

**Relationship turbulence in bridging technological discontinuities:
A network strategy perspective**

Competitive paper for the 24th IMP Conference, Uppsala 2008

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Abstract

The continuous interaction between actors, who control resources and carry out activities, produces both stabilizing and changing forces driving the development of business nets (Gadde and Mattsson, 1987; Håkansson and Henders, 1995). In highly dynamic technology-intensive industries, an actor's bridging of technological discontinuities can be a pivotal event that gives fresh impetus to the firm's long-term sustainability (Sood and Tellis, 2005); but on the other hand, such a strategic change could potentially function as a critical incident that triggers relationship turbulence between the firm and its counterparts and marks a transition period in which they migrate from their existing business net to a new business net. This paper explores the relationship turbulence that results from bridging technological discontinuities and investigates the implications of this for the net involved.

Findings are presented from case-based qualitative research which has taken place in the optical recording media industry. These findings verify the existence of relationship turbulence prior to a firm's entrance into a new business net based on the next technological generation. Our empirical data also shows that the turbulence results in the reconfiguration of the existing business net and the establishment of a new relationship that links the firm to a new business net.

Our findings suggest the following: Firstly, relationship dissolution or deterioration could be a strategic choice and could result in positive consequences. Secondly, a fading relationship may allow the firm to reallocate its resources and provide opportunities for new relationship

establishment, and in turn, generate sustainable momentum for the firm. Thirdly, a customer firm who makes a drain on its supplier's resources may encounter adverse effects and lose its influence in the relationship.

Keywords: technological discontinuities, network strategy, relationship turbulence

1.0 Introduction

Business organizations are immersed in networks of interconnected relationships whose complexity and dynamism are deeply affected by the interplay between actor bonds, activity links and resource ties (Håkansson and Snehota, 1995). The continuous interaction with other actors embeds a firm in a web of relationships and creates a unique and value-creating position in the network (Holmlund and Törnroos, 1997); and on the other hand, provides the organization with opportunities and constraints on its actions (Gulati et al., 2000; Möller and Rajala, 2007; Yli-Renko and Autio, 1998).

In an “no business is an island” environment, devising strategic activities based on the operation and unique resources within the organization no longer guarantees a firm's success in business markets (Baraldi et al., 2007; Håkansson and Snehota, 1989). A firm's long-term sustainability hinges on its relationship management ability, that is, to establish, develop, maintain and even to dissolve a relationship (Möller and Halinen, 1999; Ritter et al., 2004; Tikkanen and Halinen, 2003).

Especially in technology-intensive industries, the distinguishing characteristics of technological and market uncertainties, competitive volatility, high R&D expenditure, rapid obsolescence and presence of network externalities not only highlight the need for cooperative and collaborative partnership but also challenge the firm's ability to adapt to changing conditions in this dynamic environment (Mohr et al., 2004; Yadav et al., 2006). Additionally, the importance of using “dynamic capabilities”, which refer to a firm's ability to integrate, build, and reconfigure its internal and external resources and competencies, has been emphasized (Eisenhardt and Martin, 2000; Teece et al., 1997). Matsushita's triumph over Sony in the VCR standard battle and Intel's dominance in microprocessors for PC markets are vivid examples of this ability (Hill, 1997). However, how a business actor manages its relationships when it migrates from the existing technological paradigm to the new one remains under explored.

Bridging technological discontinuities¹ (or introducing the next generation of technology) is considered as a crucial strategic change that generates fresh impetus to a firm's long-term sustainability (Sood and Tellis, 2005; Suárez and Utterback, 1995). But this strategic action may bring about relationship turbulence which could result in radical changes in the firm's technologically-created relationships (Gadde and Håkansson, 1992; Mattsson, 1987; Moriarty and Kosnik, 1989) and ultimately the formation of a new business net based on the next generation of technology (Möller and Rajala, 2007). Thus, understanding how to bridge technological discontinuities is a critical managerial challenge.

The study of relationship turbulence triggered by an actor's bridging of technological discontinuities in a business network, which is featured by the coexistence of stability and change (Easton, 1992; Håkansson and Snehota, 1995), is often viewed as dark side of business relationships and receives relatively limited attention. However, achieving deeper insights into relationship turbulence could strengthen our knowledge of the network approach to strategic management, including network-changing strategy (Mattsson, 1987), network positioning as a strategic activity (Tikkanen and Halinen, 2003), and relationship dissolution as a strategic option (Möller and Halinen, 1999; Törnroos, 2004).

This paper starts by examining the IMP (or interaction) perspective on change, with regard to network position and changes in business networks, and discussing the interconnectedness between technology and business network strategy, so as to build a framework for empirical exploration of relationship turbulence. We then provide our rationale of method selection and how we capture the dynamics of a business network². Following the case description, we conclude this paper by discussing our findings and offering strategic implications and future research direction.

2.0 Literature review

This study aims to understand the relationship turbulence, which is caused by the focal actor's strategic change in technology adoption, and its associated strategic implications for relationship management. Ample evidence from the IMP perspective has shown that a firm's strategic actions are closely related to its position in the network (e.g., Gadde and Håkansson, 1992; Mattsson, 1987). Moreover, the existing IMP knowledge of changes in business

¹ According to Ehrnberg (1995), the appearance of technological discontinuities may require the changes in competence and other resources necessary for designing and producing the product or physical changes in the product itself or price/performance changes.

² Where network dynamics are derived from relationship dynamics, in that changes in relationship dynamics have ripple or domino effects with the network, see for instance Hertz (1998).

networks, such as mechanisms of change (Halinen et al., 1999), provides useful conceptual tools, which can be blended with the knowledge about the inter-relationship between technology and business network strategy (e.g., Thomas and Ford, 1995), to investigate the nature of relationship turbulence in a technology-intensive setting.

