

A Relational Embeddedness Perspective on Dynamic Capabilities: A Grounded Investigation of Buyer-Supplier Routines

Abstract

Our study extends the emerging inter-firm-level theorization of dynamic capabilities by articulating how firms can develop and modify their resource bases through supplier relations. Specifically, we aim to explore how different embedded relational aspects function together or separately to induce various inter-firm routines which are presumed to underpin the buying firm's dynamic capabilities. The research design is a multiple case study involving 34 buyer-supplier dyad-level innovation events across six product groups of three multinational buying firms in the Pharmaceuticals, Aerospace, and Fast-Moving Consumer Goods sectors. Our inductive analysis suggests that the social, cognitive, and physical aspects of relational embeddedness play roles, in a cumulatively sequential fashion, in inducing three distinctive routine types—*unilateral*, *quasi-unilateral*, and *bilateral*—in buyer-supplier dyads that underpin the three clusters of dynamic capabilities—sensing, seizing, and transforming, respectively. Furthermore, our study identifies two contingencies that explain variances in the observations and inferences. We thus investigate the 'black box' of dynamic capabilities in inter-firm contexts, clarifying the roles and association of relational embeddedness and patterned activities in these relationships.

Keywords: Buyer-supplier relationship; dynamic capabilities; inter-firm routines; relational embeddedness; case studies

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1. Introduction

In today's highly changing and dynamic business environment, it is imperative that firms develop dynamic capabilities—i.e., an ability to continuously sense and seize new opportunities, and thereby extend or modify their resource bases to effectively cope with the changing business environments (Helfat et al., 2007; Teece, Pisano, & Shuen, 1997). While in the literature the dynamic capabilities were originally conceptualized as a set of deliberate and identifiable intra-firm patterned activities or *routines* (e.g., Eisenhardt & Martin, 2000), research has recently begun to recognize that such capabilities also can be developed in inter-firm contexts, beyond a single firm's boundaries (Gittell & Weiss, 2004; Möller & Svahn, 2003). That is, when firms maintain multiple relations in their business network, their continuous efforts to combine or reconfigure their resources frequently require the joint involvement of their external partners (Dyer & Hatch, 2006; Forkmann, Henneberg, & Mitrega, 2018). Specifically, in the buyer-supplier context, scholars have recognized various routines such as collaborative activities (Allred, Fawcett, Wallin, & Magnan, 2011), knowledge absorption (Sáenz, Revilla, & Knoppen, 2014) and integration (Revilla & Knoppen, 2015), business relationship management (Forkmann, Henneberg, Naudé, & Mitrega, 2016) and relational learning (Smirnova, Rebiazina, & Khomich, 2018) as patterned activities that extend individual parties' boundaries and potentially foster their dynamic capabilities.

Nonetheless, a literature review reveals that a more systematic, theoretical articulation of how inter-firm routines develop and underpin dynamic capabilities has yet to be attempted. In particular, a taxonomy of such routines based on the different roles that the involved parties play in shaping their dynamic capabilities has yet to be articulated (Schepis, Ellis, &

Purchase, 2018). For instance, the level of engagement of a buyer and supplier or the nature of the agreement binding the two parties during different stages of opportunity identification and development have remained largely unexplored. Additionally, while the literature suggests that the formation (Luo, Liu, & Xue, 2009; Wagner & Bode, 2014) and efficacy (Chen & Hung, 2014; Wang, Ye, & Tan, 2014) of inter-firm routines are highly conditioned on the specific aspects of dyadic relations (e.g., social, cognitive, and physical aspects) in which the firms are embedded, the existing research falls short of clarifying the role of embedded relational aspects in the development and/or functioning of the inter-firm routines that underpin firms' dynamic capabilities.

Therefore, this paper aims to investigate the 'black box' of dynamic capabilities within inter-firm contexts. Specifically, adopting a case-based inductive approach in buyer-supplier settings, our study explores how different embedded relational aspects function together or separately to induce various inter-firm routines, which are presumed to underpin the buying firm's dynamic capabilities (i.e., sensing, seizing, and transforming, Teece, 2007).

Our research contributes in several ways to the literature, specifically on the buyer-supplier relationship and dynamic capabilities. First, our findings extend the emerging inter-firm-level theorization of dynamic capabilities (e.g., Forkmann et al., 2016; Smirnova et al., 2018) by articulating how firms can develop their resource base and capabilities through supplier relations. Specifically, we identify various inter-firm routines and distinguish them in terms of the different levels of involvement, the roles played, and the nature of the formal arrangements entailed in each of these routines between two parties. Second, while the conditions which bring about capabilities in business relationships remain unexplored (Forkmann et al., 2018), our study elaborates the roles, both separate and joint, of different embedded dyadic aspects (social, cognitive, and physical) in enabling and/or facilitating the inter-firm routines that underpin dynamic capabilities. Finally, our findings add to our knowledge from the buyer-supplier relationship research regarding the role of relational embeddedness in developing firms' innovation and competitive advantages. Compared to the

limited interest of the past research in just linking various relational aspects to different innovation types (e.g., Kim, Choi, & Skilton, 2015) or outcomes (e.g., Carey, Lawson, & Krause, 2011; Inemek & Matthyssens, 2013; Wu & Wu, 2015), our study explores the formative role of various relational embedded aspects in buyer-supplier routines, as the generative inter-firm process for firms' dynamic capabilities.

Our paper proceeds as follows. First, we establish the theoretical background of our study. We then discuss our case-based method and analysis, followed by theory development in the form of propositions that link relational embeddedness and routines in the buyer-supplier context to better understand the buyers' dynamic capabilities. Finally, we conclude with a discussion of contributions to theory, implications for practice, limitations, and future research.

2. Theoretical background

2.1. Dynamic capabilities and the underpinning inter-firm routines

Dynamic capabilities are generally defined as a firm's ability to purposefully create, extend, or modify its resource base, an ability that is necessary to stay abreast or ahead of changes in business environments (Helfat et al., 2007). Such capabilities are further viewed as inherently entrepreneurial (Teece, 2012) and are higher-order, in that they operate to change, update and better utilize the resources and capabilities that underpin the firm's ongoing operations (Helfat & Winter, 2011).

The prevalent view of the extant literature takes the view that dynamic capabilities are largely based on patterned organizational activities or *routines* (Eisenhardt & Martin, 2000; Zollo & Winter, 2002). Specifically, the organizational routines considered to underpin dynamic capabilities can be defined as "learned and stable patterns of collective activities" (Zollo & Winter, 2002, p.340) that guide the evolution of a firm's resource configuration (Helfat et al., 2007). In theorizing such routines, scholars have also considered patterned organizational activities or processes that take place internally to identify and utilize

opportunities (Di Stefano, Peteraf, & Verona, 2014). In this vein, Teece (2007) describes dynamic capabilities as a firm's capacity to continuously *sense*, *seize*, and *transform* opportunities quickly and proficiently.

Scholars now increasingly recognize that these patterned activities often extend beyond a single firm's boundaries to involve external partners with different resource sets (Forkmann et al., 2018). For instance, some recent studies in buyer-supplier settings have illustrated how firms carry out various routines involving suppliers to update or develop their own capabilities, such as routines to absorb relevant knowledge from suppliers (Brandon-Jones & Knoppen, 2018; Ettlie & Pavlou, 2006) or to manage these relations to their advantage (Forkmann et al., 2016; Mitrega, Forkmann, Zaefarian, & Henneberg, 2017; Mitrega & Pfajfar, 2015). The research has largely addressed how firms orchestrate their internal efforts to obtain value from their external relationships (Alinaghian & Razmdoost, 2018). However, recent work has observed that firms also update their abilities through *joint* activities with external partners, such as mutual learning routines (Huikkola, Ylimäki, & Kohtamäki, 2013), knowledge integration routines (joint sense-making/decision making) (Revilla & Knoppen, 2015), or coordination/synchronization routines (Ettlie & Pavlou, 2006).

Notwithstanding this increasing interest in inter-firm routines in the research, it is still under-articulated how such routines exclusively support dynamic capabilities—i.e., how to assist in firms' identification and assessment of opportunities (sensing), mobilization of resources to formulate an effective response (seizing), and implementation of the response (transforming). While these clusters of dynamic capabilities would require different patterns or levels of inter-firm involvement, coordination or control, the literature falls short of a systematic account of inter-firm routines as the indispensable factor of firms' dynamic capabilities.

2.2. Relational embeddedness and inter-firm routines

The literature has long acknowledged the importance of contextualizing individual firms'

behavior and performance within the context of inter-firm relations (Granovetter, 1985). In particular, various aspects of dyadic relations in which firms are embedded (i.e., relational embeddedness) have been recognized for their roles in fostering or impeding specific inter-firm activities (Gulati, Lavie, & Madhavan, 2011)—such as knowledge transfer (Inkpen & Tsang, 2005), knowledge acquisition (Zhou et al., 2014), knowledge utilization (Grant & Baden-Fuller, 2004), and problem solving between firms (Uzzi, 1996).

Typically, how firms are embedded in their relations has been considered in three aspects. First, transaction cost economics points to the physical resources embedded in relationships (Williamson, 1979). Specifically, the *physical* aspect of relational embeddedness is characterized by parties' levels of resource commitment (e.g., Rowley, Behrens, & Krackhardt, 2000) and frequency/amount of interactions in the relation (e.g., McEvily & Zaheer, 1999). In the buyer-supplier context, research has suggested that such relation-specific investments stimulate inter-firm collaboration (Wu, Chen, & Chen, 2015). Specifically, the literature has identified the positive effect of relation-specific assets on knowledge sharing between buyers and suppliers (e.g., Luo et al., 2009).

