



Article

Archetypes of Inter-firm Relations in the Implementation of Management Innovation: A Set-theoretic Study in China's Biopharmaceutical Industry

Organization Studies
2014, Vol 35(1) 121–145
© The Author(s) 2013
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/0170840613495339
www.egosnet.org/os


Johannes Meuer

Rotterdam School of Management, Erasmus University, The Netherlands and University of Zurich, Switzerland

Abstract

Innovation research increasingly focuses on understanding why and how firms implement new management practices, processes or structures. Emerging in the shadow of research on technological innovation, growing evidence points towards the inter-firm relation as an important locus of innovation. Yet although organizational theory suggests discrete alternative inter-firm coordination mechanisms, the literature on management innovation has thus far treated the inter-firm relation as one broad mode of organizing. This study takes a configurational perspective to identify archetypes of inter-firm relations leading to the implementation of management innovation. Using fuzzy set Qualitative Comparative Analysis (fsQCA) to analyse 56 firm partnerships in China's biopharmaceutical industry, the empirical evidence identifies four such discrete inter-firm archetypes: organic coalitions, bureaucratic foundations, coalitions of intense interdependency and reciprocal foundations. The results suggest that the type of interdependency, rather than the coordination mechanisms governing inter-firm relations, leads to the implementation of management innovation.

Keywords

China, inter-firm relations, management innovation, organizational archetypes, set-theoretic analysis (fsQCA)

Management innovation is increasingly considered a core challenge for firms to successfully compete. Defined as the development and implementation of new management practices, processes or structures (Birkinshaw, Hamel, & Mol, 2008; Kimberly, 1981), management innovation not only leads to efficiency enhancing changes in the management of firms (Hamel, 2006; Teece, 2007) but may also alter the structure of entire industries, as prominent examples such as Total Quality Management or Six Sigma indicate (Damanpour & Aravind, 2011).

Whereas most innovation research has traditionally examined technological innovations, a growing body of research focuses on how firms develop and implement non-technological forms

Corresponding author:

Johannes Meuer, Department of Business Administration, University of Zurich, Plattenstrasse 14, CH 8032 Zurich, Switzerland.

Email: johannes.meuer@uzh.ch

of innovation. These innovations have also been referred to as administrative (Damanpour, 1987), organizational (Lam, 2005; Sanidas, 2005) or management innovation (Birkinshaw et al., 2008; Kimberly, 1981). Similar to research on technological innovation, scholars in this field distinguish between the development and the implementation of management innovations. Further, differences exist in the criterion for defining the newness of innovation (Damanpour & Aravind, 2011). Most researchers argue that, to be innovative, a management technique has to be new to an organization (Mol & Birkinshaw, 2009). In contrast, others advocate a more radical understanding, defining management innovation as a “marked departure from traditional principles” (Hamel, 2006, p. 4) or requiring management instruments to be “new to the state of the art” (Birkinshaw et al., 2008, p. 825).

Scholars have also advanced different perspectives on the locus of innovation. Most innovation research adopts the individual firm as the main unit of analysis, implying that an innovation is “being produced and consumed at the same organization” (Damanpour & Aravind, 2011, p. 11). Others, referring to the literature on strategic alliances and their significant role for the re-combination of knowledge, have identified the inter-firm relation as an important locus of innovation. For example, Damanpour (1987) defined “ancillary” innovations whose “implementation is contingent upon the joint efforts of the organization and some of its clients” (p. 677). Birkinshaw et al. (2008) explicitly conceptualize management innovation as taking place between interacting organizations; and Tether and Tajar (2008) identify the organizational-cooperation mode as a particularly prominent one for non-technological innovation.

Despite the many contributions highlighting the importance of relationships between firms for management innovation, our understanding of the designs of inter-firm relations leading to the implementation of management innovation remains limited. Most research has identified the inter-firm cooperation mode of innovation alongside more prominent alternative innovation modes leading to technological innovation (Damanpour, 1987; Evangelista & Vezzani, 2010; Tether & Tajar, 2008). Others have treated the inter-firm relation as one single broad mode of organizing (Birkinshaw et al., 2008; Vaccaro, Jansen, Van Den Bosch, & Volberda, 2012). Yet, as the literature on strategic alliances and inter-firm coordination modes has shown, there are discrete alternative types of interdependence and coordination modes that render inter-firm relations effective (Grandori, 1997).

In this study I take a configurational perspective to identify and explore archetypes of inter-firm relations that lead to the implementation of management innovation. Drawing on the literature on management innovation (Birkinshaw et al., 2008), strategic alliances (Gulati, Nohria, & Zaheer, 2000) and configuration theory (Miller & Friesen, 1978) provides the conceptual framework for the empirical study presented in this paper. The analysis is based on 56 interviews with Chinese biopharmaceutical firms, which face the same managerial challenges as firms elsewhere (Pisano, 2006). Yet these challenges are intensified by a highly diverse population of firms, a growing market and a rapidly changing institutional framework (Frew et al., 2008). Such volatile conditions require the constant development of managerial instruments and make China’s biopharmaceutical industry a unique setting for studying management innovation on the inter-firm level. I examine management innovations whose implementation depends on the joint efforts of two organizations (Damanpour, 1987). Following recent calls in the literature on organizational design (Fiss, 2011; Grandori & Furnari, 2008), I use a set-theoretic method, namely fuzzy set Qualitative Comparative Analysis (fsQCA) (Ragin, 2008b), to identify discrete alternative archetypes.

Four distinct archetypes of inter-firm relations lead to the implementation of management innovation: organic coalitions, bureaucratic foundations, intense coalitions and reciprocal foundations. Consistent with innovation typologies (Burns & Stalker, 1961), organic inter-firm relations lead to more management innovation than mechanistic ones. The strongest innovation

capabilities, however, are found amongst coalitions of intense interdependence and amongst reciprocal foundations. These two archetypes lead to changes in the managerial processes of the adopting firm. This study thereby contributes to the literature on management innovation by providing the first empirical evidence for the existence of different archetypical inter-firm relations that lead to the implementation of management innovation. The taxonomy reduces the complexity of inter-firm relations to important conditions, highlighting alternatives for designing or redesigning strategic alliances.

The following section reviews the relevant literature on management innovation and on inter-firm relations. The third section describes the research setting in China's biopharmaceutical industry and presents the analysis and the results. The last section discusses the findings and concludes with implications, limitations and directions for future research.

Theoretical motivation

Management innovation is one particular type of innovation (Damanpour & Aravind, 2011), and refers to the development and implementation of new managerial practices, processes or structures (Birkinshaw et al., 2008; Kimberly, 1981). In contrast to technological innovation, management innovation affects the "social" rather than the physical technologies of a firm (Nelson & Sampat, 2001). As early as 1968, Golightly (1968) introduced the term "management innovation" in a study on management changes in the airline industry. Others have used terms such as organizational (Daft, 1978; Lam, 2005), administrative (Damanpour, 1987) or service (Evangelista & Vezzani, 2010; Tether & Tajar, 2008) innovation to refer to similar concepts.

Most of the earlier innovation research has followed a "technological imperative", a bias towards largely considering innovation as a factor connected to R&D departments and technology-intensive industries (Damanpour & Aravind, 2011, p. 2). As a result, our understanding of management innovation remains relatively limited. Increasingly, however, researchers are shifting their attention towards understanding why and how firms develop or implement new managerial processes, structures or practices.

Paralleling research on technological innovation, scholars in this field have distinguished development from implementation in management innovation (Lam, 2005). Birkinshaw et al. (2008), for example, identify five phases through which management innovations are developed. Others focus on the implementation of management innovation and its effect on organizational performance (Mol & Birkinshaw, 2009; Vaccaro et al., 2012). Differences also exist in the way scholars define criteria for "newness" (Damanpour & Aravind, 2011). Whereas most studies define management techniques as innovative when they are new to an *organization* (Mol & Birkinshaw, 2009; Vaccaro et al., 2012), others apply a more stringent definition according to which management innovation is a "*marked departure from traditional principles*" (Hamel, 2006, p. 4, [emphasis added]) or is "*new to the state of the art*" (Birkinshaw et al., 2008). A third dimension of innovation research concerns the locus of innovation (Tether & Tajar, 2008). Most innovation studies, either implicitly or explicitly, assume that innovation is a process or a product of activities taking place inside the firm. Yet the innovation literature provides ample evidence suggesting that firms are highly interdependent, in particular when it comes to innovations in their non-technical realms (Damanpour, 1987; Tether & Tajar, 2008; Whittington, Pettigrew, Peck, Fenton, & Conyon, 1999).

