Managing information sharing: Interorganizational communication in collaborations with competitors

Joyce Yi-Hui Lee [a], Carol Saunders [b,*], Niki Panteli [c], Tang Wang [d]

[a] *Department of Management Information Systems, National Chengchi University, Taipei, TW, Taiwan*
[b] *College of Business, University of Central Florida, Orlando, FL, United States*
[c] *School of Management, Royal Holloway University of London, Egham, UK*
[d] *Department of Management, College of Business, University of Central Florida, Orlando, FL, United States*

ABSTRACT

A key challenge for managing interorganizational relationships in high-tech sectors is to design information sharing practices for supporting cooperative activities without leaking competitive proprietary information. In this paper, we use a qualitative multi-case study to explore the role of communication in supporting cooperative information sharing while keeping competitive information concerns at bay. We study two contrasting dyads of a Taiwanese buyer and Korean supplier in the digital home entertainment industry — one which was a successful interorganizational relationship and led to further collaboration and the other which was unsuccessful and thus terminated. Drawing insights from Media Synchronicity Theory (MST), we develop a process model that explores the combination of communication media with communication content and processes for effective (ineffective) communication that promotes trust, information sharing and open communication in successful (unsuccessful) interorganizational relationships.

1. Introduction

Firms are increasingly cooperating with their competitors. But there is a tension related to cooperating — a tension that arises from deciding how much information they should share with their new partners (Bengtsson & Raza-Ullah, 2016; Gnyawali & Charleton, 2018; Luo, 2001). Clearly there is a need to collaborate in these relationships to nurture innovation, create value, leverage resources and ensure coordination (Gnyawali & Charleton, 2018; Gulati & Singh, 1998; Rehm & Goel, 2015). However, lurking in these relationships is the ever-present fear of inadvertently leaking critical proprietary information to partner-rivals that will use it opportunistically.

Admittedly, interorganizational communications promote a continuous flow of information and knowledge sharing between different parties to support cooperation (Walter, Walter, & Müller, 2015; Westergren & Holmström, 2012). Yet, it is the competitive aspects, notably *knowledge spillover* (i.e., unintentional transfer of knowledge to others outside the borders of the firm) and *information leakages* (i.e., flow of information in an uncontrollable, unwanted or harmful manner outside the borders of the firm) such as proprietary technology, product specification, and customer insights, that generate far more concern than information sharing and open communication in high-tech partnerships (Faems, Janssens, Madhok, & Van Looy, 2008). Thus, the central dilemma faced by high-tech

partners resides in balancing information protection (competition) against information sharing (cooperation) needs (Li, Tan, & Teo, 2012).

Successful interorganizational collaborations depend on open communication and economic incentives (Agarwal, Croson, & Mahoney, 2010). *Open communication* is defined as "disclosing important yet potentially self-damaging information, being accurate when communicating, and not filtering or distorting information" (Currall & Judge, 1995, p. 153–154). Poppo and Zenger (2002) suggest that open communication serves as a key factor for managing interorganizational relationships because communications provide "information about the cooperative behavior of exchange partners that may allow for informed choices of who to 'trust' and who not to trust" (p. 710). In contrast, *closed communication* is the situation when the flow of information between partners is constrained because of intentional delays, distortions/misrepresentations, or failure in delivering information.

Both trust and cooperation rely on effective communication (Davis, 2016; Vanneste & Puranam, 2010; Wu, 2008), and increasingly communication is viewed as an important means to achieve effective coordination in interorganizational partnerships (Agarwal et al., 2010; Estrada, Faems, Cruz, & Santana, 2016). Open, frequent interorganizational communications can facilitate trust development, constrain free-riding, increase the willingness to contribute to shared benefits, and ultimately prevent alliance dissolution (Paulraj, Lado, & Chen, 2008). Following these, the driving research question of this study is:

> **How do communication media, content and processes impact cooperative interorganizational relationships with competitors over time?**

Our focus is on information sharing and open communication in interorganizational partnerships where cooperation and competition coexist. We use a multiple-case study approach to examine two cases of interorganizational relationships in Asia. In one case, the two companies used multiple communication media for conveying both task and social content to support the communication processes in their trusting buyer-supplier arrangement. In the other case, along with a fear of information leakages, an overreliance on email as the primary communication medium contributed to a vicious cycle of distrust that led to the demise of the cooperation between two companies when the partners held up critical information and avoided sharing necessary and accurate information.

This study builds and extends prior studies on interorganizational partnerships and communication in three important ways. First, drawing on insights from Media Synchronicity Theory (MST), we describe how selecting communication media depending upon the communication processes to be supported can either promote effective, open communications that encourage information sharing, or distrusting, closed communications that are designed to avoid information leakages. Second, the current study focuses on both instrumental (i.e., task and goal-related) and social (i.e., interpersonal, socio-emotional, non-work-related) communication content that was exchanged between the partners that are competitors. Third, drawing from the two cases, we develop a process model using communication content, process and media to portray and understand communications in successful and unsuccessful interorganizational relationships that are simultaneously collaborative and competitive.

In what follows, we present relevant literature on interorganizational relationships in terms of trust, interorganizational communication and MST to build the conceptual foundations of our study. We then explain our research methodology, and present our research setting of two cases of buyer-supplier arrangements. Our central premise is that interorganizational communication can have a critical influence on the success or failure of interorganizational partnerships.

2. Theoretical foundations

2.1. Interorganizational cooperation and competition

Interorganizational partnerships represent a key strategic choice and capability in the high-tech sectors in which most contemporary businesses and transactions are positioned (Bengtsson & Raza-Ullah, 2016; Davis, 2016; Gnyawali & Charleton, 2018). However, in these fast, dynamic, and uncertain high-tech sectors, the tension between cooperation and competition is burgeoning, primarily due to the growing interdependence between rivals and the increasing demand for strategic flexibility and collective actions (Nalebuff & Brandenburger, 1996). Thus, competitors are increasingly motivated to cooperate due to the complex nature of the technology and products, as well as the need to obtain critical resources from external partners in order to create and provide innovative products and services. In fact, a term has been coined to reflect this widespread situation: *coopetition* is defined as "the simultaneous pursuit of cooperation and competition by firms" (Bengtsson & Raza-Ullah, 2016, p. 189).

Katila, Rosenberger, and Eisenhardt (2008) report a tension "between the need for resources from partners and the potentially damaging misappropriation of their own resources" (p. 295). Despite the tension it may create, information sharing is seen as a key requirement for firms to cooperate with one another (Mariani, 2009; Westergren & Holmström, 2012). Yet, the value of cooperative information sharing is questionable because the varied resources and knowledge to be shared among high-tech companies are usually the firms' core competencies such as proprietary technology, product specification, and customer insights; leakages of these core competencies may endanger their company's survival (Li, Liu, & Liu, 2011). This may make companies wary of cooperative arrangements (Gnyawali & Charleton, 2018), and cause conflicts among the collaborators (Soekijad & van Wendel de Joode, 2009). Further, closed communications may occur when partners withhold or distort information so that they can outperform the others in the collaboration (Smet, Langerak, & Tatikonda, 2016). Opportunistic behavior, fears of information leakage, as well as actual leakages, frequently undermine collaborations and induce their failure (Bengtsson & Raza-Ullah, 2016; Park and Russo, 1996).

2.2. Trust and interorganizational communication

Trust has been found to be a key remedy for fostering interorganizational collaboration and information sharing (Poppo and Zenger (2002), as well as promoting the continuance of the relationship (Hart & Saunders, 1997; Ring & Van de Ven, 1994). We define *trust* as "faith in the moral integrity or goodwill of others, which is produced through interpersonal interactions that lead to social-psychological bonds of mutual norms, sentiments, and friendships" (Ring & Van de Ven, 1994 p.93) whereas *distrust* is defined as the "confidence not to depend on the other party, with a feeling of relative certainty, even though negative consequences are possible" (McKnight & Chervany, 2001, p.43). Trust is especially important in maintaining resilience in the face of a competitive interorganizational relationship. This is supported by a meta-review of the interorganizational literature which finds that trust and collaboration between prior partners typically increases the likelihood of future alliances (Parmigiani & Rivera-Santos, 2011). Yet, much remains to be learned about how firms use and manage interorganizational communication to develop trust and attenuate such tension; that is, develop beneficial cooperative relationships while protecting themselves from deleterious knowledge spillovers and information leakages (Walter et al., 2015).

Communication governs the process by which companies in an interorganizational relationship are committed to working together. In technology and product development, communication defines the roles of R&D partners as they "complete work objectives in a collaborative context" (Davis, 2016, p.641). Rehm and Goel (2015) found that establishing work requirements and reviewing work planning in interorganizational collaborations may be rather complex and that deciding how and what knowledge would be exchanged ended up being a source of tension between the collaborators. To deal with the complexity and tensions, communication among many functions is important: When it comes to engineers, manufacturing, purchasing and others working together to design and build products, communications must not only convey the critical requirements to all involved, but also must be enacted to resolve problems. Considering how and how effectively communication works out is critical in making the collaboration work "on the ground floor".

Through communication, all partie can observe, develop and confirm trust and the other norms necessary for a cooperative relationship (Poppo & Zenger, 2002). Such communication is particularly useful in uncertain and dynamic environments which require intensive exchange and flexible adjustment to changes from all parties (Davis, 2016; Poppo & Zenger, 2002). Therefore, it is not be surprising that interorganizational communication has been linked to trust (Sheng, Brown, Nicholson, & Poppo, 2006), which is considered to be a "building block of cooperation" (Bouncken & Fredrich, 2012, p.6) and thus cooperative behavior in the absence of contractual requirements. Interorganizational communication can also improve information sharing, interactions between the parties, and shared values (Bouncken & Fredrich, 2012) which ultimately enhance relationship and financial performance (Poppo, Zhou, & Li, 2016). Of course, not all communication is necessarily or inevitably beneficial and it has been shown in some circumstances to amplify mistrust (Davis, 2016).

We found a handful of studies about communication and trust in interorganizational collaborations (Faems et al., 2008; Walter et al., 2015). Walter et al. (2015) argue that interorganizational communication reduces coordination costs, promotes trust and mutual support. A climate of open communication can induce employees at the operational level to share proprietary information in the name of mutuality and familiarity. Communication quality helps prevent perceptions of opportunism and mitigates the adverse effects of formalization, such as breeding distrust or increasing the likelihood of misunderstandings.

Although information sharing and open communication are considered to be key for building trust in interorganizational relationships, few studies have actually studied communication in these relationships at a more basic level. An exception is Sheng et al. (2006) who, in their study of buyer-supplier relationships, demonstrated that *communication content* (or the information or feelings that are conveyed in a communication exchange) mitigated information leakages and positively impacted relationships built on trust. They studied two types of communication content: Instrumental and Social. *Instrumental communication* is business-related content in the form of objective information about current and future tasks, goals, planning, coordinating activities among partners and local market demand; it could include task-related information such as test results, product specifications and production schedules. *Social communication* is more subjective and interpersonal in content. It involves non-work information on personal matters about outside interests, social meetings or perceptions or feelings. Social communication helps build personal ties and bonds. It "signals friendship and a level of caring beyond the task at hand" (Sheng et al., 2006, p.73) — such that friends do not "rip-off" or behave opportunistically towards one another. In addition, it may then "produce trust in the other party's goodwill, or if the goodwill preexists, it will give the parties greater flexibility to transcend their organizationally specified roles in adapting to changing circumstances" (Ring & Van de Ven, 1994, p.104). This quote suggests that opportunities for social communication can be limited by organizational boundaries, differences in organization culture, distance, roles, and other such factors which burden the channels for interacting.

