Industrial Marketing Management, Volume 71, May 2018, pp. 79-94
DOI:10.1016/j.indmarman.2017.12.006

How Do Network Resources Affect Firms' Network-Oriented Dynamic Capabilities?

Leila Alinaghian and Kamran Razmdoost

ABSTRACT

While the extant literature investigating the dynamic capabilities that cross the boundaries of firms (i.e., network-oriented dynamic capabilities) has predominantly focused on the identification of their underlying routines or their impact on the firms' performance, the determinants of these routines have largely remained unexplored. Our study seeks to address this issue by investigating how the attributes of network resources (i.e., assets that belong to or are deployed by actors with whom a firm is connected through direct or indirect relationships) influence firms' network-oriented dynamic capabilities. A multiple-case study including 50 network resource sets embedded in 10 business units of five multinational firms spanning pharmaceutical, aircraft power system, and consumer goods' industries is conducted. The findings reveal the effects of eight network resource attributes on the three clusters of network-oriented dynamic capabilities (i.e., sensing, seizing and transforming) as follows: rarity affects the effectiveness of sensing, complementarity affects the effectiveness of seizing, accessibility and usability affect the efficiency of seizing, scalability and appropriability affect the effectiveness of transforming, and finally utility and versatility affect the efficiency of transforming.

Keywords:

Network resources, Dynamic capabilities, Interfirm relationships, Network capital, Networking capability, Case study

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

How Do Network Resources Affect Firms' Network-Oriented Dynamic Capabilities?

1. INTRODUCTION

In rapidly changing environments, dynamic capabilities — "the organizational and strategic routines by which firms achieve new resource configurations" (Eisenhardt & Martin, 2000, p. 1107) — serve to provide sustainable competitive advantages (Easterby-Smith, Lyles, & Peteraf, 2009; Sirmon, Hitt, & Ireland, 2007). While initially focused on the internal boundaries of firms, dynamic capability routines have increasingly crossed the firms' boundaries to benefit from the network of external firms with whom different types of relationships have been formed (Blyler & Coff, 2003; Kale & Singh, 2007; Möller & Svahn, 2006). Specifically, dynamic capabilities may revolve around the initiation, development or termination of these relationships (Allred, Fawcett, Wallin, & Magnan, 2011; Capaldo, 2007; Forkmann, Henneberg, Naudé, & Mitrega, 2016). Dynamic capability routines may also be externally oriented to utilize the resources that are available via these interfirm relationships in responding to environmental changes (Heger & Boman, 2015; Huikkola, Ylimäki, & Kohtamäki, 2013; Kale & Singh, 2007). We refer to these dynamic capability routines that transcend a single firm's boundaries as *network-oriented dynamic capabilities*.

While network-oriented dynamic capability studies have largely focused on how firms orchestrate their internal efforts to obtain value from their interfirm networks, the ultimate outcome of dynamic capabilities is not merely attributed to these network-oriented routines. For instance, although a firm may have strong collaboration capabilities to establish common goals with its suppliers toward innovation (Allred et al., 2011), it will not achieve successful technological innovation if the suppliers do not possess the technological or managerial resources required for the adoption of the innovation. Similarly, while a firm may have strong networking capabilities to interact with its business partners (Mitrega, Forkmann, Ramos, & Henneberg, 2012), the frequency and quality of interactions are also influenced by the

geographical proximity of the partner and the compatibility of their systems. In fact, the resources that belong to or are deployed by actors with whom a firm is connected through different relationships (i.e., network resources, Gulati, 1999; Lavie, 2006) possess attributes that are crucial in shaping the firm's performance (Gulati, Lavie, & Madhavan, 2011). Therefore, solely relying on firms' capabilities and behavior toward the network and overlooking network resource attributes such as their utility, accessibility or complementarity, may result in an incomplete understanding of the mechanisms that underlie the outcome of network-oriented dynamic capabilities.

Our study thus aims to investigate how the attributes of network resources influence firms' network-oriented dynamic capabilities. In particular, we extend and refine the existing conceptualizations of network resource attributes by systematically and empirically articulating their multiple dimensions. We further examine the effects of these dimensions on the multiple clusters of firms' network-oriented dynamic capability routines (i.e., sensing, seizing and transforming, Teece, 2007).

Our work contributes to the network-oriented dynamic capability and network resources literature. First, our research expands the understanding of network-oriented dynamic capabilities' determinants by investigating the attributes of network resources; while the extant literature has predominantly focused on the identification of network-oriented dynamic capability routines or their impact on a firm's performance (e.g., Huikkola et al., 2013; Kale & Singh, 2007; Mitrega & Pfajfar, 2015), the antecedents of these routines have remained unexplored. Second, our study extends the literature on network resources by systematically exploring different constituent dimensions of network resource attributes. The existing network resource studies examining the effects of network resources on the performance of firms (e.g., Casanueva, Gallego & Sancho, 2013; Lavie, 2007) are inadequate

in terms of the extent to which they fully explain, or capture, the multiple dimensions of network resource attributes that affect the outcome of network-oriented dynamic capabilities.

The paper proceeds as follows. First, we establish the theoretical background of our study based on the literature on network-oriented dynamic capabilities and network resources. Next, our empirical setting and case study methodology is introduced and the data collection and analysis approaches and procedures are discussed. Following the analysis, we present a set of propositions that associate the attributes of network resources with the firm's network-oriented dynamic capabilities. Our findings are then discussed in relation to the relevant literature and the original contributions to theory are elaborated. Finally, we conclude the paper with a summary of the main findings, managerial implications, limitations and directions for future research.

2. LITERATURE REVIEW

2.1 Network-Oriented Dynamic Capabilities

Although dynamic capabilities were initially characterized as a set of organizational routines that exist within a firm's boundaries (e.g., product development, Eisenhardt & Martin, 2000; learning, Zollo & Winter, 2002; strategic decision-making, Aragon-Correa & Sharma, 2003), these routines have been extended beyond the single firm to capture the advantages available within interfirm networks (Blyler & Coff, 2003; Kale & Singh, 2007; Möller & Svahn, 2006). We label these routines as network-oriented dynamic capabilities and explain them based on the units of analysis (firm vs. dyadic interfirm relationships) adopted in two categories (see Figure 1).

The first category revolves around the firm's dynamic capability routines that are extended beyond its boundaries (Figure 1 a). This strand of work has investigated routines that enable the firm to identify, mobilize and influence network actors (Möller & Svahn, 2003). For instance, organizational routines that initiate, develop and terminate relationships

with network actors (Forkmann et al., 2016; Mitrega & Pfajfar, 2015; Vesalainen & Hakala, 2014), shape a heterogeneous portfolio of weak and strong ties with them (Capaldo, 2007) or learn from these actors through articulation, codification and sharing of knowledge (Kale & Singh, 2007) have been investigated as network-oriented dynamic capabilities.

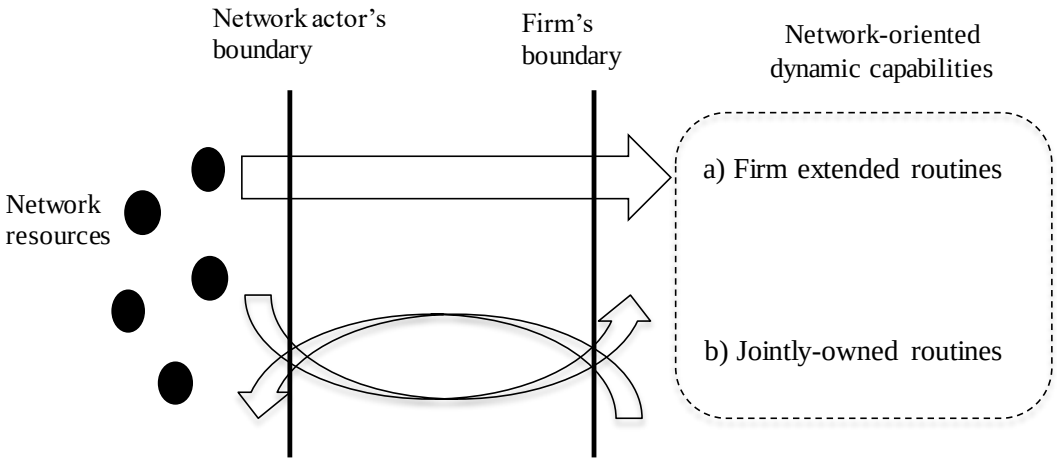

Figure 1. Network-Oriented Dynamic Capabilities

The second group considers the dyadic relationship as the unit of analysis and highlights the dynamic capability routines that are jointly employed by the firm and the network actors (Figure 1 b). Specifically, previous studies have identified joint learning, joint sense making and knowledge integration as dynamic capability routines that are jointly used and developed (e.g., through relational investments) by the firm and network actors (Huikkola et al., 2013). These routines develop shared goals, resources, risks and rewards (Allred et al., 2011), foster an understanding of the current resources possessed by each party, and indeed facilitate the joint development of new capabilities between firms (Defee & Fugate, 2010).

Although studies from both categories have reported the positive effects of network-oriented dynamic capabilities on firms' performance (e.g., Defee & Fugate, 2010; Forkmann et al., 2016; Mitrega & Pfajfar, 2015), the determinants of these routines have been considered to a lesser extent. In particular, the literature lacks an understanding of which factors outside a firm's boundaries (e.g., the characteristics or behaviors of network actors)

may drive network-oriented dynamic capabilities. Thus, our study seeks to address this gap by investigating the attributes of network resources that shape network-oriented dynamic capabilities. In our investigation, consistent with the first category, network-oriented dynamic capabilities are characterized as a set of routines that have external orientation. This allows the examination of the independent effects of network resource attributes on network-oriented dynamic capabilities from the perspective of a firm (rather than the perspective of a dyadic relationship).

2.2 Network Resources

Firms employ network-oriented routines to realize the potential benefits of network resources (Wassmer & Dussauge, 2011), which are predominantly defined as *assets* that exist in the network of interfirm relationships in which a firm is embedded (Gulati, 1999; Lavie, 2006). These include tangible and intangible assets such as technology, marketing, finance (Lavie, 2007), knowledge (Spithoven & Teirlinck, 2015), people (Wei, Chiang, & Wu, 2012), and reputation (Musiolik, Markard, & Hekkert, 2012). The importance of network resources in shaping firms' operational and strategic performance has been empirically demonstrated (e.g., Casanueva et al., 2013; Lavie, 2007; Srivastava, Gnyawali, & Hatfield, 2015). For instance, Lavie (2007) asserted that network resources, including the level of investment in technology and marketing among partners as well as their available financial resources are positively associated with the firm's market share growth. This is consistent with Casanueva et al. (2013), who revealed that network resources such as reputation and marketing, physical, technological, financial and human resources are positively related to an airline firm's operational performance in terms of income, passenger volume and transportation indicators. Further, focusing on the strategic performance of firms, Srivastava et al. (2015) identified that more extensive technological network resources increase a firm's innovation performance (i.e., the number of patents).

While network resources have been identified as an important determinant of firms' performance, the investigation of *how* network resources influence firms' performance has been largely overlooked. Specifically, the empirical studies examining network resources have largely operationalized network resources as a one-dimensional phenomenon and consequently the multiple attributes of these resources have not been investigated. Lavie (2007), for instance, operationalized technological resources through the level of R&D investments, while Casanueva et al. (2013) investigated marketing resources by counting the number of destinations that an airline serves (as an indication of the number of markets which it is active within). Gulati et al. (2011) conceptually suggested a set of network resource attributes including utility and rarity, appropriability and complementarity from which the firm may capture value. However, their study lacked a systematic account of the multiple dimensions of these attributes. In particular, the effects of network resource attributes on the firm's performance have not been investigated. Thus, in our study, we seek to empirically unpack the attributes of network resources and the way in which they influence the firms' network-oriented dynamic capabilities.

