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Innovation generation in upstream and downstream business relationships

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ABSTRACT

The purpose of this article is to examine the phenomenon of innovation generation in a firm's upstream and downstream business relationships. The study considers the role of knowledge redundancy and relational embeddedness on the generation of radical and incremental innovations. The study further considers the moderating role of complexity and globalization on the link between the independent variables and innovation generation. By deriving several theoretically sound and managerially useful propositions, this research advances knowledge in the business-to-business and innovation generation domains and offers insights for managerial practice.

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1. Introduction

Consider the U.S. auto industry scenario in December 2008: The U.S. auto industry indicated that it would shut down unless bailed out, and millions of upstream and downstream jobs would be lost. The distributors (downstream partners) had been telling the auto industry that there were too many sales dealerships and that trends in the U.S. market were changing, including increasing demand for small cars, hybrids, and more reliability; thus, the auto industry would be compromised if it did not take enough timely innovation action. Rather surprisingly, Japan-based Toyota stepped up to support a bailout effort because many suppliers (upstream partners) were common for all automobile companies and would not be able to continue after losing volumes from the U.S. auto industry. Despite common suppliers, the U.S. auto industry was slower to innovate than the rest of industry (Spector and White, 2008).

Three streams of research have studied innovation in upstream and downstream business relationships, including innovation (e.g., Anderson and Tushman, 1990; Christensen, 1993; Von Hippel, 1988), supply chain (e.g., Roy et al., 2004; Hall and Andriani, 2003), and marketing and distribution (e.g., Morrison and Roberts, 1998). Although this research has studied important points regarding several

aspects of innovation and business relationships, an integrative view of upstream and downstream relationships in the context of innovation generation is a gap in the literature. This gap is surprising because a firm's chief executive officer (CEO) and boundary personnel (e.g., sales, procurement) can directly influence the dyadic relationships with upstream and downstream partners, generate both radical and incremental innovations, and contribute to the long-term growth and survival of companies. This study addresses this important gap in the literature by focusing on the innovation generation in firms' upstream and downstream relationships. The dyadic of both upstream relationships with suppliers and downstream relationships with distributors or business customers involves direct relational contact coupled with contextual knowledge sharing. Buying from the upstream channel and selling to the downstream channel provides firms with a natural platform for interaction, knowledge creation, and innovation generation.

Several differences between upstream and downstream relationships make it imperative for researchers to focus on the similarities and differences in innovation generation in these two domains. First, the upstream business partner is farther from the customer than the downstream business partner, which has implications for customer- and market-specific knowledge available from the partner. This distance between firms has important implications for how new knowledge is collected, shared, and used to improve existing products and to develop new products. Second, the upstream business partner is a supplier, while the downstream business partner is an intermediate customer. This difference has implications for the control the focal company can exercise, the nature of dependence in the relationship, and the firm's ability to make unilateral changes in processes and systems in the interface. Therefore, upstream and

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downstream relationships differ in their ability to develop innovation generation and in the nature of product development. Finally, firms can easily implement the upstream relationship knowledge exchange in product/service design modifications and innovations, while they must further decipher downstream relationship knowledge exchange before including it in the design. This is because downstream feedback concentrates more on usage that must be converted into design, while upstream feedback is directly related to design. In addition, downstream feedback is more likely to focus on benefit increase, while upstream feedback is more likely to focus on cost reduction. While benefit enhancement and cost reduction are both beneficial and important components of innovation generation, management of each element requires different orientations and strategies to result in optimal and effective innovation generation.

The rest of the article is organized as follows: First, the study presents the conceptual model and offers direct effect propositions in which knowledge redundancy and relational embeddedness lead to incremental and radical innovation. Second, the study discusses the moderating effects of complexity and globalization. Finally, the study presents the implications for managerial practice.

2. Conceptual framework

The framework (Fig. 1) proposes that both knowledge redundancy and relational embeddedness in an interfirm relationship have direct effects on the generation of radical and incremental innovations. The framework further proposes that complexity and globalization moderate the linkages between knowledge redundancy and relational embeddedness on the one hand and innovation generation on the other. This is because, in addition to the main effect of knowledge and relationship factors, innovation generation is contingent on the complexity of a firm's operation and the extent of a firm's globalization. Taken together, this research addresses the key variables associated with innovation generation in business relationships, while offering a parsimonious model to structure the research propositions.