2.1 IMP perspective on network position

The concept of network-as-a-whole can be a starting point to investigate a firm's strategic changes in a value system which is characterized by division of work between firms, including complementary and competitive activities (Håkansson and Snehota, 1989; Mattsson, 1987). Continuous inter-organizational interaction, which can be viewed as relationship investments, gives the participator (or actor) a unique position in the network, directing its strategic deployment, and simultaneously, generating influences on the ways other actors operate in this value system (Johanson and Mattsson, 1992). In brief, a firm's position can be defined by its function performed, relative importance, strength of relationships with others, and identity in the network (Mattsson, 1987). Thus, the network position "is regarded as forming the basis of a company's strategic actions and consequently also the dynamics of business networks" (Halinen and Törnroos, 1998, p. 190).

A more complete view of network position should incorporate the concept of embeddedness which describes a firm's connections with other actors in the business network and helps explain a firm's process of investment choice (Ford et al., 1998). The concept of embeddedness, built on the resource-dependence perspective (Yli-Renko and Autio, 1998), refers to a firm's relationships with and dependence on various types of business nets, such as market, technological or vertical and horizontal embeddedness (Halinen and Törnroos, 1998). Due to this embedded nature, therefore, a firm has a specific position, develops routines through connected relationships, and conducts value-creating and delivering activities in the business network (Törnroos, 2004).

Based on the perspective of network position that encompasses the nature of embeddedness, it is possible to study a firm's strategic actions, including in what value nets (or strategic business nets) it takes part and how it coordinates and manages its portfolio of net positions (Möller et al., 2005; Ritter et al., 2004). In addition, strategic actions are "efforts by actors to influence (change or preserve) their positions in networks" (Johanson and Mattsson, 1992, p. 214). A firm's strategic change, which is considered as "a major change in the firm's network positions" (Mattsson, 1987, p. 237), may exert influences on its relationships at the micro-level (the dyad) and macro-level (the network) (Ritter et al., 2004).

Thus, a firm's attempt to change its network position, which can be defined and identified by its stable and long-term oriented interaction with the counterparts, may generate friction between established inter-organizational interfaces. An actor's strategic move may cause a misfit with regard to actor bonds, resource ties, and activity links, initiating the turbulence in its existing relationships.

2.2 IMP perspective on changes in business networks

According to Gadde and Håkansson (1992, p. 167), "the origin of change is generally related to the interface between the actor and environment". It should be noted here that it is the continuous interaction between actors that engender the new or changing conditions in the environment, such as the globalization of competition and technological changes. In order to adapt to new conditions for its survival or competitive advantage, a firm has to engage in investing or adapting activities, that is, to eliminate the mismatches between parties in terms of needs, resources, interests, functions and procedures (Halinen, 1997).

According to Brennan and his colleagues (2003), a more complete definition of inter-firm adaptations is given as that "dyadic adaptations are defined as behavioral or organizational modifications at the individual, group or corporate level, carried out by one organization, which are designed to meet the specific needs of one other organization" (p. 1639). The accumulation of adaptations allows the involved parties to minimize transaction costs and function better, e.g. achieve operational efficiency (Håkansson, 1989). However, failure or inability to maintain the balance with other parties in the adaptation process may become the driving force for network development (Mattsson, 1987). In other words, a turbulent situation that breaks the routines and stable interactions implies the turbulence initiator's attempt to re-direct the way of adaptation.

The appearance of a business network, formed by a net of connected dyads pursuing collective goals, is the result of coordination of activities (or mutual adaptation) carried out by actors (Halinen, 1997; Lundgren, 1992). The process of coordination reduces the risk and uncertainty and increases the stability and effectiveness in this value-creating system; but on the other hand, it produces changes in the existing resource structure related with an activity cycle (Lundgren, 1992). Thus, the business network contains both stabilizing and changing forces but usually remains stable.

As Easton (1992, p. 24) indicates, "Evolution is the main mode; revolution is possible but unusual...Stability also provides a platform for change". Drawing from the IMP perspective (Easton and Lundgren, 1992; Halinen et al., 1999), the changes occurring within existing

relationships could be defined as incremental changes or network adaptation and those changes related to the dissolution of old relationships or establishment of new relationships could be viewed as radical changes or network reconfiguration.

Lundgren's (1992) elaboration of "mobilisation of resources" and the study of "spread of change through network" by Halinen et al. (1999) are helpful in understanding how a business network can be radically changed or transformed. In the first instance, as Easton (1992, p. 24) argues, "At a more general level any change in a network requires resources to be mobilised". This mobilisation process can be further categorized as "network integrative mobilisation" and "network changing mobilisation" in which the former refers to "the process of expanding or extending the network in accordance with existing activity cycles" while the latter refers to "the process of establishing new activity cycles or the breaking of old ones or the combining of two or more previously unrelated activity cycles" (Lundgren, 1992, p. 160). Thus the emergence of a new network originates in mobilisation of resources and actors.

Changes that do not spread from the initial dyad to other dyads could not result in network restructuring. The key lies in how actors respond to the changes initiated by other parties in the network. An actor, functioning as a node connecting flow changes, may respond to the change by achieving different consequences, such as reflection (reject the change to the initiator), absorption (restrict the impacts of change to organization boundaries), or transmission (transmit the effects of change to other members) (Easton and Lundgren, 1992). More recently, Halinen and her colleagues (1999) introduce the mechanism of change in business networks in which two types of change have been identified: confined changes and connected changes. Changes that occur within a dyad (e.g. change of key contact person) and are not received or acted upon by other actors are viewed as confined changes. When the changes, which are initiated from a single business relationship, spread their influences on other connected relationships, such as domino effects (Hertz, 1998), they are defined as connected changes.

