Hedaa and Törnroos (2008) develop event networks (connected events) as an approach to study time and processes in business relationships. They see event networks as time-based connected event relationships, in which existing events are linked to the past and the future, appearing as event trajectories.

The study of events can be seen to include critical events such as relationship ending (Halinen et al., 1999; Tähtinen & Halinen, 2002) or reactivation (Havila & Wilkinson, 2002) that lead to network reconfiguration and changes in network position. Additionally, the manipulation of relationships, e.g. using relationships to exploit and develop new resource combinations (Harryson, Dudkowski, & Stern, 2008; Powell, Koput, & Smith-Doerr, 1996) highlights the importance of maintaining network position which signifies a firm’s ability to acquire information and access complementary resources (Johanson & Mattsson, 1992; Tsai, 2001; Zaheer & Bell, 2005). Although the concept of network position appears to be static, the concept permits the study of actors’ efforts at certain points in time to change or preserve their positions in networks, through the roles they play (Anderson, Havila, Andersen, & Halinen, 1998).

Although Pettigrew, Woodman, and Cameron (2001, p. 697) contend that “Dynamism has been difficult to study, and social science has developed quite comfortably as an exercise in comparative
statics. Static states or cross-sectional analyses are privileged over the complex processes that lead to understanding the dynamics of change across time and space”. There is a rich and evolving body of case-based research that illustrates how exploring time and process facilitates the investigation of network dynamics (Dubois & Araujo, 2004; Dubois & Gadde, 2002; Easton, 1995; Halinen & Törnroos, 1995, 2005; Medlin, 2004; Piekkari et al., 2010; Quintens & MatthysSENS, 2010). Debate occurs about alternative methods, that is, moving beyond the case study, that could be adopted for the study of complex networks and their dynamics, see Woodside (2010), which we recognize could also provide very interesting perspectives in this area.

The objective of this paper lies in illustrating how the challenges inherent in decoding network dynamics can be overcome by recognizing the temporal fluidity of the network boundary and the associated processes and events that affect this and using the concepts of network positions and roles to analyze these processes and events.

The rest of the paper is organized as follows. The paper begins with a theoretical elaboration on these methodological and analytical considerations, followed by the presentation of an empirical case illustrating how these considerations are taken into account. The case investigates how technological change affected the evolution of a focal net in the optical recording media industry. Prior to the conclusions, a reflection on the impact of these considerations in network research is provided along with associated managerial implications.

2. Considerations in decoding network dynamics

Network dynamics simply connote “changes” in networks. Changes in networks do not take place in a vacuum but in a continuum structured by actor bonds, resource ties and activity links. Such a continuum is characterized by heterogeneity, especially in terms of actors’ interaction experience and capabilities and interpretations of using aggregate resources (Ford & Håkansson, 2006; Weick, Sutcliffe, & Obstfeld, 2005). In order to decode network dynamics, a number of aspects need to be considered: how the network boundary is delimited, process, time, events and the conceptual lenses that can provide a basis for analyzing change. These are discussed in the sections below.

2.1. Delimiting the network boundary

Delimiting the network boundary is central to network research, but problematic. The problem in bounding the network is that there is no natural and pre-determined boundary in networks. An artificial boundary is needed for each piece of network research, to reduce network complexity and for analytical purposes (Halinen & Törnroos, 2005; Hedaa & Törnroos, 2008). Although the research phenomena guide the delimitation of a network boundary (Halinen & Törnroos, 2005) and such a boundary for case-based research “evolves in response to both practical contingencies affecting the research process and the dialogue between theory and empirical evidence” (Dubois & Araujo, 2004, p. 210), researchers require a boundary that is able to reflect the characteristics of connectedness and embeddedness of networks, so as to facilitate the decoding of network dynamics. In such cases, constructing a technology-bundled business net to delimit the network boundary is appropriate.

A technology-bundled business net has two main features. Firstly, this net is analogous to a focal net, which centers on the important relationships to which the focal actor is directly and/or indirectly connected. An advantage of employing a focal net perspective to understand network dynamics is as Alajoutsijärvi, Möller, and Rosenbröijer (1999, p. 7) argue that it allows understanding of the effects of other relationships on a focal dyad and illustrates that the macro-environment is not faceless.

Secondly, this net is “technology-bundled” using the work by Ford and Saren (2001), in which the net is bundled by product technology, process technology and marketing technology controlled by different actors. While product technology refers to the knowledge and ability to design a product or service valued by other actors, process technology and marketing technology respectively refer to “manufacture or produce” and “market and deliver” this product or service (Ford & Saren, 2001). It is likely that Parolini (1999) would describe such a business net as a value-creating net.

A technology-bundled net emphasizes joint value creation by different actors, including suppliers, customers and complementors through connecting productive activities. In short, this technology-bundled net, which stresses the complementarity between technologies and between activities, is able to not only reflect the industry logic but also comprises the characteristics of embeddedness and connectedness.

A technology-bundled net does not have to have a fixed and unchanging boundary. Drawing on the work by Möller and Rajala (2007), the boundary as well as the configuration of a technology-bundled net may change as the result of introducing new technology or business concepts. Holmen’s (2001) study of technical development across firm boundaries illustrates how the boundaries of an aggregate structure change during the development process. Thus, using a technology-bundled business net provides network researchers with a workable basis to observe the dynamics (e.g. changes in technical interdependency) in the business interaction process.

2.2. Process

The word “process” is seen as “movement” pieced together by actors’ deliberate actions toward combining and recombining heterogeneous resources, permitting the pursuit of individual goals (Hernes & Weik, 2007). This notion of process can be exemplified by Woodside and Biemans (2005) whose work provides a holistic account of the interlinked processes that are pivotal to bringing innovation to markets. The process of business interaction, however, is not smooth because actors’ present actions are affected by their “pasts” where the seeds of change are planted (Medlin, 2004; Weick et al., 2005).

Change forces in networks are initiated by and responded to by actors through interfirm relationships in a process of business interaction. Håkansson and Henders (1995) argue that dependencies exist between different change forces which can be described in terms of actor, resource and activity dimensions and where change in one dimension instigates changes in other dimensions. The consequence of the interplay between change forces may bring about relationship-reinforcing effects or relationship-breaking (or -initiating) effects, in which the former is labeled as “confined change” or “network adaptation” while the latter is defined as “connected change” or “network structuring” (Easton & Lundgren, 1992; Halinen et al., 1999).

The interplay between these change forces makes the process of business interaction appear to be “lumpy” (Ford & Håkansson, 2006).