2.3. Interorganizational communication and collaboration success

Several studies have been able to explore interorganizational communications in depth. In a longitudinal comparative study of two carefully-matched Industry-University new product collaborations, Estrada et al. (2016) found that dissimilarities in communication transparency, frequency and formalism likely played a role in collaboration success. In the successful collaboration, a cooperative routine and communication frequency were initially dissimilar in the two organizations. These were made more similar with weekly emails, a "red phone" to solve unanticipated problems and more frequent face-to-face (FTF) meetings. In the unsuccessful collaboration, the two organizations had similar perspectives on communication transparency and frequency, but differed about how formal meetings should be, as well as on their collaborative orientation. These differences remained unresolved until the end of the collaboration. In their qualitative study, Faems et al. (2008) described two sequential R&D collaborations between the same firms. The first collaboration relied heavily on contracts with numerous detailed clauses that were designed to safeguard from opportunistic

behaviors of the trading partner because of its "fear of unintended knowledge spillovers" (p.1060). However, when a problem developed in building the prototype, the company declined to share sensitive information that could have been used by its partner to successfully resolve the problem. In the second collaboration, the new contract stipulated that the engineering teams of both companies would work together to develop design specifications. When problems arose, technical brainstorming meetings at the operational level were organized to openly exchange information and jointly resolve the problems. While these two studies have provided rich insights about the impact of interorganizational communications on collaboration success, they have not honed in on how the choice of specific media affects communication processes that can build the trust necessary to balance the tension between cooperating and competing with one another.

2.4. Computer-mediated interorganizational communications

Increasingly in interorganizational relationships the 'how' of the communication for collaboration is through computer-mediated communications (CMC). Successful collaborations often depend on the effective use of CMC channels (Thomas, 2013), which are becoming the dominant means of communication in globally-dispersed virtual contexts (Gibson & Gibbs, 2006), especially after the COVID pandemic made CMC in the form of conferencing software such as Zoom, Webex and so on a 'must' in households and corporations alike. Though the use of CMC has been explored in new business relationships among engineering firms (Mason & Leek, 2012) and in new product designs among buyers and sellers (Thomas, 2013), only a few studies examine business communication practices in international interorganizational partnerships, the distinctive setting of our case study.

The use of CMC can provide an efficient and cost effective means to communicate in business activities, benefiting both individuals and businesses that operate across space, time and organizational boundaries (Mason & Leek, 2012). Indeed, the use of email in communication exchanges can be as effective as FTF interactions between supplier and buyer firms (Thomas, 2013). Despite these advantages, the mediated nature of communication can result in misunderstandings and conflicts, which hinder innovation (Gibson & Gibbs, 2006). Email use, for example, has been associated with increases in misunderstandings resulting from reduced informal exchanges (Gibson & Gibbs, 2006) and lack of visible social cues (Friedman & Currall, 2003). In contrast, the personal attachments demonstrated in FTF interactions afford increased communication, cooperation, and trust (Davis, 2016; Luo, 2001). Thus, effective use of CMC in combination with FTF is a pressing issue for globally-dispersed, interorganizational partners such as those which we study.

In addition to considering CMC specifically – and communication media in general – in terms of how information is shared, we also suggest focusing on communication processes; that is both communication media and communication processes are important in knowing 'how' information is shared. This is in addition to 'what' information (communication content) is shared. The combination of communication content, media and processes which form an interorganizational communication is defined as a *communication array*. A communication array is a new concept that allows us to dissect interorganizational communications in a more nuanced way in order to better understand how to increase information sharing to the degree that it can ensure collaboration success. It typically includes a set of media working together.

2.5. Media synchronicity theory and communication arrays

Communication content and media have been studied at the interorganizational level, but not, to our knowledge, communication processes. To more fully explore the 'how' of information sharing, we turn to a theory that originated in the IS discipline: Media Synchronicity Theory (MST) (Dennis, Fuller, & Valacich, 2008). MST may be useful in understanding the interplay of communication media and communication processes in information sharing since its basic components are the media selected to support the processes in communication exchanges. *Media synchronicity,* which has been linked to communication performance, is defined as "the extent to which the capabilities of a communication medium enable individuals to achieve synchronicity" (Dennis et al., 2008, p.851). Synchronicity herein represents a shared pattern of coordinated behavior among individuals working together to accomplish tasks. To achieve synchronicity in MST, the individuals who are collaborating decide on the communication media that best support the communication processes needed for their tasks.

2.5.1. Communication processes

Dennis et al. (2008) argue that the concept of task needs to be redefined in terms of underlying communication processes that must be performed such as decision making and negotiation. According to them, each task is based on the need to both transmit and process instrumental content and therefore requires two types of communication processes: conveyance and convergence. *Conveyance processes* are those communication processes that transmit a range of new information, often in large volumes, depending on the task at hand. *Convergence processes* are those which "require individuals to reach a common understanding and to mutually agree that they have achieved this understanding (or to agree that it is not possible)" (Dennis et al., 2008, p.580). In interorganizational collaborations, communication exchanges supporting conveyance processes would include product specifications and production schedules, whereas convergence processes would include negotiating product specifications or resolving production problems. MST posits that examining the communication processes needed for task accomplishment is relevant for understanding how communication media can influence communication performance.

2.5.2. Communication media

MST also considers capabilities which can be used to place media on a continuum ranging from low (i.e., email, written reports) to high synchronicity (i.e., FTF, teleconferences). MST suggests that media have varying capabilities (or affordances) to support

Table 1
Key terms in interorganizational communications.

Concept	Sub-category	Types	Definition	Example
Nature of communication	Communication	Open	"Disclosing important yet potentially self-damaging information, being accurate when communicating, and not filtering or distorting information" (Curall & Judge, 1995, p. 153–154)	Exchanging information about product specs
		Closed	The situation when the flow of information between partners is constrained because of intentional delays, distortions/misrepresentations, or failure in delivering information.	Delaying approval of product design
	Information sharing	Information sharing	Unhampered flow of information that is viewed as a key requirement for firms to cooperate with one another	Supplying production schedule
		Information leakage	Flow of information in an uncontrollable, unwanted or harmful manner outside the borders of the firm	Inadvertently conveying information about the Product Specs of a top-secret new product
Communication array	Content	Instrumental	Communication that contains task and goal-related information (Sheng et al., 2006)	Diagrams for new product
		Social	Communication that is interpersonal, socio-emotional, non-work-related (Sheng et al., 2006)	Information about oneself provided to help build trust
	Process	Conveyance	Communication designed to transfer large amounts of straightforward information and data (Dennis et al., 2008)	Sending a purchase order
		Convergence	Communication designed to create shared understanding, resolve conflicts and transfer ambiguous information. (Dennis et al., 2008)	Clearing up a disagreement
	Media	High Synchronicity	Media better for creating shared understanding (Dennis et al., 2008)	Face-to-face
		Low Synchronicity	Media better for conveying straightforward information (Dennis et al., 2008)	*E*-mail
Trust	Trust		"Faith in the moral integrity or goodwill of others, which is produced through interpersonal interactions that lead to social-psychological bonds of mutual norms, sentiments, and friendships." (Ring & Van de Ven, 1994, p.93)	Believing the explanation provided for a delay
	Distrust		"Confidence not to depend on the other party, with a feeling of relative certainty, even though negative consequences are possible" (McKnight & Chervany, 2001, p.43)	Not believing anything that is said because the person saying it is perceived as dishonest

synchronicity (Dennis et al., 2008). Media low in synchronicity have affordances that are better for information sharing (i.e., conveyance), and media high in synchronicity have affordances that are better for creating shared understanding (i.e., convergence) (DeLuca & Valacich, 2006); media high in synchronicity also have affordances that are better for building trust (Dorairaj, Noble, & Malik, 2012; Hambley, O'Neill, & Kline, 2007). Most tasks require both types of processes, and, hence, communication performance is likely to be enhanced by balancing the strengths and weaknesses of a variety of media (Dennis et al., 2008).

Maruping & Agarwal, 2004 found that, depending on the context, the better the fit or congruence between the types of processes required by a project's task (in terms of nature and timing) and the affordances of the selected medium (in terms of high and low synchronicity), then the more effective the communication tends to be. When the predominant focus is on conveying information (i.e., instrumental content) to describe a straightforward situation or reduce uncertainty about such things as a scheduled meeting time or number of products that have been ordered, a low synchronicity medium may best do the job in terms of both efficiency and effectiveness. When there is some ambiguity, such as how to solve a complex problem related to a defective part (i.e., convergence process), a high synchronicity medium such as a FTF meeting may help the partners reach the necessary meeting of minds (Maruping and Agarwal (2004). Instrumental communications may be considered ineffective if the partners select a communication medium which is of such low synchronicity that it is unable to adequately deal with a situation rife with ambiguities and lack of trust. Employing a low synchronicity medium like CMC, the partners typically may not adequately counter concerns about the integrity of the other organization which leads to situations of distrust. As a result, the partners may react to perceived danger in the relationship with closed communications that hamper information sharing. They may distort, delay or simply not send needed information. In contrast, when there is a match between task processes and communication medium, instrumental communication content provides information about their partner's competencies and ability to complete the tasks that form the basis of trust, as has been suggested in research on virtual teams (Kanawattanachai & Yoo, 2007; Panteli, Yalabik, & Rapti, 2019).

One context in which MST has not yet been studied is the competitive environment. To date, MST studies have focused on collaboration in teams where there is no competition. It has not explored situations where collaborating organizations are coopetitors — competitors who recognize the tensions of information sharing and might fear the leakage of proprietary information. Our two cases allow us to explore MST in this context.

2.5.3. Content

MST implicitly seems to focus on instrumental content in completing group tasks. Instrumental content facilitates the organization and coordination of for current and future tasks. Communicating instrumental content over time can lead to perceptions of consistent behavior that is positively associated with trust and commitment (Sheng et al., 2006). However, social content of communications, which is not explicitly addressed in MST, should be also considered in interorganizational communications (Sheng et al., 2006). Social communication "binds the parties together," "helps solidify the normative expectations about the work to be done" and helps "build an atmosphere of mutual support and respect" (Sheng et al., 2006, p. 67–68). Politeness norms are one type of normative expectation that, when established early in the relationship, enable members to become more familiar with one another, which can help improve information sharing (Maruping & Agarwal, 2004).

2.6. A synopsis of relevant literature on interorganizational communication

In summary, the literature says that strategic collaborations between competitors are increasing. While such collaborations can be beneficial to all partners, they are rife with tensions related to sharing information while preventing information leakages. To navigate these tensions and build and maintain sustainable, successful coopetitive collaborations, trust, as well as interorganizational communications characterized by open communication and information sharing, are essential. One way of exploring the 'what' of interorganizational communications at a more basic level is to study communication content (Sheng et al., 2006). However, the interorganizational literature that we reviewed does not adequately explore the 'how' of interorganizational communications. To explore the 'how' of interorganizational communications at a more basic level, we introduce Media Synchronicity Theory which focuses on the interplay of communication media and communication processes. We then combine communication content, media and processes into a new concept, called communication array, which allows us to look at interorganizational communications in a more nuanced way. For example, media with both low (notably CMC) and high synchronicity can play a role in effectively communicating instrumental and social content in cooperative relationships with rivals. Table 1 provides definitions and examples of interrelated key terms that frequently appeared in our literature review and that surface in our findings.

3. Research methodology

We conducted a qualitative multiple-case study to investigate the research question. A qualitative case study is considered an appropriate approach to answer the "how" question that we ask (Eisenhardt, 1989; Yin, 2003). This method also allows us to understand the dynamics of a phenomenon (i.e. communication in the context of the coopetitive interorganizational relationships in our study) and acquire a deep contextual understanding of it (Yin, 2003).