Damanpour (1987), for example, considered "ancillary" innovations as those "whose implementation is contingent upon the joint efforts of the organization and some of its clients" (p. 677). Similarly, advocates of "distributed" innovation (Coombs, Harvey, & Tether, 2003; Gulati et al., 2000) have long argued that firms predominantly innovate through inter-firm relations with other

organizations. Birkinshaw et al. (2008) explicitly conceptualize the development and implementation of management innovation as taking place between interacting organizations.

Empirical evidence also suggests that the inter-firm relation is an important locus of innovation. Mol and Birkinshaw (2009), for example, find that better access to external knowledge sources positively affects management innovation. Tether and Tajar (2010) study the organizational alongside the two well-established innovation modes of process and product innovation, and show that the organization-cooperation mode is not only the most prevalent innovation mode but also the most strongly associated with non-technological innovation. In sum, ample evidence supports the inter-firm relation as an important locus of innovation.

The literature on organizational learning in the context of strategic alliances provides important theoretical ideas for the distinctive features of inter-firm relations regarding their innovative capabilities. Drawing on the resource-based view of the firm (Grant, 1996; Pfeffer & Salancik, 1978), most scholars argue that firms dispose of sets of knowledge. However, organizational learning and innovation require different types of knowledge, more than are commonly available to the internal organization. As the creation and storage of knowledge is costly, and as knowledge types differ in their transferability (Kogut & Zander, 1992), firms engage in collaborative relationships for the sharing of knowledge (Mowery, Oxley, & Silverman, 1998).

Inter-firm relations thus play an important role for accessing knowledge that otherwise would be too expensive to develop internally (Grant & Baden-Fuller, 2004; Inkpen, 2000). They thus allow organizations to reduce costs, increase flexibility and enable joint-learning mechanisms; all considered prerequisites for the implementation of management innovation (Vaccaro et al., 2012). Consequently, researchers have examined various conditions that facilitate the transfer of knowledge and innovation between firms. For example, classical organizational coordination mechanisms such as specialization, centralization or formalization (Avadikyan, Llerena, Matt, Rozan, & Wolff, 2001; Vlaar, Van Den Bosch, & Volberda, 2006; Woolthuis Klein, Hillebrand, & Nooteboom, 2005) have been adopted for examining the complexity of inter-firm relations. Additionally, given the particular nature of inter-firm relations compared to internal firms or markets (Grandori, 2001; Williamson, 1975), partnering firms need to mitigate relational risks such as indirection, unreliability, defection or poor coordination whilst providing reciprocal access to unique resources (Sheppard & Sherman, 1998). Researchers have therefore examined the role of trust (Nooteboom, 1996, 2006), mutual dependence (Harrison, Hitt, Hoskisson, & Ireland, 2001) or partner similarity (Luo & Deng, 2009) in the context of inter-firm relations. Finally, researchers have examined the influence of environmental dynamics on innovation amongst strategic alliances (Unger, 2000). These studies have provided important insights into how individual mechanisms within inter-firm relations contribute to innovation.

Yet, rather than theorizing on one single and effective form of inter-firm organizing, organization theorists argue that there are alternative designs of inter-firm relations, complex combinations of relational factors and coordination mechanisms that may characterize effective inter-firm relations (Grandori, 1997). Research on organizational design has been conducted under various labels such as configurations (Meyer, Tsui, & Hinings, 1993), archetypes (Miller & Friesen, 1978; Pinnington & Morris, 2002) or generic types (Porter, 1980).¹ Research in this field takes a holistic, aggregate and systemic approach to explaining organizational phenomenon (Meyer et al., 1993; Whittington et al., 1999).

Two perspectives are central to the notion of organizational design. First, organizational systems are better explained and understood when examined as an entity, rather than when identified and qualified by relationships between individual elements. This perspective asks researchers to classify organizations into groups that share a number of crucial dimensions (Greenwood &

Hinings, 1993; Miller & Friesen, 1978). Second, the efficiency of organizational systems results from coherently aligning these crucial elements, i.e., by achieving a high degree of “fit” (Drazin & van de Ven, 1985). Combining these two perspectives gives rise to the notion of archetypes, an ideal type of an organizational system consisting of “a set of structures and systems that reflect a single interpretive scheme” (Greenwood & Hinings 1993, p. 1052).

Archetype models predominantly exist for individual firms. Burns and Stalker (1961), for example, argue that there are two distinct organizational systems. According to them, the mechanistic systems featuring specialization and task differentiation, high degrees of centralization, vertical differentiation and formalization are more suitable for stable environmental conditions. Organic systems, in contrast, feature shared responsibility, commitment and objectives, flat hierarchical structures and low degrees of vertical differentiation. They are more appropriate in unstable environments and are considered more suitable for innovation. Daft (1978) proposes another ideal type model, arguing that technical innovation emerges from an organization’s technical core, located in the lower levels of an organization’s hierarchy and moving upwards. Management innovation in contrast emerges from the administrative core and “trickles down” to lower hierarchical levels.

For the field of inter-firm relations, such typologies remain underdeveloped. Grandori (1997), however, develops a typology of interdependencies distinguishing two modes of collective action, namely pooled and intensive interdependence, and two types of transactional interdependencies, namely sequential and reciprocal interdependence. For each interdependency she proposes effective coordination mechanisms. Pooled interdependence, a situation in which firms make use of the same (non-essential) resources, requires coordination mechanisms such as decision procedures, mutual monitoring or supervising hierarchies. In contrast, intensive interdependence, referring to firms’ jointly applying complementary resources in pursuit of a common objective, requires more complex coordination mechanisms such as group decision-making and mutual monitoring. Sequential interferences exist when a product of firm A is the input of a product of firm B. Such interdependence can be effectively governed by means of programming and hierarchical decision-making for synchronizing the relevant activities of the interacting firms. Finally, reciprocal interaction exists when the transferred good or service is highly tailored. Under such conditions, the receiving firm necessarily provides an essential input, know-how or material to make the production possible. In this type of interdependence, integrated structures and authority by exception are effective governance mechanisms.

To illustrate how combinations of coordination mechanisms and actors’ preferences gain efficiency, Grandori (1997) applies these inter-firm coordination mode to two distinct preference systems: foundations, characterized by different members’ preferences, and upfront agreed-upon rules and procedures; and coalitions, characterized by an absence of common objectives or agreed-upon rules in which incentive systems are instead developed through ex-post adjustment via negotiations.

In sum, although research on management innovation has been much neglected in the past, scholars are increasingly shifting their focus towards understanding how management innovation is developed and implemented. Most research thus far uses the firm as the primary locus of innovation despite empirical evidence, conceptual work and theories on strategic alliances pointing towards inter-firm relations as an important locus of innovation, particularly for non-technological innovations. Therefore, our understanding of the appropriate designs of inter-firm relations leading to the implementation of management innovation remains rudimentary. In this paper I take a configurational perspective to identify archetypes of inter-firm relations associated with the implementation of management innovations.

Exploring Archetypical Inter-firm Relations in the Implementation of Management Innovation

Research setting and data collection

I gathered data on inter-firm relations amongst biopharmaceutical firms in China, where companies face the same technological and organizational challenges as biopharmaceutical firms elsewhere. To benefit from the variety of available technologies, they need to find mechanisms for managing the long, costly and uncertain R&D cycles, and for developing procedures for cumulative learning. One widely acknowledged strategy for integrating various technological approaches is that of engaging in relations with other organizations (Pisano, 2006).

The Chinese business environment aggravates these challenges through a rapidly changing institutional architecture and a variety of differently operating organizations. In China, a modern biopharmaceutical industry emerged during the 1990s but began flourishing only after 2003. China's regulatory regime, with respect to clinical trials or intellectual property rights protection, has undergone radical changes (Frew et al., 2008). Unbalanced adjustments in China's education system account for the lack of adequate human resources. The government, economically motivated to foster the knowledge sector, pressures the industry as a whole to develop innovative products. Therefore, despite challenges in logistics and marketing and a negative reputation for Chinese biopharmaceuticals abroad, China's biopharmaceutical industry is expected to commercialize drugs within the next few years. The absence of appropriate managerial techniques and the diversity of ties between firms make the biopharmaceutical industry in China a unique setting for studying inter-firm relations that lead to the implementation of management innovation.