2.3 Conceptual Framework

Figure 2 sets out the framework that underpins our conceptualizations of network resource attributes and network-oriented dynamic capabilities. We operationalize network-oriented dynamic capabilities through the three clusters of sensing, seizing and transforming routines. Sensing routines involve the identification and assessment of an opportunity or need for change, whereas seizing and transforming routines encompass the mobilization of resources to formulate a response and continued renewal, respectively (Teece, 2007). While Teece's (2007) framework considers both the design and the implementation of solutions as seizing, alternative conceptualizations have examined these aspects as distinct routines. For instance, in examining dynamic capability routines, Helfat et al. (2007) made a distinction

between decision-making and change management processes; similarly, Lampel and Shamsie (2003) empirically distinguished between the routines required to identify and commit resources and those that deploy the identified resources. As design and implementation routines possess distinct properties that might be uniquely influenced by network resources, consistent with these other studies, we consider design activities such as decision-making to be part of the seizing routines, and the implementation activities to be an element of transforming.

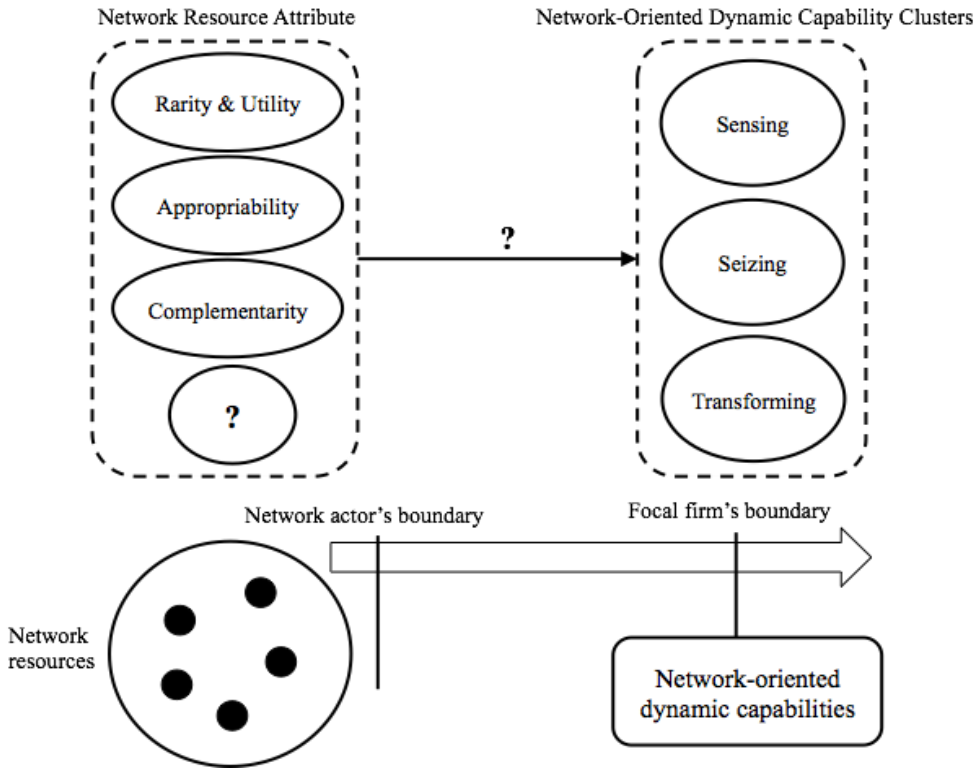

Figure 2. The Conceptual Framework

Furthermore, we evaluate the outcome of sensing, seizing and transforming based on the efficiency and effectiveness of their underpinning routines (Helfat et al., 2007). The efficiency of these routines is assessed based on the extent to which the firm's resources are suitably used for the identification, creation or development of the new opportunity, whereas their effectiveness is evaluated based on the quality of the outcome, taking into account the context in which the firm operates (Helfat et al., 2007).

The operationalization of network resource attributes is guided by the existing conceptualizations. Gulati et al. (2011) proposed four network resource attributes: utility and rarity, appropriability and complementarity (or network resource combination). Utility and rarity are defined as "the premium that users are willing to pay for services that network resources support, and the ex-ante and ex-post limits on the capacity of competitors to access similar network resources", respectively, while appropriability is conceptualized as "the extent to which network resources are accessible and transferable" and complementarity as the extent to which "combinations of network resources create synergies for the organization" (Gulati et al., 2011, p. 212). Additionally, we seek to refine and clarify these definitions and further explore new dimensions for network resource attributes. Specifically, our study aims to explore how multiple dimensions of network resource attributes may affect the efficiency and effectiveness of these network-oriented dynamic capability clusters: sensing, seizing and transforming.

3. METHOD

Given the limited theory and empirical evidence related to the influence of network resource attributes on the firms' network-oriented dynamic capabilities, an inductive theory building approach using multiple, embedded cases is adopted (Eisenhardt, 1989).

3.1 Case Selection

Our case study sample includes multiple network resource sets that played a role in a firm's network-oriented dynamic capabilities. In particular, we examined network resources that belong to or are deployed by network actors with whom the firm had a buyer–supplier relationship. Supply networks, as interfirm networks in which relationships are not exclusively formed for innovation purposes, provided a natural setting in which to examine the effects of network resource attributes on network-oriented dynamic capabilities.

We used a theoretical sampling approach (Eisenhardt, 1989) to identify information-rich cases (Hillebrand, Kok, & Biemans, 2001) that are particularly suitable for illuminating the attributes of network resources as well as explaining how these may influence firms' network-oriented dynamic capabilities. However, as our population of interest (i.e., network resources) is not as readily determined as other populations such as individuals or organizations (Patton, 2015), we could not sample network resource sets on the basis of their potential representations and variations as suggested in systematic theoretical sampling (Fletcher & Plakoyiannaki, 2011). Instead, our network resource sample was achieved through the selection of focal firms and their business units that access and utilize these resources. Specifically, as suggested by Patton (2015), we set two criteria for our selections to ensure the possibility of exploring a variety of network resource attributes.

First, to increase the likelihood of observing the network resource sets that have a role in shaping each firm's network-oriented dynamic capabilities, we selected firms from dynamic capability exemplars. This was based on the assumption that there is a high chance for firms with superior dynamic capability outcomes to engage network resources in their dynamic capability routines (e.g., Srivastava et al., 2015). Therefore, a firm selection index was developed in order to target firms that endured, grew and innovated (i.e., dynamic capability exemplars). Using the firm selection index and secondary data to identify longevity, the compound growth rate, and the number of patents, a list of 100 firms was generated. We approached 10 firms, and in each case, a conversation took place. Six multinationals subsequently contacted the researchers and indicated a willingness to participate in the study, with five of these ultimately being included. These comprised three major global pharmaceutical and medical device manufacturers, one aircraft power systems manufacturer, and one global producer of fast-moving consumer goods (hereafter referred to as F1, F2, F3, F4 and F5, respectively).

Second, to enhance the chance of observing both comparable and different attributes for network resources, we attempted to examine network resources in similar and dissimilar settings; thus, we selected multiple business units across our firm sample. Specifically, to observe a contrasting pattern in the data (Eisenhardt & Graebner, 2007), we attempted to include business units that are involved in the design or delivery of intermediate (i.e., products that needs further production processes before they are delivered to the end user, Gao & Zhao, 2015) and final products. Businesses producing intermediate products may benefit differently from network resources in comparison to those creating final products, which interact with a wide range of actors supplying multiple components. Similarly, we ensured that our sample includes business units that are primarily focused on product or process innovations to capture the differences in network resource attributes that may emerge as a result of different interactions and behaviors between the business units and their suppliers in these two different innovation settings (Wagner & Bode, 2014). Figure 3 illustrates how the 10 selected business units and the associated firms are mapped within and across the four business unit sample categories.

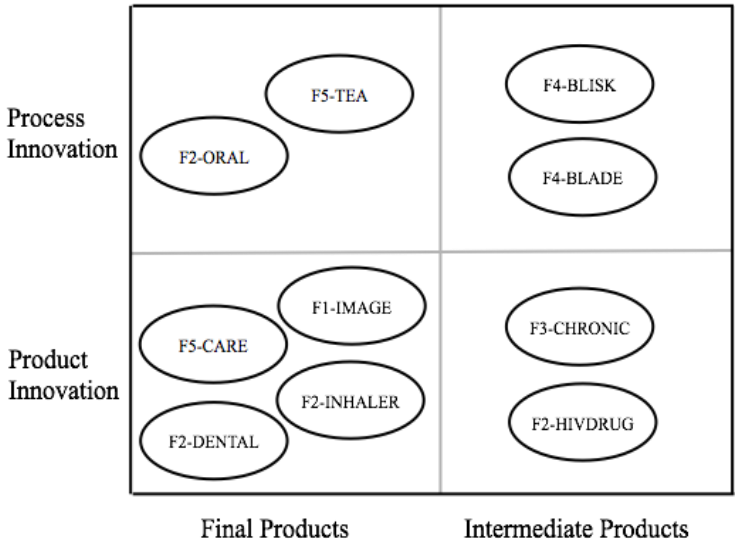

Figure 3. Business Unit Sample Categories

Within each business unit, we then selected multiple network resource sets that were involved in the network-oriented dynamic capabilities (as embedded cases). In particular, the

key gatekeepers in each business unit (a senior member within the supply chain function who enabled us to undertake the research) were asked to identify a set of recent incidents in which a supplier played a role in the identification and/or development of a new opportunity or change (as manifestations of network-oriented dynamic capabilities). As a result, throughout the investigative process, a total of 50 network resource sets were identified and examined across the 10 business units. The selection of multiple cases from a similar business unit sample category allowed a replication logic whereby each case was used to test emerging theoretical insights. Similarly, the inclusion of multiple cases from different business unit sample categories has enabled us to cover different theoretical conditions that may arise from differences in network resource attributes. Table 1 provides a descriptive summary of the case study sample.

Table 1. An Overview of Case Studies and Data Sources

Firm	Business Unit	Number of Network Resource Sets	Number of Interviews		
			Supply Chain Stage I	New Product Development Stage II	Supply Chain Stage II
F1	**IMAGE** – Medical imaging solutions	2	1	1	3
F2	**INHALER** – A portfolio of inhaler devices for key respiratory conditions	4	1	1	4
	HIVDRUG – A portfolio of active pharmaceutical ingredient (API) HIV drugs	3	1	1	2
	ORALDOSE – Oral solid dosage forms (e.g., tablets and capsules) across various disease areas	10	2	-	3
	DENTAL – A range of products in the area of dental care	7	1	1	2
F3	**CHRONIC** – A portfolio of API for uncommon chronic kidney disease	4	1	3	1
F4	**BLADES** – Rotors and stators compressor blades	6	2	1	4
	BLISK – Compressor bladed disks	2	1	2	3
F5	**TEA** – A range of tea products	3	1	2	2
	CARE – A range of home and personal care products	9	2	1	4

3.2 Data Collection

Semi-structured interviews constituted the main data source in our sample case organizations. Respondents were selected from middle and senior management levels within the supply chain and new product development functions. First, because our aim was to examine the contribution of network resources that were owned or controlled by supply network actors, regional and global supply chain directors, procurement and sourcing managers and manufacturing strategy executives constituted the primary group of interviewees. Additionally, we chose the secondary group of respondents from new product development and business intelligence/development managerial teams to ensure the views from a cross-functional group of individuals who were involved in dynamic capability activities were captured. Overall, we conducted 54 face-to-face interviews with 36 individual respondents. Each interview lasted 60–90 minutes. The data collection sources are illustrated in Table 1.

