Competitive embeddedness: The impact of competitive relations among a firm's current alliance partners on its new alliance formations

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A R T I C L E   I N F O

A B S T R A C T

Over the last decades, alliance portfolio has been an important research area within the management and international business fields. Since engaging in multiple alliances provides many advantages to firms, the extant literature rather highlights the positive side of alliance portfolios. But, at the same time, focal firms of alliance portfolios sometimes suffer from competitive relations among their partners. By applying a competitive embeddedness lens, we examine the influence of competitive relations among partners within an alliance portfolio on the focal firm's alliance formations. Also, we examine the role of the focal firm's resources which moderate the relation between competition among its partners and its alliance formations. We investigated 2539 cases of global technology alliances in the biopharmaceutical industry from 2002 to 2006 through negative binomial regression. Our findings indicate that a holistic approach toward alliance portfolios to prevent competition among partners is significant for sustainable alliance strategies. Moreover, we suggest that firm resources which attract partners also lessen the impact of competition among alliances.

1. Introduction

As a result of firms' simultaneous engagements in a number of individual alliances, firms run their own alliance portfolios (Wassmer, 2010). While individual alliance research is focused on accessing valuable resource (Chung, Singh, & Lee, 2000; Das & Teng, 2000; Eisenhardt & Schoonhoven, 1996; Lavie, 2006), learning (Inkpen, 2000; Kogut, 1988), and reducing transaction cost and uncertainty (Kogut, 1988; Kogut, 1991) through individual partners, alliance portfolio research puts the focus on the configuration and the management of the whole portfolio. This point of view leads to a holistic approach which takes the whole portfolio into account and stops treating individual alliances as independent transactions (Bamford & Ernst, 2002; Duysters, de Man, & Wilderman, 1999; Hoffmann, 2005; Parise & Casher, 2003). Alliance portfolios have firms take advantage of synergies and super-additivity among their partners or confront conflict and sub-additivity among their partners (Parise & Casher, 2003; Vassolo,

Anand, & Folta, 2004). This implies that monitoring and coordination of focal firms' partners are significant in alliance portfolio strategy so that focal firms can fully capture the value creation from the synergy in their portfolios and avoid conflict among their partners which undermines such synergy.

Especially, we need to pay more attention to the conflict among a focal firm's partners in an alliance portfolio. In previous literature, it is assumed that alliance portfolios are predominantly beneficial to focal firms. For instance, many researchers suggest that growing alliance portfolios contribute to focal firms' performance (Ahuja, 2000a; Baum, Calabrese, & Silverman, 2000; Deeds & Hill, 1996; Gulati, 1999; Shan, Walker, & Kogut, 1994; Stuart, 2000; Stuart, Hoang, & Hybels, 1999). Therefore, focusing on conflict among the focal firm's partners and the consequential deterioration of the focal firms' performance can allow us deeper insights beyond the past trend of research in alliance portfolios. Besides, the conflict suggests that it is crucial for focal firms to strategically manage and configure their alliance portfolios, not only for better performance, but also for the long term viability of their portfolios.

Conflict among alliance partners can arise from their competitive relations. Even though they are parts of the same alliance portfolio of a focal firm, they might originally be competitors in the

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same market or industry. In this paper, we study the competitive relations in alliance portfolios in terms of embeddedness. The extant research in embeddedness suggests that inter-firm alliances do not occur in isolation, but rather under the influence of existing inter-firm networks that the firms are involved in (Granovetter, 1985; Gulati, 1995a; Gulati & Gargiulo, 1999). Especially, previous literature discusses mainly how structural and relational embeddedness affect alliance formations. Adding to previous literature, the objective of this study is to conceptualize competitive relations among a focal firm's partners as competitive embeddedness in an alliance portfolio and to examine its influence on the focal firm's subsequent alliance formations. Also, we investigate the moderating role of the focal firms' resources.

Following these objectives, our paper presents two key findings: First, competitive relations among a focal firm's partners in an alliance portfolio negatively influences the rate of the focal firm's alliance formations. We operationalize competitive relations in an alliance portfolio in terms of breadth and depth and examine empirically that both dimensions of competitive relations negatively influence the focal firm's new alliance formations. Second, valuable resources of the focal firm which attract partners help negating the negative influence of competitive relations. Sometimes, focal firms are not able to transform their alliance portfolios promptly or directly because of essential partners, contract period, etc. We suggest an indirect way of managing competitive relations in an alliance portfolio by utilizing the moderating role of the focal firm's resources, in this study we consider technological resources, on the relationship between competitive relations and new alliance formations.

In this research, we make four contributions to the literature focusing on alliance portfolios and international business. First, through a holistic approach toward alliance portfolios, we conceptualize competitive relations among a focal firm's partners in an alliance portfolio as competitive embeddedness and examine its negative influence on the focal firm's alliance formations. This paper is wary of the positively biased view over growing alliance portfolios in previous literature and empirically supports existing research (Hoffmann, 2005; Parise & Casher, 2003; Vassolo et al., 2004) which highlights the negative influence of conflicts among partners on focal firms. Second, we enrich the research on the influence of embeddedness on alliance formations in two different ways. We suggest another type of embeddedness (i.e. competitive embeddedness) which affects alliance formations in an alliance portfolio in other ways than structural and relational embeddedness. At the same time, the extant research on the relationship between competitive embeddedness and alliance formations is focused on direct rivalry or dyadic networks (Gimeno, 2004; Trapido, 2007). We extend the unit of analysis of competitive embeddedness to multi-actor networks, i.e. alliance portfolios. Third, we exemplify how network relationships affect firm performance in an international context. By analyzing international alliances between US biotechnology firms and multinational pharmaceutical companies, we exemplify previous conceptual literature (Benito & Welch, 1994; Coviello & Munro, 1997; Sharma, 1993) which specifically suggests that existing network relationships might inhibit new market development and verify this suggestion empirically. Fourth, we go beyond the academic point of view and contribute to managerial practices by suggesting how to cope with competitive embeddedness in an alliance portfolio.

The remainder of the paper is organized as follows: First, we develop the theoretical background of why a holistic approach and conflict management are significant for alliance portfolios and how we can understand competitive relations among alliance partners through the lens of competitive embeddedness. We develop hypotheses which link competitive relations, alliance formations and the focal firms' resources. Second, using negative binomial

regression, we then test our hypotheses using data on 2539 global technology alliance cases in the biopharmaceutical industry from 2002 to 2006. Finally, we present our empirical results and conclude with a discussion of implications, limitations, and directions of future research.

2. Theoretical background and hypotheses

2.1. A holistic approach and conflict management in alliance portfolios

Alliance portfolio management is an important topic in international business literature. Lichtenthaler and Lichtenthaler (2004) suggest firms to manage complexity in the environment of international multi-alliances. To address the complexity, a number of studies stress the importance of a holistic approach toward alliance portfolios. Duysters et al. (1999) suggest that firms should select alliance partners based on portfolio fit by analyzing their portfolios continuously. Parise and Casher (2003) and Hoffmann (2005) suggest that firms should exploit synergies and, at the same time, avoid conflicts across the whole portfolio. More specifically, firms should assess trust and knowledge among their partners, monitor the influence of individual alliances in the portfolio on each other and on overall performance, and change portfolio configuration over time (Parise & Casher, 2003). Hoffmann (2007) also suggests that firms should build alliance management systems by monitoring and coordinating their portfolios continuously. In sum, firms should maximize benefits and minimize conflicts in their alliance portfolios through holistic management.