2.3. Time

Time is a central component in network dynamics. Probably the most obvious feature of time in business interaction is that it allows actors to learn from other actors, functioning as an important mechanism for actors to improve their status by changing the ways in which resources are combined and how activities are performed (Ford & Håkansson, 2006; Johnston, Peters, & Gassenheimer, 2006). This is similar to the position that Medlin (2004, p. 187) presents: “time acts as an environment that constrains, shapes, and patterns business interaction and the deployment of resources and activities in space". In this vein, the current interaction is loaded with the past and linked to the future.
Different perspectives of time apply in the investigation of network dynamics. Halinen and Törnroos (1995) make a distinction between horizontal time and vertical time, in which the former is treated in a linear fashion, that is, the past and the future are bridged by the present; while the latter is related to the specific cultural and contextual setting. Similarly, Orlikowski and Yates (2002) argue that time can be understood in an objective–subjective dichotomy. An objective view conceives time as existing independently of human action; time is linear, mechanical, absolute, invariant and quantitative. A subjective view conceptualizes time as socially constructed through human action; time is relative, contextual, organic and qualitative. Orlikowski and Yates (2002) contend that this objective–subjective dichotomy is clock time and event time.

2.4. Events

Using events is beneficial for studying network dynamics that result from the process of business interaction. While Pettigrew (1997, p. 338) gives the definition of process as “a sequence of individual and collective events, actions, and activities unfolding over time in context”, Hedaa and Törnroos (2008, p. 324) see events in a business network as “temporally specific outcomes of performed acts by the actors”. Thus, we view the connection between process, time and events as being that events are constituents of an interactive process in which they are organized by time.

When dealing with lumpy interaction, Ford and Håkansson (2006) suggest that researchers can begin by identifying significant events. Given that an interaction process consists of a series of interaction episodes (Ford et al., 1998), Schurr et al. (2008) indicate that critical (or significant) events are those episodes that bring about changes in actors’ interfirm relationships and the combination of resources and connection of activities across firm boundaries, affecting the company gains and losses. In this research, events are described as “milestone events2” because of the criticality of an event hinges on its contextual circumstances (Törnroos & Elo, 2005). More importantly, an event’s criticality in interactive environments is determined by actors’ individual perceptions, which are affected by time and space (network structure) dimensions (Schurr et al., 2008).

Changes that arise from milestone events may have an “enabling” character that assists or stimulates a certain process or activity or an “inhibiting” character that hinders or creates difficulties for a certain process or activity (Törnroos & Elo, 2005). These milestone events, enacted by connected actors, are responsible for uncertainties in the process of business interaction and make the future unpredictable. Gladwell’s (2010) report on a history of drug discovery nicely illustrates several milestone events as well as serendipity and unexpected consequences that characterize the development of cancer treatment drugs. As a result, events are building blocks of a process of business interaction from which network dynamics result (Van de Ven & Huber, 1990).

Fig. 1 illustrates network boundary, process, time, and events in the decoding of network dynamics. Here the lumpy process of business interaction can be seen as the product of the interplay between horizontal time and vertical time, in which milestone events occur in a chronological order but are contingent on other antecedent events and the context in which they occur. In spite of taking these dimensions into account, decoding network dynamics remains difficult in empirical investigation mainly because a network can extend boundless and its structure changes constantly.

2.5. Conceptual tools for analyzing change

When a technology-bundled business net is employed to delimit a boundary for case-based network research, the concepts of network position and role (Anderson et al., 1998; Johanson & Mattsson, 1992) act as suitable tools for analyzing network dynamics which result from the process of business interaction. The relationships that constitute a business net reveal an actor’s position which signifies its dependence on other actors (Johanson & Mattsson, 1992). The position concept is useful for examining the structures of a net at different points in time, as the result of relationship dynamics (e.g. the enhancement, establishment, dissolution or reinstatement of relationships).

Further, the understanding of these relationship dynamics can be achieved by studying the roles played by the involved actors. Seeing role as the dynamic aspect of the position, Anderson et al. (1998) argue that the roles of actors involve function, adaptation, and process. That is to say, role(s) that comes with a position represents what an actor does in relation to others, in terms of the combination of resources (or bundles of technologies) and connection of activities within the net. Changes in actors’ role sets exhibit the actors’ strategic moves to handle relationship dynamics in line with their interpretations of changing conditions (Andersen, 2008; Ritter & Gemünden, 2003).

To sum up, delimiting a network boundary within which process, time and events are considered, and using conceptual tools for analyzing change are essential in case-based research that aims to decode network dynamics. Employing a perspective of a business net to bound the network, the complexity of networks is mitigated while the features of embeddedness and connectedness are retained, allowing change influences, which contain temporality, in a process of interaction to be investigated. These change influences which make the interaction process lumpy and which result in relationship dynamics can be understood through identifying and studying milestone events among connected actors. Using the concepts of network positions and roles for analytic and illustrative purposes, enables researchers to depict change in the structure of a business net at different points in time (position change in horizontal time) and how relationship dynamics are caused (role change in vertical time). In the next section, an empirical case study that illustrates how these five considerations have been utilized is presented.

3. An empirical illustration from the optical recording media industry

Before presenting the case from the optical recording media industry, the research problem, the processual design, the data collection and analysis of this empirical illustration are described.

3.1. The research problem

The empirical investigation was undertaken to address issues related to the interrelationship between technological change and network dynamics. In particular, the research aimed at understanding the nature of the process of technological change in a network setting and the impact of this change on network (re)configuration and the network dynamics which arose from this.

3.2. A case-based processual design

A single-case study was chosen to decode network dynamics in a process of interaction driven by technological change (Halinen & Törnroos, 2005). Such a choice allowed the collection of a rich data set and facilitated the observation of changes over time (Easton, 1995) and the interpretation of messy phenomena (Dubois & Gibbert, 2010). Additionally, as Dubois and Araujo (2004) note, it permitted decisions about the bounding of the network and the temporal frame of the research to emerge as part of the research process. In order to study the interrelationship between technological change and network dynamics, the empirical examination was built on an

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2 We thank one of the reviewers for suggesting this terminology.
input–process–output model (Van de Ven & Huber, 1990). Although technological change often brings about radical changes of relationships (e.g. Aflah, 2000), technological change is not a single critical event.