3.1. Case selection

The empirical setting of this study lies in two cases of interorganizational collaborations engaged in new product co-designs with the objective of entering the digital home entertainment market. The two dyadic cases describe relationships that were built between a

large high-tech corporation in Taiwan, which we refer to as Zeta, and its two main suppliers headquartered in South Korea (Alpha and Beta). These suppliers also competed with Zeta and one another in global high-tech digital home entertainment appliances markets. Due to the unit of analysis being the interorganizational relationship (dyad), the interactions between the respective partners were aggregated to the interorganizational level. Data were collected concurrently from the two cases of interorganizational cooperation among competitors (i.e., Zeta-Alpha and Zeta-Beta) (Eisenhardt & Graebner, 2007; Yin, 2003).

The specific high-tech market in which the cases operated was highly dynamic and uncertain. It was characterized by short product life cycles, rapid growth, and frequent entry of new products, players and technologies. In the last quarter of our study, global product sales in this market grew 18% quarter over quarter. It was highly competitive, often in a state of flux and not controlled by any individual organization. The market's large capital and complex technology requirements necessitated coopetition (Bengtsson & Raza-Ullah, 2016). Despite Zeta, Alpha and Beta being competitors, they also embarked on joint product development efforts to develop novel technological equipment for new product creation so as to enter the digital home entertainment market. Selecting the cases helped us to get closer to theoretical constructs (Siggelkow, 2007) at the interorganizational level as well as to reveal the dynamics of interorganizational communication supporting cooperative information sharing while averting competitive information concerns.

3.2. Data collection

The data collection primarily involved participant observation which is a method used to collect data through the researcher's direct contact and involvement with study participants and their work setting in such a manner as to facilitate in-depth analysis (Barley, 1990). It also is designed to minimize the distortion that results from the investigator being an outsider (Kluckhohn, 1940). Nevertheless, gaining entry to the field setting for participant observation was challenging. Prior to data collection, the lead author undertook negotiations with the vice president and senior managers of Zeta to obtain their consent to embark on the fieldwork in this company, as well as with two suppliers with which it was cooperating on new product development. The researcher, who has an engineering background and experience in similar sectors, promised to help the company's product design projects without charge. She was assigned to assist the senior manager in the R&D department in the first year (i.e., labeled YR1). This strategy of making herself useful allowed her to not only observe individuals at work, but also to capture rich team interactions (Rahman & Barley, 2017). Afterwards, the researcher contacted representatives of Alpha and Beta to obtain their permission to observe their operations in Zeta, as well as collect data on a real-time basis (Davis, 2016). As the companies expressed their concern about the maintenance of confidentiality, the participant observer promised that the names of the companies, products, key technological issues and employees would be presented as pseudonyms or changed. Agreements were finally reached after several meetings. These pseudonyms and changes do not affect our research results.

During the fieldwork, the lead author was assigned to Zeta's R&D department and took charge of product specification discussions and negotiations with Alpha and Beta. Since the identity and role of the researcher were revealed to the participants prior to the fieldwork commencing, the observed initially acted and behaved self-consciously, withholding and concealing evidence when they were aware of the researcher's presence. However, after about the fourth week of the fieldwork when those observed become convinced that the researcher's intentions towards them were genuine, atypical behavior diminished gradually (Nandhakumar & Jones, 1997). They started to include her in all communications, invite her to meetings and behave more naturally as the researcher offered her help. She thus was able to engage in routine matters and attend formal and informal events (e.g., FTF meetings, product seminars, informal social activities) throughout the study period. Due to the different languages spoken among the partner organizations, English became the lingua franca for project-related communications. Internal communications were in Korean within Alpha and Beta, and in Mandarin within Zeta. They were translated into English by the researcher when presenting them in the report. The researcher recorded what she saw, heard and felt in a narrative way after participating in each event, and she wrote a daily log at the end of every workday to summarize, both in terms of description and reflection, what had happened in the research setting. As the researcher was stationed at Zeta, the viewpoints presented in this study largely pertain to and reflect the viewpoints of Zeta employees. The data collection in the field setting lasted eight months. At the end of this period, one cooperative relationship was terminated before the joint product development project was completed (i.e., Alpha-Zeta), whereas in the other (i.e., Beta-Zeta), both parties agreed to undertake further collaborative projects.

Furthermore, formal interviews based on a list of pre-designed topics were conducted to enable us to use the participants' direct

Table 2
An overview of collected data.

Case	Daily logs	Interviews		Documentation			Data sources	
	Participant observations	Formal	Informal	Email threads	Meeting minutes (FTF meetings)	Reports	Number of collaborative projects	Number of participants involved
Zeta-Alpha	Daily-basis	18	48	735	2	26	7 new product designs 1 product design change	Zeta: 23 people Alpha: 8 people
Zeta-Beta	Daily-basis	6	20	250	6	24	5 new product designs 2 product design changes	Zeta: 23 people Beta: 4 people
Total number recorded	107 daily logs	24	68	985	8	50	15 collaborative projects	35 participants involved

responses to delve deeper into the issues. The participants were key informants, or people who were perceived as having the greatest knowledge regarding the research questions, and others who were keen to provide useful information. Nevertheless, because our research came to include the sensitive topic of market competition, most participants avoided formal interviews. To accommodate them and to reduce potential response bias, the interviews were conducted on a casual basis and in situations where observations occurred that sparked questions on the part of the researcher. The observations and related discussion were then entered into the daily log. Additionally, to reduce bias and promote informant accuracy, the lead author promised the participants' confidentiality (Davis, 2016).

In addition to the daily logs and transcribed interviews, relevant documentation was collected. These included 985 email threads, minutes from eight FTF meetings, and formal and informal working reports (e.g., product specification sheets and failure analysis notes). The dataset was collected based on 15 collaborative products designs and changes, and from 35 participants, as listed in Table 2. Zeta participated in the joint product development projects with Alpha and Beta with the same group of individuals at the respective companies, including members of the Purchasing and R&D departments. The three data sources (i.e., daily logs, interviews and documentation) constitute a data triangulation approach through which multiple sources of evidence are collected to increase construct validity and to minimize the degree of distortion and biases that may lead to inconclusive arguments (Yin, 2003). The daily logs, interviews, documentation and emails were maintained in a case study database to promote reliability in terms of replicating the study (Yin, 2003).

3.3. Data analysis

The participant observation was conducted by the first author with the third author's supervision and assistance; thus, potential biases that emerged from data collection were identified and mitigated. The second and fourth authors participated in the subsequent data analysis and both offered insights in this regard. The data analysis was conducted in four stages as detailed in Table 3. First, guided by the research question as well as the theoretical foundation (i.e. MST), we conducted data coding following a template approach (Crabtree & Miller, 1992). This data organizing approach involved coding a large amount of text that was grouped and packaged into categories reflecting our theoretical arguments. The approach allowed for flexibility in adapting to the needs of our study. Following the application of this approach, our analysis involved creating a code manual using the theoretical basis of this study, and hand coding

Table 3
Stages of data analysis.

Stages	Tasks of analysis	Output
1. Conduct data coding following a template approach	• Guided by the research question and theoretical foundation (MST) • Iterative coding to theoretical saturation	Appendix: Template coding
2. The polar cases	• Understand the roots of events • Check the details about the similarities of the interorganizational setting • Identify the distinction of the collaborative outcomes between the dyadic cases	Table 4: The polar cases

3. Use comparative analysis of information sharing and communication based on the two polar cases	• Notice different communication arrays being operated by the two cases
	• Strategic level: competitive and cooperative relationships
	• Operational level:
	  - Media use for synchronicity
	  - Zeta's different interpretation of information sharing with Alpha and Beta
	  - Beta's attempts to build social communication with Zeta
		Table 5: The comparison of interorganizational communication; Also Figs. 1 and 2.

4. Generate process model to understand information sharing and communication arrays over time	• Build a framework based on findings emerging from Stage 2 and 3 to explain how the strategic interorganizational relationship characterized communication media use and content for conveyance and convergence processes • Iteratively compare the emerging conceptual model with the case evidence and existing literature related to the changes of interorganizational relationship that featured their communication, information sharing and trust • Compare the current MST and the emerging research findings • Explain the contributions	Fig. 3. Process Model of Coopetitive Communications for demonstrating open communication and a combination of communication content, media and processes in interorganizational relationships (With details in Table 6)

Table 4
The polar cases.

Case	Interorganizational competition	Interorganizational Cooperation Product co-design based on buyer-supplier relationship	Outcome of interorganizational cooperation

Zeta-Alpha	● Encountering high competition
	  - Initially Zeta did not threaten Alpha's market position. Because of market dynamics, they started competing head-on for the top brand in the digital home entertainment market in North America. Doing so created a market incompatibility.
		● Zeta and Alpha's cooperation started in YR1.01 (January in Year 1)
		● Buyer-supplier relationship
		  - Zeta was a buyer of Part D
		  - Alpha was larger than Zeta and sold in a supplier-dominated market
		  - Zeta was a buyer with knowledge that could help Alpha in home appliance design
		● Product co-design
		  - Co-design of Part D for Zeta-branded household appliances
		  - Customized electronic and mechanical designs for the Part D were required so as to fit to Zeta's product
		  - Intricate technological co-design required detailed information sharing, some were related to the companies' core technologies
			● This case was considered to be an unsuccessful relationship that was prematurely terminated.
			● Collaboration was terminated about YR2.03 (March in Year 2)

Zeta-Beta	● Potential business threat existed
	  - Zeta and Beta were not major competitors in any geographic markets, but potential threat existed.
		● Purchasing arrangement started in January two years before the start of our fieldwork (YR-2.01), initially for the electronic equipment market. Since YR1.01 (January of Year 1) they collaborated for Part D co-design for getting access to the new market (as was the case in the Zeta and Alpha relationship)
		● Buyer-supplier relationship
		  - Zeta was a buyer with knowledge that could help Beta in product design that also rescued Beta from decreasing sales in Part D
		  - Beta was larger than Zeta and sold in a supplier-dominated market
		● Product co-design
		  - Co-design of Part D for Zeta-branded household appliances
		  - Beta supported Zeta with different technologies than Alpha did
		  - Customized designs were required so as to fit to Zeta's product
		  - Intricate technological co-design required detailed information sharing, some were related to the companies' core technologies
			● This case presents a successful relationship.
			● Collaborative projects were completed successfully and continued to develop new projects.
			● Collaborations had lasted for years

the text which was empirical evidence. The theoretically-based template categories included tasks, relationship characteristics, communication content and processes, and media affordances for media of low and high synchronicity, though we also allowed for adaptations and emerging topics (e.g., social communication appeared to break the deadlocked instrumental communication), such that the categories were amended seven separate times. During the iterative coding, themes became more concrete in their depiction in each round. The template was modified when existing themes did not really fit the data: new themes were inserted; existing themes were refined or deleted. A final template of data categories in the Appendix represents a condensed version of the coding that highlights the most important and distinctive findings. In this stage, data were analyzed separately for each case.

Second, through the iterative coding, we were able to consider what was happening in the research cases. Consequently, we gained a clear understanding about the roots of the events in the research setting. The two cases had very similar interorganizational settings (Table 4, in the section of the case studies) in terms of their competitive high-tech market environment, conditions of product co-development and mix of national cultures and languages (i.e., Taiwanese and Korean). However, the outcomes of their collaborations were distinct, with one deemed a success in completing the collaborative projects whereas the other was deemed a failure when their collaboration was abruptly terminated before the projects were completed. Because of the similarities of interorganizational setting but distinct collaborative outcomes, we were able to systematically compare and contrast the two cases, while minimizing extraneous variation that might conflate our findings (Eisenhardt, 1989). It is our view that the two cases can be considered as "polar cases" (Eisenhardt & Graebner, 2007) in terms of their successfulness (i.e., continuing relationship vs. terminated relationship), while sharing the same product environment, high-tech marketplace, and mix of national cultures (i.e., Taiwanese buyer and Korean supplier).