Especially, firms should pay attention to the conflict within alliance portfolios. While it is usually seen as beneficial for firms to build an alliance portfolios because they can benefit from knowledge sharing, cooperation and synergies among their partners, previous literature suggests that building alliance portfolio sometimes happens to be harmful due to conflicts among focal firms' partners. Specifically, Lichtenthaler and Lichtenthaler (2004) suggest that every single alliance may have negative influences on other alliances due to their negative synergies in the complex international alliance environment. Parise and Casher (2003) suggest that constraining interdependencies among focal firms' partners lead to conflicts in an alliance portfolio. These constraining interdependencies occur when focal firms' alliance partners are strong rivals with one another in an industry and promote competing technologies. These interdependencies can bring significantly negative impact on focal firms' alliance performance. Vassolo et al. (2004) build on portfolio theory (Markowitz, 1959) in finance and suggest that redundant investments induce conflicts in an alliance portfolio. According to portfolio theory, the more investments in a portfolio are correlated, the lesser is the value of the portfolio. To sum up, the overlap of alliance partners leads to less return on investments and, even worse, different partners within an alliance portfolio hold each other in check and damage the value of the whole alliance portfolio. In other words, conflicts among a focal firm's partners prevent the focal firm of an alliance portfolio from obtaining benefits of the portfolio and negatively influence the focal firm's performance.

When firms build up their immediate social surrounding, i.e. their alliance portfolios, conflicts between their linked firms (partners) might also build up and an unintended consequence affects the focal firm. The influence of conflicts within an alliance portfolio can be investigated using the concept of embeddedness since one of the basic assumptions in embeddedness study is that an actor is affected by his social surroundings (Echols & Tsai, 2005; Granovetter, 1985). In the next section, we review existing

embeddedness research and explain how we adopt the concept to this study.

2.2. Competitive embeddedness and alliance formations

Embeddedness is a theoretical concept which pursues holistic approach in understanding how alliance formations are influenced by social surroundings in alliance portfolios. The key argument in embeddedness literature is that strategic relationships affect actors' actions and their outcomes (Baum & Dutton, 1996; Dacin, Ventresca, & Beal, 1999; Granovetter, 1985). Specifically, network embeddedness describes a firm's social structure, the extent to which it is connected to others and how those other firms are interconnected to each other (Granovetter, 1992; Nahapiet & Ghoshal, 1998). Some researchers describe the influence of embeddedness as follows. Granovetter (1985) suggests that an actor's social surroundings facilitate or constrain his or her economic actions. And strategic actions of a firm are determined not only by its internal context but also by its social context (Echols & Tsai, 2005; Gulati & Gargiulo, 1999). In line with this stream, researchers focus on holistic characteristics (i.e. structural embeddedness, sectoral embeddedness, etc.) of alliance portfolios and how they affect a firm's new alliance formations. For example, Garcia-Pont and Nohria (2002) suggest that structural embeddedness in an alliance network affects the likelihood of alliance formation between firms in the network, and Hagedoorn (1993) suggests that firms' sectoral embeddedness affects their propensity to engage in new alliances. Contrary to the somewhat positive view of the role of embeddedness in alliance formations, some researchers suggest possibilities of decreasing opportunities for new alliances under conditions of increasing social embeddedness (Burt, 1992; Duysters, Hagedoorn, & Lemmens, 2003; Hagedoorn, Letterie, & Palm, 2007; Uzzi, 1997).

Competitive embeddedness is a theoretical concept which accounts for how competitive relations affect alliance formations. Competitive relations refer to firms competing for limited resources or targeting the same market and include direct rivalry and indirect rivalry (McPherson, 1983). In previous literature in the field of competitive embeddedness, Trapido (2007) builds on the co-opetition concept (Brandenburger & Nalebuff, 1996) and explores how the likelihood of cooperation between two firms is influenced by their direct rivalry. Gimeno (2004) emphasizes that various network perspectives such as indirect ties have not been fully adopted to account for the relationship between

competitive relations and alliance formations in existing literature. Accordingly, Gimeno (2004) explores the likelihood of cooperation between two firms in case of their indirect rivalry. When two firms with high niche overlap have a common partner, they are considered to be substitutes in the common partner's point of view and cannot appropriate rents from the partner.

This paper differs from existing competitive embeddedness literature in two perspectives. First, existing literature highlights the impact of a focal firm's rivalry (direct or indirect) on its alliance formations. Trapido (2007) pays attention to the alliance link formation between a focal firm and its direct rival (Fig. 1a) while Gimeno (2004) pays attention to the alliance link formation between a focal firm and its rival's partner (Fig. 1b). In the meantime, this paper pays attention to the impact of rivalry between a focal firm's partners on the focal firm's alliance formations (Fig. 2). We are interested in competitive relations among partners of a focal firm and how these competitive relations affect the focal firm's alliance formations with existing or new partners. Second, the aforementioned differences between existing literature and our study lead us to go beyond analyzing dyadic relationships of a focal firm and instead to focus on the focal firm's alliance portfolio as the unit of analysis. As depicted in Fig. 2, within the portfolio, rivalries can take place across many partners of a focal firm and potentially affect all the alliance links of the focal firm.

In the next section, we examine more specifically how competitive relations between a focal firm's partners influence the focal firm's alliance formations.

2.3. The influence of competitive relations among the focal firm's partners within an alliance portfolio

2.3.1. Niche overlap between partners of the focal firm

Niche overlap is used to explain how firm performance and actions are influenced by competitive relations (Gimeno, 2004). When competitive partners with high niche overlap coexist in the same alliance portfolio, from the focal firm's perspective they are substitutable because they possess similar resources and knowledge, seek out similar markets or customers, and supply similar products or services (Baum & Mezias, 1992). This potential substitutability increases the focal firm's bargaining power over competitive partners and intensifies their competition (Pfeffer & Salancik, 1978). This competition leads to their disadvantage and failure of the alliances with the focal firm (Singh & Mitchell, 1996).
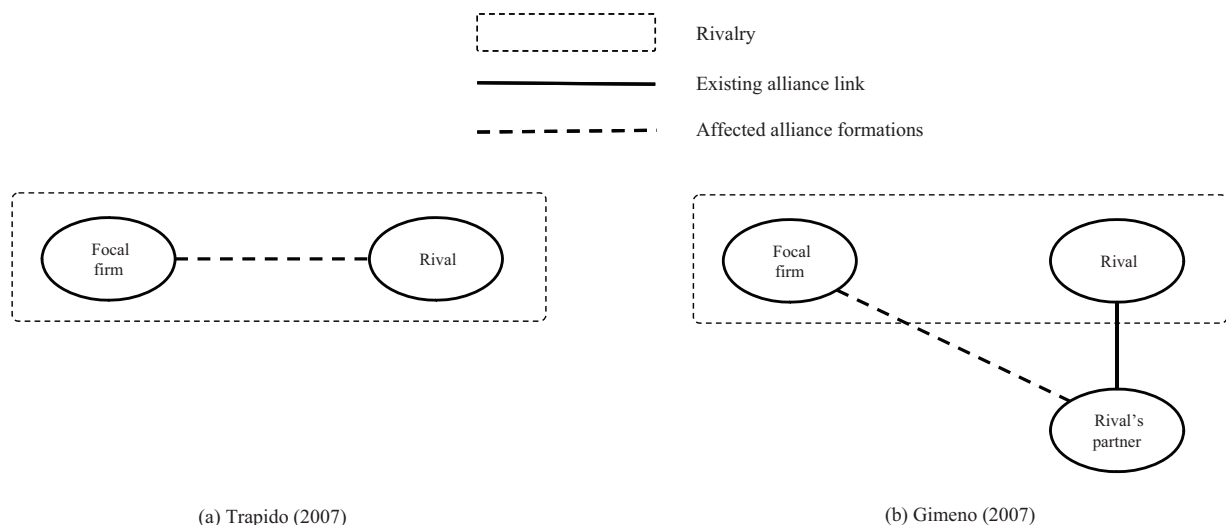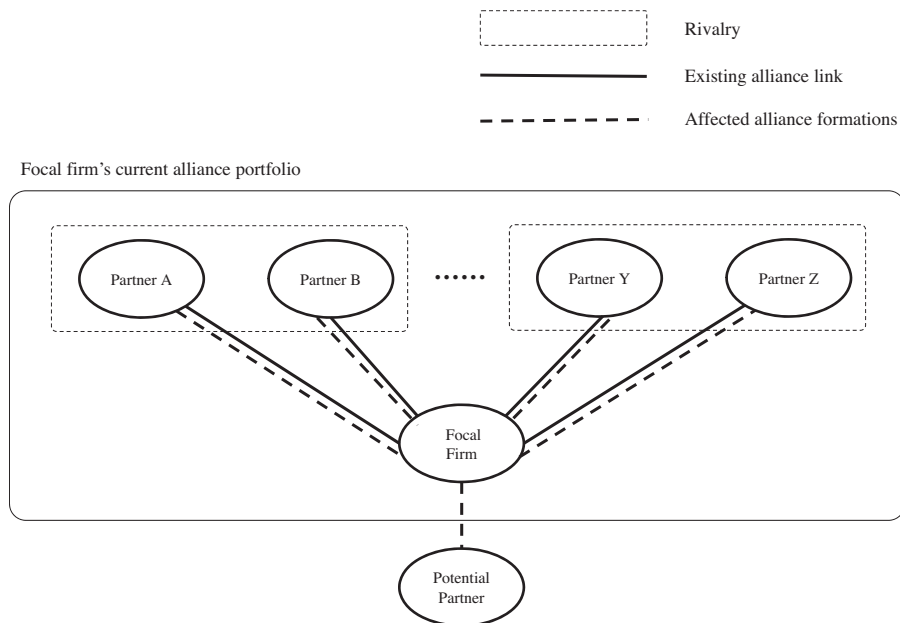