The *social* aspect of relational embeddedness relates to the behaviors that partners exhibit towards each other, manifested through the trust, norms, obligations, expectations, and identification between them (Nahapiet & Ghoshal, 1998). Specifically, prior research has suggested that mutually positive attitudes and behavioral intention independently promote more regular, inter-firm collaboration between supply chain partners (Qu & Yang, 2015). The positive role of trust between buyers and supplier as an organizing principle for parties' joint sense-making and decision-making activities has been demonstrated in the literature (Revilla & Knoppen, 2015). Similarly, the positive effects of buyer-supplier trust have been shown on collaborative information sharing (both the extent of information sharing, and the quality of information shared, Chen & Hung, 2014; Wang et al., 2014).

Lastly, the cognitively embedded dyadic aspect represents the shared context in which

the relationship occurs—namely, the extent to which two parties share the same cognitive models, typically embodied in shared meaning or categorization systems (Nahapiet & Ghoshal, 1998; Simsek, Lubatkin, & Floyd, 2003). The *cognitive* aspect of relational embeddedness has been considered the key facilitator of inter-firm collaborations (Boschma, 2005), for instance, Li, Ye., & Sheu (2014) suggested that the extent to which a buyer and supplier have a shared vision is positively related with information sharing content and quality.

Therefore, in general the stream of research suggests that two partnering firms tend to institute and maintain repeated patterned inter-activities to the extent that they make an embedded relationship (e.g., Chen & Hung, 2014; Koufteros, Cheng, & Lai, 2007). Despite the presumably salient effects of embedded relational aspects on the development of inter-firm routines, the connection has remained largely a ‘black box’ in the dynamic capabilities research. Our study seeks to investigate the underlying mechanisms in the buyer-supplier context, focusing on the roles of relational embeddedness and routines between the two parties.

3. Methods

Given the limited theory and empirical evidence in the literature, we adopted an inductive theory building approach (Eisenhardt, 1989). In particular, we use qualitative multiple case studies which enable us to investigate a series of complex organizational phenomena of interest in natural settings and develop contextualized explanations for their causality (Ketokivi & Choi, 2014).

3.1. Case selection

The research design is a multiple case study involving 34 buyer-supplier dyad-level innovation events. There were two primary considerations in the selection of cases. First, we considered information-rich innovation events only (Patton, 2015), which are particularly suitable for illuminating the roles of various embedded aspects in the buyer-supplier routines

underpinning dynamic capabilities. We began by identifying ideal manufacturing firms as the buyers. Specifically, we targeted firms that had innovated, grew, and survived various environmental perturbations, to increase the likelihood that the chosen firms use or rely on external ties for the development of dynamic capabilities (Helfat et al., 2007; Smart, Bessant, & Gupta, 2007). Then, for each sampled buying firm, we tried to identify salient innovation events, in each of which a specific supplier participated. These innovation events were examined as the patterned inter-firm activities where the buyer's dynamic capabilities are nested (Helfat et al., 2007; Teece, 2007). Furthermore, in hopes of discerning concrete cross-case patterns and thus increasing the criterion validity of our study (Eisenhardt & Graebner, 2007), we included both successful and failed events, as well as those suppliers who could have potentially engaged in innovation with each buyer but did not.

Second, to gain a more generalizable understanding of the phenomena of concern, we ensured that our sample consisted of varied industrial sectors and product groups. Consequently, the final sample reflects varying degrees of environmental dynamism (i.e., slow, medium and fast) in terms of technology, regulation, and market trends (McCarthy, Lawrence, Wixted, & Gordon, 2010). Furthermore, we chose to study multiple buying divisions in each sampled firm, which embody different product configurations and value chain stages (Srai & Gregory, 2008). Buying divisions represent different buying groups, which independently engage in purchasing activities within each selected buying firm.

Applying these criteria to secondary data, we initially generated a list of 100 candidate firms, of which a dozen multinationals were first approached. Three agreed to participate. The three multinationals, as focal buying firms (hereafter, PHAR, AERO, and FMCG), represent three industrial contexts of Pharmaceuticals, Aerospace and Consumer Goods, respectively. They collectively constitute a sufficiently diverse sample and a balanced mix—across these firms, a total of six buying divisions (respiratory inhalers, solid dosage drugs, and oral healthcare in PHAR; aero engine compressors in AERO; and tea beverages and personal/home care in FMCG) constitute a sufficiently wide spectrum of research settings to

produce appreciable cross-case patterns. As shown in Table 1, abbreviations are used to indicate the different buying divisions of the respectively sampled manufacturing firms.

Table 1. Descriptions of buying firms and divisions

Buying firm	Headquarter	Revenue	Number of employees	Buying division: description	
PHAR	UK	£23b	99,000	PHAR-RESP	Respiratory drugs: A portfolio of inhalers and injectable devices for key respiratory conditions
				PHAR-SOLID	Solid dosage form drugs: A range of medicines for pediatrics, cardiovascular, HIV and over the counter drugs, which are all, delivered in form of oral solid dosage (e.g., tablets, capsules, etc.)
				PHAR-ORAL	Oral healthcare: A range of products in dental care, gum health and denture care (e.g., toothbrush, toothpaste, mouth washes, etc.)
AERO	UK	£16b	45,000	AERO-COMP	Aero engine compressor: The unit consists of rotating and stationary blades and a shaft to which the blades are attached in ring-shaped rows
FMCG	Netherlands	£48b	160,000	FMCG-BEV	Tea and beverages: Loose leaf tea, tea bag and ice tea products
				FMCG-CARE	Personal and home care: A range of soap, detergent and cleaning products

For each buying division, with the help of principal informants, we identified multiple innovation events and the associated suppliers as the units of analysis (cases). A descriptive summary of the sample cases is presented in Table 2. The principal informants were from senior management, particularly involved in procurement and supply chain operations. They were each asked to provide recent (within the last five years) records of salient innovation events that entailed a supplier's active engagement. A total of 29 innovation events and (as many) associated suppliers were identified, which constitutes the nearly full spectrum of innovation—encompassing both radical-incremental and product-process categories. Additionally, for the sake of theoretical replication (Yin, 2013), we had the informants identify any other suppliers who could have potentially collaborated on the buyers' innovation but did not. This resulted in the inclusion of an additional five suppliers. Consequently, a total of 34 unique cases of buyer-supplier dyadic interactions were examined.

Table 2. Case study sample

Buying Division	Innovation event	(Involved) Supplier
PHAR-RESP	PR1: Development of a new inhaler device into which a special type of whistle is incorporated to help the patients understand when they have achieved the correct flow rate	S1: Device contract manufacturer
	PR2: Development of a new inhaler device through which two chemically incompatible drugs can be taken concurrently via one inhaler	S2: Device contract manufacturer
	PR3: Development of a new smart inhaler using sensor technologies to detect, record and share inhaler activation	S3: Sensor systems supplier
	PR4: Development of a bespoke plastic resin for an inhaler device to reduce the device's weight and to resolve noise and actuation issues	S4: Resin supplier
	PR5: Development of a new injectable biopharmaceutical respiratory drug	S5: Biopharmaceutical raw material supplier
	PR6: Development of a new replenishment model (real-time make-to-consumption)	S6: Logistics service provider
	PR7: A potential dyad-level innovation event	S7: Active Pharmaceutical Ingredients (API) contract manufacturer
PHAR-SOLID	PS1: Development of continuous manufacturing technologies for the commercial production of active pharmaceutical ingredients	S1: Laboratory equipment supplier
	PS2: Development of a new dose form (i.e., oral granules) for a group of pediatrics drugs which came to the end of their patent life to drive down costs in competing with generic manufacturers	S2: Dosage form contract manufacturer
	PS3: Development of new reverse logistics capabilities	S3: Logistics service provider
	PS4: Development of the new tablet-into-tablet technology for combination therapy drugs (i.e., multi-layer tablet in which multiple drugs are combined)	S4: Dosage form contract manufacturer
	PS5: Development of a telescoped process for the commercial production of active pharmaceutical ingredients, where the number of process stages were reduced from 17 to 6.	S5: API contract manufacturer
PHAR-ORAL	PO1: Development of a new continuous care toothpaste product that can repair sensitive areas of the teeth	S1: Bioactive glass provider
	PO2: Development of a new tube design to easily squeeze out the toothpaste for a group of toothpaste products	S2: Primary packaging supplier
	PO3: Development of a bold secondary packaging (using Fresnel technology) for the new continuous care toothpaste products	S3: Secondary packaging supplier
	PO4: Development of new recyclable toothbrushes	S4: Toothbrush contract manufacturer
AERO-COMP	AC1: Development of the new metal injection molding manufacturing technique to replace the traditional forging processes for rotor blades	S1: Compressor airfoils forging supplier
	AC2: Development of a new high-temperature material for high-pressure aero engines compressor vanes	S2: Manufacturing technology provider
	AC3: Development of a new single component bladed disk to replace compressor blades and rotor disks in large engines	S3: Manufacturing technology provider
	AC4: Development of new additive manufacturing processing techniques for rotating compressor airfoils	S4: Manufacturing technology provider
	AC5: Automation of (hot die and isothermal) forging processes to improve quality, reduce waste and drive down cost	S5: Compressor airfoils forging supplier
	AC6: Automation of machining processes to improve quality, reduce waste and drive down cost	S6: Compressor airfoils machining supplier
	AC7: A potential dyad-level innovation event	S7: Manufacturing (sub-assembly) service provider
	AC8: A potential dyad-level innovation event	S8: Compressor airfoils forging supplier
FMCG-BEV	FB1: Development of a new tea processing method to allow quicker infusion	S1: Primary packaging supplier