Technological change needs to be treated as an interactive process consisting of a series of milestone events which carry the influences of time and temporality and which produce change forces that affect the ways of using and combining resources across firm boundaries (Håkansson & Waluszewski, 2002; Woodside & Biemans, 2005). That is to say, a firm’s bridging of technological change or introduction of a technological innovation can only be understood from a processual point of view. Kidder’s (1981) non-fiction narrative about the development of a next generation computer by an engineering team under a blistering schedule and tremendous pressure illustrates a processual point of view. Kidder’s (1981) non-fiction narrative about the development of a next generation computer by an engineering team under a blistering schedule and tremendous pressure illustrates a processual point of view. Kidder’s (1981) non-fiction narrative about the development of a next generation computer by an engineering team under a blistering schedule and tremendous pressure illustrates a processual point of view.

### 3.3. Data collection and analysis

Realizing that the value of a firm’s technological resources resides in the combination of other resources across firm boundaries, the empirical investigation took a perspective of a technology-bundled business net as network boundary (Ford & Saren, 2001; Parolini, 1999). Drawing on this boundary and in consideration of the accessibility to rich data, company F (the focal actor), its business customers (companies C1, C2 and C3), its suppliers (companies S1, S2 and S3) and a complementor (D1) represented a focal net in the optical recording media industry. In the reconstruction of the focal net evolution, the interaction between focal net members and F’s rivals (R1, R2 and R3) and F’s other customers (C4 and C5) were included, so as to understand network dynamics triggered by technological change. We stress here, as previously discussed in Section 2.1, that the focal net boundary changed. The boundary was interaction-dependent. Table 1 briefly describes these actors.

#### 3.3.1. Data collection

In order to generate a near-realistic picture of the focal net evolution driven by technological change, the collection of empirical data mainly focused on dyadic views provided by the focal net members. The data was gathered through depth interviews and e-mail exchanges in three stages, covering a time period from late 2007 to mid 2009, see Table 2, the data collected contained both retrospective material (snapshots I–III) and real-time data (snapshot IV). Archival materials (e.g. industry reports and company documents) were also consulted. The first stage focused on radical changes in the focal actor’s interfirm relationships, which were triggered by technological change.

In the second stage where milestone events were associated with these changes, the study aimed at understanding radical changes of relationships and changes in the interdependency structure that resulted from technological change. The third stage, a follow-up stage, was carried out to clarify and confirm the findings. Between each stage relevant literature was reviewed, directing the attention of the research from a dyadic level (e.g. looking at radical changes of relationships caused by technological change) to a network level (e.g. investigating the process of technological change that bridged two net structures). Following an abductive logic allowed an understanding of the interrelationship between technological change and network dynamics to be developed (Dubois & Gadde, 2002).

\[\text{Fig. 1. Methodological considerations in decoding network dynamics.}\]

\[\text{Fig. 2. Technological change and business net evolution.}\]
Three stages of data collection.

Table 1
Actors net under investigation.
Adopted from Chou and Zolkiewski (2012).

<table>
<thead>
<tr>
<th>Stage 1: September 2007 to October 2007</th>
<th>Company Interviewee's title/Interview duration/Interview technique (F: face-to-face; T: telephone; E: e-mail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company F</td>
<td>#1 QA Section Mgr/1 h 40 min/F #2 General Mgr &amp; Deputy General Mgr (MKT dept)/2 h/F #3 ex-QA Mgr/40 min/F</td>
</tr>
<tr>
<td></td>
<td>#4 Account Mgr/1 h 20 min/F #5 ex-Sales Mgr/1 h/F #6 Project Deputy Mgr (R&amp;D)/2 h/F #7 Production Mgr/50 min/F</td>
</tr>
<tr>
<td>C1</td>
<td>#8 QA leader/35 min/F #9 Procurement Mgr/1 h/F #10 Sales Mgr/45 min/F</td>
</tr>
</tbody>
</table>

Notes:
1. The product technologies in this industry can be categorized into two types: write-once (CD-R, CD Recordable) and re-writable (e.g. CD-RW, CD Re-writable). For the convenience of the research, attention is focused on the development of write-once technologies from CD-R to DVD+/-R, DVD+/-R DL (DL stands for double layer, meaning double recording capacity of a DVD+R or DVD-R disc), and HD DVD-R and BD-R (BD stands for Blue-ray disc, which was developed by the Blu-ray Disc Association).
2. Substantial influence has been exerted in the industry by the DVD Forum (an international organization) that was established in 1997 to disseminate and verify DVD format (e.g. DVD-R or DVD-RW) and to license the DVD format logo while the DVD+RW Alliance (a rival group) was established in 2002 with similar objectives but for DVD+R and DVD+RW (RW for re-writable).
3. Dye materials, chemical compounds, are used in the coating machines to add a thin layer of organic dye on the surface of each disc, allowing data to be recorded when a disc is burned by laser beam in a drive (or recorder). This material is crucial to product quality (e.g. compatibility with drives), production yield rate and production cost. Moreover, to boost the recording speed of media (e.g. from CD-R 40× to CD-R 52×), adjusting the formulation of chemical compound is a must.

Table 2
Three stages of data collection.