The collection of data consisted of two stages of development. In the first stage, we sought to identify the key network resources that played a role in opportunity identification and development activities of firms, as manifestations of dynamic capabilities. In this stage, we conducted at least one interview with the key gatekeeper in each business unit. In particular, the gatekeepers were asked to identify episodes in which their opportunity identification activities benefited from a technology, market opportunity or new regulation trend that had been identified by a supplier. Similarly, respondents were asked to nominate instances in which suppliers have been found to be advantageous (or disadvantageous) to the successful design or implementation of a new opportunity or change. The respondents in this stage also helped to identify and establish contact with key informants who were involved in the selected incidents (i.e., the second stage of data collection).

In the second stage, we investigated *how* the identified network resource sets contributed to the network-oriented dynamic capability activities of the firm. For each identified network resource, the respondents were first asked to elaborate on the attributes of the contributory resources (e.g., technology, knowledge, equipment) as well as the actor owning or controlling them. Specifically, this stage involved a general examination of the key contributors in terms of their products or services, location, size, ownership structure, main capabilities, and their relationship with the firm. In this stage, we further asked the respondents to provide contextual information about the opportunity identification or development incidents. Specifically, building on Helfat et al.'s (2007) two yardsticks of calibrating the performance of dynamic capabilities, the respondents were asked questions about the role that the resource played in the efficiency and effectiveness of the firm's processes that underpinned these opportunity identification or development activities. For instance, we asked the respondents the following questions: "How did the new technology that was developed by supplier X contribute to the success of the new product on the market (i.e., the effectiveness)? How new is this technology, relative to competing technologies (i.e., the effectiveness)? How did involving supplier X in the development of the new manufacturing technology facilitate (impede) your design activities (i.e., the efficiency)? How beneficial or disadvantageous were their contributions (e.g., easier, faster, less expensive design; the efficiency)?" The gathered background information in stage one provided us with a preliminary understanding of the opportunity identification/development incident and further enabled us to provoke the respondents to provide evidence when discussing the attributes of network resources.

3.3 Data Analysis

The data collected were recorded, transcribed verbatim, and imported into NVivo 10. The data analysis began by preparing individual case study narrative reports for each

opportunity identification or development incident in which network resources were involved. The within-case study specifically assisted the generation of initial attributes of network resources and also the assessment of the underlying dynamic capability processes in terms of their efficiency and effectiveness.

We commenced with a line-by-line review of individual case reports. As an attribute became apparent in the text, we assigned a code (a descriptive label) to the segments of text in which the concept was present (i.e., open coding, Strauss & Corbin, 1990). As more data were reviewed, the specifications of codes were further developed and refined to fit the data. Specifically, the text segments assigned to the same code were constantly compared to ensure that they reflected the same attribute (Glaser & Strauss, 1967). We continued the process of coding until no new categories emerged (Eisenhardt, 1989). Ultimately, we identified eight categories of attributes for network resources. Similarly, we followed an open-coding procedure for the analysis of the underlying dynamic capability processes in each case. For these processes, however, we had a preliminary organizing framework for the codes (Miles & Huberman, 1994) by which multiple segments of data were linked to efficiency and effectiveness of sensing, seizing or transforming processes.

We then conducted the process of generating higher-order codes (Strauss & Corbin, 1990). Specifically, we repeated this process three times, in which we dichotomized the identified network resource attributes based on three dimensions (i.e., intrinsic vs. extrinsic, active vs. latent, and unilateral vs. multilateral). The generated open and higher-order codes are detailed in the findings section (see Table 3).

The data analysis persisted with a cross-case analysis to identify similar themes that were consistently supported across the cases (Eisenhardt & Graebner, 2007). We used our core constructs of network resource attributes as well as the efficiency and effectiveness of dynamic capability routines as the key variables to compare findings across cases.

Specifically, we used theoretical coding to explore how the generated open codes (network resource attributes) and higher-order dimensions were related to sub-clusters of dynamic capabilities (i.e., sensing, seizing and transforming) (Glaser, 1978). Using cross-coding in the form of matrices, the individual codes were related to one another in explaining how network resource attributes individually and collectively affect the sensing, seizing and transforming processes of the focal firm. The summary analysis is presented in the Appendix.

To ensure quality and rigor, we used several precautionary strategies. First, the factual accuracy of the accounts (e.g., description of network resources, incidents etc.) is achieved by the availability of informants' verbatim accounts (i.e., tape recordings and transcripts of interviews) (Johnson, 1997). Additionally, in order to ensure that respondents' viewpoints and experiences are accurately understood and interpreted by the researchers (i.e., interpretive validity), the extracted narratives have been shared with the respondents from whom the data were originally obtained to enable them to review these and provide feedback (i.e., member checking, Guba & Lincoln, 1989). The use of multiple data collection methods (i.e., documentation and semi-structured interviews) assisted with the triangulation of data (Yin, 2003). In particular, we emphasized the attributes that were confirmed by multiple respondents. Finally, an audit was conducted by a second coder in order to ensure that research findings, interpretations and conclusions are completely supported by the data (Guba, 1981).

4. FINDINGS

This section outlines and discusses the key observations that emerged from the case study analysis. First, we describe our research context; specifically, an overview of each business unit and the network resource sets that have been accessed or utilized in the network-oriented dynamic capability activities of each unit is provided. We then report on the identified attributes of these network resources. Finally, we illustrate the effects of network

resource attributes and their associated dimensions on firms' sensing, seizing and transforming capabilities.

4.1 Research Context

Our research context consists of 10 business units from five multinational firms. A summary of the activities and network resources of each business unit is provided in turn below. The network resource sets that have been accessed or utilized by each of these business units as well as the network actor who owned or controlled these resources are summarized in Table 2. Additionally, for each network resource set, a brief description of the network-oriented dynamic capability routines in which these resources played a role is provided.

Table 2. Network Resource Sets

Case	Network Resource Sets	Network Resource Owner	Dynamic Capability Manifestations
IMAGE-1	Insight into the customers' usage of imaging machines	Manufacturing supplier	The design of a new diagnostic imaging machine
IMAGE-2	Logistic services	Logistic supplier	The launch of a product in a new market
INHALER-1	The idea of developing a training whistle for respiratory inhaler devices to inform the patient of the dosage taken	Device contract manufacturer	The development of a new inhaler device
INHALER-2	The idea of developing a bespoke resin to resolve noise and actuation issues relating to inhaler devices	Resin supplier	The development of a new once-daily inhaler device
INHALER-3	Research lab including equipment and research staff	Partner university	
INHALER-4	Sensor system design and production capabilities	Plastic molding supplier	
HIVDRUG-1	Manufacturing processes	API supplier	The development of a low-cost HIV drug
HIVDRUG-2	The lack of collaborative routines	API supplier	Reconfiguration of the supply chain to reduce the western footprint
HIVDRUG-3	Joint manufacturing processes	European contract manufacturer	
ORALDOSE-1	Knowledge of local regulations	Dose form contract manufacturer	The launch of a conventional drug to a new market
ORALDOSE-2	The idea of adopting hot melt extrusion processes	Dose form contract manufacturer	The development of extended release tablets
ORALDOSE-3	The idea of adopting tablet-in-tablet technology	Dose form contract manufacturer	The development of tablet-in-tablet dose forms

Case	Network Resource Sets	Network Resource Owner	Dynamic Capability Manifestations
ORALDOSE-4	The idea of adopting micronization technology	Equipment supplier	The development of second generation drugs with improved solubility through reduced size of particles in drug substances in which the active pharmaceutical ingredient (API) is not very soluble
ORALDOSE-5	The lack of capability to meet the quality standard of a new dose form	Dose form contract manufacturer	
ORALDOSE-6	Capabilities in formulating alternatives to pork-derived gelatins	Gelatin supplier	The design of a new capsule dose form
ORALDOSE-7	Continuous kit manufacturing capabilities	Equipment suppliers	The adoption of continuous manufacturing as an alternative to batch manufacturing
ORALDOSE-8	Production capacity	Equipment supplier	
ORALDOSE-9	Capability in small-scale equipment for continuous manufacturing	Equipment supplier	
ORALDOSE-10	Production capacity	Packaging supplier	The adoption of a new packaging
DENTAL-1	Material development processes	Toothbrush contract manufacturer	The design of a new toothbrush
DENTAL -2	Manufacturing processes	Injection molding and laminator suppliers	The design of a new toothpaste primary packaging
DENTAL-3	Manufacturing processes	Cap and shoulder supplier	
DENTAL-4	Knowledge of machinery capabilities and their constraints	Cap and shoulder supplier	
DENTAL-5	Design capabilities	Board, film and carton suppliers	The design of the new toothpaste secondary packaging
DENTAL-6	Sensory design team	Flavor supplier	The design and launch of the toothpaste product
DENTAL-7	Manufacturing processes	Silica supplier	
CHRONIC-1	Manufacturing processes	API supplier	The development of a new drug for chronic kidney diseases
CHRONIC-2	The lack of liquidity	Phenylpropanolamine supplier	The adoption of continuous manufacturing as an alternative method to batch processing
CHRONIC-3	Manufacturing equipment	API supplier	
CHRONIC-4	Financial assets	Equipment supplier	
BLADE-1	The idea of automated manufacturing processes	Machining supplier	The improvement of manufacturing processes
BLADE-2	Experts, technologies and capabilities	Manufacturing technology suppliers	The adoption of a near net shape manufacturing technology (i.e., metal injection molding) to reduce the number of process stages, minimize cost and overcome complex design challenges
BLADE-3	Design capabilities and production processes	Forging and machining suppliers	
BLADE-4	Joint production facilities	Forging supplier	

Case	Network Resource Sets	Network Resource Owner	Dynamic Capability Manifestations
BLADE-5	The lack of experience with the new technology	Forging supplier	
BLADE-6	Financial assets	Manufacturing technology suppliers	
BLISK-1	Manufacturing experience with the new technology	Manufacturing technology suppliers	The adoption of a single component bladed disk (Blisk) instead of conventional blades and rotor disks in large engines
BLISK-2	Joint routines with the focal firm over long-term collaboration	Contract manufacturer	Reconfiguration of the supply chain to increase low-cost country footprints
TEA-1	R&D experts and facilities	Tea processing supplier	The modification of tea processing, to allow for quicker infusion
TEA-2	Experience with rotary packaging technology in another industry	Rotary machinery supplier	The adoption of a rotary tea packaging process as opposed to reciprocating packaging in order to increase packaging capacity
TEA-3	Financial assets	Rotary machinery supplier	
CARE-1	Local knowledge of customer preferences	Contract manufacturer	The introduction of the new washing powder to the local market
CARE-2	Anti-fungicide cardboard packaging technology	Cardboard packaging supplier	The design, development and launch of a new low-cost soap with a new fragrance, packaging and branding design to be introduced to a developing country market
CARE-3	Fast film and thin in micron flow wraps packaging technology	Flow wrap packaging supplier	
CARE-4	Capability in developing thin film	Substrate supplier	
CARE-5	Capabilities in developing novel fragrance solutions	Fragrance compound, perfume and colorant suppliers	
CARE-6	Production capacity	Flow wrap packaging supplier	
CARE-7	Logistic and distribution systems	Contract manufacturer	
CARE-8	The existing joint made-to-order production system	Flavor supplier	The introduction of a new low-cost toothpaste variant to a developing country market
CARE-9	Production capacity	Contract manufacturer	

IMAGE has been a market leader and innovator in medical imaging solutions for several decades. The business unit designs, manufactures and provides after-sales services for a wide range of medical imaging equipment such as X-Ray and Computed Tomography machines. IMAGE has a history of pioneering new medical imaging technologies due to its

strong design and engineering capabilities and aggressive acquisition strategy. However, when it comes to improving the existing offerings or introducing them to new markets, IMAGE tends to draw on the resources and capabilities of its high value suppliers, service providers and customers; for instance, IMAGE located a team of manufacturing engineers in hospitals to observe how the product is loaded into the machines and how it is administered by the technicians to identify what could be done to improve the product.