2.1. Knowledge redundancy and incremental innovation

Knowledge redundancy in business markets is a “qualifying” requirement for commencing business with an upstream partner (Cannon and Perreault, 1999). Thus, the focal firm must qualify its upstream suppliers and, in turn, be qualified by its immediate downstream partner. This qualification is a certain element of common knowledge or minimal knowledge redundancy. Thus, an upstream firm can become a supplier and respond to a request for proposal only when it has preliminary qualifications and credentials (a minimal amount of knowledge redundancy) for the subject of the bid. Similarly, at the commencement stage of a business-to-business

(B2B) relationship, the downstream relationship involves the focal firm becoming a qualified supplier to the downstream partner. Such an initial qualification is possible only if there are explicit metrics and evidence that the supplier can provide goods or services that will further the focal firm's business. The downstream customer similarly evaluates the focal firm, and the relationship commences only when the focal firm provides additional value to the business of the downstream partner.

However, as the relationship period increases, the partners will begin to increase tacit knowledge of the operations relevant to the relationship (Sivakumar and Roy, 2004). The supplier of manufacturing components will begin to understand exactly how the manufacturer's production line works and thus can become a just-in-time supplier (LaBahn and Krapfel, 2000). In a similar vein, Brennan et al. (2003) conclude that suppliers adapt more for customers than vice versa. This seems reasonable because the customer has more power and, as the buyer, pays the upstream supplier. Adaptations in the context of buyer–seller relationships (Brennan et al., 2003) include incremental innovations, such as changes in product supplied, business processes, and supplier manufacturing technology. In other words, an ongoing business relationship involves a technology platform or architecture at the focal firm, and suppliers are more willing and able to help with incremental innovations. As a supplier, the focal firm tends to be more responsive to its downstream customer, which is one step closer to the final consumer. Incremental improvements in the products are only possible if the two firms share some common knowledge. When such an overlap occurs, because of their mutual interactions, the firms will be able to uncover incremental benefits or solve problems, resulting in better products and/or services. Both the knowledge redundancy and the supplier's motivation help incremental innovations.

P1. The relationship between knowledge redundancy and incremental innovation generation is stronger for upstream (supplier) relationships than for downstream (customer) relationships.

2.2. Knowledge redundancy and radical innovation

Knowledge redundancy is important if radical innovation is to occur. Only when the focal firm is exposed to different knowledge sets can it become aware of the possibilities of creating a dominant design (Anderson and Tushman, 1990) or, conversely, miss technological opportunities if there is too much knowledge redundancy (Christensen, 1993).

This study theorizes from the perspective of a focal firm on the differences in the upstream and downstream relationships with respect to identifying new radical opportunities. In doing so, the study considers the buying side rather than the selling side of the focal firm in terms of its boundary-spanning behavior. The marketing or selling

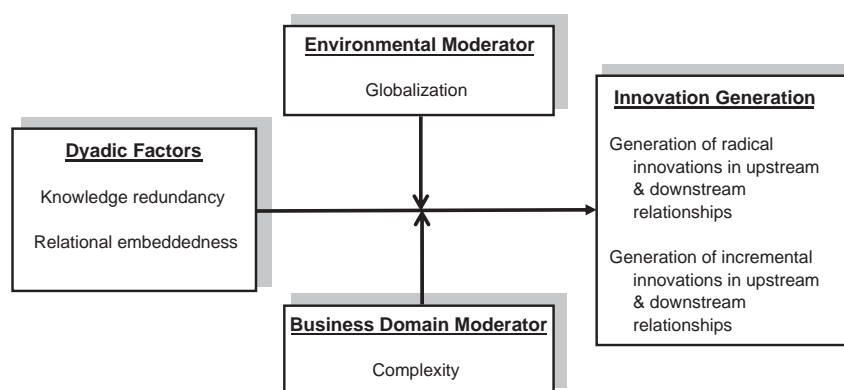


Fig. 1. A model of innovation generation in upstream and downstream business relationships.

side of the firm focuses on expanding its market share in certain market segments and attempts to pitch its offerings to the buying side of its potential customers.