The major change in a business network may result from an actor's strategic move aiming to change or preserve its position. The strategic change could be delineated by comparing an actor's position at time t_0 and time t_1 (Anderson et al., 1998). Besides this actor's relationship with its counterpart, the dyad, could act as a receiver as well as a transmitter of change (Halinen et al., 1999). When an old relationship is dissolved and/or a new relationship is established, the network is radically changed. It is suggested that focusing on a critical event, which interrupts a continuance of stability and marks the transition period in the business network (Halinen, 1997; Halinen et al., 1999), would be a beneficial mechanism for studying the radical changes. So far several critical events have been identified, including

personnel changes, shifts in organizational structure, changes in marketing and purchasing strategies, acquisitions and mergers, bankruptcies, partner switching, and changes in technology (Knoben et al., 2006).

2.3 Technology and business networks

Bridging technological discontinuities is a pivotal strategic move that allows a firm's momentum to be sustained (Sood and Tellis, 2005; Suárez and Utterback, 1995). This move hinges on the company's management ability of its internal and external resources (Ford and Thomas, 1997). Usually the source of technological innovation is found in inter-organizational interaction (Powell et al., 1996) and its occurrence must accompany network mobilization (Easton, 1992). Thus, as Håkansson and Lundgren (1995) indicate, "Technical change is a compelling component in the evolution of networks, being the outcome of or the driving force behind change processes in industrial networks" (p. 297). Three fundamental issues arise here: What is the definition of technological discontinuities? How the technology is related to business networks? And, what impacts do technological discontinuities have on the evolution of business network?

Firstly, despite a variety of terms to describe technological change, such as disruptive technology, technological breakthrough, radical innovation, new technological paradigm (Christensen, 1997; Danneels, 2004; Dosi, 1982; Sood and Tellis, 2005; Tushman and Anderson, 1986), we consider, on the basis of the work by Ehrnberg (1995), that technological discontinuities should contain at least one of following dimensions:

- Changes in competence and other resources necessary for designing and producing the product
- Physical changes in the product itself
- Price/performance changes

For example, a discontinuous change tends to render existing competence (e.g. R&D) and investments (e.g. production and marketing) obsolete (Danneels, 2004). Moreover, Sood and Tellis (2005) indicate that three kinds of technological change can be categorized into new technology: platform innovation (e.g. CD vs. magnetic tape), component innovation (e.g. floppy disk vs. zip disk), and design innovation (e.g. 3.5-inch vs. 5.25-inch hard disk drives).

Another issue to be addressed concerns technologies' relation to business networks, particularly from the network strategy perspective. As Ford and Thomas (Ford and Thomas, 1997, p. 600) point out, "Strategic action in the network is concerned with the defence and

change of this resource and interaction-based position”. These authors stress the importance of managing the bundle of resources and relationships in order to maintain a competitive position in the business network. For a technology-based firm, the strength of its technological competence could be categorized into one of the three different types of technology (also termed as “technology bundles”): product technology, process technology, and marketing technology (Ford and Saren, 2001; Thomas and Ford, 1995).

- **Product technology**, which is the knowledge and ability to design a product or service valued by other actors.
- **Process technology**, which is the knowledge and ability to manufacture or produce a product or service valued by other actors.
- **Marketing technology**, which is the knowledge and ability to market and deliver a product or service to those who require it.

Based on the heterogeneity perspective, Håkansson and Waluszewski (2002) identify “products”, “facilities”, “business units”, and “relationships” as main types of resources in technological development that are not only independent from each other but also closely related to a firm’s sustainability. In a similar vein, many scholars from the high technology field stress the importance of utilizing interfirm alliances or partnering strategies to bring high-tech products to markets (Easingwood et al., 2006; Hill, 1997; Mohr et al., 2004; Moriarty and Kosnik, 1989). As Ford et al. (Ford et al., 1998, p. 227) indicate “...technological resources are only valuable if they are important to other companies and when they are combined with the technologies of those other companies”.

The concept of technology bundles can also help explain the formation of a firm’s value net (or strategic net) in the technology-intensive industry, which usually comprises four types of firms: suppliers, customers, competitors, and complementors (Ritter et al., 2004). For instance, a firm cooperates and collaborates with competitors and complementors to develop the technology standard and construct the whole product to surmount the chasm that separates the early market and mainstream market (Hill, 1997; Moore, 1991). Furthermore, due to the differences in goals, value directions (vertical or horizontal or both), value activities and functions, specified technologies, and power distribution, a variety of value-creating nets could be classified, such as existing business nets, business renewal nets, and new (or emerging) business nets (Möller and Rajala, 2007; Möller et al., 2005). Thus, a firm’s development and management of business relationships have a strategic significance (Baraldi et al., 2007; Möller and Halinen, 1999).

However, the introduction of technological discontinuities in the existing business net could

occasion negative effects on inter-firm relationships. The extant evidence (Adner, 2002; Christensen, 1997; Danneels, 2004; Henderson, 2006; Tushman and Anderson, 1986) reveals that the arrival of technological discontinuities might have a competence-destroying, investment-obsoleting or customer-requirement-changing impact on the existing structure of a business network. For those companies who have decided to bridge technological discontinuities, this move may require the firms to eliminate or expand their core capabilities, leading the existing relational structure to an unbalanced state (Kash and Rycroft, 2002).

On other hand, the companies, who are unable or inattentive to the emergence of new technology or rest on their laurels with existing technology, may be unwilling to co-invest in technological discontinuities with their counterparts, causing conflicts in the strategic actions (Chandy and Tellis, 2000; Ghemawat, 1991; Slater and Mohr, 2006). Until now, few efforts have been devoted to research how an actor's bridging of technological discontinuities affects the development of inter-firm relationships as well as the evolution of business nets.