Fig. 1. How competitive embeddedness affects alliance formations in previous literature.

Fig. 2. How competitive embeddedness affects alliance formations in this paper.

Moreover, without collusive behavior, a partner's profitability decreases when other competing partners are more effective in cooperation with the focal firm (Salop & Scheffman, 1983). Thus a partner attempts to exclude other competing partners of the focal firm from the source of advantage, such as access to the focal firm (Krattenmaker & Salop, 1986). More specifically, competitors who have a common partner, the focal firm of an alliance portfolio in this paper, attempt to build their own specificity with the focal firm: exclusive contract and facility, operating rule, etc. At the same time, they attempt to prevent other partners' cooperation with the focal firm in explicit or implicit ways. Most of the competing partners of the focal firm would exhibit similar patterns to increase their exclusiveness with the focal firm and this would destabilize the focal firm's alliance portfolio.

Complementarity is implicitly the opposite concept of niche overlap and operationally defined as lack of niche overlap in prior alliance research (Gimeno, 2004). Complementarity can be used to explain competitive environment and alliance formations within alliance portfolios, since it is an important antecedent of alliance formations (Chung et al., 2000; Gulati, 1995a; Nohria & Garcia-Pont, 1991). Organizations which specialize in similar roles consume similar resources, and alliance portfolios composed of such organizations are thus likely to experience intense within-network competition that undermines the value created by the network (Rowley, Greve, Rao, Baum, & Shipilov, 2005). The potential for within-portfolio competition therefore depends on how many alliance partners of the focal firm perform similar roles (exhibit less complementarity) (Rowley et al., 2005). Such competition can fragment a network as partners' competing interests and appropriation concerns prevent cooperative actions (Gomes-Casseres, 1996). Consequently, partners of the focal firm leave the portfolio of the focal firm and seek new alliances in which they hold a competitive advantage and fulfill complementary roles (Hawley, 1986; Provan & Sebastian, 1998).

2.3.2. The depletion of the focal firm's alliance portfolio management capability

Competitive relations among the focal firm's partners lead to difficulties for the focal firm in managing its alliance portfolio. Parise and Casher (2003) suggest the importance of assessing trust and managing knowledge exchange, from the focal firm's point of view, within its alliance portfolio. Generally, knowledge of firms is transferred to other firms explicitly or implicitly by forming alliances (Gulati, 1998). In an alliance portfolio, the focal firm's partners are wary of indirect knowledge spillovers from them to other partners of the focal firm (Emerson, 1962; Pfeffer & Salancik, 1978; Singh & Mitchell, 1996). This leads to a deterioration of trust, one of the most critical factors determining alliance performance, between the focal firm and the partner (Das & Teng, 1998; Madhok, 1995; Nielsen, 2007). Consequently, an ill-managed alliance portfolio deteriorates the focal firm's performance and cannot be sustained. In addition, Ahuja (2000b) suggests that highly embedded firms struggle to manage the embeddedness and form fewer new linkages. It is because firms need to coordinate management efforts across alliances as well as manage individual alliances, and the cost of maintaining the alliance portfolios increases significantly (Harrigan, 1988). Thus, high competitive embeddedness in an alliance portfolio leads to focal firms depleting alliance resources (Parise & Casher, 2003), lacking alliance portfolio management capabilities (Heimeriks, Duysters, & Vanhaverbeke, 2007; Sarkar, Aulakh, & Madhok, 2009), and to be reluctant to form new alliances.

In sum, existing partners of the focal firm avoid competitive relations among them and will end alliances with the focal firm to protect itself from the negative consequences of the within-portfolio competition. The focal firm also finds it increasingly difficult to sustain current alliance links and explore alliances with new partners when it has to manage severe competition among the partners within its existing alliance portfolio.

2.4. Measuring competitive relations in alliance portfolios

In organizational ecology, the intensity of competition between organizations is mostly a function of the similarity in organizational resource requirements: the more similar the resource requirements, the larger the potential for competition (Hannan & Freeman, 1977, 1989). Baum and Mezias (1992) also suggest that the intensity of competition among firms is proportional to the overlap of their resource requirements. In line with this stream, partners' alliances with the focal firm in the same business fields can be viewed as an overlap of resource requirements thus showing that they are in

competitive relations. Partner firms in a portfolio compete with one another when their alliances with the focal firm fall within the same business field. Thus, we analyze the overlap of business fields in which partners allied with focal firms to measure the level of competitive relations within alliance portfolios

Moreover, to measure the level of competitive relations in detail and to test its influence empirically, we introduce the concept of breadth and depth. The breadth and depth concept often appears in previous literature related to knowledge configuration (Cepeda & Vera, 2007; Levinthal & March, 1993) and organizational search (Katila & Ahuja, 2002; Laursen & Salter, 2006). In the case of organizational search, these two dimensions (the breadth and the depth) are necessary to account for revisiting search in certain fields (search depth) and exploratory search in new and broad fields (search breadth) (Katila & Ahuja, 2002). Similarly in the case of competitive relations, the breadth and depth concept is necessary to account for single-point competition in one market field and multipoint competition in more than one market fields (Barnett, 1991). Competitive relations within an alliance portfolio also can intensify broadly across a variety of fields (breadth) and deeply in certain fields (depth). Thus we introduced the breadth and depth concept to measure how competitive relations build up in each alliance portfolio and to allow us to analyze their influence in more detail.

Finally, based on reasoning of the relationship between competitive relations and new alliance formations laid out in this study, we suggest that both the breadth and depth of competitive relations among partners in an alliance portfolio have a negative influence on the focal firm's new alliance formations. Therefore, we hypothesize:

H1a. The broader the competitive relations are among partners in a focal firm's alliance portfolio, the smaller is the number of new alliance formations of the focal firm.