<table>
<thead>
<tr>
<th>Stage 2: April 2008 to September 2008</th>
<th>Company Interviewee's title/Interview duration/Interview technique (F: face-to-face; T: telephone; E: e-mail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company F</td>
<td>#11 Deputy General Mgr/2 h 30 min/F #12 Sales Director/1 h 30 min/F #13 General Mgr/1 h 45 min/F #14 ex-QA Mgr/30 min/F</td>
</tr>
<tr>
<td></td>
<td>#15 Project Deputy Mgr/1 h 45 min/F #16 Account Mgr &amp; Customer Quality Eng/1 h 20 min/F #17 Global Logistics Mgr/1 h 40 min/F</td>
</tr>
<tr>
<td></td>
<td>#18 Process Div Mgr/1 h 40 min/F #19 R&amp;D Div Mgr/1 h 30 min/F #20 Customer Quality Eng/1 h 20 min/F #21 QA Section Mgr/1 h 10 min/F</td>
</tr>
<tr>
<td></td>
<td>#22 Project Deputy Mgr &amp; Deputy General Mgr (Research Center)/3 h/F #23 Project Deputy Mgr/1 h 10 min/F #24 Account Mgr/1 h 50 min/F</td>
</tr>
<tr>
<td></td>
<td>#25 R&amp;D Div Mgr/1 h 25 min/F #26 Deputy General Mgr (Prod Dept)/2 h 15 min/F #27 Project Deputy Mgr &amp; QA Section Mgr/2 h 30 min/F</td>
</tr>
<tr>
<td></td>
<td>#28 Sales Mgr/1 h 30 min/F #29 Production Director/2 h/F #30 General Mgr/40 min/F</td>
</tr>
<tr>
<td>C1</td>
<td>#31 Sales Mgr/45 min/F #32 Procurement Mgr/E #33 QA leader/2 h/F #34 QA Mgr/1 h 30 min/F</td>
</tr>
<tr>
<td>C2</td>
<td>#35 Sales Mgr (Taiwan agent)/1 h 20 min/F #36 Senior Mgr/1 h 20 min/F</td>
</tr>
<tr>
<td>C3</td>
<td>#37 Operations Mgr/3 h 40 min/F</td>
</tr>
<tr>
<td>S1</td>
<td>#38 Sales Mgr/2 h 15 min/F</td>
</tr>
<tr>
<td>S2</td>
<td>#39 Sales/1 h 20 min/F</td>
</tr>
<tr>
<td>S3</td>
<td>#40 QA Mgr/1 h 10 min/F #41 General Mgr/1 h 35 min/F</td>
</tr>
<tr>
<td>D1</td>
<td>#42 Senior Engineers/50 min/F</td>
</tr>
<tr>
<td>R3</td>
<td>#43 Deputy General Mgr/1 h 50 min/F #44 Department Mgr (Sales)/50 min/F #45 ex-Sales Mgr/1 h 20 min/F</td>
</tr>
<tr>
<td>C4*</td>
<td>#46 Sales (Taiwan Agent)/15 min/T</td>
</tr>
<tr>
<td>C6*</td>
<td>#47 Managing Director &amp; Director/2 h/F (C6 was F’s business customer based in Japan)</td>
</tr>
<tr>
<td>S4*</td>
<td>#48 Strategic Acc. Mgr/30 min/F (S4 was F’s supplier of polycarbonate materials)</td>
</tr>
<tr>
<td>S5*</td>
<td>#49 Administrator/1 h 40 min/F #50 Administrator/E (S5 was F’s supplier of polycarbonate materials)</td>
</tr>
<tr>
<td>D2*</td>
<td>#51 Product Mgr/40 min/F (D2 was a Taiwan-based maker of optical recording drive)</td>
</tr>
<tr>
<td>R4*</td>
<td>#52 Senior Mgr (R&amp;D)/2 h 30 min/F #53 Senior Mgr (R&amp;D)/50 min/F #54 Sales Mgr &amp; Senior Sales Mgr/1 h 15 min/F</td>
</tr>
<tr>
<td>C5*</td>
<td>#55 Vice President/40 min/F (R4 was F’s rival based in Taiwan)</td>
</tr>
<tr>
<td>R5*</td>
<td>#56 Senior Mgr/E (R5 was F’s rival based in Taiwan)</td>
</tr>
<tr>
<td>R6*</td>
<td>#57 Finance Mgr/1 h 40 min/F (R6 was F’s rival based in Taiwan)</td>
</tr>
<tr>
<td>T1*</td>
<td>#58 President (ex-Senior Mgr at F)/1 h 10 min/F (T1 was a technical consultancy based in Japan)</td>
</tr>
<tr>
<td>T2*</td>
<td>#59 Director/45 min/F (T2 was an industrial technology research institute in Taiwan)</td>
</tr>
<tr>
<td>T3*</td>
<td>#60 Vice President (ex-Director at F)/30 min/F (T3 was a manufacturer of pre-recorded optical media)</td>
</tr>
</tbody>
</table>

* Data collected from these actors, including F’s suppliers, complementors and rivals, facilitated the investigation of interdependency structure and co-opetition in the industry as well as within the focal net.

<table>
<thead>
<tr>
<th>Stage 3: November 2008 to June 2009</th>
<th>Company Interviewee's title/Interview duration/Interview technique (F: face-to-face; T: telephone; E: e-mail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company F</td>
<td>#61 Project Deputy Mgr/E #62 ex-Sales Mgr/E #63 Deputy General Mgr (MKT Dept)/E #64 QA Section Mgr/T #65 Account Mgr/T</td>
</tr>
<tr>
<td></td>
<td>#66 QA Section Mgr/E #67 Project Deputy Mgr/T #68 Customer Quality Eng/E #69 QA Section Mgr/E #70 QA Section Mgr/E #71 Account Mgr/E</td>
</tr>
<tr>
<td>S1</td>
<td>#72 Sales Mgr/E</td>
</tr>
</tbody>
</table>

Notes:
1. The product technologies in this industry can be categorized into two types: write-once (CD-R, CD Recordable) and re-writable (e.g. CD-RW, CD Re-writable). For the convenience of the research, attention is focused on the development of write-once technologies from CD-R to DVD+/-R, DVD+/-R DL (DL stands for double layer, meaning double recording capacity of a DVD+R or DVD-R disc), and HD DVD-R and BD-R (BD stands for Blue-ray disc, which was developed by the Blu-ray Disc Association).
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Table 1
The focal net based on CD-R technology and embedded in the optical recording media industry.

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>A Japan-based technology vendor who had an influential media brand and owned production factories in Japan, US and Europe</td>
</tr>
<tr>
<td>C2</td>
<td>A Japan-based technology vendor who had both optical recording media and drive businesses under its own brand and who was a format leader in the DVD+RW Alliance.</td>
</tr>
<tr>
<td>C3</td>
<td>A Japan-based technology vendor who had a media brand and had experience of media manufacturing</td>
</tr>
<tr>
<td>C4</td>
<td>A Japan-based technology vendor who possessed materials (including dye material) and brand businesses</td>
</tr>
<tr>
<td>C5</td>
<td>A Japan-based technology vendor who was a format leader in the DVD Forum.</td>
</tr>
</tbody>
</table>

Other actors involved in the evolution of the focal net:

<table>
<thead>
<tr>
<th>Companies</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1, R2, R3</td>
<td>All Taiwanese media makers, were F’s competitors in the optical recording media industry</td>
</tr>
<tr>
<td>C4</td>
<td>A Japan-based technology vendor who possessed materials (including dye material) and brand businesses</td>
</tr>
<tr>
<td>C5</td>
<td>A Japan-based technology vendor who was a format leader in the DVD Forum.</td>
</tr>
</tbody>
</table>