Between 2007 and 2008, I contacted Chinese firms in the biopharmaceutical industry to explore how they interact with other firms and how these interactions result in the implementation of management innovations. I used four independent contacts, instrumental in obtaining access to interview partners and gaining their trust, to approach Chinese biopharmaceutical firms. After each interview, I identified additional interview partners by asking respondents to recommend at least one other firm.

I conducted protocol-guided interviews in English or with the help of Chinese translators. That most of my interview partners regularly communicated in English, for professional reasons, facilitated data collection. Subsequently, respondents completed a questionnaire, available in both languages, which was usually returned via mail. In total, I conducted 64 interviews, of which eight were eliminated because respondents were either unwilling or unable to disclose enough information. Table 1 provides information on the 56 interviewees.

Interviews took on average 1 hour 26 minutes. I interviewed senior managers (81%) and middle managers, most of whom served as CEOs (57.1%), Chief Research Officers (25%) or Marketing Directors (8.9%), and had on average worked for four years for their firm. Most interview partners held a PhD in medicine (43.6%), chemistry (23.6%) or biology (14.5%). Only three indicated that they were members of the Chinese Communist Party (CCP); two did not answer the question. The remaining 51 respondents stated that they were not members of the CCP. Hence, the political background of China does not play an apparent role in this industry.

The firms were registered mainly in Shanghai (55.4%) and Beijing (26.8%), were on average 7.5 years old, and had 97 employees. Most were biopharmaceutical firms (67.9%), with some biotechnology service firms (14.3%) and pharmaceutical firms (10.7%). Table 2 provides descriptive information on the firms.

At the beginning of each interview I asked respondents to think about one ongoing collaboration they consider important for their firms' overall success. The control question in the survey showed

Table 1. Descriptive information on interviewees.

Position			
Senior manager		48	(85.7%)
Middle manager		8	(14.3%)
Functional background			
Chief Executive Officer (CEO)		32	(57.1%)
Chief Research Officer (CRO)		14	(25.0%)
Marketing Director		5	(8.9%)
Other		5	(8.9%)
Highest academic degree			
PhD		39	(69.6%)
Master		13	(23.2%)
Bachelor		4	(7.1%)
Membership in the Chinese Communist Party			
No		51	(91.1%)
Yes		3	(5.4%)
No answer		2	(3.6%)
Duration of employment (in years)			
<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>
1	18	4.1	2.9

Table 2. Descriptive information on interviewed firms.

Min	Max	Mean	SD
Firm age (in years)			
1	58	7.2	10.5
No. of employees			
1	900	96.5	175.6
Place of registration			
Shanghai		31	(55.4%)
Beijing		15	(26.8%)
Other (Hangzhou, Suzhou, Wuhan, etc.)		10	(17.9%)
Type of firm			
Biotechnology firm		38	(67.9%)
Biotechnology services		8	(14.3%)
Pharmaceutical firm		6	(10.7%)
Other		4	(7.1%)

that these partnerships were either very important (56.7%) or important (30.0%). Although most of the firms cooperated with more than one organization, I asked interviewees to focus on only one of their partnerships.

I conducted one interview in each firm, and focused on only one firm in each partnership. Despite disadvantages associated with the use of single informants, doing so is not uncommon in research on joint ventures and strategic alliances (e.g., Almeida, Song, & Grant, 2002; Robson, Katsikeas, & Bello, 2008). I opted for this strategy so as to cover a large number of organizations

and to collect sufficient in-depth information whilst remaining within the constraints of both time and budget.

The partnerships existed predominantly between either two biotechnology firms or a biotechnology firm and a biotechnology service firm. On average, the firms had worked together for two and a half years; only 16 had a contractually agreed-upon time limit. Amongst the 56 partnerships, more than half were purely domestic, i.e., between two Chinese firms; six had a partner outside of China but within Asia, in Hong Kong or Japan, and 22 had a partner in either in the US or Europe. Most of the partners met weekly (52%), and the remaining firms met either daily or monthly. The majority (82%) did not share physical facilities. Others jointly used offices or laboratories.

To identify management innovations, towards the end of each interview I asked respondents to describe how the relationship with their partner allowed them to cope with existing challenges or to seize new opportunities. This part of the interview was open and lasted approximately one third of the interview. Respondents described how they tried to deal with difficulties arising from China's regulatory environment, financial pressures or problems with employees. They also illustrated new organizational structures and business models for benefitting from emerging market opportunities. I focused these discussions on management instruments adopted after the partnership formed and that could not have been implemented without the participation of both firms.

In addition, during field research I interviewed 35 industry experts such as consultants, lawyers or managers of technology parks. During these interviews, I discussed management innovations that we had previously identified. In discussing the novelty of management innovations, experts regularly referred to their newness in either the industrial context (biopharmaceuticals) or the national context (China). Furthermore, they referred to a practice being applied in one of China's regional biopharmaceutical clusters in Beijing, Shanghai or Guangzhou. Thus, instead of using only one dimension, industry experts roughly used three to assess the newness of a management innovation. These dimensions were not mutually exclusive, as management innovations could be new to the industry, to China or to both. In total, together with the experts, I identified 72 management innovations whose implementation depended on the joint efforts of both organizations.

For assessing the newness of management innovations, I asked experts to indicate whether they'd consider a given case as new to any of the three contexts. This process was inductive, with parallel running processes of coding and recoding throughout the year. Additional interviews provided further information that corroborated or belied previous assessments. Out of 72 management innovations, 16 (22.2%) were considered new to the biopharmaceutical industry and to China. Most management innovations, however, were considered new only to the industry (26.4%, $n = 19$) or to China (33.3%, $n = 24$). Merely seven were new to only one of China's regions (6.9%, $n = 5$). This operationalization of the newness of management innovation closely resembles the concept of "ancillary" innovation (Damanpour, 1987) or "distributed" (Gulati et al., 2000) innovation, as possibly diffusing beyond the boundaries of the firm. Each management innovation was thus at least new to the focal organization whose management decided upon its adoption and may have even been considered new to the biopharmaceutical industry, China or one of China's regional clusters.

These management innovations were very diverse, relating to a broad range of managerial areas. To better understand the nature of these innovations I used a categorization common to the literature on non-technological innovations (e.g., Damanpour & Aravind, 2011; Evangelista & Vezzani, 2010; Tether & Tajar, 2008), distinguishing management innovations that change organizational structures from those that change organizational processes or organizational boundaries. More specifically, I adopted Whittington et al.'s (1999) classification, which, based on a comprehensive literature review, provides additionally fine-grained sub-categories. Table 3 classifies all 72

management innovations, first by the nature of their change and second, within each innovation area, by the dimensions of their newness.

As Table 3 shows, most management innovations affected the organizational structure and aimed at increasing operational or strategic flexibility (31.9%). In most instances management innovations were implemented for improving the response time to changing customer demands or legal circumstances, or for increasing profits by restructuring into smaller, more business appropriate units. Other management innovations led to changes in organizational processes, e.g., new forms of horizontal networking (13.9%)—such as seminars, conferences or regular meetings with key people—were frequently implemented. Similarly, managerially innovative HR practices (11.1%) showed that many firms considered employees and their skills as key resources. New forms and purposes of alliances (9.7%) and extensions of firms' value chains (5.6%) constituted key managerial innovations that changed the boundaries of Chinese biopharmaceutical firms.

Method and calibration

Following the literature on organizational archetypes, I divided the empirical strategy into two steps (Greenwood & Hinings, 1993). First, I drew on the literature on strategic alliances and on management innovation to identify conditions of inter-firm relations suggested as important for the implementation of management innovation. Second, following recent calls in the literature on organizational design (Fiss, 2011; Grandori & Furnari, 2008; Greckhamer, 2011), I chose a set-theoretic method, namely fuzzy set Qualitative Comparative Analysis (fsQCA) (Ragin, 2008b) to identify the structure of discrete alternative inter-firm archetypes.

Instead of comparing individual variables, fsQCA examines entire combinations of conditions simultaneously. These configurations are then minimized by algorithms, based on Boolean algebra, that eliminate irrelevant conditions and thus identify structures that may be characterized by the simultaneous presence of multiple crucial elements. fsQCA is therefore highly suitable for identifying archetypes of inter-firm relations that lead to the implementation of management innovation.

In fsQCA, values of variables are operationalized as membership scores within pre-defined sets. A score of 0 represents full *non*-membership whilst a score of 1 indicates full membership. Membership scores are obtained through calibration (Ragin, 2008a). Calibration differs from a purely numerical use of measures by defining *meaningful* anchor points within the item distribution of the selected cases, depending on the level of fit between the content of the ordinal categories and the qualitative conceptualization of membership in the set.² Consequently, I developed sets for each condition included in the analysis.