H1b. The deeper the competitive relations are among partners in a focal firm's alliance portfolio, the smaller is the number of new alliance formations of the focal firm.

2.5. The moderating role of firm resources

Even if firms recognize competitive relations among their partners, sometimes, firms are not able to transform their alliance portfolios promptly or directly. When a partner is irresistibly attractive compared to other options, firms may retain the relationship with it although it has many competing partners. Previous literature suggests that this retainment intensifies when the partner has a complementary asset because complementarity yields competitive advantages which are difficult to obtain through other means (Aiken & Hage, 1968; Greve, Mitsuhashi, & Baum, 2013; Teece, 1986). Moreover, because of reputation, it is not feasible for a firm to withdraw from some relationships on its own when the firm and its partners are involved in a dense network (Gulati & Gargiulo, 1999; Podolny, 1993; Rowley et al., 2005). Information on firms' behaviors easily diffuses across a network with dense connections. In addition, firms may not be able to withdraw from alliances until the end of the contract periods.

Then how can firms respond to competitive relations among their partners other than transforming their alliance portfolios? Ahuja (2000b) suggests that there are two perspectives to explain alliance formations and develops an integrated framework, i.e. the inducements-opportunities framework. Researchers following the inducements perspective suggest that strategic or resource needs of firms lead to inter-firm alliances (Baum et al., 2000; Hagedoorn & Schakenraad, 1990; Harrigan, 1988; Hennart, 1988; Kogut, 1988; Nohria & Garcia-Pont, 1991; Powell, Koput, and Smith-Doerr,

1996) while researchers adhering to opportunities perspective suggest that alliance formation behavior results from the social environment and reflects the prior patterns of inter-firm linkages (Gulati, 1995, 1999; Gulati & Gargiulo, 1999; Walker, Kogut, and Shan, 1997). In line with Ahuja (2000b)'s integrated framework, we suggest that those two perspectives be considered to explain alliance formations and that they complement each other. Since competitive embeddedness arises from a firm's social network, it falls under the opportunities perspective. Therefore, we suggest that a firm's resources (the inducement perspective) lessen the impact of competition among its partners (the opportunities perspective) and contribute to its new alliance formations.

In this study, we focus on biotechnology firms' technology alliances with pharmaceutical companies and describe how the focal firms' technological resources lessen the impact of competition among partners. Market uncertainties and uncertain returns of technological investments make firms' technology development decisions difficult (Ahuja, 2000b; Mitchell & Singh, 1992). Further, since knowledge accumulation in the earlier stages of the technology life cycle affects performance during later stages, firms find it progressively difficult to catch up with first movers through internal research and development (Dosi, 1988; Shan, 1990). Therefore, to stay competitive and to respond to market demand in a short period of time, firms seek alliances with other firms which already possess the required knowledge (Ahuja, 2000b; Mitchell & Singh, 1992). The past innovative activities of such firms are signs of their accumulated technological resources and attract firms who desire advanced technologies (Arora & Gambardella, 1990; Baum et al., 2000; Podolny & Stuart, 1995; Stuart, 1998; Stuart et al., 1999). Thus, accumulated technological resources of firms significantly contribute to more alliance formations and lessen the negative impact of competition among partners in the firms' alliance portfolios. Therefore, we hypothesize:

H2a

The level of technological resources of the focal firm positively moderates the relationship between the breadth of competition in its alliance portfolio and the number of its new alliance formations.

H2b

The level of technological resources of the focal firm positively moderates the relationship between the depth of competition in its alliance portfolio and the number of its new alliance formations.

2.6. The conceptual model

To describe the outline of our research more clearly, Fig. 3 shows a diagram that summarizes the research model and hypotheses. Broader and deeper competition among partners within an alliance portfolio leads to a smaller number of new alliance formations of the focal firm (H1a, H1b). In the meantime, technological resources of the focal firm positively moderate these relationships and lessen the impact of competition among partners on the focal firm's new alliance formations (H2a, H2b).

3. Methods

3.1. Data and sample

To test the hypotheses, we compiled alliance portfolios of US biotechnology firms. The collection of the data was performed as follows: First, we collected information on technology alliances formed between US biotechnology firms and multinational pharmaceutical companies from 2002 to 2006 through the Bioscan database. Alliances between biotech and pharmaceutical companies tend to be exploratory, i.e. focused on issues such as drug discovery and development, rather than exploitative,
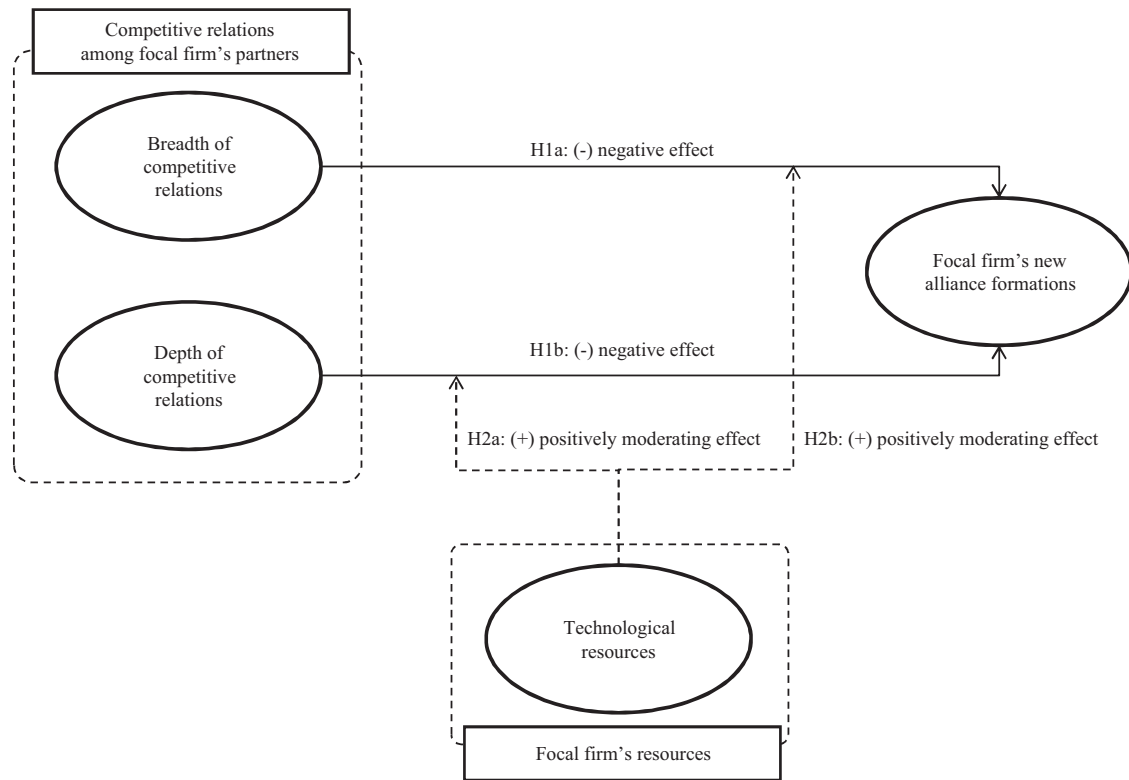
Fig. 3. The conceptual model.

e.g. marketing and sales (Vassolo et al., 2004). Nevertheless, focusing on technology alliances, we checked the qualitative section of the Bioscan database, which describes each alliance in detail, and confirmed the technology focus of the alliances in our sample while excluding those that have a purpose other than technology development (e.g. when the qualitative section includes keywords such as manufacturing and equity investment) from our dataset. Then, we added financial information such as sales and R&D expenditure from the Datastream database. Finally, we added patent information provided by the US Patent and Trademark Office. In total, we collected 2539 technology alliance cases of 159 focal firms.