Notes:
1. The product technologies in this industry can be categorized into two types: write-once (CD-R, CD Recordable) and re-writable (e.g. CD-RW, CD Re-writable). For the convenience of the research, attention is focused on the development of write-once technologies from CD-R to DVD+/-R, DVD+/-R DL (DL stands for double layer, meaning double recording capacity of a DVD+R or DVD-R disc), and HD DVD-R and BD-R (BD stands for Blue-ray disc, which was developed by the Blu-ray Disc Association).
2. Substantial influence has been exerted in the industry by the DVD Forum (an international organization) that was established in 1997 to disseminate and verify DVD format (e.g. DVD-R or DVD-RW) and to license the DVD format logo while the DVD+RW Alliance (a rival group) was established in 2002 with similar objectives but for DVD+R and DVD+RW (RW for re-writable).
3. Dye materials, chemical compounds, are used in the coating machines to add a thin layer of organic dye on the surface of each disc, allowing data to be recorded when a disc is burned by laser beam in a drive (or recorder). This material is crucial to product quality (e.g. compatibility with drives), production yield rate and production cost. Moreover, to boost the recording speed of media (e.g. from CD-R 40× to CD-R 52×), adjusting the formulation of chemical compound is a must.
3.3.2. Data analysis

Data analysis focused on searching for codes and themes through reading transcripts of interviews, field notes and archival materials. The codes were highlighted through the identification of critical passages in the transcripts. These codes were further categorized into themes related to the focal net evolution triggered by technological change. The building of linkages between codes and themes was facilitated by research notes (or memos) which were made while reading and analyzing transcripts, field notes and archival materials and reviewing scholarly literature.

This analysis allowed milestone events, which were identified among interaction episodes within the focal net, to be used to illustrate the process of technological change. These events not only carried temporal influences but also occasioned changes in the usage and combination of both tangible and intangible resources that consequently resulted in technological change and relationship dynamics. These milestone events were organized in a chronological sequence but their contexts (vertical time) were also taken into particular account in order to understand potential causal postulates (Halinen & Törnroos, 1995; Yin, 2003). For example, the occurrence of technological change could result in radical changes of relationships that marked the evolution of the focal net.

Additionally, the use of network positions and roles as analysis tools revealed dynamics related to the evolution of the focal net (Anderson et al., 1998; Johanson & Mattsson, 1992). The network dynamics that resulted from the process of interaction between focal net members are described in the next section.

3.4. The case

This case illustrates the evolution of the focal net triggered by the major technological changes from CD-R to 1) DVD-R and DVD+R, 2) DVD+/-R Double Layer (DL) to 3) HD DVD-R and Blu-ray Disc Recordable (BD-R), covering a time-span of more than 10 years from 1998 to 2008. As Fig. 3 shows, the evolution of the focal net was divided into four phases using an input–process–output model. Each major phase of technological change involves milestone events; see Table 3, which result in the reconfiguration of the focal net. In this reconfiguration the network positions of net members changed as the result of radical changes in interfirm relationships. Apart from changes in network positions, these milestone events also brought about changes in roles of net members within the technology-bundled net, as Fig. 4 indicates.

3.4.1. Phase I: a relatively stable net based on CD-R technology in 2001

A relatively stable business net centered on F appeared in 2001 after F’s establishment of customer relationships with C1, C2 and C3, supplier relationships with S1, S2 and S3 and a complementor relationship with D1. As Phase I in Fig. 2 shows, unlike C1’s and C2’s exclusive purchases of CD-Rs from F, C3 also developed a relationship with R1 (F’s competitor). Additionally, F used its in-house dye materials to produce CD-Rs for C1 and C3 while C2’s CD-Rs were produced using C2’s proprietary dye materials. As Fig. 4 indicates, both F and C2 played multiple roles in the bundling of value-creating activities within the focal net which was based on CD-R technology. Similarly, S3 not only acted as a supplier of packaging materials but also provided packaging services.

3.4.2. Phase II: the net reconfiguration triggered by technological change from CD-R to DVD-R and DVD +R in early 2004

Facing fierce competition caused by a plethora of CD-R media makers, major players (e.g., F, C1 and C2) considered releasing DVD recordable products as a crucial means to improve their competitive stance. Perceiving the importance of bridging technological change, however, some of the focal net members acted and reacted to their counterparts’ actions differently and, consequently, radical changes in relationships took place. Table 3 shows the milestone events in the process of technological change from CD-R to DVD-R and DVD +R.

As Phase II in Fig. 3 exhibits, this process of technological change leads to the reconconfiguration of the focal net: F’s relationship ending with C1 and C2 and F’s new relationship with R3. Despite the ending of the relationship, C1 and C3 were indirectly connected with F via C2 (due to C2’s partnership with F as an OEM entity). In addition to radical changes in relationships, dynamics within the focal net can be observed because changes in the roles of actors. As Fig. 4 shows, C2 played a new role as an OEM, combining its know-how in DVD+R with F’s manufacturing (or process) technology. F also developed a new role as a brand marketer because of its ability to provide a full range of optical recording media based on in-house solutions.

3.4.3. Phase III: the net reconconfiguration triggered by technological change from DVD-R and DVD +R to DVD-R DL and DVD+R DL toward the end of 2005

Because of the fierce competition, profitability-enhancement was a crucial consideration for major players in the optical recording media industry. They aimed to actively bridge technological change in terms of DVD+/-R with higher recording speeds and the next generation of technology, DVD+/-R DL. The process of this technological change, as Table 3 describes, brought about another reconconfiguration of the focal net due to the occurrence of radical changes of relationships (see Fig. 3). These changes include F’s relationship reactivation with C3 and C1 (due to F’s adoption of C3’s newly developed dye material) and C2’s ending its relationships with C1 and C3 (because C2 discontinued its OEM business). Furthermore, these radical changes of relationships can be explained by C2’s and C3’s role changes in the technology-bundled net, as Fig. 4 demonstrates. Although F sustained its relationship with C2 (see Fig. 3), their interdependence was altered after this technological change (see Fig. 4).

3.4.4. Phase IV: the net reconconfiguration triggered by technological change from DVD-R DL and DVD+R DL to HD DVD-R and BD-R in mid 2008

The focal net experienced another reconconfiguration caused by the appearance of HD DVD-R and BD-R technologies. The process of this technological change, which consisted of a series of milestone events (see Table 3), was marked by the disconnection of the F–C1 relationship (because of C1’s re-positioning as an OEM) and the F–C2 relationship (because of C2’s exit from the industry) and F’s short-lived relationship with C5, as Fig. 3 exhibits. These radical changes of relationships also accompanied changes in actors’ roles, such as C1’s stopping running a branding business but its initiation of an OEM business.