INHALER has been a leader in the respiratory industry for more than four decades. The business unit is involved in the design, development, and distribution of inhaler devices for key respiratory conditions such as asthma and chronic obstructive pulmonary disease. INHALER has maintained a clear evolution in developing new respiratory medicine and delivery devices. Specifically, as the drug molecule has been improved from a reliever to a controller, the drug delivery platforms have undergone significant changes to deliver medicines more consistently to the patients' lungs and improve compliance and convenience. While the medicine development largely occurs through the internal R&D units across the world, the advancement of delivery devices is heavily reliant on the supplier base providing material and mechanisms to improve the drug efficacy via novel delivery devices.

HIVDRUG is involved in the production of the active pharmaceutical ingredient (API) of HIV drugs. The produced APIs then go to the secondary manufacturing sites which convert the active drugs into products suitable for administration (e.g., tablets, capsules, etc.). The secondary stage of pharmaceutical manufacturing occurs under a separate business unit in F2 (i.e., ORALDOSE). The current challenge for HUVDRUG is to increase the developing world's access to its HIV medicine at more affordable prices and in sufficient quantities. In this regard, HIVDRUG has begun to reduce its western footprint and to increase the share of its sourcing from emerging countries. Significant investments were required by HIVDRUG to up-skill emerging country suppliers to fulfill the new cost requirements. Similarly, to

achieve cost savings, the business unit has collaborated with API suppliers to design new chemistry to telescope certain API manufacturing processes.

ORALDOSE produces and packages oral solid dose drugs in the form of tablets and capsules across various therapeutic areas including HIV, oncology and dermatology as well as the over-the-counter drugs. Through its extensive network of contract manufacturing suppliers, ORALDOSE has introduced novel manufacturing solutions and materials and these have driven significant value for the firm. For instance, the formulation and development of hot melt extrusion processes and their integration into final dosage forms or the adoption of tablet-in-tablet system has enabled ORALDOSE to develop and patent new formulations for existing drugs that exhibit improved therapeutic outcomes. Similarly, novel continuous processing machinery and ancillary products developed by many of its equipment suppliers have provided an effective experimentation platform for ORALDOSE to identify the potential of the new technology. Furthermore, the global reach of contract manufacturing and equipment suppliers has allowed ORALDOSE to take advantage of local regulatory and market opportunities.

DENTAL is involved in the design, development, distribution and marketing of toothpaste and toothbrush products. Over the past five years, the group has successfully launched a new product group (i.e., repair dental toothpaste). While the core technology behind the product was gained through an acquisition, the success of the new product offering has also been connected to a number of innovations that DENTAL introduced to primary and secondary packaging as well as the creation of innovative flavor concepts. For instance, clever primary packaging designs were developed within a forum held by DENTAL where a group of non-competing suppliers, including toolmakers, plastic injection molders, laminators and the caps and shoulder suppliers were brought together. Similarly, the toothbrush team at DENTAL has been working in close proximity with the toothbrush

manufacturers to develop a recyclable toothbrush which combines the firm's design capabilities with the manufacturers' material development and production competencies.

CHRONIC is engaged in the production of API for small volume therapeutic products used to treat uncommon chronic kidney disease. The final products are mainly delivered in the form of large tablets. While the pharmaceutical industry is dominated by batch production, CHRONIC has recently made a switch to new continuous manufacturing technology for its API production. The transition has benefited from the significant resource commitment made by equipment manufacturers to develop the continuous manufacturing capabilities desired for Pharma. However, when CHRONIC doubled the capacity for the API production by implementing continuous manufacturing, the material suppliers were not financially ready to support the high 'ramp-up' ahead of the implementation.

BLADE designs and manufactures compressor blades for civil aircraft gas turbine engines. The business unit is strategically accountable for both rotating and stationary blades which are used in sequential stages in the compressor. The production of blades largely occurs through forging and machining processes. In addition to its own forging and machining facilities, BLADE relies on a number of global forging and machining suppliers; it has established joint ventures with two of these. Specifically, in recent years, the unit has benefited from the innovative automation capabilities of these suppliers to boost its cost effectiveness and achieve flexible production. BLADE has also sought to develop and benefit from near net shape manufacturing technologies such as metal injection molding to reduce the number of process stages, minimize costs and overcome complex design challenges. However, as such capability did not exist within its existing supply base, the unit began to develop this new capability through forming new relationships with a number of technology providers.

BLISK designs and manufactures a single gas turbine engine component consisting of a rotor disk and blades. The business unit originated due to the introduction of a new engine architecture in which the conventional blades and rotor disks were replaced by these single components combining the two functions. The production of these components takes place through a partner supplier that has extensive experience in the manufacturing of these components for multiple market leader customers. In addition to the knowledge and experience gained through working with these customers, the supplier is not required to acquire regulatory approval to produce these components for BLISK. While there are several benefits in switching to the new engine architecture, the components are expensive to make; hence, BLISK has decided to transfer the production of these components to a low-cost country.

TEA provides a wide range of tea products in the form of teabags and loose tea leaves. The delivery of tea products takes place through a set of manufacturing operations including tea processing, blending and packaging. The fragmentation of supply sources as well as the consumer market mean that TEA also has to rely on a network of local and regional production partners across the world. Specifically, to ensure its innovation strategy, TEA needs to work closely with a range of production and machinery partners. For instance, the modification of tea processing, to allow for quicker infusion, was accomplished at the supplier's tea processing plant through close collaboration between operations and R&D groups at both parties. Similarly, in the implementation of a new teabag packaging design, the machinery supplier significantly invested in new production lines and machines to support the new development.

CARE develops, manufactures and markets a broad portfolio of home and personal care products including soaps, toothpastes and home cleaning products. The extensive portfolio of CARE has benefited from a number of innovations identified and developed by global raw

material and packaging suppliers in recent years. Furthermore, the local suppliers have occupied a key role in supporting CARE's market expansion strategies. For instance, to penetrate the low-cost segment of the Middle East and African markets, CARE worked closely with material and component suppliers to reduce the costs of goods. Specifically, the local suppliers' knowledge of consumer habits and the upstream supply base capabilities have made a significant contribution to the success of new local brands.

4.2 Network Resource Attributes

The analysis of cases revealed eight network resource attributes that affect the firms' network-oriented dynamic capabilities. These are defined and supported by illustrative examples from the case studies in Table 3. A comprehensive summary of the network resource attributes across our 50 network resource sets is provided in the Appendix. Our process of generating higher-order codes dichotomized the identified network resource attributes based on three dimensions (intrinsic vs. extrinsic, active vs. latent, and unilateral vs. multilateral) (see Table 3). In order to highlight the differences that occur among the various attributes of network resources in a parsimonious way, we will explain each dichotomy and the underlying network resource attributes in turn within the following section.

Table 3. Network Resource Attributes

Open Codes	Higher-Order I	Higher-Order II	Higher-Order III	Illustrative Example	Supporting Cases
Rarity The extent to which a network resource is uniquely available	Intrinsic	Latent	Unilateral	ORALDOSE was approached by one of its contract manufacturing suppliers who offered the new hot melt extrusion technology, as a result of which ORALDOSE managed to produce a new tablet in tablet dose form. This enabled the provision of combination therapy for HIV, a solution not offered in the market by competitors (ORALDOSE-3).	• INHALER-1, 2 • HIVDRUG-1 • ORALDOSE-1, 2, 3, 4 • BLADE-1 • CARE-1, 2, 3

Open Codes	Higher-Order I	Higher-Order II	Higher-Order III	Illustrative Example	Supporting Cases
Utility The extent to which a network resource creates functionality	Extrinsic	Latent	Unilateral	In launching a new soap product in the Middle Eastern and African markets, CARE needed to reconfigure its current global distribution network to create a new regional network of distributors. CARE benefited from the distribution network of one of its local contract manufacturers. In particular, the contract manufacturer had developed a highly-distributed network over the years to align with the fragmented trade in those markets (CARE-7).	• HIVDRUG-2 • ORALDOSE-5, 9 • CHRONIC-2 • BLADE-5 • BLISK-1 • TEA-2 • CARE-7, 9
Appropriability The extent to which a network resource is voluntarily shared with the focal firm	Intrinsic	Active	Unilateral	BLADE enjoyed successful implementation of metal injection molding. The technology provider was part of a large multinational conglomerate. In addition to the historical and political reasons that made them keen to work with BLADE, the conglomerate's massive growth agenda (to enter the gas turbine market) made it extremely proactive in making a series of investments that had not been required by BLADE (BLADE-6).	• IMAGE-2 • DENTAL-7 • CHRONIC-4 • BLADE-6 • TEA-3
Versatility The extent to which a network resource is easily re-utilized	Extrinsic	Active	Unilateral	When HIVDRUG experienced a significant change in its supply chain configuration to reduce its western footprint, one of its suppliers, which was wholly dependent on its relationship with HIVDRUG, was unable to establish a footprint in a low-cost manufacturing country and was at risk of going out of business. The existing financial rules in Europe also prevented HIVDRUG from terminating its relationship with the supplier (i.e., the lack of versatility; HIVDRUG-3).	• HIVDRUG-3 • BLADE-4 • BLISK-2 • CARE-8
Complementarity The extent to which a network resource is complementary to the focal firm's resources	Intrinsic	Latent	Multilateral	The toothbrush team at DENTAL worked very closely with a toothbrush contract manufacturer whose material development competencies was complementary to DENTAL's design capabilities in developing a new ecofriendly toothbrush product range (DENTAL-1).	• DENTAL-1, 3, 5

Open Codes	Higher-Order I	Higher-Order II	Higher-Order III	Illustrative Example	Supporting Cases
Usability The extent to which a network resource is easy to use	Extrinsic	Latent	Multilateral	During the design of a new sensory system for respiratory inhalers with one of its plastic molding suppliers, INHALER found it easy to engage with the partner as the way in which the supplier operated was known to the firm. Previous experience and prior knowledge of the partner's organizational structure and processes as well as technological capabilities contributed to a mutual understanding and therefore more effective communication throughout the design phase (INHALER-4).	• INHALER-4 • DENTAL-2 • CHRONIC-1 • BLADE-2
Scalability The extent to which network resources create an economy of scale	Intrinsic	Active	Multilateral	When the number of API suppliers of CHRONIC involved in the implementation of continuous processing increased to 30, the total cost of implementation of the new manufacturing technology dropped. This was mainly driven by the reduced price of continuous equipment and construction services (CHRONIC-3).	• ORALDOSE-8, 10 • CHRONIC-3 • CARE-6
Accessibility The extent to which a network resource is exposed to the focal firm	Extrinsic	Active	Multilateral	A manufacturing team from one of IMAGE's suppliers of gantry modules was located in hospitals to monitor how imaging machines are operated. Specifically, they observed and documented the behavior of technicians in operating the machines. The collected customer insights were held on a shared information system via which IMAGE could access and review the updates (IMAGE-1).	• IMAGE-1 • INHALER-3 • ORALDOSE-6, 7 • DENTAL-4, 6 • BLADE-3 • TEA-1 • CARE-4, 5

4.2.1 Intrinsic vs. extrinsic attributes

Intrinsic attributes pertain to those aspects of a network resource that inherently create benefits for the firm. The thin in micron flow wraps offered by CARE's local packaging supplier, for instance, has created a cheaper, more reliable, and faster packaging process, which on its own served as a unique differentiator in the launch of a new soap product (network resource rarity; CARE-3). In particular, a close examination of the cases revealed that the intrinsic attributes exist largely due to the characteristics of network resources (in the case of rarity, complementarity and scalability) or the behavior of actors owning or controlling them (in the case of appropriability) (see Table 3 for exemplar cases).