In the biopharmaceutical industry, there is a continuous knowledge flow, along the value chain, from upstream to downstream (Arora & Gambardella, 1994; Stuart, Ozdemir, & Ding, 2007). This industry is more dynamic than other industries such as steel, mechanical and electrical (Malik, 2012). Indeed, the biopharmaceutical industry shows high alliance tendencies and accounts for about 20 percent of alliances formed in high-tech industries (Hagedoorn, 1993). Therefore, the biopharmaceutical industry is an ideal setting to study alliance formations and their antecedents (Rothaermel & Boeker, 2008). In addition, the highly competitive environment of the biopharmaceutical industry, where rents accrue to the first-mover firm that makes a discovery (Malik, 2012; Vassolo et al., 2004), was appropriate to study competitive embeddedness. Moreover, diverse sub-sectors in the biopharmaceutical industry related to the field of products (e.g. cancer, cell therapy, vaccines, etc.) are appropriate to measure the breadth and depth of competition. Finally, empirical tests within a single industry do not need to control for industry effects and thus raise the reliability of results (Brouthers & Hennart, 2007).

Accordingly, a number of researchers have chosen the biopharmaceutical industry when doing research on alliance portfolios (Baum et al., 2000; Deeds & Hill, 1996; Powell et al., 1996; Shan et al., 1994; Vassolo et al., 2004). In line with previous

literature, this paper focuses on the aforementioned highly competitive environment in the biopharmaceutical industry and studies the impact of competition among multinational pharmaceutical companies on new alliance formations of US biotechnology firms.

Moreover, the biopharmaceutical industry is an appropriate choice for investigating some issues raised in previous international business literature. McDougall, Shane, and Oviatt (1994) and Bell (1995) focus on the potential impact of network relationships on small firms' internationalization. More specifically, Coviello and Munro (1997) investigate network relationships and the internationalization process of small software firms and suggest that existing network relationships of small firms can inhibit their international market development. This inhibition intensifies when partners of focal firms are larger since larger partners attempt to appropriate smaller focal firms' resources and prevent their direct access to other existing and potential partners. In this paper, we focus on alliance portfolios of predominantly small biotechnology firms which consist of larger pharmaceutical partners. Thus we could verify the existing argument in international business in a similar but different industry setting and contribute to the reliability of the argument. At the same time, this study adopts the competitive embeddedness concept and reveals the mechanism of the existing argument in detail, that is the impact of competitive relations between larger partners on alliance formations of smaller focal firms. Further, Håkansson, Kjellberg, and Lundgren (1993) analyze the patterns of biotechnology firms' international strategic alliances. Biotechnology firms form alliances with larger firms to broaden their production base and form alliances with partners in their own geographical area and in other areas to strengthen and broaden their market base and also form alliances in their own subject area to strengthen their knowledge base. Biotechnology firms normally form alliances with several partners simultaneously. Therefore, this pattern implies that more multiple multinational pharmaceutical firms might be

part of a biotechnology firm's alliance portfolio to access the same knowledge base and compete with one another. This paper focuses on this pattern and predictable competitive relations in international strategic alliances of the biopharmaceutical industry and investigates its impact on further alliance formations.

3.2. Dependent variable

The dependent variable, *Alliance formation*, is the number of technology alliances formed by each focal firm of our dataset from 2005 to 2006. Due to the fact that searching for alliance partners and finalizing a new alliance takes time, we assume that this time period reflects the effects of alliance portfolios formed in the 2002–2004 period. Our dataset only captures alliances formed until 2006 due to the fact that the number of alliance formations of our sample focal firms has reduced significantly since 2007. It is difficult to exactly point out why this reduction has occurred, but, for 2008 and later, the global economic crisis may have resulted in less alliance formations within the industry. For biotechnology firms, alliance formations with downstream partners are crucial because those alliances provide them with critical complementary assets such as distribution infrastructure and expertise in clinical trials (Pisano, 1990). Yet not all alliances are equal in terms of partners' commitment and involvement (Rothaermel & Boeker, 2008). The most usual distinction in the extant literature is between non-equity and equity alliances (Gulati, 1995b). Non-equity alliances are frequent and contract-based cooperative agreements. In the meantime, equity alliances represent even stronger ties between parties when a firm acquires an equity stake of a partner or a joint venture (Rothaermel & Boeker, 2008). To remove unobserved heterogeneity, we excluded equity alliances (less than 10 cases out of more than 2500 cases) in our dataset as mentioned earlier. In addition, to control the firm specific impact of a new alliance formation on each focal firm, we introduced some control variables such as firm size, etc. as we will discuss later.

3.3. Independent variables

In this paper, we apply the concept of niche overlap to measure competitive embeddedness. Niche overlap refers to firms seeking out the same limited resources or targeting the same markets or customers (McPherson, 1983). Some previous literature also uses this concept to measure competitive relations (Chen, 1996; Gimeno, 2004). For example, two firms are assumed to be in a competitive relationship when their industrial classification index such as 4-digit SIC code overlap (Gimeno, 2004; Park & Kang, 2009).

In the current study, the focal firms' partners, the pharmaceutical companies, do business in multiple fields. We investigated the purpose of each alliance between focal firms and partner firms designated as recorded in the Bioscan database. Each alliance relates its purpose with at least one or, sometimes, multiple business fields. Therefore we could measure the *breadth* and *depth* of competitive relations in the level of business fields. Specifically, the *breadth* of competitive relations is the scope of rivalry in an alliance portfolio. When target business fields of each alliance in an alliance portfolio overlap across many different fields, the competitive relations in the portfolio become broader. Therefore, the *breadth* is measured by counting the number of business fields in an alliance portfolio in which at least two partner firms are in competitive relations. The *depth* of competitive relations is the extent of rivalry within the business fields covered by the alliance portfolio. When more partners compete in the same business field in an alliance portfolio, the competitive relations in the portfolio become deeper. Therefore, the *depth* is measured by dividing the total competitive relations (the number of entire dyadic competitive relations) in an alliance portfolio by the number of competing business fields (*breadth*). In our study breadth and depth were analyzed for the alliance portfolios consisting of alliances formed between the focal firms and their partners between 2002 and 2004.

Fig. 4 shows an example of how *breadth* and *depth* are defined and measured in this study. The focal firm's alliance portfolio consists of partner firms A, B, and C. The target business fields of each alliance are described next to the tie between the focal firm and each partner. For example, partner A seeks the focal firm's technology in the cell therapy, cancer and vaccines field. The dotted boxes describe competitive relations between partners within this portfolio. For example, Partner A and B compete with each other in this alliance portfolio because their target business fields through the alliances with the focal firm coincide with each other in the field of vaccine development. The *breadth* of competitive relations in this portfolio is simply the number of
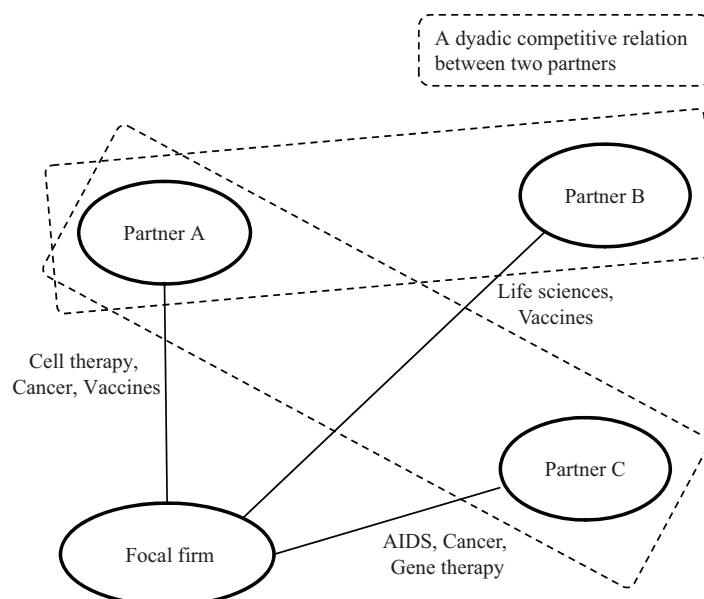

Fig. 4. An example of competitive relations among focal firm's partners.

competing fields. Since partners are competing in the vaccines and cancer fields, the *breadth* in this example is 2. There are a total of two dyadic competitive relations in this portfolio. As mentioned earlier, Partner A and B compete with each other in the vaccine field. Also, Partner A and C compete with each other in the cancer field. To measure the *depth*, we should divide these two dyadic competitive relations by the *breadth* of this portfolio. Consequently, the *depth* of competitive relations in this portfolio is 2 over 2, simply 1. We suggest that an alliance portfolio with broader and deeper competition among partners leads to smaller number of further alliance formations of the focal firm.