Third, by using comparative analysis, we derived the similarities and distinctions across different circumstances and appropriate interpretations by undertaking incident-by-incident and case-by-case comparison. By doing so, we were able to compare and contrast these two cases and generate findings and contributions. Further, we were able to triangulate our data using the different data collection methods in order to elicit more insightful information about the context of this study. Table 5 (in the Results section) compares the two cases in terms of their interorganizational relationship characteristics, as well as the communication mix of communication content, processes and media that they each exhibited. Fourth, we explained the findings through comparative analysis and used our insights to generate a process model of coopetitive communications (see Fig. 3, in the Discussion section).

3.4. The case studies

Alpha and Beta were large international companies with tens of thousands of employees each. At the time of the study, Alpha was the number one brand in terms of revenue from electronic equipment sales worldwide, including in North America, Europe and Asia Pacific. Beta was the number two brand and led product sales in Latin America, the Middle East and Africa, but did not compete heavily in North America. Compared to Alpha and Beta, Zeta was significantly smaller in terms of size with approximately 3000 employees and generated far less revenue. Zeta's primary geographical market was North America, though it was too small initially to be viewed as much of a threat by either Alpha or Beta. Nonetheless, conflict existed among the three companies due to the firms' awareness and dynamics of their competitive environment.

Zeta's collaborative relationships with its two suppliers were built around its co-design of Part D, a new electronic equipment part with an intricate technological design for developing home entertainment appliances. Customized technological design for the Part D was required to make it fit into Zeta's product. Alpha and Beta were among the small cadre of companies in the world that had the technical capability to produce such an intricate part. In 2005, Beta was at first Zeta's only supplier of Part D, making Zeta very dependent on Beta. The Zeta-Beta cooperative relationship proved to be an effective business model in that it helped Zeta to enter the North American market successfully and rescued Beta from decreasing sales in Part D. While it was a win-win partnership for both companies, Beta still posed a potential competitive threat to Zeta in the North American market.

The positive experience with Beta inspired Zeta to try to project this business model onto another supplier. Owing to the increasing complexity of technological design and scarce components, Zeta feared depending solely on one supplier for important components. It was concerned that a single supplier might not be able or willing to meet its needs and that ensuing component shortages might halt production. Hence, Zeta entered into a partnership with Alpha. Consequently, both dyadic cases involve cooperative and competitive dimensions in their relationships, though to varying degrees. Zeta was known in the market to possess a high-standard capability of mass production and strong distribution logistics in North America. Both Alpha and Beta knew that Zeta was collaborating with other suppliers concurrently for the same component, which heightened the competitive environment. Please see Table 5 (in the Results section) for the comparison of the two cases.

4. Findings

In what follows, we explore communication exchanges among competing firms that must collaborate on new product development to enter an emerging, but simultaneously uncertain, market. The findings demonstrate that both the cases experienced situations when information sharing was constrained mainly due to conflict or the participants' fears of information leakage. Nevertheless, distinct communication arrays promoting information sharing were evident in the two cases to support their collaborative tasks. We report the conveyance and convergence communication processes that were relevant to instrumental communications transmitted via email, CMC and other media, as well as complementary social communications.

The findings focus on the communications between the Purchasing and the R&D Departments at Zeta, and R&D and Sales Departments in Alpha and Beta which were essential to carry out the collaborative projects. That is, two departments in Zeta dealt directly

with the suppliers (i.e., Alpha and Beta): the Purchasing Department that placed the order with an expected delivery date; and the R&D Department (led by Charles) that needed evidence of quality control and the relevant quality tests of Part D for home entertainment appliances prior to approving the order. While Zeta had its own standards for product specification and the inspection process, these were not always shared by its suppliers and product. Thus, product quality needed to be negotiated on a case-by-case basis. Key concepts in the findings are italicized and insightful words and phrases used by the study participants appear in bold.

4.1. Zeta-alpha relationship

The cooperative relationship between Zeta and Alpha began in January in Year 1 (YR1.01) when the two companies agreed to collaborate on Part D co-design for home entertainment appliances (Please see timeline in Fig. 1). This new R&D design collaboration triggered the start of the new relationship. At first, the relationship was built on common, but guarded, trust in one another and the R&D design progressed smoothly. Eight new collaborations for product design were initiated, each triggering the continuation of the relationship. However, after trying to build effective communication and experiencing communication challenges for approximately fifteen months, the collaboration came to an end.

Table 5
Summary of findings.

| Interorganizational relationship	Communication content (and process)	Communication media	Relationship characteristics
The unsuccessful interorganizational relationship that was prematurely terminated: Zeta-Alpha	• Instrumental communication (Information conveyance) - Detailed, complete and timely technological information (e.g., product specification and inspection process) were required • Instrumental communication (convergence on meanings) - Resolving design problems (e.g., clarify the specification of pixel pitch) - Reaching a shared meaning of issues (e.g., having a mutual agreement on inspection procedure) - Little other convergence achieved • Social communication - Non-work related messages were virtually non-existent and perceived as insincere if present	• Communication relied almost exclusively on Email • Occasional use of telephone calls in early stage of the relationship	• Closed communication - Constrained information sharing - Delayed information transmission - Information not sent or is distorted - Email used as prevention from suffering losing face or aggressive behavior - Interpreted as closed communication and unwillingness for cooperation - Low trust/distrust
The successful interorganizational relationship: Zeta-Beta	• Instrumental communication (Information conveyance) - Detailed, complete and timely technological information were required (e.g. Beta's 10-page analysis reports to Zeta) • Instrumental communication (Information convergence) - Resolving design problems (e.g., sorting out the cable and connector incompatible problem) - Beta demonstrating work efforts to have Zeta's understanding • Social communication - Non-work related messages were delivered - Communication manner became softer, more neighborly and less formal, through: personalized greetings, personalized attention and farewells	• Information conveyance mainly relied on Email, but FTF meeting, instant messaging, phone calls were used as complements • FTF meeting chosen for instrumental communication, but benefited social communication • Using email for social communication when FTF meeting was not possible	• Open communication - Interpreted as being more sincere than Alpha's and as willing to share information and cooperate on project - Various media used to improve interpersonal information exchange - Special journey for FTF meetings was interpreted as respect, commitment and care - Moderate trust (greater than between Alpha and Zeta)
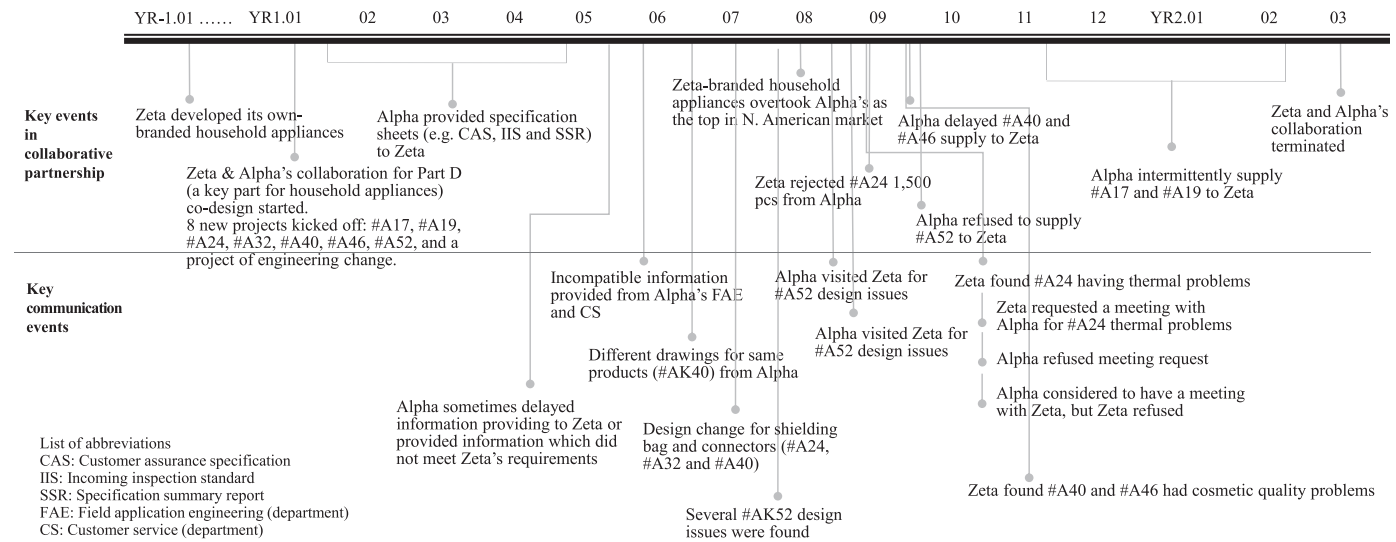
Fig. 1. Timeline for Zeta-Alpha relationship.

4.1.1. Zeta-Alpha instrumental communication exchanges

Complete and timely information sharing in these partnerships was crucial in the fast-moving market in which Zeta was operating. At the start of the relationship, *instrumental* information was often needed to support *conveyance* processes. However, almost from the beginning, the *information sharing* between Alpha and Zeta suffered from delays, with each delay challenging *open communication*. It was common to see one side urging the other to speed up the *information sharing* process, as illustrated in a Zeta engineer's email to an Alpha engineer:

"We need your clarification ASAP. Please speed up."

Information sharing delays started becoming commonplace. *Distrust* started to surface early in the relationship, as is evident when Charles wanted to make a phone call to understand the reason for the delay, and questioned Phil's excuses, such as a poor Internet connection.

> Charles [Zeta's R&D manager] was furious after the weekly management meeting. He was blamed for delaying Alpha's specification approval. [He wanted an immediate feedback from Alpha]. He wanted me [as the researcher was near] to make a phone call to Phil [Alpha's engineer] to check Alpha's progress on dealing with the cosmetic specification issues. I called Phil, and he explained that he was on business trip and was unable to connect to the Internet for a week so the document was not sent to Zeta…Charles was unhappy and said angrily, "**What a bummer?! Do you believe that his delay was because of the Internet connection? He did it intentionally. There have been so many times he did not provide us the spec timely**". (Extract from daily log)

Only four months into the project, Alpha's failure to timely deliver information to the Zeta R&D team was stressing the collaborative relationship. Timely *information sharing* between Zeta and Alpha was hampered to some extent due to the companies' different working processes and/or lack of standardized procedures regarding the high-tech products. These increased the challenges of achieving effective *information sharing*, as information requirements needed to be negotiated between the two companies on a case-by-case basis and slowed the approval process. In addition to the delays, the following emails written early in the relationship show that the misinformation and lack of standardized industry procedures and quality concerns, along with conflict and *limited trust*, promoted *closed communication* between the partners.

> Dear Robert [Alpha's manager]
> The active area of this screen is 1018.08 × 572.67 (mm). If the pixel pitch is 0.17675 × 0.17675, the resolution must be 5760 × 3240. (1018.08/0.17675 = 5760, 572.67/0.17675 = 3240) This spec is incredible. I haven't heard any supplier can make such a high grade of Ds. **Are you sure that the spec is right?**
> Stephen [Zeta's engineer]
>
> Hi Stephen
> **Sorry to make you confused.** The pixel pitch is 0.53025 × 0.53025. The pixel pitch spec I sent you was wrong. Sorry again!
>
> Robert
> [**However, the new specification was still wrong**] Stephan called Robert to confirm the pixel pitch information. Robert was angry and grumbling, "**The spec has been issued to the other customers, and no one complained about it. Only your company is never satisfied… OK! OK! I will change to whatever you want…**".

Alpha's employees sometimes explained that the delayed and incorrect information sharing were predicated on they having to consult with headquarters.