Extrinsic attributes, in contrast, revolve around those network resource aspects that create benefits for the firm by facilitating its existing routines (i.e., as a means to an end). For instance, through a collaborative forum held by DENTAL and a group of its non-competing suppliers, including toolmakers, injection molders, and laminators, the supplier's capabilities and constraints in terms of current machinery were exposed to DENTAL's design team (network resource accessibility; DENTAL-4). This was significant in facilitating the design of the pentagonal cap of a new toothpaste tube, as well as a new angle for the collapsibility of the shoulder. Specifically, the firm's knowledge about the suppliers and their capabilities appeared to support the early design decision-making in delineating the desired customer solution. The positive effects of extrinsic network resources on the efficiency of firms' routines appeared to generally be a consequence of the characteristics of these resources themselves (in the case of utility) or the existing collaborative interfirm routines binding the firm and network actors (in the case of accessibility, usability and versatility).

4.2.2 Active vs. latent attributes

A network resource is active when its benefit to the firm is actively realized (i.e., the realization of the benefit does not require an integration of the network resource with that of the firm). Indeed, a network resource is active when its benefit to the firm is realized at the time that it is accessed. The findings illustrated that the active benefits from accessing network resources may appear in the form of economical (in the case of scalability) or easily available assets (in the case of accessibility, appropriability and versatility). For instance, TEA benefited from significant capital investment made by a tobacco machinery supplier in the implementation of rotary machinery to replace the traditional reciprocating tea processing machines, which were limited in producing tea at a high speed (network resource appropriability; TEA-3). In fact, TEA actively benefited from the resources offered by the

supplier without dedicating its own resources. A regional supply chain director from TEA stated:

> *"I think they were quite keen ... the sales of new tobacco equipment were decreasing at the time because of all the pressure on no smoking and so on. They were under some difficulties and they had not been in the tea market before. So, they suddenly saw a whole new market potentially opening up for them. For them, it was a good development ..."*

Conversely, a network resource is latent when the realization of its benefit requires its integration with the firm's resources. Indeed, the latent benefits arising from the network resource are realized when these resources are utilized by the firm (in the case of rarity, utility, complementarity and usability). INHALER offers a case in point where the idea of developing a training whistle that could improve patients' adherence to and compliance with inhaled medications was suggested by a plastic molding supplier. Further development and experimentation were then required by INHALER toward developing a new device that could produce an audible whistle when the patient inhaled at the correct inspiratory flow rate. The proposed idea resolved a serious remaining problem identified by patient studies in the form of a new offering (network resource rarity; INHALER-1).

4.2.3 Unilateral vs. multilateral attributes

Unilateral attributes represent those aspects of a network resource that create benefits for the firm in their singular form. The analysis of cases indicated that the benefits arising from unilateral attributes, including utility, rarity, appropriability and versatility, are realized without the need for any other specific form of resource. For instance, in adopting a new process technology, BLISK benefited from a supplier's existing ready-made technological capabilities as no additional investment from the firm was needed (network resource utility; BLISK-1). According to a supply chain development executive at BLISK:

"If you are not the only one or the first one who makes the part, there is not a necessity to invest… For instance, we have identified suppliers who already make blisks for our competitor with competitive quality and price."

In contrast, multilateral attributes refer to the aspects of a network resource that create benefits in combination with resources owned or controlled by other actors (including the firm) (in the case of scalability, accessibility, complementarity and usability). For instance, when the number of API suppliers of CHRONIC that were involved in the implementation of a new manufacturing technique increased to 30 as a result of a collaborative agreement, the total cost of implementing the new manufacturing technology declined. This was predominantly driven by the reduced price of continuous equipment and construction services (network resource scalability; CHRONIC-3). Specifically, the opportunity to access economical assets for CHRONIC was only formed because of the combination of different API suppliers' demand for the new equipment.

4.2 The Effect of Network Resource Attributes on Network-Oriented Dynamic Capabilities

The cross-analysis of cases further revealed patterns of association between network resource attributes and the network-oriented dynamic capabilities of the firm (see the Appendix). Here, we elaborate on how multiple dimensions of network resources affect each sub-capability of sensing, seizing and transforming.

4.2.1 Network resources and sensing

The analysis of cases suggested that strategic opportunities such as capturing new markets, changing product portfolios, or merger and acquisition decisions are predominantly sensed internally within the firms. In other words, multiple functions and levels across the firm observe and make sense of external events and trends, and work toward achieving a mutual intention within the organization to address the identified opportunities. For example,

when asked about the newly identified opportunity to focus on off-patent drug products, the manufacturing strategy manager of INHALER explained:

> *"I think that really came from the business as a whole. So that was much more grassroots people saying why we are doing this, why it is like this. The whole organization just sort of woke up … and then, yeah, the support came from the [Senior Executive Team]."*

A handful of cases, however, illustrated the positive effects of network resources on the opportunity identification of the firms (i.e., sensing). In particular, our findings suggested that the rarity of the opportunities identified by suppliers (i.e., the extent to which it is uniquely available) positively influences the effectiveness of the firms' sensing routines (CARE-1, 2, 3, HIVDRUG-1, ORALDOSE-1, 2, 3, 4, INHALER-1, 2, BLADE-1; see the Appendix). The outcome of a sensing routine tends to be more crucial than the efficiency of the underlying routine. For instance, the performance of an R&D process is primarily evaluated on the basis of the routine's outcome (e.g., Werner & Souder, 1997). In view of this, our results indicated that sensing routines tend to benefit from network resource attributes that created a unique differentiator in the outcome of these routines. Along the same lines, the benefits of network resources appeared to remain latent until the sensed opportunity materialized. Furthermore, network resources that played a role in sensing routines mainly revolved around the knowledge about the presence of a potential opportunity, which, on its own (unilaterally), created benefits for the sensing routines of the firm. Thus, we propose the following:

> *Proposition 1: The rarity of network resources (i.e., intrinsic, unilateral and latent network resource attributes) positively affects the effectiveness of sensing routines.*

4.2.2 Network resources and seizing

Once sensed, opportunities must be seized through new products, processes or operating models. Our cases suggested that as firms move from sensing opportunities to

developing solutions (i.e., seizing), they become more outward-focused. Specifically, the analysis of cases revealed that network resources affect firms' seizing routines in two distinct ways.

First, the effectiveness of seizing routines appeared to benefit from the complementarity of network resources (DENTAL-1, 3, 5). Indeed, as the potential solutions such as new products or new processes often involve a number of interdependencies among their sub-elements (Teece, 2007), the successful design of a solution requires multiple resource sets that, in combination, could deal with the underlying design interdependencies. Further, the intrinsic benefits of these network resources (as opposed to their extrinsic effects on the firm's routines) are only realized when the developed solutions are implemented. Therefore, we propose:

> *Proposition 2: The complementarity of network resources (i.e., intrinsic, latent and multilateral network resource attributes) positively affects the effectiveness of seizing routines.*

Second, it has been found that the efficiency of seizing routines benefits from the accessibility and usability of network resources (see the Appendix for exemplar cases). The cases in point suggested that the network resources that are easily accessible for the firm due to the existing collaborative interfirm routines (DENTAL-4, ORALDOSE-6, 7, CARE-4, 5, BLADE-3, TEA-1), shared systems (IMAGE-1) or the geographical proximity of the two parties (INHALER-3, DENTAL-6) positively facilitate the coordination and communications required throughout the design interactions. Similarly, the firm's understanding of the network actor's way of working originating from previous experience and prior knowledge (i.e., usability; DENTAL-2, INHALER-4, CHRONIC-1, BLADE-2) created more efficient communication and engagement throughout the design phase. Indeed, the efficient communication and complementarity recognition (as microfoundations of seizing routines;

Teece, 2007) require a set of network resources that in combination with the firm's resources could create benefits (e.g., the suppliers' capabilities known to the firm in the case of usability or the geographical proximity between the firm and network actors in the case of accessibility). Thus, we propose:

Proposition 3: The accessibility and usability of network resources (i.e., extrinsic and multilateral network resource attributes) positively affect the efficiency of seizing routines.

4.2.3 Network resources and transforming

The analysis of cases revealed that network resources play a crucial role in the implementation of the seized opportunities (i.e., transforming capabilities). In particular, network resources appeared to have a positive impact on both the effectiveness and the efficiency of transforming routines.

The results illustrated that due to an economy of scale, combining multiple network resource sets provides competitive inputs that positively affect the implementation routines (i.e., scalability; ORALDOSE-8, CARE-6, 10, and CHRONIC-3). Similarly, the transforming routines appeared to benefit from network resources that have been willingly shared by the suppliers that own or control them (i.e., appropriability; BLADE-6, IMAGE-2, CHRONIC-4, TEA-3, INHALER-5, DENTAL-7). Indeed, as the success of the transforming endeavors largely relies on the acquisition and integration of resources (Dixon, Meyer & Day, 2014; Jantunen, Ellonen, & Johansson, 2012), the active resource allocation from multiple network actors, consequently eliminating a costly or delayed integration of resources, enables an effective implementation of the seized opportunity. Hence, we propose:

Proposition 4: The scalability and appropriability of network resources (intrinsic and active network resource attributes) positively affect the effectiveness of transforming routines.

Further, the results showed that network resources create utility for firms' transforming routines by providing ready-made capabilities and resources, thereby avoiding the need for the development of new resources (ORALDOSE-5, 9, CARE-7, 9, BLADE-5, BLISK-1, CHRONIC-2, TEA-2, HIVDRUG-2). Similarly, firms appeared to benefit from network resources in their transforming activities where, in creating new resource combinations, the efforts required from the firm to divest these previously accessed or utilized network resources were limited (i.e., versatility; BLADE-4, BLISK-2, CARE-8, HIVDRUG-3). In both cases, the benefits arising from network resources were shaped as they reduced the need for further investment and mobilization by the firm. Therefore, we propose:

Proposition 5: The utility and versatility of network resources (extrinsic and unilateral network resource attributes) affect the efficiency of transforming routines.

5. DISCUSSION

Our work has sought to unravel the effects of network resource attributes on the network-oriented dynamic capabilities of firms. We first identified eight critical network resource attributes that drive the efficiency or effectiveness of these network-oriented dynamic capability routines. Specifically, we suggested three dimensions around which the identified attributes can be categorized. We then inductively demonstrated how the multiple dimensions of network resource attributes affect the three clusters of network-oriented dynamic capabilities (i.e., sensing, seizing and transforming). Our findings are discussed in the following section.