2.4 Conceptual framework

Based on the above discussion, we would argue that an actor's strategic action of bridging technological discontinuities may bring about relationship turbulence that could break the existing and relatively stable value-system continuum which is structured by established actor bonds, resource ties and activity links. Relationship turbulence, as Figure 1, is a period that the initiator attempts to re-direct the way of its inter-firm adaptations through resource mobilization at the dyadic and/or triadic (network) level in order to bridge its strategic gap.

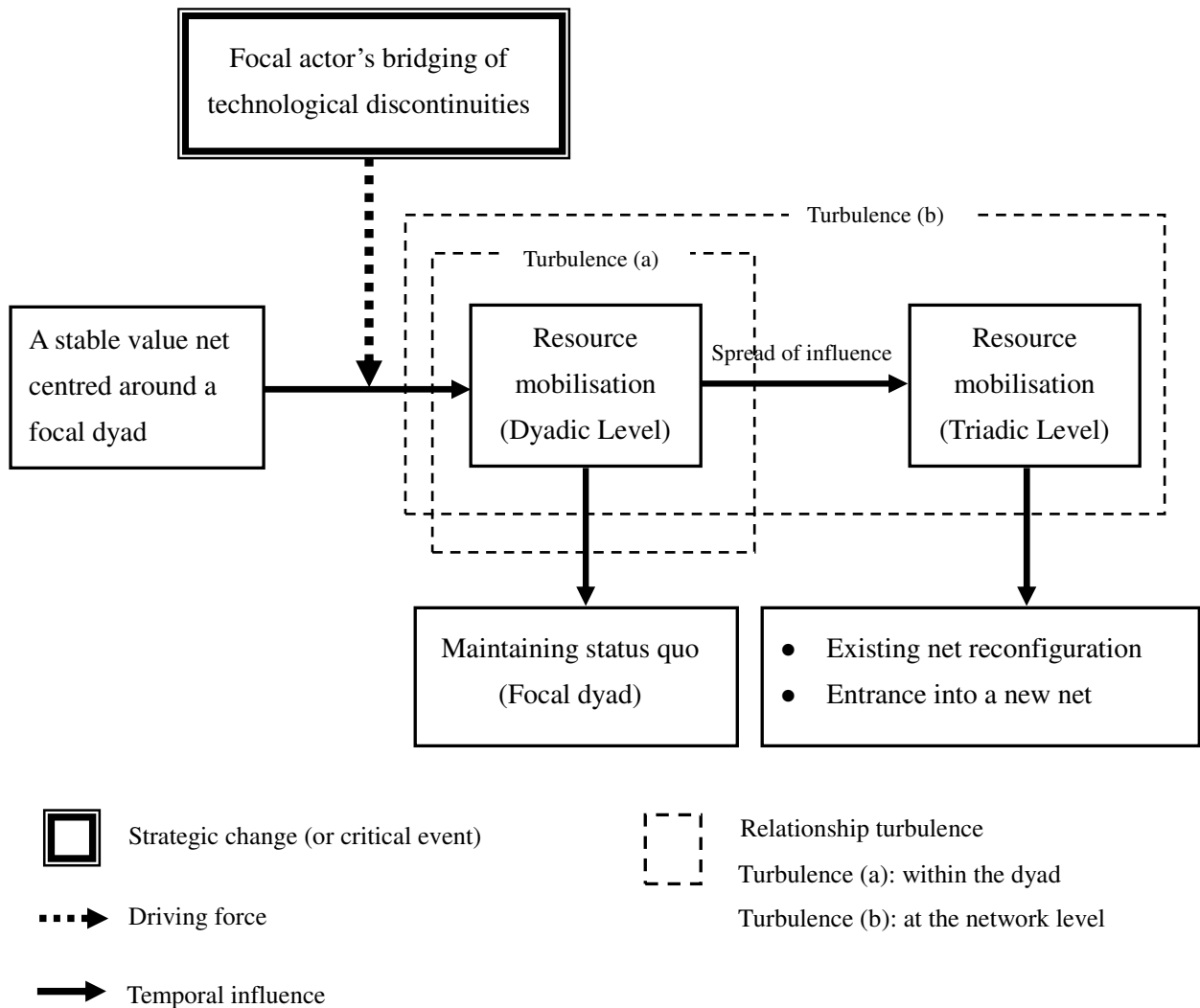
This turbulence may be radically relationship-changing, if the influence of the focal actor's technological discontinuity adoption spreads from the focal dyad (we focus on the OME-business buyer relationship in the present study) to the third party, causing the existing relationship dissolution or establishment of new relationship. Consequently this change results in reconfiguration in the existing business net and leads the focal actor to a new business net based on the new technological paradigm.

But on the other hand, since a firm's strategic actions may be affected by its past experience and current interaction with others (Håkansson and Lundgren, 1997; Lundgren, 1995), the focal dyad may be encouraged to keep the relational tie by using by using other strategies such as network integrative mobilisation (Lundgren, 1992) or awakening the counterpart to the costs of ending a relationship (Tähtinen and Vaaland, 2006). In this case, the turbulence is confined within the dyad and can be eased, see Turbulence (a) in Figure 1.

Following the presentation of theoretical framework, we come up with the following three research questions:

1. In processual viewpoints, what is the nature of relationship turbulence?
2. How does relationship turbulence alter the structure of the existing business net?
3. And, how “new” is the new business net?