Buying Division	Innovation event	(Involved) Supplier
	FB2: Development of new pyramid tea bags	S2: Primary packaging supplier
	FB3: Development of new rotary packaging machine for teabags to replace existing reciprocating machinery with limited capabilities of producing tea bags at a high speed	S3: Rotary machinery supplier
	FB4: A potential dyad-level innovation event	S4: Primary processing supplier
FMCG-CARE	FC1: Development of a new low-cost toothpaste product in direct competition with a local market	S1: Packaging supplier
	FC2: Development of a new low-cost soap product in direct competition with a local market	S2: Contract manufacturer
	FC3: A potential dyad-level innovation event	S3: Distribution service provider
	FC4: Development of concentrated washing powder	S4: Washing powder contract manufacturer
	FC5: Adoption of inkjet printing technology for the primary packaging of a new toothpaste product	S5: Packaging supplier
	FC6: Development of a new primary packaging format (laminate) for a new generation toothpaste product	S6: Packaging supplier

3.2. Data collection

At each participating firm, we conducted semi-structured interviews with the senior management members in R&D, procurement, and supply chain management. Each interview was conducted face-to-face, lasting 60-90 minutes. Besides the primary data source, we also used archives (such as assessments of product life cycle, supply strategy and supply risk strategy, and due diligence reports) within each case, which assisted with data triangulation. The data collection process proceeded in two stages over two and a half years. Table 3 provides an overview of the two-stage interview process across six buying divisions. The two stages are elaborated below in turn.

In the initial stage (Stage I), we focused on fully understanding each innovation event individually for its nature and involved dynamics, as well as the specific dyadic conditions for each buyer-supplier relation. In doing so, we employed the critical incident technique (Flanagan, 1954), whereby each respondent was asked to identify, narrate, and highlight innovation events that they had directly experienced and bore clear relevance to a new opportunity identification, design, and implementation. Specifically, the respondent was asked to recount the event's specifics in terms of context, parties, actions, and outcomes involved, which was aimed at identifying and examining any underlying buyer-supplier

routines. Furthermore, we guided the respondents in their explanation of multiple aspects of their relation with the particular supplier. The interview protocol used in this stage is presented in Appendix A.

Table 3. Interview process overview

Buying division	Number of interviews (Informant's position)		
	R&D/ NPD	Procurement and Supply chain	
		Stage I	Stage II
PHAR-RESP	1 (Medicine and process delivery lead)	2 (Director of external supply) 1 (Sourcing strategy manager) 2 (Manufacturing strategy manager) 1 (Head of tenders and distribution)	1 (Director of external supply) 1 (Manufacturing strategy manager)
PHAR-SOLID	1 (Medicine and process delivery lead)	2 (Director of external supply) 1 (Network strategy director) 1 (Global commodity manager) 1 (Director of network change)	1 (Director of external supply) 1 (Network strategy director)
PHAR-ORAL	1 (Open innovation director)	2 (Head of procurement) 1 (Global commodity manager) 1 (Manufacturing strategy manager)	1 (Head of procurement) 1 (Global commodity manager)
AERO-COMP	1 (New product introduction program manager)	2 (Executive VP supply chain development) 3 (Supply chain development manager) 2 (Contract, procurement and program manager) 2 (Engineering and technology executive)	1 (Executive VP supply chain development) 1 (Supply chain development manager)
FMCG-BEV	1 (R&D director)	2 (Regional supply chain director) 1 (Regional procurement hub manager) 2 (Manufacturing technology manager)	1 (Regional supply chain director) 1 (Regional procurement hub manager)
FMCG-CARE	1 (R&D director)	2 (Regional supply chain director) 1 (Global sourcing director) 2 (Director of manufacturing and logistics) 2 (Technical director)	1 (Global sourcing director) 1 (Director of manufacturing and logistics)

The second stage of interview (Stage II) was intended to verify and further clarify what the initial cross-case analysis of the data from Stage I revealed, especially the roles played by different relational aspects in the functioning of various buyer-supplier routines that underpin the buyer's dynamic capabilities. To that end, we held a set of interviews with a group of respondents newly selected from more senior executive roles (see Table 3). In each session, the participant was first presented with a list of pre-identified innovation events in their respective organization, along with the involved specific buying division and supplier. For each event, the participant was briefed on the preliminarily identified buyer-supplier routines and outcomes based on Stage I analysis. To clarify the roles of different relational aspects in the development of buyer-supplier routines, we asked each participant a set of 'why'

questions (such as ‘Why specifically did you involve supplier X in your experimentation activities over supplier Y?’; ‘Why do you think the prototype development activities with supplier X would have worked better than supplier Y?’). For further comparison, we also inquired about those suppliers who could have potentially collaborated on the buying firm’s innovations. Additionally, for the deviating cases (in terms of buyer-supplier routine patterns) identified through the initial analysis, we asked additional contextual questions, such as those regarding the supplier’s technological capabilities and the nature of the potential opportunity.

3.3. Data analysis

All interviews undertaken in two stages were all recorded and transcribed verbatim. After writing up each case (including both relational history and the concerned innovation event) based on the data from Stage I, we began open coding by reading each transcript word-by-word and line-by-line (Strauss & Corbin, 1990). In doing so, we assigned specific analytic dimensions to the segments of the text that exhibit explicitly different patterns of inter-firm activities—i.e., routines pertaining to different clusters (sensing, seizing, and transforming) of the buyer’s dynamic capabilities. Furthermore, in the text where the efficiency or effectiveness (or lack thereof) of these inter-firm activities was discussed, we used codes, either ‘positive’ or ‘negative.’ Additionally, to embody the various relational conditions embedded in the buyer-supplier dyad in question, codes such as trust in partner fidelity, benefit/risk sharing, socialization etc. were also created. We constantly compared the text segments with the same codes to ensure that the same conditions repeat across cases (Glaser & Strauss, 1967). This set of processes continued through all cases until no new codes emerged (Eisenhardt, 1989), ultimately yielding a total of *nine* routine categories and *seven* intrinsic relational conditions. We then proceeded to generate higher-order, more theoretical codes (axial coding, Strauss & Corbin, 1990), where we sought to connect the open coding results to some established aspects of relational embeddedness (i.e., social, cognitive, and physical) and to generate new buyer-supplier routine types (unilateral, quasi-unilateral, and bilateral). The coding process and results are illustrated in Tables 4 and 5 in the Findings

section by examples and quotes from the case studies (see Section 4.1 and 4.2).

Additionally, we explored consistent themes across cases (Eisenhardt & Graebner, 2007). Based on theoretical sorting in a matrix form (as shown in Table 6), the generated codes were woven together to show themselves how different embedded relational aspects are related, individually or collectively, to various buyer-supplier routines that pertain to the buying firm's sensing, seizing, or transforming capabilities (Glaser, 1998). The summary analysis is presented in Table 6 (see Section 4.2).

Similar to Stage I, the analysis of data collected in Stage II commenced with a line-by-line review of each transcript. In addition to verifying the initial cross-case analysis of the data from Stage I, a close examination of deviating cases in this stage revealed two contingencies for buyer-supplier routines. As a contingency became apparent in the text, we assigned a descriptive label to the segments of text in which the concept was present (i.e., open coding). The two generated contingencies are defined and illustrated by examples from the case studies in the Findings section (see Section 4.2.4).

To facilitate the entire coding process, we used NVivo 10, a qualitative data analysis tool, to which all the interview transcripts and archives were imported. It allowed us to verify the qualitative assignments of various codes and their categorizations by ascertaining their textual relationships. For further validation, an independent coder was used to assign sections of the text based on a full list of both analytic dimensions and higher-level categories, along with their full descriptions and the associated raw text. Where the overlap was low with our initial categorizations, further analysis was undertaken among the researchers to achieve a more robust set of codes and their categories.

4. Findings

This section presents the key observations and insights from our analysis. We first report on a set of buyer-supplier routines as identified in the case events as underpinning the buyers' three clusters of dynamic capabilities. We then summarily delineate the embedded relational

conditions that were found to serve as the basis for the buyer-supplier routines. Lastly, we integrate these findings, drawing on the cross-case analysis, into a theoretical framework that explains how different aspects of relational embeddedness work jointly or separately to induce various modes of buyer-supplier routines in ways that underpin buyers' dynamic capabilities. Furthermore, we reconcile some cross-case variances by identifying contingencies that cause deviations from the observed common patterns in the build-up to buyer-supplier routines.

4.1. Buyer-supplier routines

Our findings reveal a set of repetitive patterns of activities, i.e., buyer-supplier routines embedded in these relationships, which underlie the buyers' dynamic capabilities. In particular, three distinct forms of routine were identified—*unilateral*, *quasi-unilateral*, and *bilateral*—and they differ in terms of (1) the level of (voluntary) engagement, (2) type of agreement, and (3) leadership distribution between two parties. A close examination of the various innovation events in our sample demonstrates that, among the three types, unilateral routines pertain to buying firms' sensing, while the seizing and transforming are primarily supported by quasi-unilateral and bilateral routines, respectively. Below, we concisely describe each routine type and their sub-categories in turn. In Table 4, for each routine type, we present an illustrative case narrative and a set of exemplar quotes from the qualitative data.