> Stephen [Zeta's engineer] reported to Charles about his discussion with Alpha for the Project #A40's cosmetic specification, "Robert [Alpha's manager] said that **he didn't have authority to make the decision, but promised that he would pass on our requests to their HQ, and think about the possibility of spec. improvements**". - (Extract from daily log)

Alpha's response about contacting their headquarters did not help to re-build *open communication*. Instead, seeking approval from headquarters started to be viewed by Zeta people as a gatekeeping tactic to prevent *information leakages*, and as signifying Alpha's unwillingness to share sensitive information about their products:

> Charles was not happy about Alpha's feedback and said, "Is it that difficult to have an updated specification sheet? I don't understand why having an updated version needs their HQ's agreement…**except if they have some sensitive information in the test criteria we requested, and they needed to have their HQ's approval before revealing it to us…**" - (Extract from daily log)

External events which altered the competitive landscape also began to play a greater role in influencing perceptions about Alpha's *fear of information leakages*. After an industrial magazine revealed that Zeta-branded products had overtaken Alpha's as the top brand in the digital household appliance industry in North America, Zeta employees, including Charles, became very suspicious of Alpha employees who would not share product information with them. In particular, Charles thought Alpha wanted to keep the unpublished information about Part D's grades from leaking to Zeta employees. Although Alpha told Zeta employees that they [Alpha] sold the best grade to Zeta, Charles believed that Alpha, as their competitor, wanted "to keep the best for their own sales"…

> "They [Alpha] said that the Ds they sell to us are the best… But, who knows…The Ds produced by Alpha are graded into four levels, according to the cosmetic quality. But this is not defined officially…I have been working in this industry for more than 30 years?! [I knew that] **they want to keep the best for their own sales…**", said by Charles. (Extract from daily log)

Given the backdrop of their competitive relationship, suspicious Zeta employees thought that Alpha employees were holding up on their commitments, such as not committing to sending forward an analysis report or approving a product specification change, as Charles's comments on a product specification problem demonstrate:

> **I believe the product spec. controversy is just a cover-up as Alpha does not want to supply high-quality Ds to us, because our product selling has exceeded theirs**… If the D's spec. is too difficult to change as they said, it should also happen with Beta…but it doesn't. This issue occurred with both Alpha and Beta's Ds. Beta can change the procedure for us, why can't Alpha? **The answer is obvious, they don't want to!!** [Charles]

Thus, *information sharing* was increasingly constrained because of apparent distortions or withholding of information by Alpha employees (as viewed by Zeta employees). Suspicion and distrust between Zeta and Alpha promoted a strong preference among employees in both companies for the sole use of email as the communication tool and a deliberate avoidance of telephone and FTF meetings. These preferences were evident on both sides of the partnership, as these field note observations illustrate: Zeta did not want to make a phone call to Alpha, and Alpha refused Zeta's meeting request.

> Steve [Zeta Engineer] said to his manager Charles, "Robert [Alpha Manager] had just called you? Would you call him back?" "**No, I don't want to talk to him.** I know that he wanted to discuss about the rejected samples…. **If the project delayed, that's his fault, not my business.**"

> [Zeta requested a meeting with Alpha for solving #A24 thermal issues, and Alpha replied that] …**I can't hold a meeting now because our engineers are working in different offices and some are on business trips**…As soon as I have solutions [for the thermal issues], I will write you an email with analysis reports. It will be the same as having a meeting. If we need further discussion, we could arrange a meeting then…(Extract from daily logs)

A meeting for resolving the design problem was never held. Emails became the only way to convey *instrumental* information needed to maintain operations between the two companies. However, the communication processes required not only *conveyance* via email to provide the detailed information on project specifications and delivery dates, but also *convergence* to achieve a common understanding of specifications and delivery expectations. Nonetheless, both partners came to rely solely on *conveyance processes* at a time when *convergence processes* were much needed to repair the distrust and resolve thorny, complex problems. Zeta and Alpha avoided face-to-face meetings, or even phone calls, that might have mitigated the shift from productive *open communication* to unproductive *closed communication*. *Closed communication* turned out to be a collaborative partnership issue, when Zeta decided to reject the products shipping from Alpha in YR1.08, as this field observation illustrates.

> "Fine! **Reject all 1.5 K of Ds in our China factory! 100%!** Alpha should take responsibility for this", command from Charles. (Extract from daily log)

4.1.2. Social communication exchanges over email

Even though Zeta and Alpha's relationship involved *distrust*, the *social communication content* in Zeta-Alpha email exchanges, though limited, was not necessarily aggressive or hostile. In fact, negative opinions towards the other party rarely occurred in their email communication. People expressed appreciation and apologies, even in the tense atmosphere, with nearly every email including polite phrases, such as "sorry about the mistake" in a chassis gap specification.

However, the politeness was perceived by Zeta as insincere; that is, apologies and thanks were rarely meant and nothing of value had been received in what should have been an *instrumental communication*. In the email exchanges below, Alpha's manager apologized to Zeta's manager for delaying the product shipment, but the emails from Alpha also implied that it was Zeta's fault for not approving the specification and consequently causing product supply delays. While Alpha employees expressed their appreciation in the emails, they had actually already postponed the production and shipment schedule and blamed the delay on Zeta, which angered and signaled insincerity to Zeta employees.

> Dear Tony
> I **always appreciate your support**. Alpha will start #A46 mass production next week. **However, they are not for Zeta but for another customer. At the moment without having your specification approval, we cannot input the Ds you request.** You will have to wait till the week after. Please understand our situation. I will let you know our production schedule next time after having your approval. **Thank you!**
> Park [Alpha's sales manager]

Internal communication among Zeta's employees showed their anger after the production schedule was postponed:

> Charles complained to Tony, "Look! They never review that it is their engineers who caused the delay. They want me to accept everything they sent! **This is ridiculous**!"

> Tony shook his head and said, "It is a supplier dominated market now. Let's wait till it shifting to being buyer-dominated. **Then we can let them feel our revenge**."

At the end, Alpha employees also criticized Zeta for constantly creating difficulties.

Alpha's manager explained about the issue of document reference numbers, "…the specification which you [Zeta] request often surpasses our standard so we have to prepare documents especially for you…. **I can't understand why other companies we worked with can accept our documents without any problem, but you always request more. Even though we do more for you than for the other companies, you always want more**". (Extract from daily log).

While a phone communication may have been expected to help to mitigate the controversies, and rebuild *open communication*, Zeta's employees eventually became hesitant to engage in phone conversations with Alpha.

"Alpha people always behave in a very tough manner…I don't like to talk to them", expressed by Alex [Zeta's engineer]

In fact, using a different *communication medium* turned out to be futile. The instance below indicated that even a phone conversation could exacerbate the already *closed communication*.

Robert called to discuss the progress of the #A46's approval… **He suddenly shouted on the phone, "CS is CS. It's not my responsibility. You should know if you don't approve the specification, our HQ won't produce any Ds for you.**" …He continued, "**Tomorrow, if you don't approve the D's specification, we won't prepare anything for Zeta!" He then hung up suddenly**…. (Extract from daily log)

The above complaints and anger were never displayed in the emails. *Distrust* and skepticism were disguised by polite email content that was perceived to be insincere; The expressions of politeness in the emails did nothing to improve the *trust* between Alpha and Zeta:

"**You can't trust anything they said…they never told us the truth…**"– Charles (Zeta R&D Manager).

Zeta employees perceived the polite *social communications* as insincere. Whether they were or not was not a matter of fact, unless Alpha admitted they were just pretending (which they never did). However, the perceptions of the Zeta employees were as important as "fact" since they determined social expressions to be *closed communications,* because of Alpha's failing to share sufficient task-related information, distorting it, or intentionally delaying its transmission to the extent that its receipt was untimely and detrimental to operations. Consequently, the *instrumental content* needed to sustain the coopetitive Zeta-Alpha relationship was no longer communicated and *social content*, which could have complemented the *instrumental content* to enhance conveyance and convergence processes, was inadequate. Hence, the relationship deteriorated to the point of termination.

4.2. Zeta-Beta relationship

The cooperative relationship between Zeta and Beta began in YR1 when the two companies agreed to collaborate on Part D for digital household entertainment appliances and continued long after the fieldwork for this study ended in the second year (YR2) (See timeline in Fig. 2). Seven new collaborations for product design were initiated and completed during the period when the fieldwork was conducted. Zeta had purchased Part D for desk computers from Beta two years before the study started (YR-2), at which time they became familiar with some of Beta's sales personnel. However, the new collaborations related to the Part D co-design at YR1, unlike the purchasing arrangements, required intensive communication and further negotiation on the design tasks in detail (e.g. specification, procedure, and criteria).

### 4.2.1. Zeta-Beta instrumental communication exchanges

Although similar information was needed for the product co-design in both cases, the *instrumental communication* between Zeta and Beta were relatively more open than between Zeta and Alpha. Also, the Zeta-Beta relationship generally was less conflict-ridden than the Zeta-Alpha one, though it was not flawless. Zeta and Beta recognized the need to develop effective *open communications* to maintain their interorganizational operations at an early stage; however, they found it challenging to do so. The following email exchange and conversations about a cable/connector incompatibility issue illustrate the challenges of the *communication conveyance process* that they experienced. Briefly, on the assembly lines in Zeta's Chinese factory, some products displayed an abnormality on their screens, which served as a trigger for conflict in the relationship. Unfortunately, this problem did not occur with a predictable frequency and hence, its randomness made it difficult for it to be reproduced in Beta, which supplied the connector. Beta engineers promised to study this issue and provide an analysis report to Zeta. A few days later, an email with a 10-page report attached was delivered from Beta to Zeta. This report provided considerable detail regarding Beta's experiments, but left the technological problem unresolved.

Hi all [with Zeta R&D and Beta R&D Engineers enclosed in the mailing list]

Incompatibility between the cable and the connector, please see the attached photos.

[A 10-page report was attached. The example here showed some of the photos sent in the email]

Best regards, Alex [Zeta Engineer]
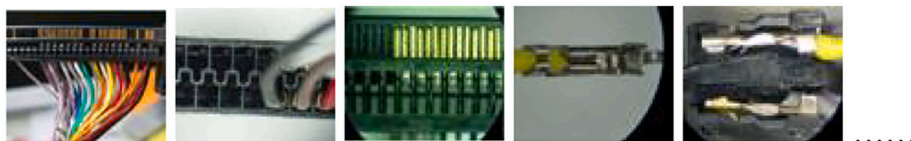
At first Zeta solely relied on emails from Beta, which was problematic since they contained a confusing mixture of semantic and pictorial descriptions. As was typical, *conveyance communication processes* like these provided large amounts of information. Emails to clarify details and discuss this issue flew back and forth continuously. However, the technological problem could not be sorted out.
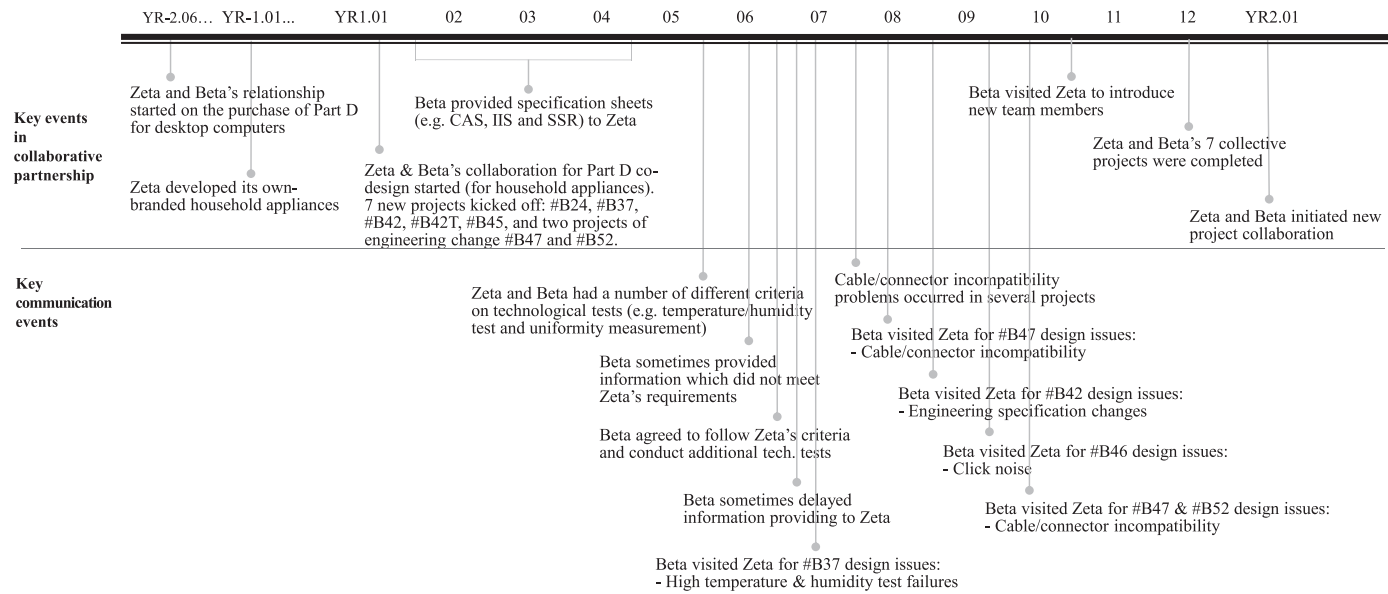
Fig. 2. Timeline for Zeta-Beta relationship.