In contrast, the focal firm's purchasing and procurement personnel are at the receiving end of potential suppliers' new ideas and thus can frequently come up with new ideas themselves. Evidence of radical opportunities due to the relationship with suppliers includes the reduction of disk drive size by new suppliers that pitched to traditional computer companies (Christensen, 1993). As Anderson and Tushman (1990, p. 617) note, "for a particular firm, betting on a particular industry standard involves substantial risk (e.g., Sony's gamble on Betavision technology, RCA's gamble on videodisks, and Sylvania's gamble on the simulcast HDTV design)." Thus, radical innovation involves activity at the supply or upstream end of focal firms.

P2. The relationship between knowledge redundancy and radical innovation generation is stronger for upstream (supplier) relationships than for downstream (customer) relationships.

2.3. Relational embeddedness and incremental innovation

Relational embeddedness denotes strong ties of the focal firm with the downstream or upstream partner to the extent that multiple communication channels and trust allow for the sharing of proprietary information and close coordination. The network learning literature has reported on multiple communications and trust at a broader level (e.g., Uzzi and Lancaster, 2003), as well as direct upstream and downstream relationships.

In upstream relationships, in general the focal firm asks suppliers to improve their offerings in the context of a contract that is initiated in the form of a request for proposal. Such an initiation means that the suppliers work within a technology platform, and therefore innovations are incremental, involving improvements in performance or a reduction in costs. In Christensen's (1993) study, the computer firms did not allow their existing disk drive suppliers to implement smaller sizes or low-performing disk drives because doing so would have disturbed the production lines. Supplier involvement in new product development (Ragatz et al., 2002) suggests a certain rigidity in the requirements of the focal firm that its downstream customer must meet. This literature also suggests that relational embeddedness in upstream relationships facilitates incremental innovation.

In a similar vein, Bonner and Walker (2004) suggest that firms can get too close to customers in downstream relationships and therefore can contribute only by way of incremental innovations. Incremental innovations are critical to exploit both technology platforms and the trust and reciprocity between adjacent partners in a value chain (Uzzi, 1997). This effect is more pronounced when customers are homogeneous or belong to a similar segment. For example, this kind of closeness to customers delayed Xerox's entry into desktop copiers because of its focus on the needs of big copy center customers. By staying with mainframes too long, IBM also delayed its entry into mini computers (Bonner and Walker, 2004).

P3. The relationship between relational embeddedness and incremental innovation generation is stronger for upstream (supplier) relationships than for downstream (customer) relationships.

2.4. Relational embeddedness and radical innovation

Relational embeddedness involves long-term relationships, and thus expectations, norms, trust, and commitment develop. Such developments inhibit radical innovation because the relationship strives to improve the prevailing dominant design (Anderson and Tushman, 1990). For a focal firm, the tendency to avoid radical

changes is more pronounced at the buying end or in its upstream relationships.

In contrast, when customers are the lead users and the focal firm learns from them (Von Hippel, 1988), radical innovation can result for the focal firm. For example, Von Hippel (1988) finds that lead users modified scientific lab equipment to meet the firm's special needs, and these modifications resulted in radical innovations for the scientific instrument industry.

Thus, for a focal firm, the ability to sense potentially radical innovation in upstream relationships is limited because these relationships primarily speak to a contract that, in turn, speaks to a dominant design, and improvements in the dominant design tend to become the role of upstream embedded relationships. However, when a lead user customer in the downstream relationship asks for a change with radical possibilities, the focal firm might be more willing and able to deploy resources, including searching or aligning upstream suppliers. Thus, when the focal firm is a supplier, in case some of its downstream customers are innovative "lead users," the firm is more likely to innovate radically, demand radical change, and provide a market for such change. Radical innovations often involve knowledge sharing in uncharted territories and uncertainties (e.g., new problems, new customer needs, and new technologies). Greater relational embeddedness actually reduces these uncertainties in relationships and therefore enables the development of radical innovations. This reduction in uncertainty is clearly more important on the customer side (because of a lack of control exercised by the focal firm) than on the supplier side (because of the control exercised by the firm).

P4. The relationship between relational embeddedness and radical innovation generation is stronger for downstream (customer) relationships than for upstream (supplier) relationships.

