



Returns to alliance portfolio diversity: The relative effects of partner diversity on firm's innovative performance and productivity



Tim de Leeuw^{a,*}, Boris Lokshin^b, Geert Duysters^c

^a Department of Industrial Engineering and Innovation Sciences, Eindhoven University of Technology, The Netherlands

^b Department of Organization & Strategy, Maastricht University, The Netherlands

^c Department of Organization and Strategy, Tilburg University, The Netherlands

ARTICLE INFO

Article history:

Received 5 February 2013

Received in revised form 7 August 2013

Accepted 12 October 2013

Available online 9 January 2014

Keywords:

R&D collaboration

Radical innovation

Incremental innovation

Technological alliances

Alliance portfolio diversity

ABSTRACT

This study considers the impact of diversification in types of technological alliances, resulting in alliance portfolio diversity, on various dimensions of a firm's performance, as they relate to exploration and exploitation. Using a large panel of innovative firms in the Netherlands, this study shows that partner type diversity in a firm's alliance portfolio has an inverted U-shaped relationship with productivity and radical innovative performance and a positive relationship with incremental innovative performance. Moreover, the results suggest that a lower level of diversity is needed to achieve an optimal level of productivity compared to radical innovative performance, whereas for incremental innovative performance a higher level of portfolio diversity appears to give the best performance.

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1. Introduction

Both practitioners and scholars agree that technological alliances, aimed at a purposeful exchange of technological resources or joint R&D is a ubiquitous phenomenon (Contractor & Lorange, 2002). Several factors such as product complexity, growing importance of time-to-market, increasingly geographically dispersed technological knowledge, as well as the rising costs of R&D, have led to a strong increase in the number of alliances between firms (De Man & Duysters, 2005; Li, Qian, & Qian, 2013). This overall growth in alliance formation coincides with an increase in the number of technology alliances that a single firm maintains (e.g., De Man, Duysters, Krijnen, & Luvison, 2011).

Due to the increased speed and sophistication of technological change a single alliance or partner type is unlikely to provide all the necessary solutions. Extant research has argued that firms increasingly adopt alliance portfolio practices, by augmenting the number and types of actors with which they interact, e.g., customers, suppliers, and research institutions and, with that, the level of diversification in their alliance portfolio. When firms maintain multiple alliances at the same time, a focus on the egocentric network of the firm or the so-called alliance portfolio is called for (Wassmer, 2010). In the alliance portfolio context, diversification (APD for short) and its implication for firm performance has recently attracted attention in the literature on alliances (e.g., Baum, Calabrese, & Silverman, 2000; George, Zahra, Wheatley, & Khan, 2001; Goerzen & Beamish, 2005; Jiang, Tao, & Santoro, 2010;

Lee, 2007; Sarkar, Aulakh, & Madhok, 2009; Terjesen, Patel, & Covin, 2011; Wassmer & Dussauge, 2011). This line of research, central to this study, looks outside the boundaries of the firm and considers the diversification of external partners as a vehicle to access external-party resources that are not otherwise available (Das & Teng, 2000; Lavie, 2006).

Previous studies usually focused on the relationship between APD and one performance dimension at a time, e.g., financial performance (Faems, De Visser, Andries, & Van Looy, 2010; Lavie & Miller, 2008; Mouri, Sarkar, & Frye, 2012; Wassmer & Dussauge, 2011), innovative performance (Duysters & Lokshin, 2011; Srivastava & Gnyawali, 2011; Wuyts & Dutta, in press), or firms' exit via sell-off and shutdown (Bryyaka & Durand, 2012).

In practice, firms simultaneously pursue multiple performance objectives, such as productivity, and radical and incremental innovation. Often this requires balancing between strategies aimed at maximizing exploration and exploitation (e.g., Cao, Gedajlovic, & Zhang, 2009; Venkatraman, Lee, & Iyer, 2007). Configuring an alliance portfolio in such a way to maximize firm performance is important in this context. Although previous studies have shown the significant relationship between APD and firm performance, most of these studies have focused on only one performance measure. This study puts forth that the relationship between APD and varying performance indicators is not uniform. In particular, from the previous APD literature little is known about the differences in the optimal level of APD for different performance outcomes. In other words, which level of APD is optimal for which performance dimension? Specifically, surprisingly little research has gone into understanding the significance of a diverse alliance

* Corresponding author. Tel.: +31 6 12628680.

E-mail address: t.d.leeuw@tue.nl (T. de Leeuw).

portfolio for firms' radical and incremental innovative performance. Yet, this is important as this contributes to the understanding of the performance implications of the balancing act as a firm strives to maximize explorative and exploitative performance.

Investigation of this research question via a comparative analysis, such as a meta-analysis of the existing studies (see Parmigiani & Rivera-Santos, 2011 for one such attempt), is complicated due to differences in APD operationalization, industry coverage and time periods, which may preclude meaningful conclusions. In contrast, considering several performance dimensions within the framework of one study enables establishing the relative performance effects of APD and uncovering the differences in its impact on multiple performance indicators, as they relate to firm's exploration and exploitation.

The aim of this paper is to fill this gap in the extant APD literature by examining the relative performance effects of diversity in a firm's technological alliance portfolio by considering three performance measures: radical innovation, incremental innovation and productivity. Following previous literature (e.g., Duysters & Lokshin, 2011), this study defines APD in terms of direct alliance partner types a focal organization is engaged with. Second, we put forth that benefits of APD are subject to decreasing returns, indicating a point where additional diversification in the types of actors with which a firm interacts becomes unproductive. Finally, this study advances that different performance-maximizing levels of APD are required for radical and incremental innovation as well as for productivity. The paper proceeds as follows. The next section provides a literature background. The subsequent section develops a set of hypotheses that propose a relationship between APD and each of the performance measures, followed by the data and methods section, which explains the empirical approach. The paper concludes with the discussion and the practical implications of the results.