Unlike the radical changes in F’s relationships with its business customers, F’s supplier relationships remained quite stable in the face of technological change from CD-R to DVD+/-R, DVD+/-R DL and HD DVD-R and BD-R (see Fig. 3). There are several reasons that may explain these stable relationships. Firstly, the competences of some suppliers (e.g., S2 and S3) did not become out of date after technological change. Secondly, the co-existence of old and new technologies could allow a relationship to survive the technological change. For example, although S1 failed to migrate to the next generations of optical recording technology, its relationship with F continued because its dye material had become the dominant solution for CD-R manufacturing. Thirdly, these suppliers (except S1) did not control key resources in technology bundling which would drive actors to change their relational ties to pursue competitive advantage.

4. Discussion

Viewing the case as an input–process–output model shows that the decoding of network dynamics hinges on delimiting a network boundary within which process, time and milestone events are taken into particular account, and on using the concept of positions
C1 ceased overseas production
F's new VP on board
R2 purchased C1's production lines
F set up a new marketing team
F-C2 partnership for DVD+R production
F launched an outsourcing project
C1 ceased overseas production
R2 purchased C1's production lines
F signed OEM and technology transfer agreements with C2
Sales Manager and Sales Director left F
C2 launched DVD+R 16X
F set up a subsidiary in Japan
F launched an outsourcing project
C2 gave up its role as an OEM
F achieved a breakthrough in HD
F hesitated to promote HD DVD-R
F started a small volume production of BD-R
C2 decided to exit from the industry
C5 decided to discontinue HD DVD
C1 sold its brand recording media
F began restructuring its production
F started DVD+R DL production using in-house solution
F started DVD-R DL mass production using in-house solution
C1 achieved a breakthrough in HD
C6 approached F to cooperate on HD DVD
C2 decided to exit from the industry
C5 decided to discontinue HD DVD
C1 sold its brand recording media
F began restructuring its production
F started DVD+R DL production using in-house solution
F started DVD-R DL mass production using in-house solution
F hesitated to promote HD DVD-R
F started a small volume production of BD-R
C2 decided to exit from the industry
C5 decided to discontinue HD DVD
C1 sold its brand recording media
F began restructuring its production
F started DVD+R DL production using in-house solution
F started DVD-R DL mass production using in-house solution
F hesitated to promote HD DVD-R
F started a small volume production of BD-R
C2 decided to exit from the industry
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C1 sold its brand recording media
F began restructuring its production
F started DVD+R DL production using in-house solution
F started DVD-R DL mass production using in-house solution
F hesitated to promote HD DVD-R
F started a small volume production of BD-R
C2 decided to exit from the industry
C5 decided to discontinue HD DVD
C1 sold its brand recording media
F began restructuring its production
F started DVD+R DL production using in-house solution
F started DVD-R DL mass production using in-house solution
Fig. 3. The evolution of the focal net triggered by technological change.
Adopted from Chou and Zolkiewski (2012).
Table 3
Milestone events and their impact on relationship dynamics.

<table>
<thead>
<tr>
<th>Change process</th>
<th>Milestone events</th>
<th>The impact of milestone events on relationship dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological change from CD-R to DVD-R and DVD+R</td>
<td>a) C1 ceased overseas production (Jan 2001)</td>
<td>The process of the technological change from CD-R to DVD-R and DVD+R led to radical changes of relationships within the focal net. F's new VP and newly established marketing team, as events b) and d), adjusted F's operational strategies to enhance the company's competitive stance: accelerating the launch of DVD+R products by installing new production lines and transferring some of the CD-R production lines. Viewing used CD-R production lines as a burden, F's new VP was reluctant to purchase C1's CD-R production lines released from C1's closure of its US-based factory. This event and the subsequent CD-R markup (one of new policies devised by F's marketing team) and the departure of C1 Sales Manager and Sales Director disappointed C1 and forced them to turn to R2, who was F's main competitor and who took over C1's used production line, as the event c). The F–C1 relationship faded away from early 2004 although top management teams from both parties met several times, trying to continue their cooperation. Prior to this fading relationship, F's launched a project to outsource CD-Rs, which contributed to its initiation of exchange relationship with R3 to tide over the shortage in CD-R supply. On the other hand, F's new criteria of selecting new OEM customers (another policy made by its marketing team) made its relationship with C3 discontinue from mid 2003 mainly because C3's orders were neither stable nor large. Important considerations for F's new criteria of selecting customers included its ability to volume produce DVD-Rs using in-house solutions (as the event e), its partnership with C2 as an OEM entity (as the event f), in which F was in charge of manufacturing media while C2 controlled product quality and managed business customers and it deployment of own brand business by its marketing team. C2's cooperation with F allowed them to release new products with high quality ahead of competition, and thus, C2 was able to acquire OEM orders from C1 and C3. This process of the technological change from DVD-R to DVD+R resulted in relationship dynamics, including radical changes of relationships. In order to strengthen its communication with the DVD-RW Alliance and the DVD Forum for new product verification and expand its market share in Japan, F set up a subsidiary in Japan. This need also came from F's failure to upgrade its DVD-R to higher recording speed in mid 2004, which made F turn to external dye materials provided by C3, allowing the F–C3 relationship to be reactivated. This reactivation of relationship was followed by F's re-acquisition of C1's orders because F's DVD-Rs using C3's dye materials could diversify C1's product lines. Additionally, F actively prepared its introduction of DVD+R DL (as the event b) and DVD+R 16× (as the event c) attempting to maintain its advantage, which was gradually neutralized by its competitors, e.g. R2. Later, F continued its partnership with C2 by signing OEM and technology transfer agreements. However, it was difficult for C2 to sustain its partnership with F as an OEM entity because their profits of DVD-R DL business were significantly squeezed, especially when competing products (DVD-R DL discs) were available (e.g. as the event f) and when many of their competitors were able to produce DVD+R 16×. Consequently, C2 gave up its business model, partnering with F as an OEM, and retained its materials and brand businesses. Due to this change, C2's business customers were taken over by F. The process of the technological change from DVD-/+R DL to HD DVD-R and BD-R resulted in relationship dynamics that brought about the realignment of the focal net. In the face of the rapid technological change, bridging technological change had become a must to stay competitive in the optical recording media industry. Relying on its research and development, F was able to volume produce HD DVD-Rs and BD-Rs from April 2006 and March 2007 respectively. However, F encountered challenges in promoting their new products. On the one hand, despite its ability to produce high quality, industry-leading HD DVD-Rs with very low cost, F's marketing team hesitated to promote this R&amp;D achievement because of the team's attitude of sitting on the fence toward the format rivalry between HD DVD and Blu-ray Disc. This decision remained unchanged until CS (a format leader of the HD DVD camp) approached F to co-promote HD DVD in mid 2007, as the event d). However, F's cooperation with CS was short-lived owing to CS's decision to discontinue its HD DVD business from early 2008. On the other hand, F had to rely more on its brand business to promote its BD-Rs because C1 sold their brand recording media business and re-positioned themselves as an OEM (thus becoming F's competitor). Following C1's strategic change, C2 decided to exit from the optical recording media industry because they thought they were not a patent member and did not possess key materials in the BD-R field.</td>
</tr>
<tr>
<td>Technological change from DVD-/+R DL to HD DVD-R and BD-R</td>
<td>a) F achieved a breakthrough in HD DVD-R development (Apr 2006)</td>
<td>The process of the technological change from DVD-/+R DL to HD DVD-R and BD-R resulted in relationship dynamics that brought about the realignment of the focal net. In the face of the rapid technological change, bridging technological change had become a must to stay competitive in the optical recording media industry. Relying on its research and development, F was able to volume produce HD DVD-Rs and BD-Rs from April 2006 and March 2007 respectively. However, F encountered challenges in promoting their new products. On the one hand, despite its ability to produce high quality, industry-leading HD DVD-Rs with very low cost, F's marketing team hesitated to promote this R&amp;D achievement because of the team's attitude of sitting on the fence toward the format rivalry between HD DVD and Blu-ray Disc. This decision remained unchanged until CS (a format leader of the HD DVD camp) approached F to co-promote HD DVD in mid 2007, as the event d). However, F's cooperation with CS was short-lived owing to CS's decision to discontinue its HD DVD business from early 2008. On the other hand, F had to rely more on its brand business to promote its BD-Rs because C1 sold their brand recording media business and re-positioned themselves as an OEM (thus becoming F's competitor). Following C1's strategic change, C2 decided to exit from the optical recording media industry because they thought they were not a patent member and did not possess key materials in the BD-R field.</td>
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Remark:
F's relationships with S2, S3 and D1 survived technological change because the usage and combination of their resources were not significantly affected by the technological change at the focal net. As for S1, although they had been successful in the CD-R dye business and were able to release new materials for DVD manufacturing, they failed to get DVD products using their materials verified by the DVD Forum and DVD+RW Alliance (for political reasons), and thus, they lost their momentum in the optical recording media industry. And the F–S1 relationship remained in the CD-R business.