Zeta's engineers began to complain and blame Beta:

> "**Beta is just trying to pass the buck**. They did a lot of experiments and the results were all passed. So, **what is the solution?**" (Extract from daily log)

Some suspicions about a cover-up started surfacing among Zeta's employees, decreasing their *trust* in Beta's employees, as shown below:

> "Why did Beta do a tensile test and show only part of the test results? **What did they try to cover up? What were they hiding**". (Extract from daily log)

The increasing communication difficulties prompted the change to a *medium* that could better support *convergence processes*. Consequently, a senior manager from Beta decided to take a trip to Zeta's Chinese factory to work with Zeta's engineers, gain a shared understanding of the problem, and resolve it:

> Dear Charles
> We apologize that we have not sorted out the cable/connector problem. **I have decided to fly to your Chinese factory tomorrow to discuss this issue. Leo [Beta engineer] will go with me.** Would you ask one engineer on your side to work with us when analyzing the problem?
> Kim [Beta's senior manager]

The above extract shows that when a difficulty arose in the Zeta-Beta communications, Beta was willing to try new channels and approaches to maintain productive, *open communication*. This special journey was interpreted by Zeta as a willingness to *share information*, jointly solve the problem, and thus restore the relationship:

> Charles was pleased that Beta made a special journey to the Chinese factory. He said to me, "**They are willing to go there because they care**…although I don't know whether this issue would be sorted out this time, but **I reckon that sometimes the benefits of the meeting for improving organizational relationships are more important than dealing with the technological problem itself**". (Extract from daily log)

During the period studied Zeta and Beta had six FTF meetings. There was no guarantee that the meetings would lead to positive results in terms of resolving technological problems. In fact, some remained unresolved or still required follow-up with some additional *instrumental content* from Beta:

> Alex [Zeta's engineer] described his opinion regarding the unsolved issues "About the temperature and humidity tests…I don't think we will reach an agreement. It is difficult to ask Beta change the test chamber's conditions just for us… **Charles would probably require some more test data from Beta, but I think he will leave it pending and allow this project to be continued.**" (Extract from daily log)

Beta downplayed the importance of this *instrumental content* by only providing enough to solve some problematic issues, while leaving others pending. However, evidence emerged that such contact did improve the business relationship between the two companies.

> [After a meeting], Zeta's Vice President Tim talked to Charles who also attended the meeting, "…it's good to see that they [Beta] came with such a big team (two top managers and seven engineers), **which shows their sincere intention to sort out this issue**…**I am happy that they showed their respect to our professionals, rather than complaining we are being fussy like the other company did** (implying Alpha) …**I am more confident regarding this cooperation now**". (Extract from daily log)

The above observation indicates that making a special journey for FTF meetings was interpreted as showing "respect", "commitment" and "care" for Zeta. The reason for holding meetings was because the *instrumental content* was not being conveyed properly through emails, as well as the partners' inability to reach *convergence*. Ironically, while issues with *instrumental content* were only partially solved, the medium change from a low-synchronicity to a higher one facilitated the delivery of the *social content* needed for maintaining *trust* between the two organizations.

4.2.2. Social communication exchanges over email

Our analyses of the content of a vast number of email messages that were available to us presented distinct patterns of *social communication* exchanges between Zeta and Beta employees that did not emerge in the Zeta-Alpha exchanges. In the Zeta-Beta communications, we found that even when email messages contained conflicting task matters, they had a recurring *social communication content* that made them "softer", more "neighborly" and less formal, through: personalized greetings, personalized attention and farewells, as well as empathetic expressions added to the main text of the *instrumental communication content*. Such complementary *social communication content* appeared to minimize the effects of email's social constraints and played an important role in relational *trust*-building. The *social content* also helped make the email exchanges more pleasant. That is, *social communications* conveyed goodwill that helped build *trust* and alleviate tensions, beyond the subject matter and written content. For example, personalized greetings (e.g., "Hello Simon. Glad to know that you are back from the USA.") or situation-specific notes (e.g., "I heard that Typhoon Krosa attacked Taiwan last weekend. Hope you are all right!") sequentially generated and encouraged informal and friendly response messages from the recipients. Through the personalized content, the social relationships and intimacies between the communicators were established over time, as the email exchanges below show:

> Hello Zeta members,

How is everything going? I heard that Typhoon Krosa attacked Taiwan last weekend. Hope you are all right! ……
May I have your comments about the subject issue? Thanks!
Best wishes,
Simon [Beta's Manager]

Dear Simon
Thanks for asking. **The typhoon has caused serious damage. We are fine, but there are still lots of rains here**……
Regards,
Stephen

Similarly, there were examples of farewells that revealed expressions of familiarity and caring, such as "have a nice journey to China". Although we did not find any email responses to such warm and friendly farewells, positive reactions to them were noted by the participants:

[Charles was reading an email] He smiled and seemed to be murmuring to himself, "**oh…surprised that he remembers I am going to China…**" I didn't hear clearly what else he was saying, but I felt that the controversial design issues will be sorted out soon. (Extract from daily log)

Also, emails combined *instrumental* and *social content* as illustrated below: While empathetic expressions of comprehension of emotions (*social content*) was given, such as "I understand that you are worried about the product schedule", the description of task efforts (*instrumental content*) were expressed to gain sympathy, such as "our engineering have been working very hard" and "we are doing 24-hour-test".

Dear Stephen [Zeta's engineer]
I understand that you are worried about the production schedule. If I were in your situation, I would be even more worried about the results. But the measurement of EMI really is time-consuming. I promise that I will let you know as soon as I have the result from the EMI engineer. …
Regards,
Kevin [Beta's engineer].

Dear Charles
Thanks for your comments. Our engineer is analyzing this issue. **We have been working very hard. We are not only modifying these components but also ensuring that no side effect may occur**. Please give us more time to finish it. **As you know, this phenomenon does not always occur so that we are doing 24-hour-test** with your design board. We're trying very hard to study any possibilities to resolve this issue. Please kindly understand our situation.
Best regards,
Tina [Beta Engineer]

These *social communications* were embedded in *instrumental communications*. While they did not directly lead to the completion of tasks themselves, they helped the message recipients to understand that the senders were striving to resolve issues.

Taking these examples together, it can be seen how, over time, in this case of constructive cooperation, there was a shift in the content of email communication in that the communicators started to insert interpersonal messages that conveyed *social content* in otherwise institutionally task-oriented, *instrumental communications*. That is, in the case of Zeta-Beta, the data revealed recurring *social content* in their email exchanges that promoted *open communication*, delivered signals of the willingness to maintain relationships and mend any fences that may have been broken in earlier exchanges. This arrangement could be characterized as high relational *trust* and consequently, led to a virtuous cycle with more *open communication*, more *information sharing* and increased interest in cooperating.

Moreover, the participants in Zeta gradually started to use instant messaging for communication with Beta and vice versa. Although the communication content was private and therefore not accessible to the researcher, participants' openness to using multiple communication media was noted. Zeta-Beta communications suggest that varied choice of communication media (i.e., FTF meeting, instant messaging, phone calls) was perceived by the communicators as a willingness to have *open communication* and *share information*.

4.3. Case comparison

A comparison of the findings of the two cases suggests that a *communication array*, encompassing *communication content, processes and media,* could impact the success (or failure) of interorganizational relationships (see Table 5). While both relationships exhibited constrained *information sharing* due to their fears of information leakage and slow email replies, Zeta employees interpreted Alpha's constraints as unwillingness to cooperate, but they thought Beta was more sincere about collaborating. What led to such different conclusions? The research evidence points to the use of *communication media*, as well as how both *instrumental and social communication content* were conveyed through them to support *convergence* and *conveyance processes*.

Clearly the Zeta-Alpha interorganizational relationship was not working well. The *instrumental communications* between Zeta and Alpha became increasingly *closed* as the participants' *media* choice narrowed down to just email. Alpha employees used carefully-constructed emails that had to be approved by headquarters as a way of maintaining the tenuous relationship while avoiding *information leakages* since their emails could be carefully evaluated to ensure that no proprietary information or critical knowledge was

leaked. Further, as Alpha employees delayed approvals and sent incorrect (or no) needed information to Zeta, the communications became even more closed. The *closed instrumental communication* hurt the relationship which in turn caused the communications to become even more closed and defensive, and *distrust* to burgeon. There was virtually no *social communication content* to mitigate the damage. The few polite *social communications* used by Alpha employees were perceived as insincere by Zeta employees. Concomitantly, Alpha sent Zeta products with quality problems, delayed the supply of products, and eventually refused to supply products that it had promised to Zeta. Eventually, Zeta and Alpha dissolved the arrangement acrimoniously.

Zeta and Beta also experienced ineffective communications and rocky periods in their relationship. In contrast to the Zeta-Alpha relationship, Zeta and Beta worked together to develop effective communications that utilized various *communication media* appropriately, effectively conveyed both *instrumental and social content*, and reached mutual understandings about how to proceed in their relationship and initiate new collaborations. Over time, repeated interactions and communication helped build a high level of *trust* that proved useful in other projects that they subsequently initiated. While potential for *information leakage* detrimental to either party might have been a concern to Beta and Zeta, their willingness to continue their collaboration was transmitted and understood by the two parties, ultimately benefiting the maintenance of their interorganizational relationship. In contrast to Zeta employees' negative perceptions of Alpha employees, Zeta participants perceived that Beta employees' interactions and communications were more sincere, even though their relationship built upon business coopetition had never been totally stable. The following quote from a Zeta manager indicated the significant contrast between working with Alpha and Beta.