5.1 Network Resource Attributes

Our research extends and refines the existing conceptualizations of network resources by systematically articulating the multiple attributes of these resources. The prior work has tended to concentrate on the utility, rarity, appropriability and complementarity of network resources (e.g., Gulati et al., 2011; Wassmer and Dussauge, 2011). For instance, Wassmer

and Dussauge (2011) conceptually proposed that network resources that are supplementary or complementary to the firm's resource portfolio provide greater benefits for the firm. However, our empirical investigation of 50 network resource sets has revealed additional network resource attributes which have an influence on firms' performance (here, network-oriented dynamic capabilities) including accessibility, usability, scalability and versatility.

Our process of generating higher-order codes provided further conceptual clarity with regards to network resource attributes. In particular, the higher-order codes dichotomizing the identified network resource attributes around the three dimensions (intrinsic vs. extrinsic, active vs. latent, and unilateral vs. multilateral) helped to systematically clarify the differences and similarities of these network resource attributes (Strauss & Corbin, 1990). Thus, it became possible to distinguish between the network resource attributes that were presented as a single aspect in previous studies. For instance, while Gulati et al. (2010) have defined the appropriability of network resources as the extent to which these resources are accessible and transferable, we separated the exposure of network resources to the firm (i.e., network resource accessibility) from the extent to which they are voluntarily shared with the firm (i.e., network resource appropriability). Specifically, we argue that the conflation of their distinct impacts on the firm's performance can only be avoided by maintaining a conceptual distinction between multiple attributes.

The extant empirical investigations of network resources have also predominantly considered these resources as a one-dimensional phenomenon. Specifically, in operationalizing network resources, previous empirical studies have largely used the magnitude of network resources. For instance, Srivastava et al. (2015) investigated the number of patents as an indicator of network technological resources. Similarly, to operationalize network resources, Lavie (2007) applied the partners' level of investment in their resources (e.g., technology, marketing). Casanueva et al. (2013) also measured the

physical resources of networks using the number of planes owned by partner airliners. However, the proxies used to operationalize network resources can only reflect the rarity or utility of these resources. For instance, investment in network resources may result in the development of resources that are unique (i.e., rarity) or have specific functionalities (i.e., utility). Similarly, as a proxy for technological network resources, the number of patents could demonstrate the extent to which network resources are uniquely available (i.e., rarity).

We suggest that the main reason that the network resources are conceptualized through certain attributes (e.g., complementarity, rarity and utility) or operationalized as a one-dimensional concept lies in the way these resources are defined. Previous studies have mainly considered network resources as *assets* owned or deployed by network actors (e.g., Gulati, 1999; Lavie, 2007), which resulted in a particular emphasis being placed on the properties inherently owned by these assets (e.g., Casanueva et al., 2013; Srivastava et al., 2015; Wassmer & Dussauge, 2011). Our study, however, illustrates that in addition to the inherent characteristics of these assets, the organizational routines or the behavior of actors owning and controlling network resources also determine the attributes of these resources.

The importance of organizational routines in creating new resource configurations that allow the ongoing generation of sustainable competitive advantage has been acknowledged by previous research (e.g., Dierickx & Cool, 1989; Williamson, 1999). Consistently, our results suggest that the organizational routines that are jointly developed by network actors and the firm shape the usability of network resources. In particular, through these routines, firms learn about network resources and thus can easily utilize them within their network-oriented dynamic capability routines. Furthermore, in addition to the structure of routines that are used by network actors (i.e., the ostensive aspects of routines), the behavior of actors toward network resources in terms of the actual enactment of routines (by specific people, at specific times and in specific places; i.e., the performative aspects of routines) shapes the

benefits or drawbacks that can be gained from these network resources (Feldman & Pentland, 2003); for example, the appropriability of network resources can be associated with the positive behavior of network actors in voluntarily sharing their resources with the firm. Consequently, to capture network actors' routines or their behavior, we suggest that the definition of network resources should be expanded to *the capacity of network actors in creating strategic benefits for the firm.*

5.2 Network Resource Attributes and Network-Oriented Dynamic Capabilities

In examining network-oriented dynamic capabilities, the extant literature has predominantly focused on identifying their underlying routines and the impact they have on firms' performance (e.g., Kale & Singh, 2007; Mitrega & Pfajfar, 2015). For instance, Mitrega and Pfajfar (2015) have characterized network-oriented dynamic capabilities in terms of relationship initiation, partner development and relationship ending routines; they further documented the effects of the identified routines on the total value that a firm receives from its suppliers. Nonetheless, these studies lack explanations regarding the antecedents of these network-oriented dynamic capabilities. Our study advances the understanding of these antecedents by demonstrating how different attributes of network resources may influence the network-oriented dynamic capabilities. In particular, our research explains how these multiple attributes are related to the efficiency and effectiveness of sensing, seizing, and transforming capabilities (see Figure 4).

Furthermore, prior network resource literature investigating the impact of network resources on firms' performance (e.g., Casanueva et al., 2013; Gulati, 1999; Lavie, 2006) does not explain how these resources might influence firms' ability to alter the way in which they currently operate within dynamic environments (i.e., dynamic capabilities). Recently, Srivastava et al. (2015) documented the effect of technological network resources on a firm's technological innovation outcomes (the number of patents). However, measures such as the

number of patents provide an incomplete insight into dynamic capabilities. Our study thus sheds light on the link between network resources and firms' innovation-oriented performance by exclusively examining the effects of the attributes of these resources on the three clusters of network-oriented dynamic capabilities (i.e., sensing, seizing and transforming).

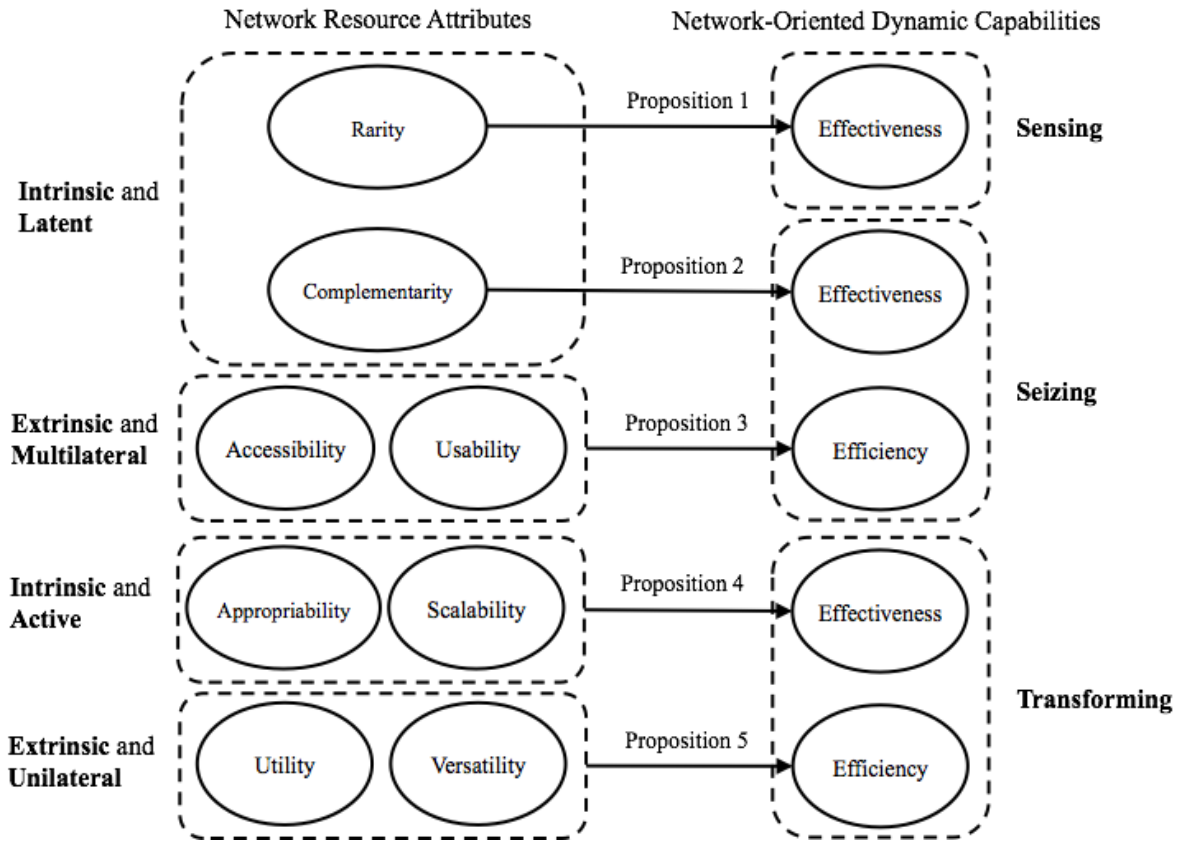

Figure 4. The Effect of Network Resource Attributes on Network-Oriented Dynamic Capabilities

Our research demonstrates that despite the firms' network-oriented dynamic capabilities, network resources can accrue attributes that influence the efficiency and effectiveness of these capabilities. Therefore, extending dynamic capability routines beyond the boundaries of firms to merely access and utilize network resources as suggested by scholars (e.g., Blyler & Coff, 2003) is insufficient in creating the ultimate advantage in a turbulent environment. Firms also need to engage with network actors in order to identify, create and further develop value creating network resources.

6. CONCLUSIONS

Our work has demonstrated how network resources influence firms' network-oriented dynamic capabilities. In particular, our findings revealed three main dimensions around which the attributes of network resources can be classified: intrinsic vs. extrinsic, active vs. latent, and unilateral vs. multilateral. These dimensions create the following eight network resource attributes: rarity, utility, appropriability, accessibility, complementarity, versatility, scalability and usability. The effects of these attributes on the three clusters of dynamic capabilities (i.e., sensing, seizing and transforming) are summarized in Table 4.

Table 4. The Effect of Network Resource Attributes on Network-Oriented Dynamic Capabilities

	Efficiency	**Effectiveness**
Sensing		Rarity
Seizing	Accessibility, Usability	Complementarity
Transforming	Utility, Versatility	Appropriability, Scalability

The findings showed that the success of the opportunity identification (i.e. the effectiveness of sensing routines) is positively influenced by the extent to which the contributing network resources are rare in the market. However, the role of network resources in driving the efficiency of sensing routines appears to be limited. Indeed, once a new idea is identified or recognized, a wide range of opportunity identification and validation activities are required within the internal boundaries of the firms to reach collective decisions regarding the opportunity. These activities require limited interactions with network resources.

Furthermore, our results suggested that the success of seizing routines relies on multiple resource sets that are only capable of addressing the interdependencies that exist among the sub-elements of the seized solutions in combination. Thus, the effectiveness of seizing routines appears to be positively influenced by the complementarity of network resources. The efficiency of seizing routines in which these complementary network

resources are utilized seems to improve through accessible and usable network resources. In fact, the coordination and communication required in interactive design processes can be efficiently managed in situations where the network actors' resources are known by (in the case of usability) or exposed to (in the case of accessibility) the firm.

Finally, our results illustrated that appropriable and scalable network resources positively affect the effectiveness of transforming routines. Specifically, the success of these transforming routines is achieved due to the access and utilization of network resources that are available through the economy of scale (in the case of scalability) or alternatively are voluntarily dedicated by network actors (in the case of appropriability). Moreover, the efficiency of transforming routines appeared to benefit from the utility and versatility of network resources. These resources eliminate the necessity for the firm to identify, evaluate and/or develop new resource combinations (in the case of utility) or to easily re-utilize or divest previously accessed resources (in the case of versatility).