3. The moderating effect of complexity

Complexity and assortment have engaged scholars of both the downstream marketing channel (Balderston, 1956) and the upstream supply chain (e.g., Pagh and Cooper, 1998). Assortment and complexity increase customer satisfaction, but they become a negative for the upstream supply chain that has multiple stock-keeping units and wants to keep track of different suppliers for different components (Novak and Eppinger, 2001) or maintain a balance between utility and complexity (Dellaert and Stremersch, 2005).

Scholars of both boundaries (downstream and upstream) of the firm agree that customer choice, assortment, and variety are desirable and that postponement of manufacturing is a good solution (Pagh and Cooper, 1998). With the Internet, Anderson (2006) offers the idea that the digital age provides unlimited distribution possibilities with digital supplies or a combination of digital and physical distribution. Similarly, if innovation in B2B relationships is considered important, complexity should become more manageable (Wilkinson and Young, 2002).

For the purposes of this article, information technology (IT) systems manage or potentially manage the complexity in B2B products and effectively deploy them. This article discusses upstream and downstream relationships in turn.

3.1. Complexity's role in incremental innovations and upstream knowledge redundancy

Complexity in the marketplace can arise within the dominant design or with new dominant designs (Anderson and Tushman, 1990). For the same dominant design (e.g., a tape-based Walkman), customers might ask for features such as different colors, more tape space, a lower price, and lesser weight. These complexities involve

work with upstream suppliers and the creation of incremental innovations. Indeed, the more customers demand complexity from the marketplace, the greater will be the “mining” of knowledge redundancy for incremental innovations to deliver on the marketplace’s complex demands. In other words, as long as complexity increases within the same dominant design, the focal firm can expect knowledge redundancy to enhance incremental innovation generation.

P5a. Complexity moderates the impact of knowledge redundancy on incremental innovation generation in upstream relationships. As complexity increases, the influence of knowledge redundancy on incremental innovation generation becomes stronger for upstream (supplier) relationships.

3.2. Complexity's role in incremental innovations and downstream knowledge redundancy

In the marketplace, complexity is relayed up the supply chain. Each upstream member stocks inventory in an effort to deal with and cushion any stock-out situations. Conversely, the closer the firm is to the final consumer, the less the “bullwhip” effect will occur (Lee et al., 1997). Not only will inventory be more stable downstream, but knowledge redundancy will also be greater at the downstream end. Here, firms will try to pass on information about the changing requirements of the customer upstream. Indeed, the downstream partner might frequently claim that its customers have demanded the requirements and ask the upstream partner to assist in their creation. From this perspective, the greater the complexity in the market, the lower is the incremental innovation in the downstream relationship.

P5b. Complexity moderates the impact of knowledge redundancy on incremental innovation generation in downstream relationships. As complexity increases, the influence of knowledge redundancy on incremental innovation generation becomes weaker for downstream (customer) relationships.

3.3. Complexity's role in radical innovations and upstream knowledge redundancy

Consider complexity that involves potentially new dominant designs (Anderson and Tushman, 1990). For example, when Apple introduced the iPod, the Sony Walkman, the Sony Discman, and other competing products were available in the market. Any of the tape-based Walkman-type producers might have explored possibilities with upstream suppliers, but no amount of work would have transformed tape-making facilities into a hard disk-type production line. Accordingly, companies that moved from “tape music” to MP3s would have needed to involve entirely new types of suppliers. Just as Christensen (1993) notes, for the hard disk industry, entire supply industries were wiped out as dominant designs changed. In line with this logic, as complexity increases in emerging dominant designs, knowledge redundancy is a liability for radical innovation and deters radical innovation with suppliers.

P6a. Complexity moderates the relationship between knowledge redundancy and radical innovation in upstream relationships. As complexity increases, the influence of knowledge redundancy on radical innovation generation becomes weaker for upstream (supplier) relationships.