4.1.1. Unilateral buyer-supplier routines

This type of routine refers to those activities, processes, and practices that originate in one party's boundaries but are aimed at the other party. That is, while the routine was initiated and is still steered by one party, it is intended to tap the resources held by or accessible via the other firm. As the relevant cases commonly indicate, typically no explicit inter-firm agreement is required in the relationship to frame or validate such routines.

Furthermore, four sub-categories were found for this type of routine that pertain to the buying firms' sensing.

First, *buyer-led intelligence gathering* is a buyer's repetitive deliberate attempt in the relationship to acquire information through the supplier about a new opportunity or technology trend (see Table 4 for an exemplar case and illustrative quotes). *Buyer-led experimentation* is another subcategory that involves a buyer's own iterative trials and errors to create new opportunities, in which it somehow tries to informally engage the supplier. A similar act, but on the supplier side (*supplier-led experimentation*) was also observed, where the party, in the hope of landing a new business, repeatedly engages its buyer in on-going in-house experiments. In both types, while both parties are rather "uncertain and ambiguous" about future steps, the initiating party tries to implicitly keep the other engaged in their subdued negotiations of intellect. The last subcategory of the unilateral routines is *supplier-led continuous improvement*, where the supplier carries on incremental improvements throughout the product lifetime and the effects trickle down to the buyer. Here, it should be noted that experimental routines differ from the continuous improvement type, in that the former typically relies on random discoveries or 'bleeding edge' technologies, while the latter evolves around focused targets (either a particular product or process).

Table 4. Illustration of buyer-supplier routines

Buyer-supplier routines		Illustrative cases	Illustrative quotes
Unilateral routines	Buyer-led intelligence gathering	PO3: PHAR-ORAL's innovative new toothpaste packaging was initially inspired by a packaging film supplier, S3. While ceaselessly trying to improve the design aesthetics, PHAR-ORAL's design team, somehow accidentally, came across an engaging new idea via meeting with S3, who had just now commercialized a new filming technology (called 'Fresnel lens laminate') for a different industry. Eventually, its incorporation helped the buyer successfully created a 3D effect of looking at a lifelike model of a tooth.	<p>"Just through talking to this supplier [S3], we become aware of who their customers are and what they are doing. Through going to visit them about cardboards, we are having a look around and we can see there's all the glossy 3D packaging being produced on their lines. We're just gathering intelligence." [Head of procurement, PHAR-ORAL]</p> <p>"At one of our annual suppliers' award events, we were chatting to one of our logistics providers, we found out that they're already providing reverse logistics services within the NHS Hospital Trust. We realized we could tap into these other capabilities [return and recovery services] that they use for their other customer. The whole thing snowballed from the conversation with this supplier" [Network strategy director, PHAR-SOLID]</p>
	Buyer-led experimentation	PR2: In its quest to develop a new inhaler device (intended to take two chemically incompatible drugs concurrently via one inhaler), PHAR-RESP's casually consulted a device contract manufacturer (S2) and run past them the newly designed prototype for the idea's feasibility in terms of costs, benefits, efficiency and overall commercializability.	<p>"Our R&D and manufacturing teams had been working on this technology for a long time. We'd put a lot of money and effort into that, but we needed to go up a few levels to commoditize what was in the lab. We knew there is this laboratory equipment supplier that could potentially develop its continuous lab-scale offerings. So, we put together a little working party which included our folks in R&D, our technical folks, our supply chain folks. We pull them [S1] in for a meeting to discuss our idea and to get some feedback on its feasibility and affordability" [Director of external supply, PHAR-SOLID]</p> <p>"Our internal R&D had been working on this new tea processing method for some time but there was this point where we thought we need to discuss this with this packaging supplier [S1] to see how they think the design of tea bag packaging could support this idea. We invited them in for consultation. And then there was a follow-up discussion in which we explored the idea in more in-depth." [Regional procurement hub manager, FMCG-BEV]</p>
	Supplier-led experimentation	PS4: A new "multi-layer tablet" technology enabling simultaneous administration of two drugs in a single tablet was first presented to PHAR-SOLID by a contract manufacturer, S4. PHAR-SOLID's sensing benefited from its occasional discourse on early results of S4's own experiments and casual consultations on the technology's potential for offering combination therapy to HIV patients.	<p>"They [S4] are very proactive in approaching us. They aggressively invest in a range of innovative technologies, for which they are trying to find a home. Recently, for example, they asked to come in to talk about one of their recent developments (hot melt extrusion technology). This coincided with us looking for a solution to offer combination therapy for our HIV drugs. A light bulb went on for us. So, we invited them back to explore this further, which eventually enabled us to produce tablet in tablet dose forms" [Global commodity manager, PHAR-SOLID]</p> <p>"We recently had an interesting debate with one of our suppliers of respiratory devices, they came in to see us. In that meeting, they told us about a new technology they were developing with their other partners including one that was in a completely different field to us, but they thought the capabilities might be useful, so they organized follow-up meeting and they actually brought this other company in. And this person came in and talked about what they've been doing with this supplier of ours and how things did work and didn't work." [Sourcing strategy manager, PHAR-RESP]</p>

Buyer-supplier routines		Illustrative cases	Illustrative quotes
	Supplier-led continuous improvement	AC5: AERO-COMP benefited from morsels of ideas it came across through its site visits and inspection of a forging supplier (S5) on how to improve and automate hot die and isothermal forging processes. While there is no a mandatory policy in place to do so, S5 informally and regularly engaged AERO-COMP in meaningful dialogues and various debates about potential process improvements, eventually leading to some adjustments to their contract.	<p><i>“They [S4] tended to come to us with pretty simple but interesting ideas like well your plastic gear wheel for instance, instead of them being solid gear, you also could cut it out of little bits and they still do the same job. It saves a little bit of plastic. We do a 100 million so that still significant amount of money saved. It helps the green agenda as well. They constantly come up with those sorts of innovations throughout the life of these inhalers, that’s their bread and butter” [Manufacturing strategy manager, PHAR-RESP]</i></p> <p><i>“There is a good example where an API supplier did come up with a second-generation process idea on their own. We had a 17-stage process to make an API, and they came up with a process which was only 6 stages. It’s going to cost a lot less money, it is more robust, because its less stages” [Global commodity manager, PHAR-SOLID]</i></p>
Quasi-unilateral routines	Sense making	PS1: In the effort to transition to a new manufacturing technology (continuous processing), PHAR-SOLID had spent several months trying to involve S1, a laboratory equipment supplier. Specifically, PHAR-SOLID had hosted numerous sessions over a year to explain its view of the vast untapped potential of S1’s lab-scale continuous flow process equipment for the production of rare diseases and oncology products. S1 appeared eager to gain a deeper understanding of what the application would possibly look like. In those regular meetings, they discussed the prospects of a new production system and its development, articulating the growth and innovation agenda. The involved routine proved particularly useful in reconciling their divergent views due to different knowledge bases.	<p><i>“We put together a little working group which included our folks and their [S1] people in R&D, supply chain and business development to develop the idea further. Seeing a whole new market potentially open up, they were really keen to learn more about the idea. In those sessions, we managed to influence their thoughts on where their product lines were going. They [S1] were focused on technology, but they had to understand that the technology had to be project ready, not in engineering terms but in terms of value to the patient [Director of External Supply, PHAR-SOLID]</i></p> <p><i>“What we do all the time is we look at the feasibility of the idea through follow up sessions. It could be hours, days discussing to reach a collective understanding of what the opportunity would look like. The other thing you would do in the follow up engagements is to clarify the benefit. I remember I went to his (S2’s VP of global operations) office with a pile of evidence that has been generated through our communications, told him this is how you are going to benefit from this and this is how we are in the long run.” [Executive VP supply chain development, AERO-COMP]</i></p>
	Prototyping	AC2: To develop a new high-temp aero engines compressor vane, AERO-COMP’s material and manufacturing teams showed to S2, a casting supplier the outlined drawings of the envisaged compressor parts, along with their size and shape best suited to test the new materials and casting production technology. AERO-COMP also helped multiple different functions of S2 identify and verify the right equipment (molding, furnace, etc.), machinery and processes to produce and test a prototype of the new high-temperature resistant compressor blades. Along the process, both parties became much closer to a shared understanding of what benefits and other outcomes they could possibly see.	<p><i>“They [S1] arranged for us to see what they were doing. They showed us something which was in the lab rather than in a plant, 20 times smaller. This process enabled us to correct the design faults. We ran several processes and tested multiple types of flow reactors, pumps etc. We had to reconfigure the little flow plant many times. Also, together we needed to generate long term stability data, evidence that the process is capable for the regulatory authority to review and approve” [Director of network change, PHAR-SOLID]</i></p> <p><i>“We used the earlier workshops with them [S2] to put together a request for a proposal and got them to formally tell what they could do and what did it cost by developing a prototype. They provided subsequent developments on an ongoing basis and wherever required, for example, as a result of changes in the size of the tea bags or quantity of tea in the tea bag, which later helped us to put together all the numbers” [Regional supply chain director, FMCG-BEV]</i></p>
Bilateral routines	Joint development	PR2: In developing a new inhaler device through which two chemically incompatible respiratory drugs could be taken concurrently, PHAR-RESP called on a molded plastic device supplier, S2, specifically to develop a new	<i>“We worked closely with this supplier company to develop and set up the new process at their facilities. It took us one year and a half to get to where we are. Our material and manufacturing teams were working closely with this supplier to co-develop the tools and processes. High levels of collaboration and communication were needed to combine resources. I think we worked with</i>