Dependent measure

To develop the set of inter-firm relations important for the implementation of management innovation, I considered the following: if an inter-firm relation led more frequently to the implementation of management innovations or to the implementation of more innovative management innovations, then that inter-firm relation could be considered more facilitative to the implementation of management innovation.

I subsequently assigned membership scores according to four guidelines.³ First, an inter-firm relation leading to the implementation of more than two management innovations or of two management innovations, one of which new to China—was considered fully in the set of inter-firm relations important for the implementation of management innovation. It therefore received the full

Table 3. Classification of management innovations according to type and newness.

Innovation area	No.	(%)	Management innovations
A Changing structures			
A1 Operational strategic	23	(31.9%)	<p>Considered new to China and the biopharmaceutical industry</p> <ul style="list-style-type: none"> — Dual governance structure to meet different customer demands — Registration of overseas IP office to protect technology from main competitor <p>Considered new to the biopharmaceutical industry</p> <ul style="list-style-type: none"> — Restructuring of business model into three service lines — Extension of business line — Separation of services offered — Development of molecular service platform — Establishing of research base in the U.S. — Separate business location for improving profitability — Sponsoring of selected university laboratories — Restructuring organization for providing tailor made services <p>Considered new to China</p> <ul style="list-style-type: none"> — Establishment of overseas investment office — External scientific advisory board — Opening of marketing department — Registration of joint IP office — Develop marketing capabilities in rural areas — Restructure global operations around global clinical trials — New IP protection to harness firm-specific knowledge — Implementation of employee incentive schemes — Regional diversification to access local-specific HR — Establishment of ethical oversight committee <p>Considered new to one of China's clusters</p> <ul style="list-style-type: none"> — Offering contract manufacturing
A2 Project-based structure	1	(1.4%)	<p>Considered not new</p> <ul style="list-style-type: none"> — Restructuring around new disease focused R&D <p>Considered new to China</p> <ul style="list-style-type: none"> — Structures around flexible composition of project teams
B Changing processes			
B1 Electronic data interchange	2	(2.8%)	<p>Considered new to the biopharmaceutical industry</p> <ul style="list-style-type: none"> — IT systems for circumventing credit risk <p>Considered new to the biopharmaceutical industry</p> <ul style="list-style-type: none"> — Invite foreign researchers for training employees — Consulting contracts for expats to enhance reputation — Establish firm network for increasing responsiveness to clients — Exchange between European scientists and senior researchers — Networking with Chinese scientists to connect key personnel — Establish regular meetings with IP officers for product development <p>Considered new to China industry</p> <ul style="list-style-type: none"> — Web-based platform for marketing drugs to doctors <p>Considered new to China</p> <ul style="list-style-type: none"> — MBA training for board members for establishing network in business community — Implementation of strict compliance rules for dealing with SFDA officers <p>Considered new to one of China's clusters</p> <ul style="list-style-type: none"> — Attracting reputable scientist for training employees
B2 Horizontal networking	10	(13.9%)	<p>Not considered new</p> <ul style="list-style-type: none"> — Establishment of joint offices for better use of employees and facilities

Table 3. (Continued)

Innovation area	No.	(%)	Management innovations
B3 HR practices	8	(11.1%)	<p>Considered new to China and the biopharmaceutical industry</p> <ul style="list-style-type: none"> _ Development of "Plug & Play" training system to respond to customer needs _ Hiring of returnees for mid-level careers to attract new clients _ Hiring of marketing specialist for distribution of products in China <p>Considered new to China</p> <ul style="list-style-type: none"> _ Implementing online courses with foreign researchers _ Policy focusing on hiring returnees <p>Considered new to one of China's clusters</p> <ul style="list-style-type: none"> _ Adoption of HR systems from university
B4 Technology strategies	7	(9.7%)	<p>Considered new to the biopharmaceutical industry</p> <ul style="list-style-type: none"> _ Hiring of returnees for the implementation of the new strategy _ Hiring new personnel for implementation of clinical trials <p>Considered new to China</p> <ul style="list-style-type: none"> _ Global procedures for technology acquisition _ Exclusive focus on global clinical trials _ Implementation of joint quality testing procedures _ Exclusive focus on global patenting <p>Considered new to one of China's clusters</p> <ul style="list-style-type: none"> _ Implementing int. quality control procedures
B5 Organizational integration	4	(5.6%)	<p>Considered new to China and the biopharmaceutical industry</p> <ul style="list-style-type: none"> _ Regular meeting between project leaders to identify new markets _ Implementation of joint technology evaluation practices <p>Considered new to the biopharmaceutical industry</p> <ul style="list-style-type: none"> _ Behavioural codes for developing corporate identity _ Foster exchange between scientists <p>Considered new to China</p> <ul style="list-style-type: none"> _ Varying project teams
C Changing Boundaries			
C1 Down scoping and focus	2	(2.8%)	<p>Considered new to China</p> <ul style="list-style-type: none"> _ Taking focal position in value chain _ Down scoping to adopt strategic position in value chain
C2 Outsourcing	4	(5.6%)	<p>Considered new to China and the biopharmaceutical industry</p> <ul style="list-style-type: none"> _ Outsourcing of HR management <p>Considered new to the biopharmaceutical industry</p> <ul style="list-style-type: none"> _ Outsourcing of low value chain activities for better use core resources <p>Considered new to China</p> <ul style="list-style-type: none"> _ Outsourcing of formal HR training <p>Considered new to one of China's clusters</p> <ul style="list-style-type: none"> _ Outsourcing of early stage product development

(Continued)

Table 3. (Continued)

Innovation area	No.	(%)	Management innovations
C3 Alliances	7	(9.7%)	Considered new to China and the biopharmaceutical industry _Accessing local knowledge to improve response time to political changes _Stringent selection rules for alliance partners _Facilitating access to foreign scientific knowledge _Alliance formation for improving lobbying position Considered new to the biopharmaceutical industry _Alliance for accessing financial resources _Reducing bankruptcy risk by pooling resources _Enhancing financial means by re-establishing local contacts
C4 Extending the value chain	4	(5.6%)	Considered new to China and the biopharmaceutical industry _Upstream integration of manufacturing capacities Considered new to the biopharmaceutical industry _Extending supplier network to respond to customer demands _Upstream integration of manufacturing capacities _Downstream integration for new marketing approaches
Total No.	72	(100%)	

membership score. Second, an inter-firm relation leading to the implementation of two management innovations received the full newness score of their most innovative managerial tool and an additional 10% of the second management innovation. Third, inter-firm relations leading to the implementation of only one management innovation had the newness score of their management innovation reduced by 10%. Fourth, an inter-firm relation that did not lead to the implementation of a management innovation received full *non-membership*.

Independent measures

To identify conditions of inter-firm relations important for the implementation of management innovation, I drew on the literature on management innovation and on organizational learning in the context of strategic alliances. This research has shown how relational (Luo & Deng, 2009; Woolthuis Klein et al., 2005), structural (Avadikyan et al., 2001; Vlaar et al., 2006) and environmental conditions (Delmestri, 1998) of inter-firm relations influence their potential for learning and innovation. Drawing on this literature, I consider six inter-firm conditions important for the implementation of management innovation.

First, *mutual dependence* amongst inter-firm relations averts unilateral enforcements and mitigates relational risks, thereby facilitating the circulation of information between firms, a precondition for innovation (Sheppard & Sherman, 1998). Second, the similarity of partners as an indicator for the *heterogeneity* of geographical, cultural or organizational knowledge available for developing new managerial instruments is important for management innovation (Mol & Birkinshaw, 2009).

Third, from a structural perspective, *decentralization* is an important trait of innovating organizations. In such decentralized systems, specialists are included in decision-making processes, thereby raising their levels of awareness, commitment and involvement (Damanpour, 1991). Fourth, researchers have considered the role of *formalization*, i.e., the codification of coordination mechanisms, in innovation amongst strategic alliances (Damanpour, 1991). Some researchers argue that formalization discourages innovation by inhibiting experimentation (Thompson, 1965) whereas others consider it important for increasing attention, articulation and reflection between partners (Vlaar et al., 2006). Yet, despite this disagreement, most agree that formalization is an important organizational condition for innovation. Fifth, *vertical differentiation* serves to align interests, avoid disagreement and create consensus amongst interacting firms, and is therefore conducive to management innovation (Daft, 1978; Damanpour, 1991).