2. Theoretical background and hypotheses

2.1. Alliance portfolio diversity and alliance types

The APD concept, which has recently received much scholarly attention, consists of two elements. The first is the *alliance portfolio*, which in line with previous research is defined as the set of focal firm's active formal alliances (e.g., Baum et al., 2000; Ozcan & Eisenhardt, 2009). The alliance portfolio approach to studying alliances enables scholars and practitioners to investigate the (dis)synergetic effects between multiple alliances maintained by a firm at one point in time (Wassmer & Dussauge, 2011, 2012). This feature of the alliance portfolio is highly relevant because of the growing evidence that firms frequently maintain multiple alliances at one point in time (e.g., De Man et al., 2011) and that alliance synergies indeed have an effect on the value derived from the alliances (Belderbos, Carree, & Lokshin, 2006; Wassmer & Dussauge, 2012).

The second element of APD is *diversity*, which in general refers to the distribution of differences in relation to an attribute "X" (Harrison & Klein, 2007). Prior literature has considered such attributes as, organizational size, age, geographical location or partner type (e.g., Isobe, Makino, & Montgomery, 2000; Wuyts & Dutta, in press). These contributions have established, for instance, that larger firms have more abundant resources and may handle more easily the management of multiple technology alliances with firms of different size (e.g., Belderbos et al., 2006; Duysters, Lokshin, Heimeriks, Meijer, & Sabidussi, 2012). The concept of diversity of firm age is related to firm experience and learning. Wuyts and Dutta (in press) show that a firm's past strategies for internal knowledge creation can be a source of experience that increases the firm's capability to leverage extramural knowledge. Diversity with respect to geographical locations of partners can provide the focal firm with highly sophisticated, specialized, and partially tacit knowledge from local sources (Meyer-Krahmer & Reger, 1999).

This paper refers to APD as the diversity of firms' alliances types (different categories of firms, universities, and other research or

technology institutions) that represent different channels that firms rely upon in order to improve their innovative and productive performance. The focus is on different types of (national and foreign) alliance partners because different partner types can serve different purposes such as providing the focal firm with different resources, knowledge, and expertise useful for improving innovative performance and productivity (e.g., Aschhoff & Schmidt, 2008; Belderbos, Carree, Diederer, Lokshin, & Veugelers, 2004; Teece, 1980).

The importance of collaborative strategies is demonstrated in various studies. These studies investigate the extent to which different alliance types lead to improvement in firm's performance outcomes (e.g., Belderbos, Carree, & Lokshin, 2004; Köhler, Sofka, & Grimpe, 2012; Laursen & Salter, 2006; Salge, Farchi, Barrett, & Dopson, 2013). Cooperation with suppliers, for instance, has been shown to help improve exploitation-related performance, such as input quality improvements, process innovations, and cost reductions because suppliers may possess knowledge related to the actual production processes (Sobrero & Roberts, 2002). Customers, on the other hand, can provide the focal firm with product and service feedback that could be used for product, process, and service improvements or development of altogether new products (Lee & Wong, 2009; Von Hippel, 2007). Customers can reduce the uncertainty that is associated with new market introductions. Their input may be essential for market expansions and for adaptations in products and services (Tether, 2002). Competitors can provide the focal organization with access to industry-specific knowledge and could share (research) facilities (Kim & Higgins, 2007) and (research) costs (Miotti & Sachwald, 2003). Alliances with competitors could also be used to deal with industry standards and regulations (Nakamura, 2003). However, collaboration with competitors can have a downside due to an increased risk of outgoing knowledge spillovers because competitors (compared to other partner types) are better able to use unintended knowledge spillovers (Park & Russo, 1996). Cooperation with universities and public research institutions can be an important source of new scientific and technological knowledge. Prior research has demonstrated that university collaboration can, for instance, lead to development of new (radical) applications of already existing technology (Archibugi & Coco, 2004; Arvanitis, Kubli, & Woerter, 2008; Drejer & Jorgensen, 2005). Universities and research centers can be attractive for industry partners providing low-cost access to generic R&D (Arranz & Arroyabe, 2008; Beers, Berghall, & Poot, 2008; Mototashi, 2005).

Taken together, the alliance types described above make up a focal firm's alliance portfolio. This is in line with for instance Faems, Van Looy, and Debackere (2005) and Oerlemans, Knobens, and Pretorius (2013). In sum, the alliance partner diversity concept assumes diversity between alliance partner types because different partner types can differ in their categorical attributes, i.e., their resources, capabilities, competences, and industrial backgrounds. Due to possible (dis)synergies between the alliance partner types, APD can impact the focal firm's performance above and beyond the effect of individual alliances.

2.2. APD and firm performance

Prior research on the diversity of alliance partners suggests that having heterogeneous partners can lead to performance benefits, because different types of organizations provide access to more diverse information and resources (e.g., Beckman & Haunschild, 2002; Wuyts, Dutta, & Stremersch, 2004). Other research shows that alliance partner diversity can have negative effects on firm performance (e.g., Faems et al., 2010; Goerzen & Beamish, 2005). Notwithstanding that diversity can lead to more information and resources, too much diversity and the corresponding (cognitive) distance between the focal firm and their partners hinders the exchange and integration of information and resources. Other studies found an inverted U-shaped relationship between the diversity of alliance partners and various performance dimensions, suggesting that diversity is beneficial to a certain point, after which further

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