In addition, we tested the moderating role of the focal firms' *technological resources*. *Technological resources* of each focal firm are measured by counting the total number of patents applied by it until 2001. Patents are an appropriate measure of a firm's innovation success and thus can be interpreted as a signal of the firm's technological resources (Narin, Noma, & Perry, 1987). Previous literature also suggests that the patenting record can be understood as a firm's technological stature (Narin et al., 1987; Trajtenberg, 1990), and counts the number of cumulative patents applied for by a firm to measure its technological resources (Park & Kang, 2013; Silverman, 1999). Patents also record a firm's evolving or emerging technology and thus represent a milestone in its advance in discovery and innovation (George, Zahra, Wheateley, & Kahn, 2001). In case of biotechnology firms, they have a shorter span of history compared to firms in other industries and their technology is most of their meaningful resources. Therefore the history of their patenting activities represents their technological stature in the industry and attracts potential partners. Further, biotechnology firms can obtain significant bargaining power through patents and negotiate with their commercial partners (Pisano, 1990). Therefore patents are an appropriate measure of technological resources which lessen the impact of competition within the alliance portfolio and lead to more alliance formations of the focal firm.

3.4. Control variables

We added six control variables which describe some characteristics of the focal firms and may directly affect the dependent variable. First, *firm size* measures the sales of the focal firms. We considered the economic volatility and measured the averaged annual value of sales during the 2002–2004 period. Second, *firm age* measure the number of years passed between the year when a focal firm's had its first sales and 2002. Third, *R&D expenditure* is a focal firm's averaged annual expenditure for R&D during the period of 2002–2004. Fourth, *prior M&A experience* is set to 1 (previous experience) or 0 (no experience). Fifth, *prior manufacturing alliance experience* is set to 1 (previous experience) or 0 (no experience). M&A experience and manufacturing alliance experience of focal firms may lead to their advantageous positions in forming alliances

and affect the dependent variable. Finally, the *IPO* (Initial Public Offering) distinguishes public companies (coded as 1) from private companies (coded as 0). Compared to private companies, the ownership of public companies is decentralized and public companies have to publicize their financial information and performance. Thus, their strategy and decision making would be different from those of private companies. To sum up, we controlled a few variables to increase the reliability of the test results and examined the pure effect of partners' competition on the focal firms' new alliance formations.

3.5. Empirical model specification

In the current study, the dependent variable is new alliance formation. Table 1 shows that new alliance formation is a variable for discrete events and has a positive integer value. The dependent variable shows over-dispersion distribution. Specifically, the standard deviation, 2.97, is greater than the mean value, 2.05. In case of a dependent variable with over-dispersed count data, negative binomial regression is appropriate to analyze the model (Barron, 1992; Cameron & Trivedi, 1986; Ranger-Moore, Banaszak-Holl, & Hannan, 1991). Moreover, the dependent variable in this research consists of 63 zeros out of total 159 values. In other words, zeros account for almost 40 percent of the entire values for the dependent variable. This characteristic of the dependent variable may cause a bias and decrease the reliability of the model. One approach to analyze count data with many zeros is using zero-inflated negative binomial distribution (Greene, 1994). To choose a relevant model between the negative binomial and the zero-inflated one, we implemented the Vuong test. The Vuong test compares the zero-inflated model with the ordinary negative binomial regression model. In the Vuong test, the z-statistic indicates whether the zero-inflated model is better than the ordinary one (Long, 1997). The result of the Vuong test showed that the p-value is 0.1016. Therefore, the null hypothesis, that the difference of the two models is not statistically significant, cannot be rejected and the ordinary negative binomial model is supported. However, we cannot assert that the ordinary negative binomial model is better than the zero-inflated one because the p-value is only slightly out of the range to reject the null hypothesis. As a result, we tested both models and increased the reliability of the results.

4. Results

Table 2 presents the results from the negative binomial regression, whereas Table 3 presents the results from the zero-inflated negative binomial regression. The two regressions indicate a small difference in significance for some variables, such as *Technological resource* and *Depth × Technological resource*. However, the regressions obtain similar results for the direction and the

Table 1
Descriptive statistics and correlations matrix.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	Mean	SD.
Firm size	1.00												2797.20	12762.58
Firm age	0.36	1.00											8.84	5.40
R&D expenditure	0.62	0.44	1.00										321.68	1044.78
M&A experience	0.21	0.06	−0.01	1.00									0.06	0.25
Manufacturing alliance	0.16	0.18	0.10	0.03	1.00								0.22	0.41
IPO	0.07	0.14	0.09	0.00	0.09	1.00							0.81	0.38
Breadth	0.13	0.15	0.37	−0.14	−0.13	−0.02	1.00						1.50	1.52
Depth	−0.01	0.08	−0.02	−0.02	0.11	0.03	0.12	1.00					2.95	8.88
Technological resource	0.23	0.30	0.47	−0.05	0.05	0.10	0.23	−0.04	1.00				97.18	320.56
Breadth × Technological resource	0.30	0.24	0.58	−0.04	0.07	0.06	0.61	−0.01	0.56	1.00			258.22	1529.14
Depth × Technological resource	0.48	0.24	0.32	0.09	0.18	0.07	0.19	0.74	0.16	0.22	1.00		200.38	964.33
Alliance formation	−0.04	0.11	−0.01	0.07	0.22	0.10	−0.17	−0.13	0.38	0.10	−0.07	1.00	2.05	2.97

Table 2
Negative binomial regression results.

Depend variable	Model 1		Model 2		Model 3	
Alliance formation	Coefficient	S.E	Coefficient	S.E	Coefficient	S.E
Control variables						
Firm size	−0.0000	0.0000	−0.0000	0.0000	−0.0001[**]	0.0000
Firm age	0.0298	0.0196	0.0176	0.0181	0.0282	0.0181
R&D expenditure	0.0000	0.0001	0.0000	0.0001	−0.0002	0.0002
M&A experience	0.5528	0.3684	0.5292[*]	0.3273	0.4245	0.3131
Manufacturing alliance	0.6800[***]	0.2265	0.7095[***]	0.2073	0.6271[***]	0.2062
IPO	0.3375	0.2268	0.2364	0.2453	0.2116	0.2391
Independent variables						
Breadth			−0.1301[*]	0.0681	−0.2711[***]	0.0876
Depth			−0.0263[*]	0.0150	−0.0970[***]	0.0289
Technological resource			0.0009[***]	0.0002	0.0006[**]	0.0002
Breadth × Technological resource					0.0003[***]	0.0001
Depth × Technological resource					0.0009[***]	0.0003
N	159		159		159	
Log likelihood	−297.661		−285.023		−277.734	
Pseudo R^{2a}	0.0305		0.0716		0.0954	
LR χ^2	18.70		43.98		58.55	
Regression p-Value	0.0047		0.0000		0.0000	

[a] The pseudo-R squared value in Table 2 is McFadden's pseudo R-squared. According to Long and Freese (2006), the pseudo R-squared of negative binomial regression does not carry the same meaning as the R-squared in OLS regression (the proportion of variance for the response variable explained by the predictors). But when comparing two models using the same data, McFadden's pseudo R-squared would be higher for the model with the greater likelihood.
[*] $p < 0.10$.
[**] $p < 0.05$.
[***] $p < 0.01$.

magnitude of coefficients in testing our hypotheses. Therefore, the following analysis of the results is based on model 3 of Table 2 which includes all variables and shows greater likelihood compared to other models in the table.