Sixth, *environmental uncertainties*, by triggering problem-solving and opportunity seeking mechanisms amongst organizations, have been associated with management innovation (Birkinshaw et al., 2008; Jansen, Van Den Bosch, & Volberda, 2006).

Although these six conditions are not exhaustive, they cover the most relevant relational, structural and environmental conditions identified by prior research (Damanpour, 1991). One notable exception is *specialization*. Due to the empirical context of a high-technology industry, I was not able to develop a scale for specialization. Nearly all employees engaged in the partnerships were professionals, so that meaningfully separating their educational background—the usual indicator for specialization—was not possible. Consequently, I could not include specialization in the analysis.

To develop sets for each of the six conditions and to measure the membership scores of each inter-firm relation in these sets, I used interview and questionnaire items common in studies on management innovation (Damanpour, 1991; Mol & Birkinshaw, 2009). Table A1 in the Appendix lists the items used for measuring set-membership in each of the facilitating conditions and explains the logic underlying their calibration.

Assessment of measurement biases

I took several steps to reduce the risks of social desirability, pro-innovation and common method bias inherent in research on management innovation (Damanpour, 1991). First, all documents for data collection were pre-tested several times. To guarantee accuracy in the Chinese documents, the English questions went through three rounds of back-and-forth translation. This process helped clarify meaning and prevent ambiguous questions. Second, I explicitly assured the respondents confidentiality, a measure for reducing the risk of social desirability bias. Third, to avoid the selection problem inherent in research using key informants (Kumar, Stern, & Anderson, 1993), I interviewed only senior and middle managers with first-hand knowledge on their firm partnerships. Fourth, the three-dimensional coding scheme for measuring management innovation based on expert judgement is strongly context-embedded and more appropriately captures the newness of innovations (Gupta, Tesluk, & Taylor, 2007). Finally, separating the measurement of management innovation from the conditions of inter-firm relations further reduced social desirability and pro-innovation biases, thereby avoiding common-method biases.

Analysis

Having calibrated the conditions of inter-firm relations, fsQCA organizes all logically possible combinations of absent and present conditions in a truth table. I then minimize the truth table by considering the coverage threshold, which indicates the minimum number of empirically observed cases for each configuration, and the consistency threshold, which displays the proportion of cases consistent with the outcome. A consistency score of 1 indicates a high, and a score of 0.5 a low, level of consistency. For this analysis I set the consistency threshold at 0.79, above the usually recommended minimum of 0.75 (Fiss, 2011; Ragin, 2006), and the coverage threshold at one case.

Overall, 26 of the 56 inter-firm relations are represented by configurations exceeding both the coverage and the consistency threshold. The 30 remaining cases were omitted for two reasons. Eighteen cases corresponded to configurations in which inter-firm relations had not led to the implementation of management innovations at all. Another 12 cases fell into configurations in which some partnerships had implemented management innovations whereas others had not. These configurations of relational, structural and environmental conditions thus did not provide a sufficiently consistent account of configurations leading to the implementation of management innovation. The differences between the 26 included and the 30 excluded cases, in terms of the firm characteristics, were negligible. Although the firms included in the analysis were somewhat older and smaller, were rather located outside the two main technology regions (Beijing and Shanghai), and were engaged in activities secondary to the industry, independent *t*-test statistics indicated that the differences were not significant. The exclusion of cases should therefore not affect the overall conclusions of the paper.

Using Boolean logic, fsQCA reduces these configurations to identify combinations of inter-firm conditions that—in conjunction—are associated with the implementation of management innovation. The intuition is that if two inter-firm relations differ only in a single condition whilst both lead to the implementation of management innovation, this distinguishing condition is irrelevant and can thus be eliminated.

I use the algorithm included in the fs/QCA software (Ragin, Drass, & Davey, 2006), which is based on a counterfactual analysis. It allows the categorization of conditions into core and peripheral conditions (Fiss, 2011). Core inter-firm conditions are those essential for the implementation of management innovation; peripheral conditions support core conditions but are not vital for explaining management innovations emerging from a specific archetype.

Archetypes of inter-firm relations in management innovation						
Archetype label	Organic Coalitions		Bureaucratic Foundations		Intense Coalitions	Reciprocal Foundations
Permutation	OC ₁	OC ₂	BF ₁	BF ₂	IC	RF
Relation						
Mutual dependence		●		●	●	●
Heterogeneity					⊗	●
Structure						
Decentralization	●	●	●	●	●	●
Formalization	●		●	●	●	
Vertical differentiation	⊗	⊗	●	●		●
Environment						
Uncertainty	●	●	⊗	⊗	●	
No. of inter-firm relations	3	5	2	1	8	7
Rel. importance of IFR for						
(A) Changing structures	3	3	0	0	2	3
(B) Changing processes	1	1	1	1	7	5
(C) Changing boundaries	1	3	2	0	5	2
Consistency	77.7%	82.5%	82.3%	80.5%	81.6%	78.7%
Raw coverage	30.5%	35.8%	26.2%	27.8%	44.9%	44.9%
Unique coverage	0.5%	3.0%	0.9%	0.6%	9.9%	7.8%
Overall solution consistency	79.2%					
Overall solution coverage	66.7%					

Figure 1. Archetypes of inter-firm relations that led to the implementation of management innovation.

Results

The configuration chart (Ragin & Fiss, 2008) in Figure 1 illustrates the results. Large circles represent core conditions; small circles, peripheral conditions. Crossed-out circles denote that the absence of an inter-firm condition is important for the implementation of management innovation. Empty cells indicate “don’t care’s”, i.e., neither their presence nor their absence is associated with the implementation of management innovation.

The chart also includes the number of inter-firm relations that exhibited each archetype, along with information on whether the implemented management innovations led to changes in the boundaries, processes or structures of the adopting firm. The solution exhibits an overall consistency score of 79.2%, considered sufficient for fuzzy set analyses (Fiss, 2011; Ragin, 2008b), and explains approximately two thirds of the implemented management innovations (66.7% coverage).

Four archetypes of inter-firm relations in China’s biopharmaceutical industry led to the implementation of management innovation. As indicated by the large circles, these archetypes differ in the core conditions. Additionally, some cores are surrounded by peripheral conditions that support the implementation of new managerial instruments.

Organic coalitions

At the core of the first inter-firm archetype lies decentralization and the absence of vertical differentiation, i.e., a flat hierarchy. Environmental uncertainty surrounds these central conditions and contributes to the implementation of management innovation. There are two permutations of this

first archetype indicated by the peripheral conditions of formalization (OC_1) and mutual dependence (OC_2). Amongst the 56 inter-firm relations, eight correspond to this archetype.

The decentralized and flat hierarchical structure reflects the organic nature of this archetype. Moderately high levels of environmental uncertainty support this interpretation, suggesting that the value of contributions by either firm is difficult to measure. That formalization may serve as a substitute for mutual dependence points towards the “enabling” rather than the “coercive” form of formalization (Adler & Borys, 1996) for establishing levels of trust between partnering firms. Consequently, the governance mechanisms serve the constant realignment of objectives. These features indicate a coalitional system. I therefore label this archetype for implementing management innovation an “organic coalition”.

The types of management innovations that were implemented based on the joint efforts of both organizations indicate that the majority of management innovations predominantly affected the organizational structure of the adopting firms. Thus firms opened marketing departments, established scientific advisory boards or re-structured their firm to improve access to crucial resources. Overall, firms pool knowledge internal to the partnership to develop new managerial instruments for addressing uncertainties arising from their environment. Safeguarding mechanisms, such as formalization or mutual dependence, facilitate the exchange and sharing of knowledge.

Bureaucratic foundations

The core of the second archetype contains a strong hierarchical structure operating in stable environmental conditions. Formalization contributes to the implementation of management innovation. Again, two permutations are discernible: one based on decentralization (BF_1), the other prevalent amongst heterogeneous partners (BF_2). Only three inter-firm relations correspond to this archetype.

The hierarchical structure, the relatively stable environmental conditions and the supporting role of formalization point toward an organizational system whose efficiency derives from a mechanistic or bureaucratic structure. This archetype contains a complex mix of coordination mechanisms and a constitutional framework of rules and regulations. Firms in these relations appear to have conflicting interests suggesting that contributions and objectives are measurable. These features resemble the preference structure of a foundation. I therefore label this second archetype a “bureaucratic foundation”.

With only three cases identified, bureaucratic foundations show the lowest propensity for implementing management innovations. None of the management innovations that depended on the joint effort of firms in a bureaucratic foundation affected the structure of the adopting organization. Implemented management innovations, such as the practice of downstream integration or the implementation of “plug & play” HR modules, appeared better governed by highly formalized structures. Overall, bureaucratic foundations at best lead to marginal changes in the processes or at the boundaries of the organization.