Buyer-supplier routines		Illustrative cases	Illustrative quotes
		injection mold tooling. The existing technologies for the production of respiratory inhalers all ran around a weld angle, which leave insufficient room to accommodate two metering chambers (which were required for the new device). Hence, a whole new assembly line was needed to be developed in one of the S2's European production facilities, where PHAR-RESP also made a significant capital investment.	<p>more 70 people from different parts of their organization" [Engineering and technology executive, AERO-COMP]</p> <p>"Our material and manufacturing teams worked closely with this casting supplier [S2] to develop a new grade of material that can operate to a higher temperature and also keeps high strength and resistance. We brought our decades of engineering and design expertise and combined them their knowledge of high temperature material development to develop these high-pressure compressor vanes" [Supply chain development manager, AERO-COMP]</p>
	Joint deployment	FB3: FMCG-BEV's development of a new rotary packaging machinery to produce teabags at a high speed simply entailed deploying and combining in new ways of its product knowledge (tea leaf) and S3's manufacturing knowledge of Tobacco rotary machinery. Although not commonly used for teabags, rotary machinery had existed for a while and begun to see immense growth in the tobacco industry, by some of the early industry pioneers, such as S3.	<p>"They [S3] well knew how to make high speed rotary machinery for tobacco industry. Tobacco rotary machinery handles very similar materials to tea. Therefore, the challenges of dynamically handling something at that speed was quite similar. We were not reinventing the wheel. What we were interested was the application, put some tea leaf into the machinery. Our technical team had to work with this supplier to work out what tea paper, what quantity could be used for the teabag." [Manufacturing technology manager, FMCG-BEV]</p> <p>"The development of the new toothpaste product needed their commitment, but the development process was rather straightforward. The existing production line was perfectly capable of producing the new product, but the supplier could not deliver on the affordability agenda (which was one of the key futures of the new toothpaste idea) due to its existing set up of only one line. Thus, we invested in capital to expand the small operation of one line to six lines so as to achieve economies of scale, they put together the equipment, but we oversaw the process" [Director of manufacturing and logistics, FMCG-CARE].</p>
	Joint divestment	AC1: AERO-COMP's development of a new metal injection molding process for compressor blades required the recovering of some of the resources from the traditional forging technology initially developed via its joint venture with a supplier, S1. To sustain the benefits of high efficiency and productivity, both parties agreed that AERO-COMP re-purposed most of the existing forging assets and other production facility. At the same time, S1 re-purposed the remaining forging equipment to target the new market of low carbon industries. These divestment actions occurred concurrently where both parties supported each other's activities by channeling relevant existing resources to facilitate the related processes.	<p>"We made significant investments in the assets of this forging supplier. We owned assets across their geographically distributed manufacturing network. When the new technology was introduced later, we needed to re-purpose our asset into the new technology that could add more value for us. We had to work very closely and carefully throughout the transition. Otherwise the adoption of the new technology would have been hindered" [Supply chain development manager, AERO-COMP]</p> <p>"When the plastic tubes were introduced and the demand for aluminum based primary packaging dried up, we had long painful discussions with this supplier. We did invest in capital for them to build plants for us. Breaking up was hard to do but they didn't have the capacity/capability to embrace the new technology and we needed to repurpose the asset to take advantage of the new market conditions [Global sourcing director, FMCG-CARE]</p>

4.1.2. *Quasi-unilateral buyer-supplier routines*

This routine type denotes such activities, processes, and practices that originate within either party's boundaries yet without formally binding the other party, while entailing its somewhat supportive and responsive engagement; that is, one party takes the lead and the other follows, whereby there are no contractual role obligations imposed but only implicit agreements between two parties. The cases show that as the prospects of benefit from such routines loom progressively stronger (i.e., from sensing to seizing), both parties grow their desire to pursue them deeper—in this case, higher levels of engagement appear to be necessary by the follower as well as a more precise assessment of the opportunity in question. Our case study identifies two forms of quasi-unilateral routines—sense making and prototyping.

Sense-making routines involve the initially passive party becoming more active in the acquisition of information regarding the opportunity that had been rather cursorily communicated and casually sought during the earlier phases (see Table 4 for an illustrative case narrative and supporting quotes). Here, the initiating party assists in the process of exchanging detailed information and its interpretation. The two parties now try to synchronize their understanding of the perceived opportunity. Another quasi-unilateral type is *prototyping*. This involves a set of activities by the initiating party to create representations or models suitable for a further evaluation of the pursued opportunity—especially for its feasibility and utility. It should be noted that, in such routines, while the follower may assist in a deeper appraisal of the opportunity, the leading party is still expected to assimilate all the information and communicate the outcomes in a clear and meaningful way back to the other party.

4.1.3. *Bilateral buyer-supplier routines*

These routines consist of more formalized activities, processes, and practices that are shaped by both parties' mutually active involvement. Our case analysis suggests that the

realization of opportunity (i.e., transforming) is typically supported by such routines that are jointly endorsed by both buyer and supplier, through their explicit, formal contractual agreement. We identified three forms of bilateral routines—joint development, joint deployment, and joint divestment.

Joint development routines involve both parties working together to mobilize their diverse resources in anticipation of creating new resources. In particular, such routines involve transforming the original properties of resources that are devoted by each party to shape a completely new form of resource (see Table 4 for an exemplar case and illustrative quotes). In contrast, *joint deployment* routines represent the activities of resource rearrangement or reconfiguration between two firms, in which the original properties of their resources remain largely preserved. That is, this second type entails simply combining or structuring two parties' existing resources in different ways to extend their original functions. Lastly, *joint divestment* routines involve parties in the relationship re-using and re-focusing part of the already tightly-coupled resources outside their relationship. Such a case was mostly observed where the two parties, facing new resource/capability requirements coupled with the existing resource constraints, needed to divest and rationalize some of the shared resources and jointly agreed to move those resources outside the relationship. Specifically, this type often involves the shedding of any of the under-used resources to help realize the pursued opportunity.

4.2. Relational embeddedness conditions requisite for buyer-supplier routines

The case analysis also revealed certain embedded relational conditions that seem requisite for the shaping and workings of various buyer-supplier routines. Specifically, we identified three sets of conditions reflecting social, cognitive, and physical embeddedness. *Socially embedded* conditions represent the relational quality and attitudes commonly perceived by both buyer and supplier. In our cases, they are manifested through *trust in partner fidelity*, *benefit/risk sharing*, and *socialization*, each of which serves as a trigger for

the initiation or execution of buyer-supplier routines. *Cognitively embedded* conditions represent a similarity between two parties in how they understand, process, and apply information within and outside their relation. Our analysis indicates two key cognitive conditions— *similar perceptions/mental models* and *cultural congruence*— that enable and promote regular activities between buyers and suppliers. *Physically embedded* conditions refer to the infrastructures accessible via the relation, in the forms of capital resources or physical systems. We identified two major conditions in this category—*relation-specific coordination systems* and *the existence of multiple simultaneous (multiplex) ties*—that facilitate buyer-supplier routines. Some verbatim quotes, as the evidence for those requisite embedded conditions and their definitions, are presented in Table 5.

Our cross-case analysis suggests that the three relational embeddedness aspects inform the buyer-supplier routines in distinct yet supplementary ways. Table 6 summarizes the results of analysis of 34 cases for the link between embedded conditions and buyer-supplier routines. Specifically, we identified two types of association. In some cases, the embedded conditions serve as the necessary conditions or *enablers*—the conditions that must be present for a given buyer-supplier routine to exist. In other cases, the embedded conditions promote either the efficiency or effectiveness of a specific buyer-supplier routine already put in place, i.e., *facilitators*. Below, we elaborate on how different sets of embedded conditions play different roles in unilateral, quasi-unilateral, and bilateral buyer-supplier routines.