Figure 1. A model of relationship turbulence



3.0 Methodology

3.1 Research Design

A single case study has been selected for two reasons. First, the scarcity of substantive research into the combination of two different literatures (network strategy and marketing technological discontinuities) encourages the employment of an exploratory research method (Ghauri, 2005). Second, this research aims to achieve a deep understanding of the complex social phenomena of relationship turbulence in a technology-intensive setting. A case study is thus considered appropriate (Yin, 1994).

Drawing the boundary of the network is a central issue in conducting business network research. To capture the dynamics of a value net centred round an OEM-Technology vendor relationship (or business buyer), our focal dyad, we must take into account three conceptual tools: micro-position (Johanson and Mattsson, 2002), dyad-network perspective (Halinen and Törnroos, 1998), and focal net (Salmi, 2000). The concept of micro-position helps the inquirer to observe the focal actor's role for, importance to, and strength of relationship with the counterpart. It also allows the research to locate the focal actors' positions in a business net and their interdependencies, such as roles defined by using the concept of technology bundles (Ford and Saren, 2001).

The dyad-network perspective emphasizes that the dyad's function as transmitters and transformers of network change. In addition to helping investigate the spread of change from a certain dyadic relationship, the dyad-network perspective enables the researcher to discover what resources are invested (or committed) and what activities are carried out by the focal dyad and their relation to the other connected dyads, including network adaptation. As for the focal net concept, according to Salmi (2000), this concept comprises both direct and indirect relationships that the company identifies as important for its business, and thus, is a suitable analytical tool for examining actors' strategic thinking. Moreover, the purpose of the research requires a longitudinal case study that covers the stability and change related with firms' strategic actions in the business network.

3.2 The case under investigation

The focus of this empirical investigation is placed on the relationships between technology vendors and their OEMs (also vendor-partner). This relationship is usually at the central area of a vertically formed value net receiving and generating influences on its upstream and downstream connected dyads. In addition, this relationship is characterized by increased

technological interdependence where mutual adaptations have been made and activities have been aligned, so as to pursue operational efficiency and to penetrate the market using a specific technological paradigm (Heide and Weiss, 1995; Mohr et al., 2004; Möller et al., 2005).

The case studied is from the optical recording media (or storage media or blank media) industry which is characterized by short product lifecycles and that has gone through several technological paradigms over the past decade from CD-R (CD-Recordable), DVD-R (DVD-Recordable) to the recent win-out of Blu-ray DVD over HD DVD. The technological discontinuities between CD-R and DVD-R in product design and production system prove a platform to examine the impact of an actor's bridging technological discontinuities on an actor's value-creating network.

The Alpha-Beta relationship (for the sake of confidentiality the company's identity is not revealed) is the focal dyad investigated in the case where Alpha is a Taiwan-based OEM in the industry of optical recording media while Beta is a Japan-based technology vendor (or business buyer) who possesses know-how in recording media production and has an influential brand image in the industry. The relationship, which was built on CD-R technological interdependence in late 1998, enabled Beta to acquire competent CD-R production capacity and concentrate more on its marketing activities, and on the other hand, allowed Alpha to pursue a competitive position in optical media manufacturing service. This relationship faded away in 2004.

Moreover, based on our focal dyad's information, particularly from Alpha, we include the relationships that are tied with this focal dyad in the case analysis, such as Alpha's material suppliers and one complementor (drive maker). With these relational ties a focal net centred around the Alpha-Beta relationship can be presented and the impact of technological discontinuity adoption on these actors can be studied.

3.3 Data collection

The study combined various sources of data, including in-depth interviews, documentary and archival data (e.g. annual reports and minutes of meetings), and industry statistics and information. The main source of data was collected through semi-structured interviews with 11 managers, eight from Alpha and three from Beta, who were involved in the six-year relationship. The interviews were guided by an interview protocol developed from our understanding of network strategy and technological changes. All interviews were recorded and transcribed. Furthermore, the triangulation between supplementary material data and

multiple perceptions allows us to mitigate the weakness of longitudinal studies (e.g. memory loss) and provide a more adequate and rich description (Halinen and Törnroos, 1995; Miles and Huberman, 1984).

4.0 Case presentation

The history of the six-year Alpha-Beta relationship can be divided into three phases: a CD-R-based value net, relationship turbulence, and the fading relationship.

4.1 A CD-R-based value net

After approximately two years' contact (including marketing and sales visits, product verification, and production site audit), Alpha earned business agreements from Beta in late 1998. In the face of the booming CD-R market, this relational tie allowed Beta to obtain a stable, qualified cost-competitive source of CD-R capacity, so as to concentrate more on its marketing deployments. On the other hand, it facilitated Alpha to pursue the scale of economy in CD-R production and strengthen its technological competence by taking advantage of Beta's experience in product development and manufacturing management.

In order to build Beta's confidence in product quality and to ensure sufficient production capacity, Alpha made adaptations and special arrangements. First, it arranged specified production areas for Beta. The production flows were running at a much higher standard than the level it produced for other customers, such as using strict production parameters and increasing frequencies of quality inspection. It also installed several expensive apparatuses identified by Beta to test and control the product quality. To meet Beta's requirements, Alpha organized a project team consisting of a number of experienced professionals from different functional departments, such as R&D, QA and process engineering. At the beginning of the relationship, the issue of low yield rate troubled the team for a couple of months.

When routines and procedures between Alpha and Beta were gradually developed, a value-creating business net centered on this dyadic relationship evolved. For example, the industry rivalry, which lay in enhancing the recording speed of a disc and its compatibility with drives (or burners), urged Alpha and Beta to co-work closely with major drive makers and software developers. In addition, Alpha established new relationships with a packaging subcontractor and suppliers of disc-label-printing ink and packaging materials in order to satisfy Beta's needs. This business net based on CD-R technology covered several tasks, such as operational efficiency (e.g. driving production cost down) and new product development (e.g. boosting recording speed). Thus, by the end of 2001, Alpha's monthly CD-R shipment

to Beta worldwide reached a record-high number of 25 million pieces and contained more than 80 items of packaging styles.