3.4. Complexity's role in radical innovations and downstream knowledge redundancy

In contrast, lead user customers (Von Hippel, 1988) might be able to spot an emerging dominant design and provide input to the focal

firm to explore adding capabilities either internally or externally (Novak and Eppinger, 2001). Lead users or lead B2B customers might be able not only to spot emerging dominant designs but to create them as well. Lead users tend to experience needs much faster than the average customer. Knowledge redundancy of lead users is less than other customers, and these users are among the downstream customers of the focal firm or are available in analogous markets (Thomke, 2006). For example, 3M's surgical drape business (Thomke, 2006) tried to observe downstream surgical infection prevention in developing countries. Developing countries suffer from challenges in hygiene in the operation room, and surgeons want affordable solutions to contain infection. The 3M team came up with radical innovations to create product lines that would address the needs of entirely new, resource-poor markets.

P6b. Complexity moderates the relationship between knowledge redundancy and radical innovation in downstream relationships. As complexity increases, the influence of knowledge redundancy on radical innovation generation becomes stronger for downstream (customer) relationships.

3.5. Complexity's role in incremental innovations and upstream relational embeddedness

Complexity is proliferating in marketplace offerings, in which multiple consumer choices lead to highly sophisticated, agile B2B systems (Stern and Rose, 2006). How does complexity affect incremental innovation? The greater the complexity, the greater are the development and deployment of B2B IT systems to keep components, parts, transactions, and services both visible and agile. Such IT systems might actually improve the relational embeddedness between B2B partners. However, relational embeddedness will be stronger with existing suppliers when complexity occurs downstream. When the firm is faced with complexity in requirements, it tries to adapt internally and with its existing suppliers first before seeking new suppliers or acquiring new capabilities. Thus, although complexity is created downstream, the impact on incremental innovation will be greater with relationally embedded suppliers upstream.

P7a. Complexity moderates the relationship between relational embeddedness and incremental innovation in upstream relationships. As complexity increases, the influence of relational embeddedness on incremental innovation generation becomes stronger for upstream (supplier) relationships.

3.6. Complexity's role in incremental innovations and downstream relational embeddedness

Because the focus of this article is on B2B relationships and complexity occurs as a result of changes in the offerings to the final consumer, this study considers the actions a downstream partner can take for an upstream partner. Because the complexity occurs downstream, the B2B partner transmits the changing customer preferences or competing downstream offerings. The downstream partner in the embedded relationship is looking for upstream supply chain flexibility Singer and Donoso (2008) and responsiveness. Thus, the downstream partner can do little to make changes in the delivered product. Similarly, Brennan et al. (2003) point out that customer relationships still do not cause the burden of adaptations to move to the customer, but rather the supplier needs to adapt or generate incremental innovations.

P7b. Complexity moderates the relationship between relational embeddedness and incremental innovation in downstream relationships. As complexity increases, the influence of relational

embeddedness on innovation generation becomes weaker for downstream (customer) relationships.

3.7. Complexity's role in radical innovations and upstream relational embeddedness

Complexity emanates from the final business-to-consumer market. In this market, customers want more choices and marketers must offer variety. However, the complexities of demand at the customer end must be managed at the upper reaches of the value chain. The focal firm might change its internal processes or its make-versus-buy criteria to deal with complexity (Novak and Eppinger, 2001). Relational embeddedness facilitates routine, generates incremental innovations, and, in general, deals with improvements within the same dominant design. However, when complexity in market demand introduces new dominant designs, embedded relationships do not work at either upstream or downstream relationships. The focal firm must ally with new upstream suppliers that bring in the inputs required to meet the complexity demands of the downstream customers. Alternatively, downstream markets and relationships need to be abandoned.

P8a. Complexity moderates the relationship between the generation of radical innovations and upstream relational embeddedness. As complexity increases, the influence of relational embeddedness on radical innovation generation becomes weaker in upstream (supplier) relationships.

3.8. Complexity's role in radical innovations and downstream relational embeddedness

Although they are embedded in the existing product range of the supplier, lead users (Von Hippel, 1988) face problems for which they tend to innovate on their own and find innovative solutions. In other words, lead users face complexities ahead of regular users. For example, marathon runners modified running shoes and provided new ideas to the athletic shoe market, which later became an entire segment of shoes for “joggers.” In B2B markets, market sensing (Day, 1994) helps firms identify lead users among customers. In other words, the focal firm must be able and willing to distinguish between large and dominant customers who do not feel the need for change (e.g., the copy center customers who delayed Xerox's entry into the desktop copier market; see Christensen, 1993) and the average user who is a good customer. With lead users, however, the downstream embedded relationships can yield radical innovations as complexity increases.