and roles for analyzing change. The boundary delimitation, from a perspective of a technology-bundled business net, facilitates the investigation into the evolution of an interdependent structure driven by contextual factors (e.g. technological change), in which some dynamics appear in the form of radical changes in interfirm relationships following the changes in actors’ positions and roles. The resource-dependent, learning and evolving nature of business interaction make these methodological considerations imperative and tightly connected in network dynamics research (Ford et al., 1998; Johnston et al., 2006; Mathews, 2003). The case illustrates network dynamics that are decoded by employing a technology-bundled business net as the research boundary within which stability and change are captured using time, process and events and are examined through the theoretical lenses of
As Fig. 3 demonstrates, the research boundary allows us to produce snapshots of net configuration at different points in time when radical changes in relationships that render changes in network positions are identified. Then, using time and events (that is, events unfolding over time) permits the bridging of each individual snapshot and, thus, illustrating how interaction facilitates the evolution of the business
net (Ford & Håkansson, 2006; Wilkinson & Young, 2002). As a process marked by several snapshots is constructed, it is possible to examine the reconfiguration of the network and the dynamic aspect of business interaction respectively using the concepts of network position and roles (Anderson et al., 1998; Johanson & Mattsson, 1992).

The case example exhibits that the network research boundary does not remain fixed or unchanged; instead, the boundary is fluid, e.g. C2's new relationships with C1 and C3 (Phase II in Fig. 3), the short-lived F–C5 relationship, and, the ending of F's relationship with C1 and C2 (Phase IV in Fig. 3). Understanding this fluidity or evolution permits a deeper understanding of the network dynamics derived from the process of business interaction, including how a firm is able to act in a new role and why a firm's network position is maintained or changed through the establishment, ending or reactivation of interfirm relationships (Ritter & Gemünden, 2003). In order to capture the fluid nature of the research boundary in a network study, it is important to be able to distinguish events and, in particular, milestone events (Schurr et al., 2008; Törnroos & Elo, 2005). The importance of studying events is that events are interconnected in horizontal time, forming an event network that may involve a number of actors as well as interfirm relationships (Hedaa & Törnroos, 2008) and which allows the fluidity of the boundary to be explored.

The empirical case shows that events not only exist in relation to other events in horizontal time but also represent vertical time enabling or constraining the actions of actors (Halinen & Törnroos, 1995; Schurr et al., 2008; Törnroos & Elo, 2005). As Fig. 3 and Table 3 show, the understanding of the focal net evolution marked by four snapshots is deepened by arranging the milestone events in a chronological sequence but also studying the impact of a particular event on another in order to know the effects of events upon certain relationships. In other words, decoding network dynamics through studying events has to take into account both objective and subjective relationships. In other words, decoding network dynamics through studying events has to take into account both objective and subjective relationships. Thus, the case study enables us to examine some relevant “how” and “why” questions about the relationship of events over time, not merely to observe the time trends alone.

The empirical results reveal that drawing on a combination of several process theories as motors is beneficial for explaining process; which accords with Van de Ven and Poole (1995) who distinguish four types of motor (life cycle, teleology, dialectics and evolution) and who argue that the degree of nesting of motors and the degree of complementarity among motors need to be considered in an account for process. As the case demonstrates, while the establishment of the F–C1 relationship, its maintenance, ending and reactivation exhibits life-cycle logic, the incompatible interpretations of surroundings and collision of events between F and C1 present dialectical points of views. An evolutionary perspective also helps interpret the empirical data, showing that for technological change to occur, the stability in the business net has to be interrupted by resource mobilization between relational linkages. The importance of considering the interplay between process theories is as Van de Ven and Poole (1995, p. 526):

Attempts to explain this process with a single motor run the risk of oversimplification and selective attention to one aspect of the change process at the expense of others.

As Fig. 3 indicates, while F's business customer relationships are quite dynamic, its complementor and supplier relationships stay relatively stable following the shifts in the mainstream technology. This finding leads to additional methodological questions: If we only study F's relationships with its suppliers (e.g. S1, S2 and S3), are we able to see the richness of network dynamics? Or, if our focal net is built on a supplier's (e.g. S1) or customer's (e.g. C1) perspective, rather than a media maker's view (e.g. F), what picture regarding network evolution can we depict? Indeed, if we only consider F's direct relationships, are we able to decode dynamics that resulted from the cooperation and competition between connected actors and to understand how an ended relationship can be later reactivated? Nevertheless, boundary setting crucially impacts upon the research results and network dynamics researchers have to progressively construct the context and boundaries of the phenomenon under investigation (Dubois & Araujo, 2004).