4.2 Relationship turbulence

Although there were dissatisfactory episodes occurring in the exchange relationship between Alpha and Beta, such as delayed delivery and mixed shipments, the dyad remained stable. An important factor that tied the dyad closely was that Alpha was willing to adjust its activities and spare resources to meet Beta's needs in terms of production capacity, product quality, and logistics and Beta continuously placed considerable CD-R orders in return.

However, the intensifying industry competition changed the situation, especially after 2002. The availability and diversity of CD-R brands and burners, falling street prices, and the popularity of application (e.g. MP3 download and data backup) boosted a strong demand for blank discs. But the prosperity of end-user markets incited manufacturers to expand their production capacities and this resulted in a price war. The fierce competition burdened Alpha's relationship with Beta in which Alpha's profitability was rapidly eroded. In addition to carrying out cost-down plans and developing niche products that brought higher margins (e.g. business-card-sized CD-R), Alpha was thinking about the phase-in of DVD recordable mass production as an important means to enhance its profitability.

In late 2001, Alpha had achieved a successful pilot-production of DVD recordable products. Then, it started sending samples to its main and potential customers for verification, including Beta. Without receiving positive feedback from Beta, in late 2002, Alpha decided to phase-in the mass production of DVD recordable products by transferring CD-R production lines to DVD-R. Beta was unhappy with Alpha's decision because this move would cause a shortage in CD-R supply and hinder its sales momentum. The dyad entered into negotiation.

Although the top management teams of both parties were involved in the negotiations from April 2003, the dyad failed to reach common ground. Perceiving decreasing margins in manufacturing CD-R (especially for Beta), Alpha held that either CD-R price markup or Beta's release of DVD-R orders could help tide over the fierce competition. Facing the growing CD-R markets, on the other hand, Beta thought that utilizing Alpha's CD-R production capacity and efficiency and holding DVD-R development and production in its factory in Japan was the best strategy to maximize its interests. Moreover, at this point Beta asked Alpha to purchase its used CD-R production equipment as a condition of price markup. But for Alpha, taking over Beta's equipment was not a realistic proposition. Due to goal incompatibility between Alpha and Beta, the negotiation reached a deadlock for several

months.

Alpha and Beta undertook their own strategic actions while the negotiations were stalled. Externally, Alpha was more actively approaching Gamma (a Japan-based technology vendor) who possessed patents in DVD recordable technology that allowed Alpha to enhance its technological competence and waive royalties for each output of DVD discs. Internally, Alpha transferred its account manager for Beta to handle a CD-R outsourcing project from June 2003. By cooperating with second or third tier CD-R manufacturers in Taiwan, the project aimed to acquire some capacities to tackle the shortage caused by its transition to DVD-R production. Later in August, the firm transferred the Beta sales manager in order to develop new customers for DVD recordable products. This change of key contact personnel, who had worked with Beta since the beginning of the relationship, was viewed as a critical episode by the counterpart. Perceiving little possibility to complete the negotiation, Beta speeded up an approach to Theta, another OEM in Taiwan, who was able to meet its strategic goals.

4.3 The fading relationship

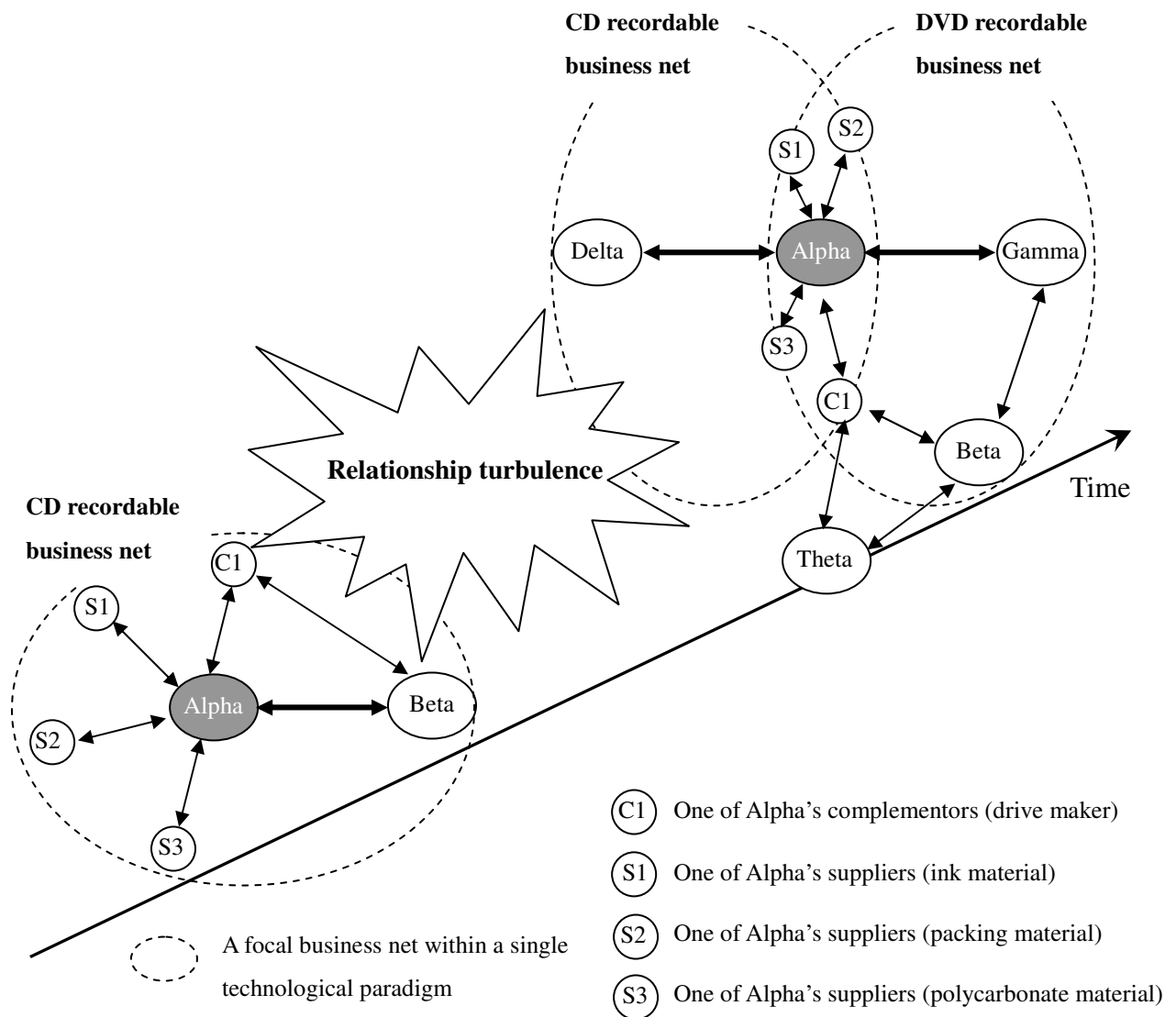
With the completion of the last CD-R order in February 2004, Alpha's relationship with Beta faded away. The fading relationship partly resulted from Beta's alliance with Theta who purchased Beta's used production equipment and simultaneously, obtained its media OEM orders. Another reason was Alpha's active relationship with Gamma. Alpha's superior process management, technological base, and resources released from the operation with Beta (e.g. production capacity and managing team) were the key factors in the relationship development with Gamma. Thus, a fading relationship and new relationship establishments put an end to the relationship turbulence occasioned by Alpha's strategic move to DVD recordable technology.