P8b. Complexity moderates the relationship between the generation of radical innovations and relational embeddedness in downstream relationships. As complexity increases, the influence of relational embeddedness on radical innovation generation becomes stronger in downstream relationships.

4. The moderating effects of globalization

As a result of globalization, B2B relationships can be both global and upstream and global and downstream. Today, firms can buy raw materials, goods, and services from overseas suppliers and can develop knowledge redundancy and relational embeddedness with them. The Internet, inexpensive telephony, and prevalence of air travel have all made global dealings much easier and the delivery of digital services more possible than ever before. In addition, global suppliers frequently open offices “near shore” (Kathawala et al., 2005) to maintain human contact at the point of delivery, particularly for services. Similarly, the globalization of markets has meant that B2B downstream relationships can postpone manufacturing across

countries both for adding agility to the supply chain and to reduce cost (Pagh and Cooper, 1998). The focus of this article is on B2B relationships, and thus it excludes multinational corporations from consideration to stay within the arm's-length B2B downstream relationships in the internationalization of the firm (Johanson and Vahlne, 1990).

Globalization moderates the impact of knowledge redundancy and relational embeddedness. The degree of globalization for the considerations herein involves a high level of differences in culture (Hofstede, 1980), legal regimes (Durnev and Han Kim, 2005), and business practices (Rosenzweig and Nohria, 1994).

4.1. Globalization's role in incremental innovations and upstream knowledge redundancy

When suppliers are global, knowledge redundancy can be low. The global supplier might be unaware of the situation in the downstream partner's market, particularly for legal and cultural matters. Consider the recent cases of toy recalls involving lead paint from China. Lead paint is not strictly illegal in China, but because toy importers (e.g., Mattel) must avoid lead paint for children's toys in the United States, problems occurred with toys with lead paint. Global suppliers are involved for low-cost reasons in the high-cost developed countries and for technology transfer reasons (Mowery et al., 1996) in low-cost developing countries. For focal firms in either developing or developed countries, knowledge redundancy is low, which signifies that the firm supplying to the focal firm does not fully appreciate the market situation of the focal firm compared with domestic partners.

P9a. Globalization moderates the impact of knowledge redundancy on incremental innovation generation in upstream relationships. As globalization increases, the influence of knowledge redundancy on incremental innovation generation becomes weaker for upstream (supplier) relationships.

4.2. Globalization's role in incremental innovations and downstream knowledge redundancy

Downstream global relationships involve moving closer to the final consumer. Thus, a European company might employ its Asian agent or assembler in Singapore for Southeast Asian markets, but after goods and services are transferred, the rest of the activities might be handled closer to the market. Because much of the core knowledge (Prahalad and Hamel, 1990) is with the overseas focal firm, there is low knowledge redundancy in the downstream relationship. Such low knowledge redundancy can help the downstream partner provide feedback, but not actually improve the offering incrementally.

P9b. Globalization moderates the impact of knowledge redundancy on incremental innovation generation in downstream relationships. As globalization increases, the influence of knowledge redundancy on incremental innovation generation becomes weaker for downstream (supplier) relationships.

4.3. Globalization's role in radical innovations and upstream knowledge redundancy

With increased globalization, upstream knowledge redundancy can be low. Low knowledge redundancy means that the upstream supplier operates with domain knowledge that is set in a different world view (Harland et al., 1999). Dossani and Kenney (2004) report how a Mumbai (Bombay)-based service provider for an airline helped calculate (by tallying boarding cards issued to travel agent) payments to determine that travel agents were paying approximately 1% less than what was due to the airline. This gap per ticket, though miniscule, added up, and from the data generated, the airline

persuaded travel agents to correct the short payments. The high knowledge redundancy assisted in generating this rather radical innovation.

P10a. Globalization moderates the impact of knowledge redundancy on radical innovation generation in upstream relationships. As globalization increases, the influence of knowledge redundancy on radical innovation generation becomes stronger for upstream (supplier) relationships.