First, the *Breadth* of competitive relations is negatively related with the focal firms' future alliance formations and this relationship is highly significant ($p < 0.01$). Therefore, H1a is supported. This result implies that focal firms face more difficulty in forming new alliances when their existing partners compete with one another across diverse fields within the focal firm's alliance portfolio.

Second, the *Depth* of competitive relations is also negatively related with the focal firms' future alliance formations and this relationship is highly significant ($p < 0.01$). Therefore, H1b is also supported. This result implies that focal firms face more difficulty

in forming new alliances when many of their existing partners compete with one another in the same field within the focal firm's alliance portfolio.

Furthermore, two interaction terms, *Breadth × Technological resource* and *Depth × Technological resource*, are introduced to examine whether a focal firm's technological resources lessen the negative effect of competition between partners on the focal firm's new alliance formations.

First, the coefficient of *Breadth × Technological resource* is positive and significant ($p < 0.01$). Therefore, H2a is supported. This result implies that a focal firm with abundant technological resources can lessen the impact from the breadth of competition among its partners.

Second, *Depth × Technological resource* also has a positive and significant ($p < 0.01$) coefficient. Therefore, H2b is supported. This

Table 3
Zero-inflated negative binomial regression results.

Depend variable:	Model 4		Model 5		Model 6	
Alliance formation	Coefficient	S.E	Coefficient	S.E	Coefficient	S.E
Control variables						
Firm size	−0.0000	0.0000	−0.0000	0.0000	−0.0001[**]	0.0000
Firm age	0.0279	0.0218	0.0106	0.0185	0.0226	0.0181
R&D expenditure	0.0001	0.0002	0.0001	0.0002	−0.0002	0.0002
M&A experience	0.6013	0.4179	0.5629[*]	0.3351	0.3693	0.3080
Manufacturing alliance	0.7237[***]	0.2560	0.7261[***]	0.2170	0.5521[***]	0.2132
IPO	0.4205	0.2984	0.3889	0.2547	0.4167[*]	0.2426
Independent variables						
Breadth			−0.1528[**]	0.0733	−0.2741[***]	0.0920
Depth			−0.0167	0.0112	−0.0764[***]	0.0310
Technological resource			0.0009[***]	0.0003	0.0006[***]	0.0002
Breadth × Technological resource					0.0002[***]	0.0001
Depth × Technological resource					0.0007[**]	0.0003
N (zero obs)	159 (63)		159 (63)		159 (63)	
Log likelihood	−290.569		−279.227		−274.467	
LR χ^2	16.29		38.97		48.49	
Regression p-value	0.0123		0.0000		0.0000	
Vuong test p-value (z)	0.4529 (z = 0.12)		0.1066 (z = 1.24)		0.1012 (z = 1.27)	

[*] $p < 0.10$.
[**] $p < 0.05$.
[***] $p < 0.01$.

result implies that a focal firm with abundant technological resources can lessen the impact from the depth of competition among its partners.

Additionally, the coefficient of a control variable, *Manufacturing alliance*, shows positive and significant value in both the negative binomial regression and zero-inflated negative binomial regression. This result shows a characteristic of the biopharmaceutical industry. *Manufacturing alliance* indicates whether focal firms (biotechnology firms) have experiences of entering manufacturing alliances. These experiences signal the focal firms' past cooperation with pharmaceutical companies to launch end products. These experienced focal firms may contribute more to generating sales in future alliances and thus attract more attention from pharmaceutical companies looking for biotechnology partner firms.

5. Discussion

This paper contributes to alliance network and international business literature by highlighting the significance of managing competition within alliance portfolios and by empirically verifying suggestions found in previous literature.

First, the presented results empirically verify previous qualitative or case research which suggests the significance of managing the whole alliance portfolio and conflicts within the portfolio (Hoffmann, 2005; Hoffmann, 2007; Lichtenthaler & Lichtenthaler, 2004; Parise & Casher, 2003). As Hoffmann (2005) points out coordination as one of the major tasks in alliance portfolio management in his combined (qualitative and quantitative) research, he suggests that the overlap in an alliance portfolio leads to conflicts among partners. Further, these conflicts require management attention and resource dedication by the focal firm of the alliance portfolio. This explains how focal firms deplete alliance portfolio management capabilities. Additionally, in the case study of Hoffmann (2007), it is suggested that the performance of alliance portfolios should not be analyzed from a firm's viewpoint but be understood through the interaction of the constituent firms' strategic intents. Therefore, the configuration and management of alliance portfolios are considered firms' important strategic issues. For future research, Hoffmann (2007) suggests studying how a focal firm coordinates its own alliance portfolio plans with the alliance strategies of its partners and overcomes possible conflicts within its alliance portfolio. Our study has been motivated by this suggestion and we respond to it by introducing the competitive relations concept to analyze conflicts among a focal firm's alliance partners. We also suggest a way to deal with these conflicts. This allows us to focus on a specific point of view and empirically verify his argument. In Parise and Casher (2003)'s qualitative research, the authors suggest that constraining interdependencies among a focal firm's alliance partners are present in case of deep research and development alliances in the life science industry. This study follows Parise and Casher (2003)'s suggestion and tests hypotheses in the biopharmaceutical industry. Finally, in their conceptual research, Lichtenthaler and Lichtenthaler (2004) suggest that every single alliance may have negative influences on other alliances. They also suggest that the negative influences should be tested empirically. A variety of previous literature calls for a systematic approach toward why the manager of an alliance portfolio (the focal firm) pays attention to competitive relations among its alliance partners through empirical tests. This study tests related hypotheses in the setting of the biopharmaceutical industry and empirically supports existing suggestions on alliance portfolio management.

Second, we contribute to the ongoing discussion on the impact of competitive embeddedness on alliance formations. Conventionally, the impact of the surrounding network structure, i.e. structural embeddedness, on linkage (alliance) formations is discussed in network embeddedness research. But, as of late, some researchers suggest the impact of competitive embeddedness on alliance formations. Gimeno (2004) argues that a firm allies with its rival's partner or forms a countervailing alliance under the influence of competitive embeddedness. Trapido (2007) argues that competitive embeddedness between two different firms promotes their alliance formation. In line with this research, this paper also studies the impact of competitive embeddedness on alliance formations. Our approach differs from the existing literature in that we go beyond dyadic relationships and focus on alliance portfolios of firms, and that we focus on the negative influence of competitive embeddedness on alliance formations. Thus we extend the unit of analysis in competitive embeddedness research and verify the impact of competitive embeddedness on network sustainability.

Finally, this paper empirically verifies some suggestions from case studies found in previous international business literature and examines the mechanisms behind the suggestions. Previous literature suggests that the existing network relationships of a firm can impact or sometimes inhibit its further actions such as its internationalization process (McDougall et al., 1994; Bell, 1995; Coviello & Munro, 1997). We focus on competitive relations among a focal firm's partners and investigate how their competition inhibits the focal firm's alliance formations by analyzing international alliances between US biotechnology firms and multinational pharmaceutical companies. We empirically test specific hypotheses, developed from previous literature, in the biopharmaceutical industry and increase the reliability of the previous literature which mainly focused on case studies in the software industry (Bell, 1995; Coviello & Munro, 1997).