> "It is common that there are many disputes on specific issues when different companies work together, but it's really hard to deal with these disagreements with Alpha. **When we highlight the issues to them, we hope to have further discussion, but they don't instinctively treat these issues as potential problems and are not willing to give explanations.** They should face up to and resolve the issues, but they only blame us for being fussy…**Working with Beta is much better. At least, they are more willing to exchange information and ideas, so that we can work towards a compromise, rather than insisting on their positions being adopted.** They seem to understand that if we want to develop products successfully, we both have to make compromises on our original requirements…" said by Stephen (Extract from daily log)

5. Discussion

The study was driven by a specific interest to understand the impacts of communication and information sharing on coopetitive interorganizational relationships over time. By adopting the longitudinal participant observation approach, we found that where instrumental content was communicated exclusively by email, with virtually no social content, there was a growing distrust and closed communications over time, contributing to the abrupt demise of the relationship. In contrast, the effective match of communication media with communication processes for communicating instrumental content, complemented by social content, led to growing trust, open communications, and a commitment to continuing the relationship over time. Thus, the communication array elements of communication content, media and processes were the key to understanding our findings and building our model (see Fig. 3). After presenting our model, we describe its theoretical contributions and practical implications, followed by the limitations of our research, and suggestions for future research.
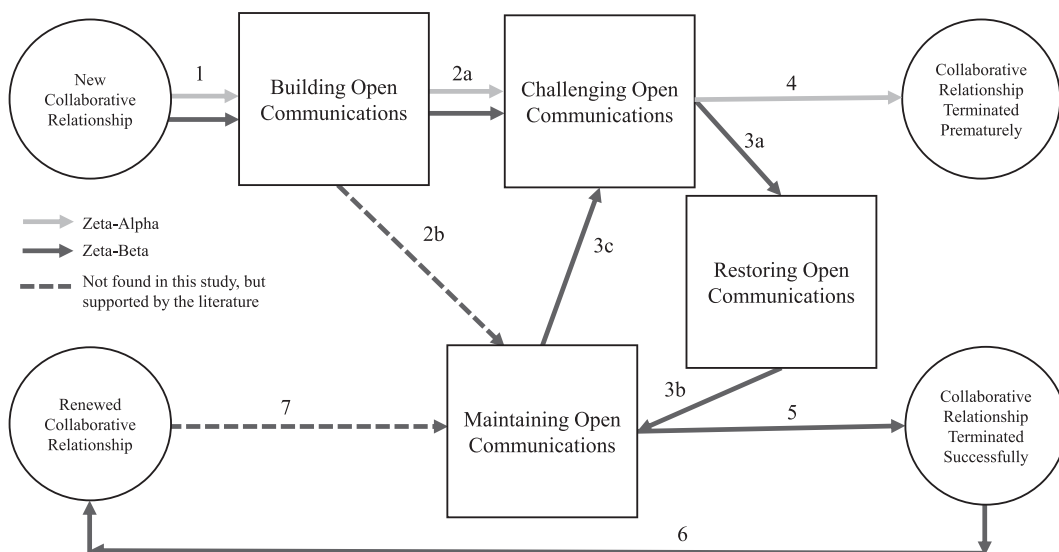

Fig. 3. Process model of coopetitive communication.

5.1. Process model of coopetitive communication

Interorganizational communication is integral to the case-based Process Model of Coopetitive Communication in which we present the two different trajectories of the Zeta-Alpha and Zeta-Beta cases (See Fig. 3). The model is based on a nuanced view of interorganizational communications using the concept of communication arrays comprised of media, processes and content. It represents a type of iterative process theory in which the different stages are critical events that occur during the life of coopetitive relationships involving collaboration on one or more projects. As the cases show, the different combinations of communication array elements impact or are impacted by information sharing, open communication, trust, cooperation and competition over time. The model is iterative because the communications and relationships involved in coopetitive relationships can evolve, by regressing or progressing towards more effective relationships. Table 6 describes the stages in the Process Model of Coopetitive Communication.

A new project may trigger the collaboration between different organizations and the move (See #1) to the model's first stage, the *Building Stage*. In our study, both cases experienced some difficulties in building collaborations that were tempered by fear of inadvertent information leakages through their communications with the competitive partners. In the case of the Alpha-Zeta relationship, it appeared that in the *Building Stage* (#1) competition was being kept at bay and there was some trust and commitment, albeit limited, to the co-design project. It was a risky endeavour because the project was about designing a critical part in a major product in a major marketplace in which they were head-on competitors. While the two parties' exchanged instrumental communications related to Part D and its design, there was little social communication exchanged between the two parties.

In the case of the Beta-Zeta relationship, Zeta had purchased Part D for desk computers from Beta two years before the co-design collaboration for Part D for home entertainment appliances began. The purchase of Part D for desk computers did not involve any collaboration and Zeta employees did not interface with the Beta engineers on the team. At that time, Beta and Zeta were both marketing the same product, but the competition was only moderate because the market overlap was minor, albeit potentially greater. When Beta and Zeta entered a true collaboration on the co-design of Part D for home entertainment appliances, the project was more complex than a mere purchase and greater trust was required on the part of both parties (Ring & Van de Ven, 1994). In order to build the relationship, the literature suggests the parties create open and effective communications by seeing what works, (Sheng et al., 2006), surfacing differences and dependences (Rehm & Goel, 2015), discussing the nature of each other's roles (Ring & Van de Ven, 1994), and matching communication media with communication processes (convergence vs. conveyance) (Maruping & Agarwal, 2004). For the most part, Zeta and Beta had established basic channels of communication, but then needed to define their new roles and communicate just enough information to get the collaboration going.

Over time, conflicts, misunderstandings, closed communications, or changes in expectations that lower trust and the willingness to cooperate can occur in interorganizational relationships (Ring & Van de Ven, 1994), suggesting a move (#2a) to a *Challenging Stage*. Both relationships that we studied experienced rocky times and entered into this stage from the *Building Stage*. In both relationships, information sharing was constrained and trust was lower. In the *Challenging Stage*, there might be difficulties with information conveyance and convergence processes. A heightened competitive landscape might also have played a role in this stage (as it did for Alpha and Zeta). Typically, skepticism about whether the other side would keep communications open and share critical information might creep into the relationship. In the Zeta-Alpha case, Alpha's delays in the information sharing were viewed by Zeta as an unwillingness to commit to the relationship or a fear of information leakage. Their communications in this stage became closed when

Table 6

Stages of coopetitive communications.

Stage	Building	Challenging	Restoring	Maintaining
Trigger	Start of a new project with a new collaborator	Emergence of conflict, misunderstanding, information leakage or closed communication	Mutual commitment of collaborators to restore damaged trust and closed communications	First entry: Start of a new project with previous collaborator; the successful end of a Building Stage with a new collaborator; or the restoration of open communication from the Restoring Stage
Information Sharing	Abundant to support exchange of new project information	Constrained	Improved	Frequent and appropriate to support collaboration
Nature of Communication	Open	Partially open/partially closed	Increasingly open	Open
Effectiveness of Communication based on Communication Array	Building Effective Instrumental Communication; Polite social content; should have introductory social content	Ineffective Instrumental Communication; Lots of social content to demonstrate commitment to collaboration	Increasingly Effective Instrumental Communication; Lots of (polite) social content	Effective Instrumental Communication; Empathetic, polite social content
Trust	Building virtuous cycle of trust	Start of vicious cycle of distrust; Too much distrust may lead to end of collaboration	Restored focus on virtuous cycle of trust	Steady state of trust
Cooperation vs. Competition	Growing cooperation	Heightened competition; Too much competition may lead to a premature end of cooperation	Growing cooperation	Steady state of cooperation with competition held at bay; May end in successful collaboration termination

Alpha repeatedly provided misinformation or delayed information transmission. Their information exchanges mostly lacked social content or were perceived as insincere; instrumental communication was overly reliant on a low synchronicity medium (email) that did not afford enough convergence ability to solve the design problems and related conflicts. Thus, instrumental communication content proved to be ineffective and social communication content was inadequate. In this conflictual situation, Maruping and Agarwal (2004) would suggest using a high-synchronicity medium (or media) especially early in the relationship — such as when the *Challenging Stage* is reached (#2a) directly from the *Building Stage*. However, Maruping and Agarwal (2004) note that if the parties have considerable shared experience and knowledge in solving conflicts together, a low-synchronicity medium may be appropriate.

If the *Challenging Stage* is unsuccessfully navigated the relationship likely would move (#4) to premature termination. If low levels of trust, or even distrust, cannot be repaired, it is likely that the project might be terminated, as was the case with the Zeta-Alpha relationship. Project termination associated with animosity was triggered by extreme distrust and dissatisfaction with the relationship (Ring & Van de Ven, 1994). Due to fears related to intense competition, the parties are not likely to collaborate again, in which case there will be no loop back to a renewed relationship.

Even in successful relationships such as the Zeta-Beta relationship, it is probable that some conflicts, misunderstandings or information leakages emerge, creating partially closed communications. In the Zeta-Beta relationship, difficulties in information conveyance and convergence triggered the move (#2a) to *Challenging Stage*. Zeta was sometimes suspicious about Beta holding up sensitive information. If enough trust and effective communications are displayed in the *Challenging Stage* to promote efforts to repair trust and deal with its problems, the relationship would likely start an iterative cycle by moving (# 3a) to the *Restoring Stage*, as we saw several times in the Zeta-Beta relationship; if not, then a move (#4) might be triggered to terminate the project prematurely as discussed above.

The *Restoring Stage* is often triggered by the felt need to correct the negativity in a vicious cycle veering towards distrust. The focus is on building the trust needed to repair the relationship and conveying a willingness to continue the collaboration (Ring & Van de Ven, 1994). It is premised on a recognition of the value of continuing the relationship. In the Zeta-Beta case, the Beta employee flew from Korea to Zeta's Chinese factory to resolve the problems FTF with the Zeta employees. The change in medium to FTF from low synchronicity media was prompted because the instrumental content was not being conveyed properly and the convergence processes were failing. The high synchronicity FTF meeting cleared up some misunderstandings and signaled caring, respect and a commitment to continue the relationship. At the end of the *Restoring Stage*, competition may subside, cooperation may improve, communication may open up, and trust may be restored, as it did multiple times in the Bet-Zeta relationships.

The re-emergence of a positive cycle of building trust serves as a trigger for transitioning (#3b) to the *Maintaining Stage*. The *Maintaining Stage* is characterized by a positive cycle of building trust — even under competitive situations. During this stage, the partners may benefit by adding social content to low synchronicity media to help sustain the rebuilt communication practices and develop trust. Trust has been found to improve collaboration and knowledge sharing (Al-Ani, Marczak, Prikladnicki, & Redmiles, 2013; Henttonen & Blomqvist, 2005). In the Zeta-Beta case, trust had returned to a steady state, while communication was open and frequent enough to support the collaboration. Instrumental communications were predominately effective and were complemented by polite, empathetic and extensive social communications. Even though not much information about the ongoing product tests was always delivered by Beta, enough information about Beta's work efforts was communicated to gain Zeta's "understanding". Thus, social communication content complemented the instrumental communication content in strengthening the relationship and building trust through the appearance of benevolence.

In successful collaborations, the project moves (#5) from the *Maintaining Stage* to a successful project completion. At this point, the parties probably have lived up to their promises (Ring & Van de Ven, 1994). Both parties are open to collaborating together in the future. When a new project comes along, the relationship moves (#6) to a renewed status. That is, the end of one project can lead to the beginning of the next one in the renewal of the collaborative relationship (Faems et al., 2008), such as was manifested in the Zeta-Beta relationship.

To summarize our findings, the Zeta-Alpha relationship was initiated about the time that our fieldwork began and lasted for about 15 months before it was acrimoniously terminated. It only traversed two stages: the *Building* and *Challenging Stages* (See Fig. 3). It could be argued that the intense competition between Alpha and Zeta was the sole factor contributing to the demise of the relationship. However, our model offers a more nuanced view. Closed communications with a lack of social content, overreliance on email, and ineffective information sharing in the early stages of the relationship hampered the building of trust and a collaborative relationship between the two "partners" that could have mitigated the effects of competition. Zeta and Beta also went through the *Building* and *Challenging* Stages. However, the relationship then iterated twice through a *Challenging Stage* followed by a *Restoring Stage* to eventually return to the *Maintaining Stage* where emails were buttressed with visits, instant messages and phone calls. At the end of the year, the seven collective projects were successfully completed and the relationship cycle started over.