4.4. Globalization's role in radical innovations and downstream knowledge redundancy

As globalization increases, knowledge redundancy will be high in downstream relationships. The redundancy in knowledge can create a new opportunity for radical innovation for the downstream partner or the focal firm. Roy and Wilkinson (2004) report how the Indian partner of the Swedish packaging company Tetra Pak developed edible oil packaging technology when faced with market demand in which certain types of the upstream European technology could not be implemented in the Indian market in the late 1980s. Because the focal firm must deal with the local market and cannot call in its foreign upstream partner at every step, given the low knowledge redundancy of local requirements, the local partner must find radical solutions.

P10b. Globalization moderates the impact of knowledge redundancy on radical innovation generation in downstream relationships. As globalization increases, the influence of knowledge redundancy on radical innovation generation becomes stronger for downstream (supplier) relationships.

4.5. Globalization's role in incremental innovations and upstream relational embeddedness

Globalization enables the development of long-term supplier relationships (Johnston et al., 1999) and suppliers align their processes, routines, and methods to improve their offerings to the overseas customer. Overall, satisfaction with an upstream supplier might allow the focal firm to renew contracts. As a result of the high degree of differences in culture (Hofstede, 1980), legal regimes (Durnev and Han Kim, 2005), and business practices (Rosenzweig and Nohria, 1994), suppliers might want to work with only the contract and therefore may be reluctant to become involved in any radical innovations. Consider the recent apology by the CEO of Mattel to its Chinese supplier for the defective design of toys with magnets. The implication of the apology was that though the supplier was an established and long-standing one, the onus of the design was entirely the upstream partner's.

P11a. Globalization moderates the impact of relational embeddedness on radical innovation generation in upstream relationships. As globalization increases, the influence of knowledge redundancy on incremental innovation generation becomes weaker for upstream (supplier) relationships.

4.6. Globalization's role in incremental innovations and downstream relational embeddedness

Globalization works differently for downstream relationships. Whenever the supplier (focal firm) visits its overseas partner, the differences in culture (Hofstede, 1980), legal regimes (Durnev and Han Kim, 2005), and business practices (Rosenzweig and Nohria, 1994) enable new and radical ideas to emerge. Consider the commencement of outsourcing services to India when American Express reviewed its market and costs in India in the mid 1980s (Knowledge@Wharton, 2003). American Express was struck by the

low cost per transaction that enabled the firm to move its back office for large parts of Asia to India. American Express was one of the earliest firms to leverage services sourcing.

P11b. Globalization moderates the impact of relational embeddedness on radical innovation generation in downstream relationships. As globalization increases, the influence of relational embeddedness on radical innovation generation becomes stronger for downstream (customer) relationships.

4.7. Globalization's role in radical innovations and upstream relational embeddedness

Relational embeddedness can be a liability for upstream radical innovation when suppliers are global. Relationships involve norms and expectations (Lusch and Brown, 1996), and the expectation that products and services will be as contracted and implicitly understood will be high as embeddedness increases. Increased globalization means the availability of alternative suppliers in different countries with different cost structures. Consider the December 2007 entry of Aviation Industries of China into the jet plane market in competition with Canada's Bombardier and Brazil's Empresa Brasileira de Aeronáutica (Deveau, 2007). Radical innovation by existing players is unlikely to occur because, for the moment, they are likely to stay in the market by continuing to advance incremental innovations, including lean and waste reduction exercises. The higher the cost (e.g., Canada), the lower will be the radical innovation attempts.

P12a. Globalization moderates the impact of relational embeddedness on radical innovation generation in upstream relationships. As globalization increases, the influence of relational embeddedness on radical innovation generation becomes weaker for upstream (supplier) relationships.

4.8. Globalization's role in radical innovations and downstream relational embeddedness

Because of the necessary divide between global suppliers and the need to follow the contract, relational embeddedness actually facilitates radical innovation. For suppliers (focal firms) that are global, whether in developed countries with high technical resources or developing countries with lower cost structures, an embedded relationship is an important route to introducing radical innovations. A focal firm will likely take the time to understand the value chain of the downstream partner and, without disturbing the dominant design (Anderson and Tushman, 1990), come up with a potentially radically different solution on a radically different technology platform. That is, while domestic suppliers have better access to the customer and therefore fall into the innovator's dilemma (Christensen, 1993), global suppliers, which are removed geographically, culturally, economically, and legally, can work on a radically new idea and obtain a better reaction from the customer.