From Alpha's viewpoint, these radical changes in relationships not only ended the relationship turbulence but also provided the firm with new directions of business net development. As shown in Figure 2, the consequence of turbulence brought about a reconfiguration of Alpha's CD recordable business net and Alpha's entrance into a new business net based on DVD recordable technology. In the period of relationship turbulence, Alpha re-organized its resources for its relationship with Gamma to develop new business and on the other hand, it established a strategic partnership with Delta (a second-tier OEM in Taiwan) through its outsourcing activity to sustain its existing CD-R business.

Although Alpha's relationship with Beta faded away after the turbulence, their relationship

was indirectly connected through both Gamma and a drive maker under this study (see Figure 2). Here, Gamma adjusted its role in the industry from a technology vendor promoting its own brand to an OEM promoting its DVD recordable technology and combining Alpha's process technology. Then, Gamma acquired orders from major technology vendors in Japan, including Beta. As for the suppliers in the study, such as suppliers of label-printing ink (S1 in Figure 2), packaging materials (S2) and polycarbonate (S3), their relationships with Alpha were not affected by the radical changes in the business net. These relationships remained working closely with Alpha when the mainstream technology gradually migrated from CD recordable to DVD recordable.

Figure 2. Business nets evolution before/after relationship turbulence
(Alpha's focal/small net perspective)



5.0 Discussion

This study empirically verifies the existence of relationship turbulence which lies in an actor's bridging of technological discontinuities and brings about the network reconfiguration. This turbulence accentuates the focal actor's technological development as well as its business nets' evolution. In order to better study the development of business nets and to answer our research enquiries, the conceptual tools of micro-position (Johanson and Mattsson, 2002), dyad-network perspective (Halinen and Törnroos, 1998), and focal net (Salmi, 2000) are employed in our case research; and they are found to be interrelated and useful in capturing the dynamics.

An important reason for us to construct the past (before the turbulence) is just as Håkansson and Lundgren (1997, p. 122) argue, "...the relationships cannot escape from the pattern created by their own development. There is a path dependence in the development of relationships and networks". Based on this, the questions of how the existing net is reconfigured and how new the new net is can be addressed. As Lundgren (1995, p. 95) stresses, "In the emergence of a new network, identification of something new and different manifests the evolution of the network". The dynamics of business networks can thus be studied by incorporating a stability dimension with a change-process dimension (Anderson et al., 1998), including the relationship turbulence.

From the retrospective point of view, Alpha's bridging of technological discontinuity could be viewed as a critical event because it initiates relationship turbulence that results in a fading relationship and the establishment of new relationships. However, it is still arguable to categorize an actor's bridging of technological discontinuity as a critical event. In our case analysis, the fading relationship is compounded with other factors, including unilateral decision to bridge technological discontinuities, failure to re-align strategic goals, and the change of key contact personnel. A fading relationship is thus a complex social phenomenon and requires a detailed study. It would be fairly to say that technological discontinuity adoption is an important "trigger" that marks the development of business networks.

Our empirical findings show that the focal actor's strategic move to the next generation of technology (DVD recordable) begets the relationship turbulence and interrupts a deeply structured business system based on the existing technology (CD recordable). This turbulence begins with the initiator's (Alpha) mobilization of resources related with its counterpart (Beta) and then results in the changes of their network positions (the dyadic level). Finally, the turbulence spreads its influences to other dyads (the network level) causing a reconfiguration in the existing business net and appearance of a new technologically-based business net (see

Figure 2). Due to the mobilization of resources and changes of network positions, the focal dyad is unable to maintain its strong relational bond (the status quo) and also acts as the transmitter of radical changes in the network (Easton, 1992; Easton and Lundgren, 1992; Halinen et al., 1999).