Table 5. Relational embeddedness conditions

Relational embeddedness conditions		Illustrative quotes
Social	Trust in partner fidelity: The confident that the ownership and intellectual property rights of any new idea are assured within the relationship	<p><i>"We are confident that the ownership and intellectual property rights of our new ideas are protected by them [S2]" [Head of procurement, PHAR-ORAL]</i></p> <p><i>"We have complete confidence in them [S2]. I don't think they would abuse their position, by leaking the sensitive information shared in early stages of this initiative. We always try to minimize the risk of innovation leakage, but we trust them, and I think they trust us" [Global sourcing director, FMCG-CARE]</i></p>
	Benefit/risk sharing norm: The confidence that the potential benefits/risks related to any new opportunity is shared fairly within the relationship	<p><i>"We trust this supplier [S3]. From experience, we know that they always keep our best interest in mind .. we are confident that our contributions will be acknowledged or that the risks will be shared fairly between us" [Sourcing strategy manager, PHAR-RESP]</i></p> <p><i>"If we set up the relationship around the product groups as opposed to programs or projects, this would encourage them [S7] to invest in research and development. Now they gain no benefit from investing in new technologies for us" [Supply chain development manager, AERO-COMP]</i></p>
	Socialization: Informal and unintentional conversations in which parties are frequently engaged	<p><i>"We set up routine visits for audits, quality issues, sometime to resolve a contract dispute. Lots of social interactions occur during the coffee breaks, lunch breaks or evenings drinks when it's a longer visit. This is where you build relationship, I can just pick up the phone and call their [S2] VP" [Head of procurement, PHAR-ORAL]</i></p> <p><i>"Their [S3] engineering team was based here in our headquarters for some time. I used to bump into them at lunchtime and then we had a chat. These interactions helped us to learn new ideas" [Global sourcing director, FMCG-BEV].</i></p> <p><i>"I regularly go to their [S1] manufacturing facility in Bombay. The meetings are often at an Indian restaurant, we sit there for hours discussing various things, it's an ideal setting for a relaxed discussion" [Regional supply chain director, FMCG-CARE]</i></p>
Cognitive	Similar perceptions/mental models: The parties shared narratives and collective experiences	<p><i>"We know how they [S1] work, how they think, where their priorities lie... you're not having to argue with anyone over the direction you want to choose to go" [Global commodity manager, AERO-COMP]</i></p> <p><i>"We have a good understanding of each other's [S1] interests and capabilities. We've been exposed to each other's working culture" [Global commodity manager, PHAR-SOLID]</i></p> <p><i>"We've gone through a number of negotiations over the years. These previous experiences taught us a lot. We have a good knowledge and understanding of their [S1] organizational structure, processes and general attitudes" [Regional procurement hub manager, FMCG-BEV]</i></p>
	Cultural congruence: Inherent congruence between parties in terms of their value and ways of working	<p><i>"They [S6] operate very similar to us. We both have a global mindset, operating in same geographies. We have a similar decision-making culture. We [both] have been living with slow decision making as a result of corporate set up" [Global sourcing director, FMCG-CARE]</i></p> <p><i>"We both [with S2] have an entrepreneurial culture. When you have high levels of discretion, it would be difficult to work with a rule-driven and bureaucratic culture. We are both defined by our world-class engineering expertise" [Contract, procurement and program manager, AERO-COMP]</i></p>
Physical	Relation specific coordination systems: The shared infrastructures between parties in the forms of capital resources or physical systems	<p><i>"We have several joint investments in the respiratory space. In their [S2] Midlands facility, the assembly lines and the injection mold tooling are owned by us. We bought the product specific stuff, and they were responsible for buying the non-product specific stuff. They were expected to provide the fundamental equipment, the infrastructure and the buildings" [Manufacturing strategy manager, PHAR-RESP]</i></p> <p><i>"Our teams [with S3] are connected through an effective collaboration tool. It's an excellent way for diverse teams to communicate. We also use this platform for document collaboration to avoid long email trails" [Sourcing strategy manager, PHAR-RESP]</i></p>

Relational embeddedness conditions		Illustrative quotes
		<p><i>“Our information systems are integrated with theirs [S3]. We can track things, make comments, their [supplier’s] updates and responses are then integrated back” [Sourcing strategy manager, PHAR-RESP]</i></p>
	<p>Multiplexity: Resource engagement at multiple points (e.g., functions, business groups, etc.) between the two parties</p>	<p><i>“Our relationship is multi-faceted. They [S7] invest in our different engine projects. At the same time, they supply us with a specific type of compressor airfoil, which they will then assemble it into the compressor system along with the other components that they receive from us. It's a complicated relationship managed through different contracts” [Supply chain development manager, AERO-COMP]</i></p> <p><i>“This technology provider was part of a large Indian multinational conglomerate comprising over 100 operating firms in seven business sectors. We have a number of parallel agreements with them. One of our company business units have a joint venture with them. The new technology contract is a small one compared to other engagements we have with them across our different businesses” [Executive VP supply chain development, AERO-COMP]</i></p>

Table 6. Cross case analysis

Cases	Relational embeddedness			Buyer-supplier routines underpinning Dynamic capabilities					
	Social	Cognitive	Physical	Unilateral		Quasi-unilateral		Bilateral	
PR1	✓	✓	✓	Buyer-led experimentation	+	Prototyping	+	Joint deployment	+
PR2	✓	✓	✓	Buyer-led experimentation	+	Prototyping	+	Joint development	+
PR3	✓	✓	✓	Supplier-led experimentation	+	Sense making Prototyping	+	Joint deployment	+
PR4	✓	✓	×	Supplier-led continuous improvement	+	Prototyping	+	Joint development	+
PR5*	×	×	×	Supplier-led experimentation	-	Sense making	-	N/A	
PR6	✓	×	✓	Buyer-led experimentation	+	Sense making	-	N/A	
PR7	×	×	✓	N/A		N/A		N/A	
PS1	✓	✓	×	Buyer-led experimentation	+	Sense making Prototyping	+	Joint development	-
PS2	✓	×	✓	Buyer-led experimentation	+	Sense making Prototyping	-	N/A	
PS3	✓	×	×	Buyer-led intelligence gathering	+	Sense making	-	N/A	
PS4	✓	×	✓	Supplier-led experimentation	+	Sense making Prototyping	-	N/A	
PS5	✓	×	✓	Supplier-led continuous improvement	+	Sense making Prototyping	-	N/A	
PO1*	×	×	×	Buyer-led experimentation	-	Sense making	-	N/A	
PO2	✓	✓	✓	Buyer-led experimentation	+	Prototyping	+	Joint deployment	+
PO3	✓	✓	✓	Buyer-led intelligence gathering	+	Sense making Prototyping	+	Joint deployment	+
PO4	✓	✓	×	Buyer-led experimentation	+	Sense making Prototyping	+	Joint deployment	-
AC1	✓	✓	×	Buyer-led experimentation	+	Sense making	+	Joint divestment	-
AC2	✓	✓	×	Buyer-led experimentation	+	Sense making Prototyping	+	Joint development	-
AC3	✓	×	×	Buyer-led experimentation	+	Sense making Prototyping	+	N/A	
AC4*	×	×	✓	Supplier-led experimentation	-	Sense making	-	N/A	
AC5	✓	✓	✓	Supplier-led continuous improvement	+	Prototyping	+	Joint development	+

Cases	Relational embeddedness			Buyer-supplier routines underpinning Dynamic capabilities					
	Social	Cognitive	Physical	Unilateral		Quasi-unilateral		Bilateral	
AC6	✓	✓	×	Supplier-led continuous improvement	+	Prototyping	+	Joint development	-
AC7	×	✓	✓	N/A		N/A		N/A	
AC8	×	✓	×	N/A		N/A		N/A	
FB1	✓	✓	✓	Buyer-led experimentation	+	Prototyping	+	Joint deployment	+
FB2	✓	✓	✓	Buyer-led experimentation	+	Prototyping	+	Joint deployment	+
FB3	✓	✓	×	Buyer -led intelligence gathering	+	Sense making Prototyping	+	Joint deployment	-
FB4	×	✓	✓	N/A		N/A		N/A	
FC1	✓	✓	X	Buyer-led experimentation	+	Sense making Prototyping	+	Joint development	-
FC2*	×	✓	×	Buyer-led experimentation	-	Sense making Prototyping	-	Joint deployment	-
FC3	×	×	✓	N/A		N/A		N/A	
FC4	✓	×	✓	Buyer-led experimentation	+	Sense making	-	N/A	
FC5	✓	✓	✓	Buyer-led experimentation	+	Sense making	+	Joint divestment	+
FC6	✓	✓	×	Buyer-led experimentation	+	Sense making	+	Joint divestment	-

✓ / × The presence or lack of embeddedness conditions

+/- The efficiency and effectiveness of buyer-supplier routines

* Cases that deviate from the observed most common patterns

4.2.1. Roles of embedded relational aspects in unilateral buyer-supplier routines

The results demonstrate that socially embedded conditions *both* enable and facilitate the unilateral buyer-supplier routines, as a result supporting buyers' sensing. Without such conditions put in place, unilateral routines would hardly be enacted in the relation. Furthermore, even when already instituted, whether such routines function well is contingent on levels of social embeddedness.

As evidenced in many of the cases (see Table 6), a socially embedded (close and trustful) tie serves as a pre-requisite to unilateral routines between the buyer and supplier.

Specifically, across all such cases (e.g., FMCG-CARE and S4–S6) that involve unilateral routines, the results suggest, for the most part, that both parties are confident that the ownership and intellectual property rights to their ideas will be assured. For instance, the established trust in PR6 case motivated PHAR-RESP to informally engage S6 (a logistics service provider) in its internal experimentation from the early stages. Similarly, in another case (PR4), PHAR-RESP’s opportunity identification benefited from a resin supplier’s unilateral continuous improvement routines, which was made possible due to two firms’ shared feeling regarding partner fidelity and equitable benefit/risk sharing. These cases also indicate that such effects would hold regardless of the presence of either cognitive or physical embedded conditions— e.g., PHAR-RESP’s sensing benefited from two forms of unilateral routines (as noted above) even when the buyer and the supplier shared few experiences in joint projects and meaning systems (in the PR6 case) or no physical assets in the relation (in the PR4 case). Furthermore, socially embedded conditions appeared to foster already-set-in-unilateral routines, despite the absence of both common mental models and a shared physical infrastructure between parties (as attested to in the case of PS3 for buyer-led intelligence gathering and in the case of AC3 for buyer-led experimentation, for instance).

However, absent socially embedded conditions, unilateral routines would hardly set out, as demonstrated in several cases (e.g., PR7, AC7, AC8, FB4, FC3). As shown in the PR7 case, for instance, a joint venture between PHAR-RESP and S7, an Indian API contract manufacturer, represents a high equity stake for both parties (i.e., common heavy capital investments in API manufacturing and processing equipment). Nonetheless, their lack of confidence in the partner keeps both of them from engaging the other in their internal opportunity sensing activities. According to the director of external supply at PHAR-RESP:

“We are very nervous about discussing our new product ideas with this contract manufacturer (S7), because then the other generic companies will have something on the market quickly. While we have to wait for regulatory approval prior to large-scale

manufacturing, they manage to get approval from a local regulatory authority fairly quickly.”