Coalition of intensely interdependent partners

Relational conditions are characteristic of the third archetype of inter-firm relations leading to the implementation of management innovation. Firms are mutually dependent, similar to one another and strongly reliant on the formalization of joint activities. Eight of the 56 inter-firm relations exhibit these characteristics.

This archetype is not readily allocated along the organic-versus-mechanistic divide. Similarly, the preference structure of these inter-firm relations is ambiguous. Although the importance of formalization points towards a foundational nature, the high degree of mutual dependence and the supporting function of environmental uncertainty suggest a coalition. The most characteristic feature of this archetype lies in the nature of the interdependence that prompts firms to join resources and to act collectively. Complementary resources are jointly applied in the pursuit of common objectives. That firms are so similar to each other suggests relatively high appropriation risks, which in turn makes measuring contributions and outcomes easy. Extensive formalization is therefore required for reducing relational risks. Overall, these features imply a coalition of intense interdependence.

Coalitions of intensely interdependent partners are found highly effective in implementing management innovation, with 14 instances identified. The majority of these management innovations change the organizational processes or boundaries of the firm. Management innovations, for example, occurred through introducing new technology acquisition strategies or developing essential quality, safety or ethical operating procedures. All these examples indicate that management innovation strongly depended on the intense relationship between partners and that the coalition formed between firms potentially threatened important competitive capabilities. Moreover, the implemented management innovations pertained to managerial factors highly obscure to outsiders. In this archetype the implementation of management innovations thus appears facilitated by each partnering firm's tacit understanding of the other's systemic operations.

Reciprocal foundations

The fourth archetype exhibits at its core a heterogeneous relationship with a decentralized structure. This core is supported by vertical differentiation. Seven inter-firm relations correspond to this archetype.

The heterogeneity between partners suggests different resources, and the relatively complex mix of coordination mechanisms implies a foundational preference structure. The relatively supervisory hierarchical roles that nonetheless transfer decision-making rights to lower hierarchical levels point towards a situation of reciprocal interdependence, in which joint contributions are tailored to the needs of the partnering firms. Given the strongly aligned interests and the high degree of reciprocal interdependency, I label this archetype a "reciprocal foundation".

With 10 instances observed, reciprocal foundations led to the implementation of a large number of management innovations (as does the coalition of intense interdependence). These management innovations primarily change the firm's organizational processes. Most of the implemented management innovations based on this archetype concerned horizontal networking where firms used established contacts, for example, to provide training, to connect key personnel, to search for new business opportunities or to tailor services. As these examples indicate, the resources contributed by each partner were valuable but not essential, i.e., not an imminent threat to the partner's core capabilities.

Again, the type of management innovation that presumably requires the most tacit knowledge appears facilitated when firms share a particular form of interdependence. In reciprocal foundations, however, tacit knowledge is transferred via transactional interdependence rather than via interdependence by collective action as in the case of the intensely interdependent coalition.

Discussion and Conclusion

Despite the many contributions that attribute an important role in the implementation of management innovation to inter-firm relations (Damanpour, 1987; Tether & Tajar, 2008), research thus far

has treated collaborations as one broad mode of organizing (Grandori, 1997). The goal of this study was to provide the first empirical evidence of archetypes of inter-firm relations, discrete combinations of coordination mechanisms, and types of interdependencies leading to the implementation of management innovation. The results identify four archetypes, which I have labelled according to their primary characteristics.

Organic coalitions combine decentralized coordination mechanisms and a flat hierarchical structure with uncertainties arising from the difficulties in measuring the value of each partner's contribution to the collaboration. The bottom-up processes thought to occur in such organizational systems frequently lead to the implementation of management innovations affecting the surface rather than the substance of the firm. In contrast, bureaucratic foundations are characterized by a hierarchical, formalized structure and operate in stable environments. The sparse evidence suggests that, in a top-down manner, bureaucratic foundations are at best useful for implementing established management innovations that make singular changes in the boundaries or processes of the firm.

These findings provide initial validity to Burns and Stalker's (1961) distinction between mechanistic and organic organizational systems and their propensity towards innovating. Organic systems, also on the inter-firm level and in the case of non-technological innovation, more frequently lead to the implementation of management innovation.

However, two archetypes put this interpretation in a different light. Coalitions of intensely interdependent partners and reciprocal foundations show the highest propensity towards leading to the implementation of management innovation. Characteristic of each is that core competencies of both partners are affected in the joint efforts leading to implementation. Higher degrees of interdependency thus appear to lead to more substantive management innovations affecting the internal processes governing the firm. This finding suggests that types of interdependency—and more specifically those interdependencies requiring each firm to provide access to essential capabilities—are more important for implementing management innovations than coordination mechanisms. Thus, whereas intensive and reciprocal interdependency (as proposed by Grandori's 1997 model) prove decisive for the implementation of management innovation, the alternatives—pooled and sequential interdependency—are not as relevant. In these types of interdependencies, an adequate mix of coordination mechanisms as indicated by the organic coalition or the bureaucratic foundation may outweigh their disadvantages in the implementation of management innovation.

Overall, the results provide the first empirical evidence of four discrete alternative inter-firm archetypes for the innovation implementation of management innovation. This taxonomy reduces the hypothetical complexity of inter-firm relations by stripping away irrelevant conditions and highlighting those essential for the innovation implementation. It provides an overview of possible solutions that managers can evoke when seeking to trigger a search for new managerial instruments. To facilitate managerial renewal, firms' decision-makers may adjust existing relationships according to the taxonomy. The relational and environmental conditions provide first indicators for determining which archetype may serve as an ideal type for modelling existing inter-firm relations. Likewise, during the formation of new ties, managers may choose potential partners according to their preference with regards to the available coordination mechanism.

This study's setting in China's biopharmaceutical industry, i.e., an emerging country and a dynamic industry, proved highly suitable for studying the implementation of management innovation at the inter-firm level. At the same time China's unstable business environment creates voids of formal institutions (Puffer, McCarthy, & Boisot, 2010). The firms in this study face more risk and uncertainties than Western firms. By operationalizing the newness of management innovation alongside the three contextual dimensions of industry, country and region, this study suggests that

inter-firm relations may facilitate the implementation of institutional templates governing a wider organizational population. For example, the establishment of ethical oversight committees may at one earlier point be considered a management innovation; later on, however, it may transform into a formal institution “governing” an entire industry. Some of the inter-firm relations may thus be considered “collaborative institutional entrepreneurs” (Phillips, Lawrence, & Hardy, 2000) fostering the structuration process of China’s institutional environment.

The contributions of this study are constrained by at least three limitations that at the same time suggest directions for further research. First, I have provided the first empirical evidence of discrete combinations of relational, structural and environmental conditions of inter-firm relations. Much of the current literature emphasizes the role of human agency, in particular that of top management teams in management innovation (Vaccaro et al., 2012). This perspective may fruitfully be extended, for example through an examination of how different characteristics of top managers and their leadership styles influence the management of inter-firm relations.

Second, beyond the distinction of core and peripheral conditions, fsQCA is not capable of assessing the impact of individual conditions within given archetypes. As the method is relatively young and methodological developments are still taking place, these shortcomings may be partly ameliorated in the future. Nevertheless, future studies may further scrutinize the results by applying statistical techniques more suitable for unravelling the associations between conditions of inter-firm relations and the implementation of management innovation.

Moreover, I have introduced a new, multi-dimensional construct for measuring management innovation. Recent research on management innovation has developed alternative measurement approaches, such as the use of singular items in large-scale surveys (e.g., Mol & Birkinshaw, 2009) or the construction of new scales (e.g., Vaccaro et al., 2012). How different approaches to measuring management innovation relate to one another, and what implications they have for interpreting and comparing empirical results deserves further attention.

Third, I have not been able to draw conclusions about the performance implications of management innovation. Most research suggests a positive link between management innovation and competitiveness (e.g., Evangelista & Vezzani, 2010; Mol & Birkinshaw, 2009). My results show that firms in the Chinese biopharmaceutical industry do not merely copy existing management instruments but instead rapidly and effectively develop and introduce new ones. Yet at this stage of observation, i.e. when management innovations had just been implemented, one can only speculate on their impact on the competitiveness of firms. Future research may ask why some management innovations alter the shape of an industry whilst others affect the competitive position of individual firms.