We recognize that the trajectories of the two cases we observed do not, nor cannot, represent all possible movements through the model. For example, it is possible that the relationship could move (#2b) to the *Maintaining Stage* (described above) if the *Building Stage* were not problematic. Typically, what we would expect to see in the *Building Stage* (but did not see in our study) is social communication in the form of personal information (e.g., introductory social content) enhancing personal ties and bonds that can build trust and foster collaborations in supplier-customer relationships (Sheng et al., 2006). Social communication content (i.e., compliments and encouragement) also has been related to high levels of trust in global virtual teams, whereas teams with low trust display no emotion or positive tones (Jarvenpaa, Knoll, & Leidner, 1998; Panteli & Tucker, 2009). As the parties work together on challenging tasks that require convergence of meaning, positive social communication content can help develop a deeper trust which augurs the continuance of the relationship (Hart & Saunders, 1997).

Further, we did not see the situation when a new project is started with previous collaborators. In that situation, the renewal of a

relationship through a new project triggers the move (#7) to the *Maintaining Stage* which could be expected to be very similar to starting a new relationship in terms of the new project trigger and willingness to collaborate with a competitor. The *Maintaining Stage* in renewed relationships is characterized by a positive cycle of building trust — even in a competitive context. Research has found that when partners have worked successfully together, the level of trust is higher (Ring & Van de Ven, 1994). Open and effective instrumental communications have likely already been established. After having worked together successfully, the coopetitors may be willing to commit more of their available resources to bigger, more complex projects (Poppo et al., 2016; Ring & Van de Ven, 1994). Finally, though we did not see a direct move from the start of the renewed collaboration to (#7) the *Maintaining Stage* to (#5) a successful termination in our study, it is conceivable. These additional possible paths are shown in dotted lines on Fig. 3. Admittedly, we are not aware of all possible trajectories; not all coopetitive relationships follow through all the stages; some relationships may skip some stages; others may repeat some stages many times. Further, the duration of a stage may vary across the relationship based upon a number of contextual factors, the individuals involved and their previous interactions.

5.2. Emerging communication issues

5.2.1. Are open communications always effective?

Interorganizational communications, taking context into account, are effective when (1) there is a match between the task processes and the media selected to transmit instrumental content and (2) these instrumental communications are complemented by facilitative social content; interorganizational communications are ineffective when this match does not exist or the social content is lacking (Maruping & Agarwal, 2004). For the most part, effective communications are open communications and ineffective communications are closed communications. However, effective interorganizational communication is not always the same as open communication. Even though communication may be open and helpful in maintaining trust and cooperation, the seemingly effective mix of content, media and processes still could be considered ineffective because too much effort is being expended to transmit straightforward, often voluminous, instrumental information using a high synchronicity medium (e.g., face-to-face). Even more problematic in a competitive context is the reality of an inadvertent leakage of proprietary information (that we did not actually see in our cases) when the conversation deviates from the immediate task at hand or is buried in voluminous transmissions.

5.2.2. The role of email communications

Email was a core communication media in the cases studied. It was through email communications that both Zeta-Alpha and Zeta-Beta articulated, interpreted, protected and manipulated the role that their own firm had in the collaborative arrangement. In essence, the dynamic relationships between these companies were demonstrating a binary loop in which their open (or closed) information sharing interactions reinforced (or negatively impacted) one another over time (Faems et al., 2008; Majchrzak, Jarvenpaa, & Bagherzadeh, 2015). The open flow of information across organizations was dependent upon their mutual trust (Westergren & Holmström, 2012). In the Zeta-Alpha relationship, the pattern of email use stayed relatively constant throughout the study period even though the failure to deal with negative perceptions, communication problems, and Zeta's suspicions about Alpha's fear of information leakages led to increased distrust and closed communication. Unfortunately, Zeta and Alpha did not successfully add social content to their instrumental communications. Their use of politeness strategies such as writing "Please" and "Sorry" served as "social brakes" that reinforced email's leanness (Carlo & Yoo, 2007) and was perceived as insincere. Consequently, the Zeta employees doubted the integrity and goodwill of the Alpha employees and the relationship started spiraling into a disastrous state as their joint distrust burgeoned. The vicious cycle initiated by the virtually exclusive use of emails, especially in inappropriate situations, became obvious shortly after the study started, as likely were the suspicions since "competing firms stay in a constant state of suspicion" (Gnyawali & Charleton, 2018, p.2512).

In contrast, Zeta-Beta communication exchanges benefited from using social content to complement instrumental communications, including in email exchanges, throughout all stages of the project, especially when compared to the lack of viable social content in the Zeta-Alpha exchanges. For example, during the *Maintaining Stage*, Zeta-Beta members crafted their email messages to have increased social cues and interpersonal greetings and messages. Consequently, the exchanges with social content increased their "likability" and "familiarity" with each other. The empathetic expressions appeared to show understanding and tried to gain sympathy from the other party. The email exchanges here reduced misunderstandings: While one party could not see, monitor or control the other party's work, it would not accuse the other for not working hard on their products. The social content also allowed both parties to save face and display their willingness to continue working together. The effective mix of communication content, media and processes set Zeta-Beta's relationship onto a virtuous loop which ended successfully. The arrangement was one in which communications were open, trust could grow, and information was willingly shared. For example, Beta used a FTF meeting to build a trustful relationship with Zeta when ambiguity occurred (Estrada et al., 2016; Faems, Janssens, & Van Looy, 2010).

5.3. Contributions to research

Theoretically, we develop and present a stage-based process model of interorganizational communications. The model results from a longitudinal study of the interorganizational communications of two coopetitive relationships in a more nuanced way. In particular, we use the concept of a communication array, which is the combination of communication media, processes (conveying and converging) and content (instrumental, social), to define effective and ineffective communications. We study these communication constructs in addition to those that are more typically studied when looking at communications at the interorganizational level, most notably trust, open/closed communication and information sharing/leakages. Our process model is designed to help understand the

role that various communication arrays play in the dynamics of successful and unsuccessful coopetitive interorganizational relationships.

Further, we extend MST, typically applied at the team level, by applying it to the the tensions in information sharing that manifest themselves at the interorganizational level when considering the competitive context. These tensions have not surfaced when studying information sharing in teams where information sharing is deemed to be highly desirable and not subject to fears about information leakages, which is a challenge in interorganizational relationships, especially where more competition than cooperation may prevail. In addition, this study broadens MST's application in terms of communication content. Since both the instrumental and social content of communications should be considered in interorganizational communications (Sheng et al., 2006), we extend MST by including social content to complement the instrumental content focus of MST. In so doing, we emphasize that even media that are considered low in synchronicity like email can provide convergence when integrated with social content, such as is demonstrated when contrasting the Zeta-Alpha and the Zeta-Beta cases. Thus, the idea of communication array may be a better "unit of analysis" than media channels matched with communication processes. Incorporating these extensions to MST into our theoretical process model of coopetitive communication allows us to better understand the information sharing vs. leakage dilemma in the context of competitive interorganizational relationships while also taking into account social communication aspects.

5.4. Implications for practice

In practical terms, the findings of the study provide managers who engage in coopetitive arrangements with a better understanding of critical events that occur during interorganizational partnerships and increased awareness of the complex dynamics that influence the choice and use of communication media depending upon the type of processes involved in order to facilitate effective communications. We also found numerous ways in which managers can use social communication content to complement effective instrumental communications in improving and sustaining interorganizational relationships. A related practical implication is the need to combine multiple communication media (i.e. low and high synchronicity media) as a way for restoring open communication, supporting different tasks, and maintaining the interorganizational partnership.

Further, even though we did not see any actual leakage of proprietary information, we found that the fear of this leakage was enough to propel collaborating companies into the *Challenging Stage*. Managers should be aware of this concern that their collaboration partners may have and convey to them their goodwill and intent not to use proprietary information opportunistically even if were to be leaked inadvertently. For one thing, they could use social communications to show commitment to the relationship and caring for the other party. Of course, in these tenuous situations, managers should realize that their "partners" may not be acting in an irrational or ill-informed way, but rather they might be using the choice of a low-synchronicity medium void of social content as a conscious strategy to prevent information leakage – as Zeta suspected Alpha of doing. It might be better for their "partner" overall to end the partnership than to continue in a relationship where they could suffer severe negative consequences from information leakages or supporting the other's success. It is likely that no amount of social content or choice of media use could save such partnerships.

6. Conclusions, limitations and future research

In this paper, we explore the role of effective communication on information sharing in coopetitive partnerships. Based on rich, qualitative data, our two case studies offer a window for viewing how the combination of communication content, media and processes impacts trust, open communication and information sharing in successful and unsuccessful collaborations. We draw from MST to introduce the concept of a communication array and employ it in developing a process model to understand how matching multiple communication media and content with communication processes can promote successful coopetitive relationships while signaling problems in unsuccessful ones (most notably one that over-relied on email).

Despite its contributions, our study has limitations, too. The companies involved under our microscope were situated in collectivist societies and did not rely heavily on contractual governance. Future research should explore the role of communication in cooperative arrangements where contractual governance is dominant (probably in more individualistic countries). Further, our study focused on buyer-supplier dyads. It may be worthwhile to study group dynamics in the interdependent high-tech ecosystems of R&D alliances (Davis, 2016). Future research should also explore more fully how collaborators employ communication arrays to encourage information sharing with protections designed to keep proprietary information from leaking to their current partners who are also rivals. Although we compared and contrasted two polar cases manifesting a minimum influence of extraneous variation, the findings are grounded in a specific Asian context. Thus, our study was limited in that it studied two cases with Korean suppliers who collaborated with the same Taiwanese buyer. Future research could be designed to explore impact of culture and language on interorganizational communications more fully. In particular, future research could see if our model applies to Western coopetitive relationships as well as in Asian cultures. Studying the international dimension is important because culture and language have not been given sufficient attention in the existing interorganizational communication literature (Chen & Miller, 2015; Li, Poppo, & Zhou, 2010; Zhou, Poppo, & Yang, 2008). In summary, future research clearly seems warranted to apply our model to assess the role of communication arrays in other types of coopetitive arrangements.

Author statement

No authors have any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work.

Declaration of Competing Interest

None.

Appendix. Template coding

Categories	Sub-categories	Descriptions
Relationship characteristics	• Trust • Information sharing • Open communication • Cooperation	• High versus low trust (or even distrust) • Willingness for information sharing versus fear of information leakage • Open versus closed communication • Cooperation and competition
Communication content (and processes)	• Instrumental (Conveyance of information) • Instrumental (Convergence on meaning) • Social	• Providing information about products, inspection criteria, reliability tests, hazardous materials, etc. for having component approval • Incoming inspection criteria, inspection methods and cosmetic specifications • Reliability test conditions, assessments and product warranties • Certain hazardous substances not to be used in producing the goods • Setting up meetings to resolve problems or shared meaning of issue • Gaining mutual agreement about specifications • Determining why product is not performing as specified • Reaching shared understanding for demonstrating work efforts • Conveying interpersonal, non-work-related messages • Personalized attention and farewells • Personalized greetings • Empathetic expressions in text • Messages perceived as insincere • Introductory • Polite
Media capability for media synchronicity	• Media synchronicity • Media being used or chosen • Media capabilities	• High versus low • Email, instant messaging audio-conferencing meetings, telephone and FTF meetings • Transmission velocity, parallelism, symbol sets, rehearsability and reprocessability (not a focus in this study)

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