In addition, the socially embedded conditions, when set in place, would facilitate the existing unilateral routines and thereby support the opportunity identification of the buying firm. For instance, while FMCG-BEV were engaging both a tea processing supplier (S1) and packaging supplier (S2) in its in-house experimentation (FB1, FB2), the overall process proceeded much quicker and more smoothly with S1 than with S2. The trusted S1 was invited from the very early stages to brainstorming sessions to discuss how to make tea infuse quicker, whereas it took FMCG-BEV a few months to involve S2 in their internal discussions regarding the idea of the new tea bag design. The above observations lead us to the following proposition:

Proposition 1: *In the buyer-supplier relationship context, socially embedded conditions (trust in partner fidelity, benefit/risk sharing norm, and socialization) tend to both enable and facilitate unilateral inter-firm routines in ways that support the buyer’s sensing.*

4.2.2. Roles of embedded relational aspects in quasi-unilateral buyer-supplier routines

In many cases (e.g., PR1 and PR2, in Table 6), the quasi-unilateral routines were observed even in the absence of either cognitive or physical embedded conditions. That is, this type of routine may shape up insofar as socially embedded conditions are set in place in the relation. For instance, in the AC3 case, AERO-COMP’s assurance in partner (S3) fidelity and equitable benefit/risk sharing seemed to be sufficient to drive sense making routines, even when there is a lack of both shared cognitive and physical systems between two firms. Specifically, even without an explicit formal agreement in place between them, their established trust encouraged AERO-COMP to transfer detailed information, accelerating a shared understanding of the new single component bladed disk design. In support, a supply chain development manager at AERO-COMP remarked:

“This was a kind of project that could not fly without trust. The exchange of huge amounts of [accurate] technical and cost data was essential for us to evaluate the feasibility of the idea.”

Also, S3’s confidence that whatever the outcomes from this opportunity (whether they be their benefits or risks), they will be fairly distributed, boosted the supplier’s desire for a better sense of the proposed new design by the buyer. Furthermore, in most of the cases deficient in socially embedded conditions (i.e., PR7, AC7, AC8, FB4 and FC3), the quasi-unilateral routines were non-existent or under-developed.

However, the findings indicate that the presence of cognitively embedded conditions, while not necessary in the shaping of quasi-unilateral routines, influences the efficiency and effectiveness of sense making and joint prototyping routines (i.e., seizing). For instance, in the PS2 case, in order to drive down cost and combat competition from generic copies, PHAR-SOLID was planning on revising the dose form of its pediatrics drugs. While a new oral granules form had been informally discussed with a UK-based contract drug maker (S2), no follow-up sessions were helpful in reaching common ground on a final form and the required quality standards. In particular, two parties’ misaligned knowledge bases and expectations as well as a lack of shared narratives stymied information exchange at a granular level.

In contrast, where cognitive conditions were embedded (on top of social conditions) in a relation, sense making or prototyping activities between two parties were more likely to achieve the desired results—as demonstrated in all the relevant cases (see Table 6). In our sample, when the relation features similar mental and value systems between parties (e.g., PS1), it tends to take a shorter time in opportunity evaluation and the related decision-making when compared to less culturally congruent relations (e.g., FB3, FC3). Take, for instance, the PS1 case, where S1 as part of a large conglomerate has a similar organizational culture and internal decision-making processes to PHAR-SOLID. Both firms, in evaluating any

opportunity/proposal, required formal discussion and approval by a central decision-making body, whereby a series of faceless bureaucrats and long written communications over periods of months were the norm. The similar culture and systems aligned the two firms in their timelines and expectations, enabling a smooth transition from opportunity identification (sensing) to opportunity design (seizing). Interestingly, whether or not physical conditions are present seems to have little effect on such quasi-unilateral routines. Therefore, we propose:

Proposition 2: *In the buyer-supplier relationship context, cognitively embedded conditions (similar mental models and cultural congruence) tend to facilitate quasi-unilateral inter-firm routines, in ways that support buyer's the seizing, whereby the enabling of these routines typically pre-requires socially embedded conditions in place between two parties.*

4.2.3. Roles of embedded relational aspects in bilateral buyer-supplier routines

Our case study revealed that bilateral routines were salient only when the relation has both the social and cognitive embedded conditions properly set in place (both as the prerequisites) (see Table 6 for the pertinent cases). Namely, absent mutually positive attitudes and shared meaning systems, two parties' bilateral routines of any type are hardly initiated. Take PS4 as an exemplar, where a large-scale joint project to develop a new multi-layer tablet for a group of HIV drugs was conceived between PHAR-SOLID and S4, but never undertaken. Despite the persistence of the contract manufacturer to engage the buyer in the development of the new technology, S4 failed to understand the complex internal regulatory and decision-making structures of PHAR-SOLID. Furthermore, some potential risks the buyer identified during the design phase as related to the required changes in manufacturing process were not effectively communicated to S4. Similarly, in AC7's case, even with cognitive (i.e., shared engineering acumen) and physical conditions (i.e., mutual capital investment via previous engine projects) embedded in the relation, bilateral routines between

AERO-COMP and the sub-assembly service provider (S7) were never enabled due to their lack of assurance in the fair risks/benefits sharing from any new opportunity.

It was also found that while the physically embedded conditions do not play a substantive role in the establishment of bilateral routines, such conditions, once set in place, tend to boost the efficiency or effectiveness of those routines (i.e., a facilitator). Take, for example, the PR3 case, where two mutually trusting and culturally aligned firms (PHAR-RESP and S3) also have highly-integrated information systems in the relations. Specifically, the cloud-based system connecting multiple teams (R&D, regulatory affair, quality control, and manufacturing) from both firms facilitated their joint activities to develop a new smart inhaler by enabling the timely communication of information required to keep the development on track. That is, with any physical resources tightly coupled between a buyer and supplier, their bilateral routines are more likely to run as planned and successfully, as pointedly remarked on by a sourcing strategy manager at PHAR-RESP:

“When we moved to physically develop the device, this platform significantly supported our constant interchanges. You can’t do without such systems otherwise the development process becomes very inefficient.”

Likewise, the efficiency gap between two cases (FC5 and FC6) involving FMCG-CARE’s activities to re-focus the resources shared with two of its packaging suppliers (S5 and S6) can be explained based on the presence of inter-firm physical systems. The buyer’s investment in knowledge sharing system to facilitate formal engagements with S5 in multiple different supply domains apparently aided in their joint divestment routines, whereas the lack of an information exchange system between the buyer and S6 took them several months to re-direct the shared assets toward the creation of a new packaging facility. Therefore, we offer the following proposition:

Proposition 3: *In the buyer-supplier relationship context, physically embedded conditions (relation-specific coordination systems and multiplexity) tend to facilitate*

bilateral inter-firm routines, in ways that support the buyer's transforming, whereby the enabling of these routines typically pre-requires both socially and cognitively embedded conditions in place between two parties.

4.2.4. Contingencies for buyer-supplier routines

While the socially embedded conditions appear as a necessary condition for buyer-supplier routines, we observed some exceptions (cases marked with an asterisk in Table 6), where such routines were observed even when no socially embedded conditions are set in place in the relation. Specifically, two contingencies are salient—(1) the leading party's overwhelming power advantage and (2) the apparent immediate benefits for both parties. First, a few cases indicate that even when no social conditions are embedded in the relation, the leading party was still able to initiate and carry on unilateral and quasi-unilateral routines (or even bilateral routines on the condition that cognitive conditions were present) to the extent that it exercises various forms of power to mobilize the resources held by or accessible via the other party (as in AC4 and FC2). However, we also note that without having socially embedded conditions in place, the power advantage would not guarantee that such routines would function properly in the relation. To take the example of FC2, the lack of mutually positive attitudes did not prevent FMCG-CARE from engaging the local consumer goods contract manufacturer (S2) in a series of sessions to assess the feasibility of a new low-cost soap product idea. Here, apparently, FMCG-CARE's higher relational power forced S2's consultation about the local market (i.e., local supply base capacity, local consumers' habits, and their price threshold); however, S2 did not share any information beyond that which existed through other available channels.

Furthermore, even when a buyer and supplier are socially detached from each other, apparent immediate mutual benefits provide sufficient incentives for two parties to engage in inter-firm routines (unilateral or quasi-unilateral), even sharing proprietary information (as in PO1 and PR5). Take the PO1 case as an example, where PHAR-ORAL was trying to engage

a bioactive glass supplier (S1) in a discussion for a new toothpaste product since the supplier was one of the few sources for the special tooth repair ingredient. For the supplier, the main draw was PHAR-ORAL's toothpaste production and distribution capabilities, along with its broad experience in the fragmented local markets and regulatory requirements, which they believed could open up an entirely new market. Consequently, despite the lack of socially embedded conditions in their relation, the two parties' anticipated significant benefits stimulated them to work together to craft a solid agreement (including mutually-agreed idea protection policies), taking a rough idea and plan to the successful development of a new repair toothpaste product. Therefore, we propose:

***Proposition 4:** The leading party's overwhelming power advantage and/or two parties' mutually perceived apparent immediate benefits over a given opportunity tend to weaken the role of socially embedded conditions in enabling buyer-supplier routines.*

5. Discussion and conclusions

Our inductive analysis reveals how three relational embeddedness aspects (i.e., social, cognitive and physical) can inform the unilateral, quasi-unilateral, and bilateral buyer-supplier routines that underpin buyers' dynamic capabilities. Our real-world cases suggest that these three aspects work, in sequential *and* cumulative ways, forge and execute three different types of buyer-supplier routines in ways that support the buyers' sensing, seizing, and transforming capabilities (see Figure 1). Furthermore, we identified some contingencies for the buyer-supplier embeddedness-routine argument to resolve the variance in our observations and inferences.