6.1 Managerial Implications

Our study is an attempt to provide managers with a framework that will assist them in both *selecting* their strategic partners and *managing* the relationships with them to use the full potential of these relationships in improving their network-oriented dynamic capabilities. In particular, our study demonstrated that, in improving their network-oriented dynamic capabilities, firms should appreciate and understand the various attributes of the resource sets that a potential or existing partner may own or control.

First, while in selecting the strategic partners generally (e.g., Diestre & Rajagopalan, 2012) and suppliers particularly (e.g., Rezaei & Ortt, 2013) extant research has identified the capabilities or the attributes of these actors as an important factor, our findings suggest that managers should be aware of a set of distinct network resource attributes that exclusively promote their firm's sensing, seizing and transforming capabilities. For instance, while the

effective design of a new idea may require the network resources that are complementary to those of the firm (i.e., network resource complementarity), a firm that is concerned with the fast implementation of its new ideas also needs to focus on building relationships with those partners whose resources can be easily re-utilized (i.e., network resource versatility) in new settings to support the rapid materialization of new products, processes or business models.

Further, our findings suggest that, to improve network-oriented dynamic capabilities, managers should give exceptional attention to effectively developing relationships with those partners who own or control rare, utility-rich and complementary resources. In particular, the results of our study indicate that further investments in these relationships can bring to light additional attributes (e.g., usability, appropriability, etc.) which pertain to effective or efficient utilization of network resources. For instance, collaborative joint routines between firms and their partners may improve the usability of network resources (by increasing the firm's knowledge about the partner's resources). Similarly, close engagements and well-established relationships in which the benefits and risk are evenly shared could encourage partners to voluntarily share their resources with the firm (network resource appropriability).

6.2 Limitations and Future Research

The data collected in this study on network resources were sourced from the focal firm. This potentially generates biases in the findings of the research, as suppliers' viewpoints of the events were not taken into consideration. Recent studies have attempted to apply multiple sources of data to reduce such biases. For example, Hartmann and Herb (2015) investigated social capital in dyads and triads using multiple sources of data. It is suggested that future research investigates network resources and their effect on firms' performance by collecting data from multiple sources.

The unit of analysis in our research consists of network resource sets embedded in dyadic relationships linking the firm to the supply network actors. However, other factors that

can only be explored in triad and network settings (e.g., the structural and relational properties of network actors; Casanueva et al., 2013) may also determine the way in which network resources influence firms' performance. Thus, it is proposed that further research studies adopt triads or networks as the unit of analysis for examining network resources.

Consistent with Gulati et al. (2011), we found that network resources occasionally generate strategic benefits in combination with the firm's resources (i.e., multilateral network resources). While prior literature has examined the firm's routines by which these network resource combinations can be identified and coordinated (Tolstoy & Agndal, 2010), the generation of strategic benefits of these resources also relies on routines that are jointly developed by network actors and the firm. It is suggested that further research identifies the jointly developed routines and behavior through which network resources influence firms' performance.

Lastly, our research applies inductive reasoning to develop a theoretical model. We suggest that future research studies construct network datasets considering eight network resource attributes to generate an empirical platform for deductively examining their impact on firms' performance.

REFERENCES

Allred, C.R., Fawcett, S.E., Wallin, C., & Magnan, G.M. (2011). A dynamic collaboration capability as a source of competitive advantage. *Decision Sciences*, 42(1), 129-161.

Aragon-Correa, J.A., & Sharma, S. (2003). A contingent resource-based view of proactive corporate environmental strategy. *Academy of Management Review*, 28(1), 71-88.

Blyler, M., & Coff, R.E. (2003). Dynamic capabilities, social capital, and rent appropriation: ties that split pies. *Strategic Management Journal*, 24(7), 677-686.

Capaldo, A. (2007). Network structure and innovation: The leveraging of a dual network as a distinctive relational capability. *Strategic Management Journal*, 28(6), 585-608.

Casanueva, C., Gallego, Á., & Sancho, M. (2013). Network resources and social capital in airline alliance portfolios. *Tourism Management*, 36, 441-453.

Defee, C.C., & Fugate, B.S. (2010). Changing perspective of capabilities in the dynamic supply chain era. *The International Journal of Logistics Management*, 21(2), 180-206.

Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35(12), 1504-1511.

Diestre, L., & Rajagopalan, N. (2012). Are all "sharks" dangerous? New biotechnology ventures and partner selection in R&D alliances. *Strategic Management Journal*, 33(10), 1115-1134.

Dixon, S., Meyer, K., & Day, M. (2014). Building dynamic capabilities of adaptation and innovation: A study of micro-foundations in a Transition Economy. *Long Range Planning*, 47(4), 186-205.

Easterby-Smith, M., Lyles, M.A., & Peteraf, M.A. (2009). Dynamic capabilities: Current debates and future directions, *British Journal of Management*, 20(S1), 1-8.

Eisenhardt, K.M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532-550.

Eisenhardt, K.M., & Graebner, M.E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), 25-32.

Eisenhardt, K.M., & Martin, J.A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, 21(10-11), 1105-1121.

Feldman, M.S., & Pentland, B.T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly*, 48(1), 94-118.

Fletcher, M., & Plakoyiannaki, E. (2011). Case selection in international business: key issues and common misconceptions. In R. Marschan-Pierkkari & C. Welch. (Eds.), *Rethinking the case study in international business and management research* (pp. 171-192). Cheltenham, UK: Edward Elgar.

Forkmann, S., Henneberg, S.C., Naudé, P., & Mitrega, M. (2016). Supplier relationship management capability: a qualification and extension. *Industrial Marketing Management*, 57, 185-200.

Gao, L., & Zhao, X. (2015). Determining intra-company transfer pricing for multinational corporations, *International Journal of Production Economics*, 168, 340-350.

Glaser, B.G. (1978). *Theoretical sensitivity: Advances in the methodology of grounded theory*. Mill Valley, CA: Sociology Press.

Glaser, B.G., & Strauss, A.L. (1967). *The Discovery of grounded theory: Strategies for qualitative research*, Chicago: Aldine Publishing Company.

Guba, E.G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Technology Research and Development*, 29(2), 75-91.

Guba, E.G., & Lincoln, Y.S. (1989). *Fourth generation evaluation*. London, UK: Sage.

Gulati, R. (1999). Network location and learning: The influence of network resources

and firm capabilities on alliance formation. *Strategic Management Journal*, 20(5), 397-420.

Gulati, R., Lavie, D., & Madhavan, R. (2011). How do networks matter? The performance effects of interorganizational networks. *Research in Organizational Behavior*, 31, 207-224.

Hartmann, E., & Herb, S. (2015). Interconnectedness of actor bonds in service triads - A social capital perspective. *Industrial Marketing Management*, 44, 154-165.

Heger, T., & Boman, M. (2015). Networked foresight – The case of EIT ICT labs. *Technological Forecasting and Social Change*, 101, 147-164.

Helfat, C.E., Finkelstein, S., Mitchell, W., Peteraf, M.A., Singh, H., Teece, D.J., & Winter, S. (2007). *Dynamic capabilities: Understanding strategic change in organizations.* Malden, MA: Blackwell Publishing.

Hillebrand, B., Kok, R.A.W., & Biemans, W.G. (2001). Theory-testing using case studies: A comment on Johnston, Leach, and Liu. *Industrial Marketing Management*, 30(8), 651-657.

Huikkola, T., Ylimäki, J., & Kohtamäki, M. (2013). Joint learning in R&D collaborations and the facilitating relational practices. *Industrial Marketing Management*, 42(7), 1167-1180.

Jantunen, A., Ellonen, H.K., & Johansson, A. (2012). Beyond appearances – Do dynamic capabilities of innovative firms actually differ? *European Management Journal*, 30(2), 141-155.

Johnson, R.B. (1997). Examining the validity structure of qualitative research. *Education*, 118(2), 282-292.

Kale, P., & Singh, H. (2007). Building firm capabilities through learning: The role of the alliance learning process in alliance capability and firm level alliance success. *Strategic Management Journal*, 28(10), 981-1000.

Lampel, J., & Shamsie, J. (2003). Capabilities in motion: New organizational forms and the reshaping of the Hollywood movie industry. *Journal of Management Studies*, 40(8), 2189- 2210.

Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of the resources-based view. *Academy of Management Review*, 31(3), 638-658.

Lavie, D. (2007). Alliance portfolios and firm performance: A study of value creation and appropriation in the US software industry. *Strategic Management Journal*, 28(12), 1187-1212.

Miles, M.B., & Huberman, A.M. (1994). *Qualitative data analysis: An expanded sourcebook*. 2nd ed. Thousand Oaks, CA: Sage.

Mitrega, M., Forkmann, S., Ramos, C., & Henneberg, S.C. (2012). Networking capability in business relationships - Concept and scale development. *Industrial Marketing Management*, 41(5), 739-751.

Mitrega, M., & Pfajfar, G. (2015). Business relationship process management as company dynamic capability improving relationship portfolio. *Industrial Marketing Management*, 46, 193-203.

Möller, K., & Svahn, S. (2003). Managing strategic nets: A capability perspective. *Marketing Theory*, 3(2), 209-234.

Möller, K., & Svahn, S. (2006). Role of knowledge in value creation in business nets. *Journal of Management Studies*, 43(5), 985-1007.

Musiolik, J., Markard, J., & Hekkert, M. (2012). Networks and network resources in technological innovation systems: Towards a conceptual framework for system building. *Technological Forecasting and Social Change*, 79(6), 1032-1048.

Patton, M.Q. (2015). *Qualitative research and evaluation methods*. (4th ed.). Thousand Oaks, CA: Sage.

Rezaei, J., & Ortt, R. (2013). Supplier segmentation using fuzzy logic. *Industrial Marketing Management*, 42(4), 507-517.

Sirmon, D.G., Hitt, M.A., & Ireland, R.D. (2007). Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of Management Review*, 32(1), 273-292.

Spithoven, A., & Teirlinck, P. (2015). Internal capabilities, network resources and appropriation mechanisms as determinants of R&D outsourcing. *Research Policy*, 44(3), 711-725.

Srivastava, M.K., Gnyawali, D.R., & Hatfield, D.E. (2015). Behavioral implications of absorptive capacity: The role of technological effort and technological capability in leveraging alliance network technological resources. *Technological Forecasting and Social Change*, 92, 346-358.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Teece, D.J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350.

Tolstoy, D., & Agndal, H. (2010). Network resource combinations in the international venturing of small biotech firms. *Technovation*, 30(1), 24-36.

Vesalainen, J., & Hakala, H. (2014). Strategic capability architecture: The role of network capability. *Industrial Marketing Management*, 43(6), 938-950.

Wagner, S.M., & Bode, C. (2014). Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing, *Journal of Operations Management*, 32, 65-78.

Wassmer, U., & Dussauge, P. (2011). Value creation in alliance portfolios: The benefits and costs of network resource interdependencies. *European Management Review*, 8(1), 47-64.

Wei, L.Q., Chiang, F.F.T., & Wu, L.Z. (2012). Developing and utilizing network resources: Roles of political skill. *Journal of Management Studies*, 49(2), 381-402.

Werner, B.M. & Souder, W.E. (1997). Measuring R&D performance: state of the art. *Research Technology Management*; 40(2), 34-42.

Williamson, O.E. (1999). Strategy research: governance and competence perspectives. *Strategic Management Journal*, 20(12), 1087-1108.

Yin, R.K. (2003). *Case study research: Design and methods*. (3rd ed). Thousand Oaks, CA: Sage.

Zollo, M., & Winter, S.G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3), 339-351.