5.1. Implications

This paper provides firms with recommendations on how to configure their alliance portfolios. The configuration of alliance portfolios is one of the major topics in the alliance portfolio literature (Wassmer, 2010). Especially previous literature is interested in partner-dimension (Lavie, 2007; Stuart, 2000; Stuart et al., 1999), structural dimension (Ahuja, 2000a; Gulati, 1999; Hoffmann, 2007; Koka & Prescott, 2008), and relational dimension (Hoffmann, 2007; Rowley et al., 2000) related to the configuration. Competitive relations among partners allow us deeper insights into the configuration of alliance portfolios beyond these past trends of research. A focal firm is attracted to the benefits provided by each alliance partner and might not consider the fit among its partners. What if they compete with one another for the same resource of the focal firm? In that case they are not willing to actively participate in alliances with the focal firm (Khanna, Gulati, & Nohria, 1998) or repeat alliances with the focal firm. Accordingly, the focal firm depletes its resources in managing its alliance portfolio (Heimeriks et al., 2007; Parise & Casher, 2003; Sarkar et al., 2009) and even faces difficulties in searching for new partners. As a result, competitive relations among partners can disrupt a focal firm's alliance portfolio. Therefore this study suggests that it is crucial for focal firms to strategically manage and configure their alliance portfolios for the long term viability of their portfolios.

Further, we also suggest how to cope with competitive relationships among partners in an alliance portfolio. First, focal firms should be wary of potential conflicts among partners when they form each alliance. Focal firms should avoid putting direct competitors in their alliance portfolio at the same time. Even though two partners in an alliance portfolio are not direct competitors, they might put themselves in competitive relations when the purpose of their alliances with the focal firm coincides. Therefore, when focal firms consider an additional alliance, they

should not only look at prospective benefits but also carefully examine its fit with their existing alliances as well. Second, focal firms should utilize their resources to cope with competition among their partners. Most existing firms might not be able to transform their alliance portfolios promptly or directly, even if they recognize competitive relations among their partners, because of existing partners' attraction, their complementarities with the focal firms (Aiken & Hage, 1968; Greve et al., 2013; Teece, 1986), the damage in reputation (Gulati & Gargiulo, 1999; Podolny, 1993; Rowley et al., 2005), contract period, etc. In this case, firms should examine how many resources, significant to their existing and potential partners, they have accumulated. Firms with more resources can handle a certain level of competition among their partners and maintain attractive partners in their alliance portfolios. Meanwhile, firms with little attractive resources should avoid competition among their partners and in case of existing competition transform their alliance portfolios as soon as possible. Therefore we also suggest that firms accumulate valuable resources to sustain their alliance portfolios.

5.2. Limitations and directions for future research

This paper employs the concept of competitive embeddedness to analyze the effects of competition among alliance partners of the same focal firm on that firm's subsequent alliance formations. While we found this novel approach to be very useful in deepening the understanding of the potential negative effects of alliance portfolios, we acknowledge a number of limitations related to the operationalization and measurement in our empirical study.

First, although the unit of analysis in this paper is alliance portfolios, we analyze dyadic relations to calculate the breadth and depth of competition in the alliance portfolios. We overcome the limitation of measuring competition in previous literature and introduce the concept of breadth and depth in order to capture different dimensions of intensifying competition. This concept, however, is based on the sum of dyadic relations which constitute an alliance portfolio and does not analyze the portfolio as a whole. We wish we could introduce a holistic, network-level variable which measures the level of competition within a network as a whole. Such a development remains as a future task for research in the field of network analysis.

Second, some other factors can affect a focal firm's alliance formations other than competitive relations among the focal firm's partners. For example, direct conflict between a focal firm and its partner might affect the link between them. In this paper, focal firms are biotechnology firms and their partners are pharmaceutical firms. Competitive relations between these two parties are not as severe as competitive relations between pharmaceutical firms. Even more, a biotechnology firm and a pharmaceutical firm are direct alliance partners in this paper and promote cooperation between them. Nevertheless, previous literature suggests that task-oriented conflicts and relation-ship-oriented conflicts can harm an alliance relationship (Corser, 1956; Guetzkow & Gyr, 1954; Jehn, 1992; Priem & Price, 1991; Pinkley, 1990). In other words, a focal firm cannot sustain its partnerships when the focal firm or its partners are dissatisfied with each other due to alliance performance or each other's behavior. This type of conflict can also affect the focal firm's alliance formations. In the meantime, Parise and Casher (2003) mention their interviews with multiple alliance managers and suggest that competitive relations among a focal firm's partners are sources of the conflict between a focal firm and its partners. Competitive relations among a focal firm's partners lead to distrust, lower transparency, and decreased commitment to the relationship between a focal firm and its partners. Controlling the

conflict between a focal firm and its partners in any way would increase the reliability of the test results. But a set of qualitative research including interviews with alliance mangers is required to obtain detailed information on this type of conflict. We expect future research to overcome this limitation and to find suitable approaches to operationalizing conflict between a focal firm and its partners.

Third, the dependent variable in this study, focal firms' alliance formations, does not consider the significance of each alliance. Any alliance with a pharmaceutical firm is crucial for biotechnology firms since it provides complementary assets and contributes to their sustainability (Pisano, 1990). Nevertheless, the impact of each alliance on focal firms might be different. Therefore, controlling the impact of each alliance would increase the reliability of the test results. But we were not able to find appropriate measures to capture the difference between each alliance without interviews with alliance managers. We expect future research to focus on ways to include possible differences between individual alliances that are part of the same portfolio.

Fourth, this paper considers the total number of patent applications of focal firms to measure their technology resources. This measurement is meaningful in that biotechnology firms have a shorter span of history compared to firms in other conventional industries and patent records represent their technological stature (Narin et al., 1987; Trajtenberg, 1990). However, focusing on specific technologies of firms or recent technologies would increase the reliability of the test results and thus we expect future research to introduce more systematic approaches to measuring technology resources. This involves identifying patents of a focal firm that make it attractive to potential partners. One could consider the influence and technological value of individual patents which can be estimated through citation network analysis. In conclusion, we expect to see future research find and adopt an improved method for measuring technology resources and strengthen the argument of our study.

6. Conclusion

Nowadays, the growth of alliance formations is greatly influenced by the process of globalization (Narula & Duysters, 2004). In the meantime, the importance of choosing alliance partners has been significantly increased in terms of international strategic alliance performance (Harrigan, 1988; Killing, 1983; Mohr & Spekman, 1994; Park & Ungson, 1997; Parkhe, 1991). Previous literature suggests that when forming new alliances, firms consider the best fit between their partners and themselves (Dong & Glaister, 2006). In this study, however, we extend this previous literature and suggest that also the fit between partners is critical for focal firms to sustain their alliance portfolios and thus should play a bigger role in alliance decisions.

Specifically, we start from an introduction of a holistic approach toward alliance portfolios, narrow it down to conflict management and finally apply the competitive embeddedness lens to analyze the effect of competition among partners on focal firms' new alliance formations. We exemplify why a holistic approach and conflict management are not optional but essential for the long term viability of alliance portfolios. Moreover, we suggest competitive embeddedness in alliance portfolios which affects inter-firm linkages and, at the same time, extend the unit of analysis of competitive embeddedness to the multi-actor network. Further, this study provides managerial practices with recommendations on how to strategically configure an alliance portfolio and how to strategically respond to competition among the focal firm's partners.

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