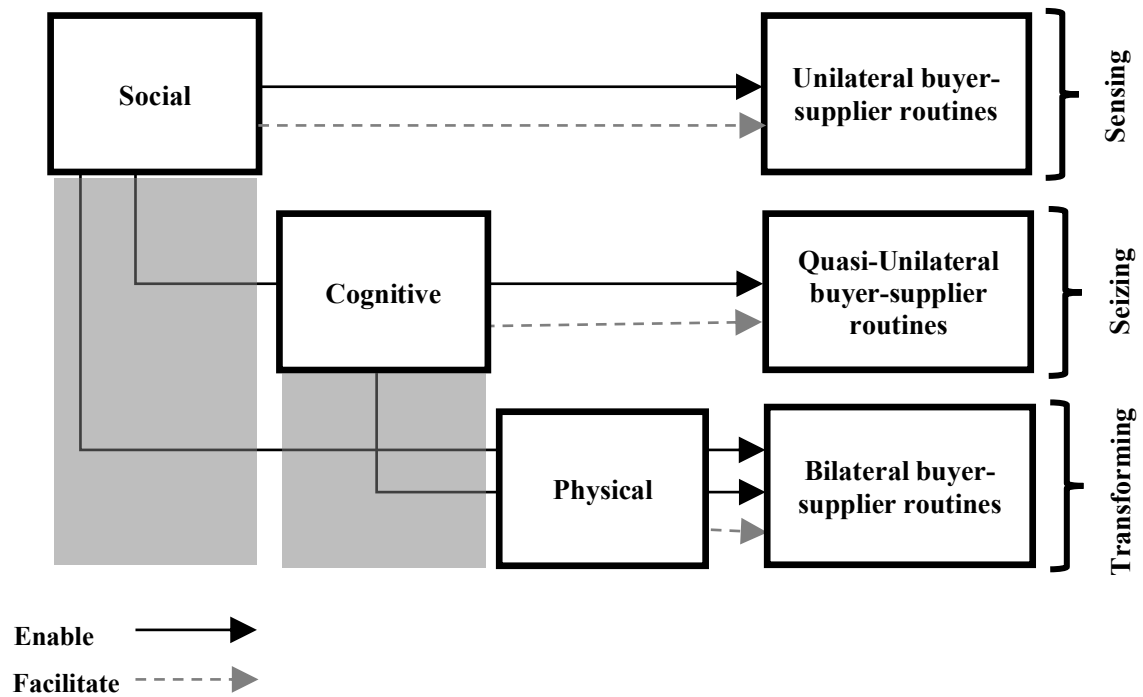


Figure 1. Cumulative model of dynamic capability development within buyer-supplier contexts

The dominant view in the extant literature is that the development of various clusters of dynamic capabilities occurs in a discrete way (Brown & Eisenhardt, 1997; Eisenhardt & Martin, 2000). That is, the three clusters of sensing, seizing and transforming are executed separately and in the order, making a linear sequence (Teece, 2007). However, our research suggests otherwise; namely, a cumulative model—the successful development of dynamic capabilities may follow a cumulative fashion. Specifically, we argue that the successful development of dynamic capabilities, particularly in dyadic contexts, is preceded by the successful deployment of different buyer-supplier routines, which require relationally embedded conditions as both the necessary and instrumental conditions.

In particular, the results indicate that the unilateral routines, as enabled and facilitated by socially embedded conditions, lay the basis for quasi-unilateral routines. Put differently, the unilateral routines, when properly operational to support the firm's sensing, set the stage for the quasi-unilateral routines that pertain to the firm's seizing. However, the presence of unilateral routines would not necessarily warrant the proper functioning of quasi-unilateral routines, which actually requires cognitive embedded conditions to be put in place as well.

Only then will the two routine types work in tandem to aid the firm in its seizing and set the stage for bilateral routines that support its transforming. Our study still warns that the presence of the former two routine types do not provide the sufficient condition for successful bilateral inter-firm routines—its prospects are still contingent on the physical conditions of embeddedness.

Therefore, in developing a tie with suppliers, a firm should place special attention on the relational quality to be shared with them, because the social aspects of the relationship are the building block of various inter-firm routines. When it comes to developing firms' dynamic capabilities, it should be also noted that the functional values of both cognitive and physical embedded conditions and their corresponding quasi-unilateral and bilateral routines may fall short should both parties not be socially embedded in the first place, since their access and mobilization of the resources will be ineffective in their relation.

5.1. Implications

Our study contributes to several research streams, especially the work on buyer-supplier relationships, dynamic capabilities, and innovation in buyer-supplier contexts. Prior research has largely examined how different relational attributes causally affect firm-level outcomes such as innovation (e.g., Inemek & Matthyssens, 2013; Lawson, Tyler, & Cousins, 2008; Wu & Wu, 2015) or inter-firm level activities such as collaboration (e.g., Chen & Hung, 2014; Zhou et al., 2014). However, there is a lack of attention paid to the underlying mechanisms linking relational factors and inter-firm capabilities (Forkmann et al., 2018). Our study takes this research one step further by identifying how different relational conditions can influence dynamic capabilities through inducing various types of buyer-supplier routines. In particular, our case study suggests that social, cognitive, and physical embedded conditions play distinct roles in a cumulatively sequential way in forming and facilitating various buyer-supplier routines.

Specifically, within dyadic settings, we identified three distinctive types of buyer-

supplier routines (unilateral, quasi-unilateral, and bilateral) as the important elements of the buyers' dynamic capabilities. Some recent work that has attempted to investigate dynamic capabilities in broader contexts (beyond single firms) (e.g., Allred et al., 2011; Huikkola et al., 2013; Mitrega et al., 2017; Smirnova et al., 2018) still falls short of incorporating interactions between firms as the key drivers of dynamic capabilities. Our study contributes to these studies by demonstrating how inter-firm routines are developed based on the role of the parties involved (i.e., levels of involvement, types of agreements, the leadership distribution between parties) to foster dynamic capabilities, and how these inter-firm routines are enabled and facilitated by the different conditions embedded in the relationship. This leads to some key practical implications.

First, buying firms should be aware that their relationships with suppliers are in fact important channels for realizing the potential of their internal unilateral routines (in terms of opportunity identification). Similarly, it is also important for buying firms to make social investments in their suppliers, so that they can voluntarily push new opportunities to their buyers or engage them in their own innovation efforts. Second, firms should understand, as an opportunity becomes a more visible target, the important role of the cognitive alignment with their partners in moving forward to more precisely assess the latent potential. Finally, commitment and leadership from both parties as well as physical inter-firm systems are vital to the successful implementation of any envisaged opportunity.

5.2. Limitations and future research

This study is limited in several ways that suggest opportunities for future research. First, future work may need a wider consideration of inter-firm routines beyond the relational context of this study primarily defined by product categories. Such an approach would present other possible contingencies, leading to a more comprehensive view of the development of buying firms' dynamic capabilities within inter-firm contexts. Second, our study focuses on the roles of embedded relational aspects and inter-firm routines in the

individual buyer-supplier contexts. However, to extend our understanding of dynamic capabilities, other (either upstream or downstream) multiple relationships in which the buyer or supplier are simultaneously engaged (i.e., the larger network of inter-firm ties in which the focal buyer-supplier tie is also embedded, Kim, Choi, Yan, & Dooley, 2011) may provide a richer context. Future research may investigate how the relational attributes of buyer-supplier triads (as the smallest unit of analysis for a network) can influence the buyer's dynamic capabilities by inducing or shaping various types of inter-firm routines at a multi-actor level. Finally, this study examined the effects of relational embeddedness on dynamic capabilities primarily from the vantage point of buying firms. Future work may investigate the effects from various different (yet related) angles to triangulate our findings and offer a more holistic view of the effects of a firm's social or network embeddedness on its dynamic capabilities.

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Appendix A. Stage I Questionnaire

Part A – Dynamic capabilities (Sensing, Seizing, Transforming)

- How was the opportunity for innovation (need for change) first realized? Who was involved (e.g., individuals, teams, functions of different organizations)? How was it communicated?
What were the potential benefits (risks) for you?
 - How would you assess the overall efficiency and effectiveness of these (opportunity identification) activities?
- How were benefits/ risks evaluated? Who was involved (e.g., individuals, teams, functions from of different organizations) and what role did each play in the assessment and decision-making? How were these activities coordinated?
 - How would you assess the overall efficiency and effectiveness of these (opportunity evaluation) activities?
- How was the innovation implemented? Who was involved and how did each party contribute to the materialization of the opportunity?
 - How would you assess the overall efficiency and effectiveness of these (opportunity implementation) activities?

Part B – Buyer-supplier relational attributes

- How would you describe your relationship with supplier X?
 - History/duration of relationship
 - Contract type
 - Shared resources (e.g., integrated information systems, production line etc.)
 - Multiple simultaneous agreements (contracts) of various types
 - Mutual trust/ respect/reciprocity (relying on each other to fulfill obligations, behave predictably, and act in good faith).
 - Shared business values, ambitions, goals, agreement on what is in the best interest of the relationship