Appendix: Cases, Network Resource Attributes and Network-Oriented Dynamic Capability Outcomes

Case	Network Resource Attribute	Network Resource Attribute Illustration	Dynamic Capability Outcome	Dynamic Capability Outcome Illustration
IMAGE-1	Accessibility	Manufacturing supplier's customer insight available to the focal firm through a shared information system	Seizing – Efficiency	Efficient knowledge management in the design of the new diagnostic imaging machine
IMAGE-2	Appropriability	Supplier's decision to remove logistic services due to the change in management	Transforming – Effectiveness*	Reduced chance of a new market launch as it took six months to develop routines such as the SAP system with a new supplier
INHALER-1	Rarity	The novel idea of developing a training whistle for a new respiratory inhaler device to inform the patient of the dosage taken suggested by the device contract manufacturer	Sensing – Effectiveness	Improved patient compliance in using the inhaler device
INHALER-2	Rarity	The idea of developing a bespoke resin to resolve noise and actuation issues of a new once-daily inhaler designed to improve patients' adherence problems put forward by the resin supplier	Sensing – Effectiveness	Reduced 90% of the noise in the new respiratory device
INHALER-3	Accessibility	University researchers and research labs available to the focal firm as a result of geographical proximity to develop a new inhaler device	Seizing – Efficiency	Highly interactive and efficient collaboration in developing a new respiratory device
INHALER-4	Usability	Plastic molding supplier's capabilities, technologies and experts known to the focal firm through existing collaborative routines in developing new sensor systems for an inhaler device	Seizing – Efficiency	Efficient communication and fast design process in developing new sensor systems for the new respiratory device
ORALDOSE-1	Rarity	Knowledge of a contract manufacturer in relation to local regulations which was only available due to the manufacturer's operation in the target country	Sensing – Effectiveness	Acceptance of the product in the new market by local authorities
ORALDOSE-2	Rarity	Hot melt extrusion technology of a delivery platform contract manufacturer which was an advanced technology in the industry	Sensing – Effectiveness	Successful development of extended release tablets
ORALDOSE-3	Rarity	Tablet-in-tablet technology of a delivery platform contract manufacturer which was an advanced technology in the industry	Sensing – Effectiveness	Successful development of tablet-in-tablet dose forms providing good bioequivalence control

Case	Network Resource Attribute	Network Resource Attribute Illustration	Dynamic Capability Outcome	Dynamic Capability Outcome Illustration
ORALDOSE-4	Rarity	Micronization technology of an equipment supplier was an advanced technology in the industry	Sensing – Effectiveness	Successful development of second generation drugs with improved solubility through reduced size of particles in drug substances in which the active pharmaceutical ingredient (API) is not very soluble
ORALDOSE-5	Utility	Contract manufacturer's lack of capability to meet the quality standard of the new dose form	Transforming – Efficiency*	Delayed launch of the second generation of existing drugs
ORALDOSE-6	Accessibility	Tier-three gelatin supplier's capabilities in formulating an alternative to pork-derived gelatins available to the focal firm through existing contractual links	Seizing – Efficiency	Efficient coordination of a new capsule design by directly accessing tier-one to tier-three suppliers' capabilities
ORALDOSE-7	Accessibility	Continuous kit equipment suppliers' manufacturing capabilities available to the focal firm through existing contractual links	Seizing – Efficiency	Efficient experimentation of the new continuous kit in switching to continuous manufacturing
ORALDOSE-8	Scalability	An increase in the equipment supplier's production scale made the equipment cheaper for the focal firm	Transforming – Effectiveness	Successful adoption of continuous manufacturing
ORALDOSE-9	Utility	Equipment supplier's capability in small-scale equipment for continuous manufacturing	Transforming – Efficiency	Significantly reduced the time taken to approve commercial critical trials in switching to continuous manufacturing
ORALDOSE-10	Scalability	Multiple packaging suppliers seeking to implement the new packaging component	Transforming – Effectiveness	Successful suppliers' engagement to adopt the new drug packaging component
HIVDRUG-1	Rarity	The API supplier's novel idea of optimizing the API manufacturing processes by telescoping some of the process steps	Sensing – Effectiveness	Successful launch of a new streamlined process in which the need for isolation of material at different stages of API production was eliminated
HIVDRUG-2	Utility	The API supplier's lack of collaborative routines with large firms to implement new changes	Transforming – Efficiency*	Investment in establishing coordination mechanisms and collaborative routines to meet supply chain reconfiguration objectives
HIVDRUG-3	Versatility	The focal firm's joint-routines with a European contractor protected by European law inhibiting the removal of the contractor	Transforming – Efficiency*	Failure in divesting the supplier and non-economical operation of the supplier to meet supply chain reconfiguration objectives
DENTAL-1	Complementarity	Material development processes of a toothbrush manufacturer, complementary to the focal firm design capabilities	Seizing – Effectiveness	A wide range of new toothbrush designs

Case	Network Resource Attribute	Network Resource Attribute Illustration	Dynamic Capability Outcome	Dynamic Capability Outcome Illustration
DENTAL-2	Usability	Injection molding and laminator suppliers' internal processes and capabilities known to the focal firm as a result of existing collaborative routines	Seizing – Efficiency	Efficient coordination and management of toothpaste design activities
DENTAL-3	Complementarity	Lack of complementary knowledge of tier-three supplier's cap and shoulder manufacturing processes	Seizing – Effectiveness*	Impractical design in which limitations associated with the angle at which the shoulder is welded to the laminate in the new toothpaste design were overlooked
DENTAL-4	Accessibility	Cap and shoulder supplier machinery capabilities and their constraints available to the focal firm through a collaborative forum	Seizing – Efficiency	Fast completion of the new pentagonal cap of the toothpaste tube
DENTAL-5	Complementarity	Complementary design capabilities of the board and carton supplier, the film supplier and the focal firm	Seizing – Effectiveness	Easily implementable new toothpaste packaging design
DENTAL-6	Accessibility	Sensory design team available to the focal firm through co-location	Seizing – Efficiency	Highly interactive and efficient new toothpaste design process
DENTAL-7	Appropriability	Silica supplier's manufacturing capability not offered to the low-volume customers	Transforming – Effectiveness*	Failure to launch the new toothpaste due to the lack of the new grade of the material
CHRONIC-1	Usability	The API supplier's capabilities not known to the focal firm due to the lack of collaborative routines	Seizing – Efficiency*	Challenging communication and exchange of information in the design of the new drug
CHRONIC-2	Utility	Phenylpropanolamine supplier's lack of liquidity to mobilize new manufacturing facilities	Transforming – Efficiency*	Delayed transformation due to the slow investment in new facilities feeding continuous manufacturing
CHRONIC-3	Scalability	Multiple API suppliers seeking to implement continuous processing	Transforming – Effectiveness	Successful adoption of continuous manufacturing due to the lower cost of implementation
CHRONIC-4	Appropriability	Equipment supplier's voluntary investment in new facilities	Transforming – Effectiveness	Successful implementation of continuous manufacturing
BLADE-1	Rarity	The novel idea of automated manufacturing process for a machining supplier	Sensing – Effectiveness	Efficient manufacturing process leading to a more competitive pricing
BLADE-2	Usability	Process technology suppliers' experts, technologies and capabilities not known to the focal firm due to the lack of collaborative routines	Seizing – Efficiency*	One-and-a-half year of effort to create a collaborative design process in developing the new process technology
BLADE-3	Accessibility	Forging and machining suppliers' design capabilities and resources not available to the focal firm due to the lack of IP protection	Seizing – Efficiency*	Delayed design and development of the new process technology

Case	Network Resource Attribute	Network Resource Attribute Illustration	Dynamic Capability Outcome	Dynamic Capability Outcome Illustration
BLADE-4	Versatility	The focal firm's existing joint asset with a forging supplier inhibiting flexible re-allocation of the asset	Transforming – Efficiency*	Excess capacity for the traditional technology and non-economic transformation toward new process technology
BLADE-5	Utility	Manufacturing technology provider's lack of experience in the new technology	Transforming – Efficiency*	Delay in the implementation of the new process technology due to the establishment of collaboration routines with the supplier
BLADE-6	Appropriability	Investment in new facilities required for the new process technology as a result of the supplier growth agenda	Transforming – Effectiveness	Successful adoption of the new process technology
BLISK-1	Utility	Existing manufacturing experience with the new technology that facilitate the adoption of blisk in large engines	Transforming – Efficiency	Rapid implementation of the new process technology, as there was no need for the focal firm to seek approval for the new technology
BLISK-2	Versatility	Contract manufacturer's joint routines with the focal firm during a long-term collaboration creating complexity in the termination of the relationship	Transforming – Efficiency*	Costly divestment of supplier facilities to meet the supply chain reconfiguration objectives
TEA-1	Accessibility	Tea processing supplier's R&D capabilities and resources available to the focal firm through colocation and existing IP protection arrangement	Seizing – Efficiency	Efficient collaboration between the focal firm's and supplier's R&D teams to modify tea processing
TEA-2	Utility	Rotary machinery supplier's experience in the rotary packaging technology in another industry that facilitated the adoption of technology	Transforming – Efficiency	Efficient switch from reciprocating to rotary tea processing in order to increase packaging capacity
TEA-3	Appropriability	Investment in developing new machinery	Transforming – Effectiveness	Successful implementation of rotary tea processing in order to increase packaging capacity
CARE-1	Rarity	Local knowledge of a contract manufacturer in relation to customer preferences which was not available to the direct competitor	Sensing – Effectiveness	Acceptance of the new washing powder in the market
CARE-2	Rarity	Anti-fungicide cardboard packaging technology of a packaging supplier as a novel technology	Sensing – Effectiveness	The packaging well matched with the new soap brief (i.e., health and cleanliness)
CARE-3	Rarity	Fast film and thin in micron flow wraps packaging technology of a packaging supplier new to the industry	Sensing – Effectiveness	Cheaper, stronger and more consistent new packaging
CARE-4	Accessibility	Substrate provider's capability in developing thin film available to the focal firm through a direct contractual relationship	Seizing – Efficiency	Efficient co-design of the fast film in the new packaging process

Case	Network Resource Attribute	Network Resource Attribute Illustration	Dynamic Capability Outcome	Dynamic Capability Outcome Illustration
CARE-5	Accessibility	Fragrance compound, perfume and colorant suppliers' design capabilities available to the focal firm through existing contractual relationships	Seizing – Efficiency	Efficient interaction with suppliers (fast response to the briefs) to develop the new soap
CARE-6	Scalability	An increase in the new packaging format demand made the flow wrap production more economic	Transforming – Effectiveness	Higher chance of success in offering a low-cost soap to the market
CARE-7	Utility	The supplier's strong distribution system facilitating the launch of the new soap	Transforming – Efficiency	No need for the development of distributors for the new market
CARE-8	Versatility	The focal firm's existing joint made-to-order production system with a perfume supplier	Transforming – Efficiency	Quick switch to the new toothpaste variant as a result of low stock levels
CARE-9	Utility	Lack of economic production as a result of one-line production plant	Transforming – Efficiency*	Investment to expand the production capacity to benefit from an economy of scale in producing a new low-cost toothpaste

*Note: * indicates a negative effect*

How do network resources affect firms' network-oriented dynamic capabilities?

Alinaghian, Leila

2017-12-19

Alinaghian L, Razmdoost K. How do network resources affect firms' network-oriented dynamic capabilities? Industrial Marketing Management, Volume 71, May 2018, pp. 79-94
https://doi.org/10.1016/j.indmarman.2017.12.006