P12b. Globalization moderates the impact of relational embeddedness on radical innovation generation in downstream relationships. As globalization increases, the influence of relational embeddedness on radical innovation generation becomes stronger for downstream (customer) relationships.

5. Discussion

Managerially speaking, the focal firm can attempt to manage its supplier (upstream) relationships and its customer (downstream) relationships for innovation generation rather than wider entities, such as networks. To understand innovation generation, the article examined two constructs, namely, knowledge redundancy and

relational embeddedness. The first captures knowledge considerations (Kogut and Zander, 1992) and the second captures business relationship considerations (Bonner and Walker, 2004) in the generation of incremental and radical innovations. The article then examined the generation of incremental innovations in the upstream and downstream B2B relationships.

In the new millennium, technology and market research now make it possible to provide a multitude of consumer choices involving complexity and assortment (Dellaert and Stremersch, 2005). However, this knowledge of consumers' preferences can create increasing challenges to the upstream supply chain, the most basic of which is the "bullwhip" effect on inventory (Lee et al., 1997). This article extends the reality of complexity in terms of its moderating effects on the upstream and downstream relationships of a focal firm. Another major environmental variable of the new millennium is globalization. Therefore, the article examined the moderating impact of globalization in terms of differences in culture (Hofstede, 1980), legal regimes (Durnev and Han Kim, 2005), and business practices (Rosenzweig and Nohria, 1994) between firms that are either upstream or downstream globally.

5.1. Research implications

This research is the first comprehensive conceptual examination of the B2B innovation question from both upstream and downstream perspectives. In doing so, it contributes to both the knowledge-based theory of the firm (Grant, 1996) and relationship marketing theory (Dwyer et al., 1987). More important, the article examined B2B innovation from the context of two of the most challenging variables, namely, complexity and globalization.

This research descends to the dyadic level of the firm and explores the upstream and downstream boundary of the firm for its potential to generate incremental and radical innovations. Further research should focus on the implications of a focal firm in coordinating its buy-and-sell efforts, which frequently remain in "silos" (Lambert and Cooper, 2000), so that further insight can be gained into how these boundary spanners might work together to maximize the innovation potential of a focal firm. Further research is needed to examine empirically the propositions this article offers, particularly in the context of innovative and functional products (Lee, 2002), because the article does not differentiate between these categories for parsimony.

Several implications for academic researchers exist. One useful area of scholarly inquiry would involve examining the relative magnitudes of the impact of the various factors this article considered. In addition, the contingency effect of a firm's internal factors as well as factors related to the specific dyads would be useful areas of research.

Another avenue for further research would be the development of a normative model for designing and sustaining upstream and downstream business relationships to optimize the generation of innovations. Finally, frameworks and methodologies must be developed to relate the role of upstream and downstream relationship factors to the financial performance of innovations as well as the overall financial performance of firms.

5.2. Managerial implications

This article provides several implications for managers at different levels (Yadav et al., 2007). The CEO is responsible for the firm as a whole and must connect the silos of boundary personnel (i.e., marketing and sales with procurement and supply chain functions). In doing so, the CEO must form appropriate cross-functional teams for incremental and radical innovation. For example, total quality and Six Sigma-type teams that have strong representation from procurement and supply chain personnel and some representation of the marketing and sales function will help in enlisting suppliers in improving quality and reducing waste within the existing technological platform of the

focal firm. However, for radical innovation teams, strong representation of the marketing and sales functions providing trends in the downstream market will encourage product and procurement to identify and develop existing suppliers or launch new supplier searches that can overcome the knowledge redundancy and relational embeddedness constraints of existing suppliers.

Depending on the complexity and globalization of the focal firm's industry, different emphasis on incremental innovations versus radical innovations might exist in the firm's overall strategy. Thus, in industries that are relatively stable (e.g., construction), a focus on incremental innovation might be more important. Conversely, high-tech industries, such as pharmaceuticals and electronics, might call for stronger emphasis on radical innovations because technological platforms can change rapidly.

In summary, organizations need to see the opportunity that immediate upstream and downstream partners provide for innovation generation. A focal firm needs to appropriately mobilize its boundary personnel (i.e., marketing and sales personnel) who are close to the downstream partners and the procurement and supply chain personnel who are close to its upstream partners.

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