5. Implications for managers

The case study demonstrates that network dynamics stem from the actions and reactions of interrelated actors that change the manner in which resources are used and combined through relational linkages; and thus have managerial implications. The following sections consider managerial actions related to each of the five methodological issues discussed in this research.

5.1. Network boundary: scope for value co-creation

The case findings illustrate that the strategic implications of considering the network boundary relate to value co-creation because a firm's competitive advantage rests on the combination of resources derived through interfirm connections (Lavie, 2006). Firms in a web of business relationships develop their respective network boundaries, within which their scope for relating their resources and activities to those of others is defined (Gadde et al., 2003). Using a technology-bundled net perspective, a firm's performance hinges on how its specialized technology is bundled with others’ technologies that form an aggregate structure co-producing value for users (Normann & Ramirez, 1993; Parolini, 1999).

5.2. Process: thinking processually for strategic actions

An important implication concerning process is that managers need to base their strategic actions on process thinking that considers dynamic phenomena, so as to be in line with changing conditions (Langley, 2007). As the case shows, the network boundary evolves through the process of business interaction. Changes in network boundary reflect actors’ attempts to connect their present statuses to their individual histories and expectations for the future through adjusting their portfolios of relationships, through which the pool of resources can be renewed and developed.

5.3. Time: the platform for learning and improving

The case results enable us to argue that time, from a perspective of objective (horizontal) time, permits the continuation of business interaction within which actors can continuously learn from their past and improve the present accordingly. Put differently, time, to some extent, allows actors to apply new knowledge acquired from the foregone interaction to the conditions present for strategic purposes (Chou & Zolkiewski, 2010; Cohen & Levinthal, 1990). However, the case reminds managers that the influences of subjective time generated from their respective interpretations of the past may facilitate or constrain their actions concerning the existing interaction with other actors; and thus, condition the performance of firms.
5.4. Events: ingredients of strategy formulation

A significant implication of events for managers is that events can be ingredients of strategy formulation as well as everyday aspects of operations. The case shows that events, as building blocks of process, carry temporal influences which may positively or negatively affect the subsequent combination of resources and connection of activities at an aggregate level. Thus, studying and analyzing events, particularly milestone events, are vital for managers to better understand the opportunities and constraints exposed in business networks, so as to strategize in line with changing conditions. This corresponds with the view of the lumpy process of business interaction in which individual firms engage in loops of sensemaking and strategizing (Ford & Håkansson, 2006; Weick et al., 2005; Whittington, 2006).

5.5. Positions and roles: role change as an exercise of dynamic capabilities

The case provides a strategic insight whereby a firm’s role change can be seen as an exercise of its dynamic capabilities to strengthen its position in a business network. Changes in roles represent actors’ strategic moves to achieve competitive advantage by adjusting certain routines embedded in their interfirm structures. Managers need to be aware that role change hinges on the mobilization of certain resources through relational linkages, where the temporal influences traveling within these linkages matter. But, utilizing role change does not assure firm competitiveness because the renewed interfirm structure following the mobilization of resources may not be in line with the environment (Ambrosini & Bowman, 2009).

Although the above methodological issues have strategic implications for firms operating in business networks, managers need to treat these issues as a whole, rather than considering them in isolation, when formulating or amending their strategies. In sum, the competitive advantage of firms resides in a continuum of absorbing new knowledge developed from the regular decoding of network dynamics of which they are part.

6. Conclusions

This research addresses five methodological considerations related to decoding network dynamics: network boundary, process, time, events, and conceptual tools for analyzing change. The incorporation of these issues in network research has proved to be beneficial in decoding and understanding network dynamics as illustrated by a case study which is built on a processual design. From this case we have learned two important things pertaining to decoding network dynamics.

The first is the importance and usefulness of employing the concept of roles to analyze change (Anderson et al., 1998). Radical changes of relationships that result in changes of actors’ network positions are more easily detected using milestone events (e.g. Halinen et al., 1999). However, these radical changes of relationships provide limited understanding of network dynamics. Instead, investigating actors’ roles acting on an array of value-creating activities within the established relationships, particularly taking from an evolutionary perspective on the structure of a business net, provides an important source of understanding network dynamics. In other words, capturing and decoding network dynamics need to include the dimensions of stability and change where the concepts of network position and roles are equally important (Anderson et al., 1998; Johanson & Mattsson, 1992).

The second relates to the adoption of an abductive logic in case-based network research (Dubois & Gadde, 2002). There are a number of merits to using an abductive logic concentrating on the dialog between theory and empirical evidence in this study. One merit is that an abductive logic permitted an ideal match between the network boundary drawn for empirical study and the conceptual tools for analyzing change. Additionally, such logic allowed us to achieve a tight linkage between two perspectives of time and milestone events that constituted the process of interaction between net parties (Halinen & Törnroos, 1995; Orlikowski & Yates, 2002; Pettigrew et al., 2001). Another merit is that the iteration between theory and empirical data facilitated the combination of different process theories that offered a richer description of network dynamics (Van de Ven & Poole, 1995).

In spite of the usefulness of employing these methodological considerations, decoding network dynamics is never easy due to the connectedness of relationships and the interactive and evolving nature these relationships. In particular, we have been aware that there are two limitations. The first limitation is concerned with what constitutes an exchange relationship. As Zolkiewski (2004) points out, how the definition of a relationship is construed lacks consensus. That is to say, the criteria used in judging the existence and discontinuation of business relationships may differ among researchers and practitioners. Only when a definition of relationships is given is it possible to decode relationship dynamics, including the establishment, enhancement, dissolution and reactivation of relationships. Once relationship dynamics are decoded, network dynamics can be studied and understood.

The second limitation is the delimitation of network boundary. Theoretically, the boundary of each piece of network research has to be intentionally delimited, in an attempt to examine the context of the research problem, and at the same time, to retain the characteristics of connectedness and embeddedness (Anderson et al., 1994; Uzzi, 1997). Methodologically and empirically, a purposeful setting of network boundary is necessary, so as to make sure that the accessibility to the field is guaranteed and the collection of data is possible within limited time, meeting the objectives of the study (Halinen & Törnroos, 2005; Silverman, 2005). When a boundary is drawn in research, however, the understanding of reality (network dynamics) is constrained.

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References


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