Moreover, this study finds that the relationship turbulence is ended by the existing net restructuring and the initiator's (Alpha) entrance into new business net. But how the existing net is reconfigured and how new the new net is hinge on the impacts of technological discontinuities. As shown in Figure 2, the radical changes caused by an actor's bridging of technological discontinuities take place in relationships that are tied or need to be tied by resources created to use or integrate the existing and/or new technology, especially in terms of technology bundles (e.g., Thomas and Ford, 1995). As for those relationships built on resources that are not involved in the usage of that technology (e.g. supplier of packaging materials) or not affected by technological advancement (e.g. ink supplier or drive maker), they can easily survive relationship turbulence and be able to serve different business nets.

Our results also reveal that the adaptation process between Alpha and Beta that resulted in increasing interdependences could be viewed as the process of learning as well as the accumulation of network power. From the angle of Alpha's position, this adaptation process allowed Alpha to strengthen its power basis (e.g. expertise) and extend its scope of power (e.g. influences in optical media production) at the network level (Axelsson, 1992). Consequently, Alpha was able to make its own strategic decisions, such as the alliance with Gamma in the DVD recordable business, although its dependence on Beta (e.g. business orders) increased at the same time. This is a paradox of network power in the adaptation process. In addition, the spread of changes in the turbulence can be regarded as flows of network power from the organizational level to the network level (the power shifting) (Zolkiewski, 2001); and the network reconfiguration and the emergence of a new business net are the efforts to balance the power between business actors.

6.0 Managerial Implications

In the rapidly changing technology-intensive environment, the company cannot avoid confronting the relationship turbulence occasioned by its or the counterpart's bridging of technological discontinuities, a major strategic change in technological development. The lethality of a relationship turbulence, which breaks the balance of an actor-resource-activity established structure, lies not in its appearance but in involved parties' ability to cope with it, that is, the ability of resource mobilisation and resource combination, such as working with a new counterpart or with an old one in a new way (Håkansson and Waluszewski, 2002).

As Lundgren (1995, p. 96) indicates, “Changes emerge from pre-existing structures and, if viable, they will eventually be re-integrated with the structures from which they originated”. This suggests that, in accordance with our empirical results, the successful bridging of technological discontinuities depends on how the focal actor strikes a balance between the reconfigured net and emerging net. Sometimes the willingness to sacrifice resources for new activity development is necessary. It also suggests that the length of the turbulence is determined by how the actor balances its roles in business nets. Being swamped in relationship turbulence implies that the actors are struggling to find a way to adapt to the counterparts. That is, the more time an actor stays in turbulence periods, the more severely it suffers³.

Moreover, a new position by ending a relationship in some senses can be mostly positive (Törnroos, 2004), such as Alpha’s entry into the DVD recordable business net after its fading relationship with Beta. A crucial reason is that Alpha’s relationship with Beta represents “a major drain on the company’s account management, product, and production resources and may not be profitable” (Ford et al., 1996, p. 158), especially in the face of intensifying competition and the emergence of a new technological paradigm. By releasing its resources tied with Beta, Alpha is able to move to a suitable position accommodating new relationships for serving different business nets. As Johanson and Mattsson (1992, p. 216) point out, “...the position in the old network can be a constraint on movement into new networks to the extent that commitments made in the old exchange relationships cannot be kept if new exchange relationships are added”.

Last but not least, a company’s network of relationships provides opportunities, but on the other hand, it may become a strategic constraint or strategic block, preventing the firm from cooperating with others (Gulati et al., 2000; Tikkanen and Halinen, 2003). In addition, the ability to successfully develop and manage relational ties allows a firm to effectively and dynamically allocate, adjust, and/or integrate its internal and external resources, and thus, this ability is strategically meaningful and is the source of competitive advantages (Eisenhardt and Martin, 2000; Powell et al., 1996; Ritter et al., 2004). This study empirically validates that dissolving a relationship can be a strategic option for the firm’s growth or survival in technology-intensive industries in which technological lock-in effects are common (Ford and Thomas, 1997; Håkansson and Lundgren, 1997; Möller and Halinen, 1999; Tikkanen and Halinen, 2003; Törnroos, 2004).

7.0 Conclusions and future research directions

³ Failure to build or re-establish an adaptation process means failure to develop operational efficiency.

This study places a particular attention on one facet of the IMP network approach to strategic management: changing network position by establishing and dissolving relational bonds with other organizations. We find that actors-resources-activities framework (e.g., Håkansson and Snehota 1995) and technology bundles (e.g., Ford and Thomas 1997) are powerful conceptual tools to study network dynamics in technology intensive industries. By introducing a stability dimension and temporal influence in the study, the relationship turbulence triggered by an actor's bridging technological discontinuities, which can be viewed as a pivotal event as well as a major strategic change, can be better understood.

Since the business network has a dynamic and evolving characteristic, more efforts need to be devoted to confirm the findings of this single-case-based study. Although the technological change is proven to be as a compelling event in the development of business networks, more studies on other events from different settings, such as e-commerce or technological convergence (e.g. GPS technology integrated in the mobile phone device), could expand our existing knowledge. Moreover, it would be beneficial to study how the firm manages its multi-positions created by its continuous bridging of technological discontinuities, including balancing multiple business nets (also multiple roles or positions) or withdrawing an old net. Lastly, although this single-case study provides profound insights of relationship turbulence, the limitation lies in its generalisation of results.

Acknowledgement

We would like to thank the anonymous referees for their beneficial comments and suggestions.

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