This study contributes to the literature on management innovation in several ways. It shifts the focus of the analysis to the inter-firm level, thereby complementing existing conceptual models and emerging evidence for the important role of inter-firm relations in inducing management innovation. Further, it introduces a new analytical approach, fsQCA, to the study of management innovation and has developed a novel, multi-dimensional construct that measures management innovation across the industry, country and cluster level. Finally, for inter-firm relations the results have identified four discrete archetypes that lead to the implementation of management innovation.

Acknowledgements

I thank Barbara Krug, Peer Fiss, Paul Adler, Sergey Osadchiy, and Uschi Backes-Gellner, and the seminar participants USC Marshall Business School for their helpful comments. I am also grateful for the suggestions made by the senior editor, Alice Lam, and three anonymous reviewers. Earlier versions of this paper were presented at the EGOS Colloquium in 2009 and at the 2010 Academy of Management Meeting in Montréal.

Funding

The research was generously supported by the Erasmus Research Institute of Management and the Vereniging Trustfonds Universiteit Rotterdam.

Notes

1. Despite conceptual differences, the terms “configuration” and “archetype” are often used synonymously. “Configurations” are more generic, universal ideal types. “Archetypes” are specified by the institutional constraints of a certain sector (see e.g., Cooper, Hinings, Greenwood, & Brown, 1996; Greenwood & Hinings, 1993).
2. For more information on the calibration technique, see Ragin (2008a) or Fiss (2011).
3. As some inter-firm relations developed more management innovations than others, computing simple weighted averages amongst all partnerships would disproportionately penalize a partnership with a single highly innovative management tool in comparison to one with two management innovations, one highly innovative and the other incrementally so.

References

- Adler, P. S., & Borys, B. (1996). Two types of bureaucracy: Enabling and coercive. *Administrative Science Quarterly*, 41, 61–89.
- Almeida, P., Song, J., & Grant, R. M. (2002). Are firms superior to alliances and markets? An empirical test of cross-border knowledge building. *Organization Science*, 13, 147–161.
- Avadikyan, A., Llerena, P., Matt, M., Rozan, A., & Wolff, S. (2001). Organisational rules, codification and knowledge creation in inter-organisation cooperative agreements. *Research Policy*, 30, 1443–1458.
- Birkinshaw, J., Hamel, G., & Mol, M. J. (2008). Management innovation. *Academy of Management Review*, 33, 825–845.
- Burns, T., & Stalker, G. M. (1961). *The management of innovation*. London, UK: Tavistock Publications.
- Coombs, R., Harvey, M., & Tether, B. S. (2003). Analysing distributed processes of provision and innovation. *Industrial & Corporate Change*, 12, 1125–1155.
- Cooper, D. J., Hinings, B., Greenwood, R., & Brown, J. L. (1996). Sedimentation and transformation in organizational change: The case of Canadian law firms. *Organization Studies*, 17, 623–647.
- Daft, R. L. (1978). A dual-core model of organizational innovation. *Academy of Management Journal*, 21, 193–210.
- Damanpour, F. (1987). The adoption of technological, administrative, and ancillary innovations: Impact of organizational factors. *Journal of Management*, 13, 675.
- Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, 34, 555–590.
- Damanpour, F., & Aravind, D. (2011). Managerial innovation: Conceptions, processes, and antecedents. *Management and Organization Review*, 8, 423–454.
- Delmestri, G. (1998). Do all roads lead to Rome... or Berlin? The evolution of intra- and inter-organizational routines in the machine-building industry. *Organization Studies*, 19, 639–665.
- Drazin, R., van de Ven, A. H. (1985). Alternative forms of fit in contingency theory. *Administrative Science Quarterly*, 30, 514–539.
- Ernst & Young. (2006). *Beyond Borders – The Global Biotechnology Report 2006*. http://www2.eycom.ch/publications/items/biotech-report/2006/2006_EY_Global_Biotech_Report.pdf.
- Evangelista, R., & Vezzani, A. (2010). The economic impact of technological and organizational innovations. A firm-level analysis. *Research Policy*, 39, 1253–1263.
- Fiss, P. (2011). Building better causal theories: A fuzzy set approach to typologies in organizational research. *Academy of Management Journal*, 54, 393–420.

- Frew, S. E., Sammut, S. M., Shore, A. F., Ramjist, J. K., Al-Bader, S., Rezaie, R., . . . Singer, P. A. (2008). Chinese health biotech and the billion-patient market. *Nature Biotechnology*, 26, 37–53.
- Golightly, H. O. (1968). Case study in management innovation *Management Review*, 57, 29.
- Grandori, A. (1997). An organizational assessment of interfirm coordination modes. *Organization Studies*, 18, 897–925.
- Grandori, A. (2001). Neither hierarchy nor identity: Knowledge governance mechanisms and the theory of the firm. *Journal of Management and Governance*, 5, 318–399.
- Grandori, A., & Furnari, S. (2008). A chemistry of organization: Combinatory analysis and design. *Organization Studies*, 29, 459–485.
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17, 109–122.
- Grant, R. M., & Baden-Fuller, C. (2004). A knowledge accessing theory of strategic alliances. *Journal of Management Studies*, 41, 61–84.
- Greckhamer, T. (2011). Cross-cultural differences in compensation level and inequality across occupations: A set-theoretic analysis. *Organization Studies*, 32, 85–115.
- Greenwood, R., & Hinings, C. R. (1993). Understanding strategic change: The contribution of archetypes. *Academy of Management Journal*, 36, 1052–1081.
- Gulati, R., Nohria, N., & Zaheer, A. (2000). Strategic networks. *Strategic Management Journal*, 21, 203–215.
- Gupta, A. K., Tesluk, P. E., & Taylor, M. S. (2007). Innovation at and across multiple levels of analysis. *Organization Science*, 18, 885–897.
- Hamel, G. (2006). The why, what, and how of management innovation. *Harvard Business Review*, 84, 72–84.
- Harrison, J. S., Hitt, M. A., Hoskisson, R. E., & Ireland, R. D. (2001). Resource complementarity in business combinations: Extending the logic to organizational alliances. *Journal of Management*, 27, 679–690.
- Inkpen, A. C. (2000). Learning through joint ventures: A framework of knowledge acquisition. *Journal of Management Studies*, 37, 1020–1043.
- Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2006). Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science*, 52, 1661–1674.
- Kimberly, J. R. (1981). Managerial innovation. In P. C. Nystrom, & W. H. Starbuck (Eds.), *Handbook of organizational design* (pp. 84–104). New York, NY: Oxford University Press.
- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3, 383–397.
- Kumar, N., Stern, L. W., & Anderson, J. C. (1993). Conducting interorganizational research using key informants. *Academy of Management Journal*, 36, 1633–1651.
- Lam, A. (2005). Organizational innovation. In J. Fagerberg, D. C. Mowery, & R. R. Nelson (Eds.), *Handbook of innovation* (pp. 84–104). Oxford, UK: Oxford University Press.
- Luo, X., & Deng, L. (2009). Do birds of a feather flock higher? The effects of partner similarity on innovation in strategic alliances in knowledge-intensive industries. *Journal of Management Studies*, 46, 1005–1030.
- Meyer, A. D., Tsui, A. S., & Hinings, C. R. (1993). Configurational approaches to organizational analysis. *Academy of Management Journal*, 36, 1175–1195.
- Miller, D., & Friesen, P. H. (1978). Archetypes of strategy formulation. *Management Science*, 24, 921–933.
- Mol, M. J., & Birkinshaw, J. (2009). The sources of management innovation: When firms introduce new management practices. *Journal of Business Research*, 62, 1269–1280.
- Mowery, D. C., Oxley, J. E., & Silverman, B. S. (1998). Technological overlap and inter-firm cooperation: Implications for the resource-based view of the firm. *Research Policy*, 27, 507–523.
- Nelson, R. R., & Sampat, B. N. (2001). Making sense of institutions as a factor shaping economic performance. *Journal of Economic Behavior & Organization*, 44, 31–54.
- Nooteboom, B. (1996). Trust, opportunism and governance: A process and control model. *Organization Studies*, 17, 985–1010.
- Nooteboom, B. (2006). Trust: reason, routine, reflexivity. *Organization Studies*, 27, 1907–1910.

- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependency perspective*. New York, NY: Harper and Row.
- Phillips, N., Lawrence, T. B., & Hardy, C. (2000). Inter-organizational collaboration and the dynamics of institutional fields. *Journal of Management Studies*, 37, 23–48.
- Pinnington, A., & Morris, T. (2002). Transforming the architect: Ownership form and archetype change. *Organization Studies*, 23, 189–210.
- Pisano, G. P. (2006). *Science business*. Boston, MA: Harvard Business School Press.
- Porter, M. E. (1980). *Competitive strategy*. New York, NY: Free Press.
- Puffer, S. M., McCarthy, D. J., & Boisot, M. (2010). Entrepreneurship in Russia and China: The impact of formal institutional voids. *Entrepreneurship Theory and Practice*, 34, 441–467.
- Ragin, C. C. (2006). Set relations in social research: Evaluating their consistency and coverage. *Political Analysis*, 14, 291–310.
- Ragin, C. C. (2008a). Measurement versus calibration: A set-theoretic approach. In J. M. Box-Steffensmeier, H. E. Brady, & D. Collier (Eds.), *The Oxford handbook of political methodology* (pp. 174–198). Oxford, UK: Oxford University Press.
- Ragin, C. C. (2008b). *Redesigning social inquiry*. Chicago, IL: University of Chicago Press.
- Ragin, C. C., Drass, K. A., & Davey, S. (2006). Fuzzy-set/Qualitative comparative analysis 2.0 [Software]. Tucson, AZ: Department of Sociology, University of Arizona.
- Ragin, C. C., & Fiss, P. (2008). Net effects versus configurations: An empirical demonstration. In C. C. Ragin (Ed.), *Redesigning social inquiry* (pp. 190–212). Chicago, IL: University of Chicago Press.
- Robson, M. J., Katsikeas, C. S., & Bello, D. C. (2008). Drivers and performance outcomes of trust in international strategic alliances: The role of organizational complexity. *Organization Science*, 19, 647–665.
- Sanidas, E. (2005). *Organizational innovations and economic growth: Organosis and growth of firms, sectors and countries*. Cheltham, UK: Edward Elgar.
- Sheppard, B. H., & Sherman, D. M. (1998). The grammars of trust: A model and general implications. *Academy of Management Review*, 23, 422–437.
- Teece, D. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28, 1319–1350.
- Tether, B. S., & Tajar, A. (2008). The organisational-cooperation mode of innovation and its prominence amongst European service firms. *Research Policy*, 37, 720–739.
- Thompson, V. A. (1965). Bureaucracy and innovation. *Administrative Science Quarterly*, 10, 1–20.
- Unger, B. (2000). Innovation systems and innovative performance: Voice systems. *Organization Studies*, 21, 941–969.
- Vaccaro, I. G., Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2012). Management innovation and leadership: The moderating role of organizational size. *Journal of Management Studies*, 49, 28–51.
- Vlaar, P. W. L., Van Den Bosch, F. A. J., & Volberda, H. W. (2006). Coping with problems of understanding in interorganizational relationships: Using formalization as a means to make sense. *Organization Studies*, 27, 1617–1638.
- Whittington, R., Pettigrew, A., Peck, S., Fenton, E., & Conyon, M. (1999). Change and complementarities in the new competitive landscape: A European panel study, 1992–1996. *Organization Science*, 10, 583–600.
- Williamson, O. E. (1975). *Markets and hierarchies: analysis and antitrust implications: A study in the economics of internal organization*. New York, NY: Free Press.
- Woolthuis Klein, R., Hillebrand, B., & Nooteboom, B. (2005). Trust, contract and relationship development. *Organization Studies*, 26, 813–840.

Author biography

Johannes Meuer is a Post-Doctoral Researcher at the Department of Business Administration of the University of Zurich. He received his PhD in 2011 from Rotterdam School of Management, Erasmus University. His current research focuses on theories of management innovation and on the application of set-theoretic methods in organization studies. He has published in the Academy of Management Best Paper Proceedings and contributed to books published by Edward Elgar and Springer.

Appendix

Table A1. Measuring membership scores in sets of facilitating conditions.

Item	Question	Answers	MS scores
Set of mutually dependent inter-firm relations			
1	How did you identify your partnering firm?	Prior social ties Third party referral Impersonal	[1.0] [0.7] [0.0]
2	Did any of you make significant investments for the partnership?	Yes No	[1.0] [0.0]
3	Did the other party match that investment?	Yes No	[1.0] [0.0]
4	Age of inter-firm relation (in years): <i>Membership scores assigned by percentiles</i>	5–8 (12%) 3–4 (35%) 2 (28%) 0–1 (25%)	[1.0] [0.6] [0.3] [0.0]
5	How frequently do you meet?	Daily (24%) Weekly (52%) Monthly (21%) Less frequently (3%)	[1.0] [0.6] [0.3] [0.0]
Set of heterogeneous inter-firm relations			
1	Categorical distance on value chain ^a	Other ^b Pharmaceutical firms Biotechnology service Research hospital Univ. labs, research inst. Biotechnology firm	[1.0] [0.8] [0.6] [0.4] [0.2] [0.0]
2	Age difference between firms (in years)	> 40 9–15 4–8 0–3	[1.0] [0.6] [0.3] [0.0]
3	Difference in ownership form	Private & SOE Private & Coll./ Coll. & SOE Same ownership	[1.0] [0.7] [0.0] [0.0]
4	Place of registration	Intercontinental Continental (Japan/ Korea) Domestic	[1.0] [0.7] [0.0]
5	Presence of returnees	Yes No	[1.0] [0.0]
Set of decentralized inter-firm relations			
1	Describe the style of decision making in the partnership	Consensual Neither.../nor... Hierarchical	[1.0] [0.5] [0.0]
2	Employees are included in the decision-making process	7-point Likert scale ^c	[1.0] [0.0]
3	Leadership groups take most of the decisions within the partnership	7- point Likert scale	[1.0] [0.0]

(Continued)

Table A1. (Continued)

Item	Question	Answers	MS scores
Set of formalized inter-firm relations			
1	Existence of a contractual agreement	Yes No	[1.0] [0.0]
2	Presence of a system of rules and regulations governing the activities of the partnership	Yes No	[1.0] [0.0]
3	Presence of formalized training programs	Yes No	[1.0] [0.0]
4	Clear division of labour between the partnering firms	Yes No	[1.0] [0.0]
Set of vertically differentiated inter-firm relations			
1	Are there designated administrative leadership positions within the partnership?	Yes No	[1.0] [0.0]
2	Are there designated scientific leadership positions within the partnership?	Yes No	[1.0] [0.0]
3	Compared to a university department, how hierarchical is your partnership organized?	Less hierarchical Equally hierarchical More hierarchical	[1.0] [0.5] [0.0]
4	To what extent are decision-making processes within your inter-firm relationship organized hierarchically?	7-point Likert scale	[1.0] [0.0]
Set of inter-firm relations experiencing environmental uncertainties			
1	Is the number of competitors...	Increasing Stable Decreasing	[1.0] [0.5] [0.0]
2	Is the strength of competitors...	Increasing Stable Decreasing	[1.0] [0.5] [0.0]
3	How easy is it for competitors to copy your products?	Easy Neither easy nor difficult Difficult	[1.0] [0.5] [0.0]
4	Preferences of customers change frequently.	7-point Likert scale	[1.0] [0.0]
5	"It is crucial for our collaboration to match these changes."	7-point Likert scale	[1.0] [0.0]
6	"Technology changes rapidly in our field."	7-point Likert scale	[1.0] [0.0]
7	"It is important for our partnership to match these changes."	7-point Likert scale	[1.0] [0.0]
8	"In the biopharmaceutical industry our field of research is relatively labour intensive."	7-point Likert scale	[1.0] [0.0]
9	"In the biopharmaceutical industry our field of research is relatively capital intensive."	7-point Likert scale	[1.0] [0.0]
10	"There is a high amount of regulations and policies we need to comply with."	7-point Likert scale	[1.0] [0.0]
11	"Regulatory requirements affecting our partnership are straightforward."	7-point Likert scale	[1.0] [0.0]

Table A1. (Continued)

Item	Question	Answers	MS scores
12	"Policies and regulations affecting our partnership change frequently."	7-point Likert scale	[1.0] [0.0]
13	"The legal mechanisms already in place sufficiently safeguard the interests of both our collaboration partners."	7-point Likert scale	[1.0] [0.0]
14	"We are able to participate in the development and changes of national and provincial policies."	7-point Likert scale	[1.0] [0.0]

^aI have used a standard value chain of the biopharmaceutical industry (Ernst & Young, 2006; Pisano, 2006).

^bOthers include: Industry associations, technology parks, VCs and public authorities.

^cThroughout the closed questionnaire I used a 7-point Likert scale measuring the agreement of respondents with statements from [0] disagree to [1] agree.