

Creating new technology through alliances: An empirical investigation of joint patents

Changsu Kim^a, Jaeyong Song^{b,*}

^aCollege of Business Administration, Ewha Womans University, Seoul 120-750, Korea

^bStrategy and International Management, Seoul National University, Seoul 151-742, Korea

Abstract

Why are some alliances more productive than others in terms of creating new technology? Using a novel measure of alliance performance, that is, joint patents, this study aims to tackle this question. Our results from the global pharmaceutical industry show that joint invention has an inverted U-shape relationship with a path-dependent technology base, with the level of joint patents initially increasing and then decreasing beyond a certain level of path dependence. The results also show that joint patents are more numerous when the alliance partners have had prior ties with each other. Overall, the finding suggests that creating new technology through alliances can be facilitated by ensuring the positive side of absorptive capacity, while avoiding its downside.

© 2007 Elsevier Ltd. All rights reserved.

Keywords: Innovation; Alliances; Joint patents; Absorptive capacity

1. Introduction

Firms frequently use partnerships to acquire new technology (Powell et al., 1996), to pool complementary technologies (Teece, 1992), or to share the costs of exploiting a certain form of technology (Nakamura et al., 1996). In some rapidly evolving sectors, where the locus of proprietary knowledge is dispersed across companies and shifts quickly over time, the pooling of resources can lead to superior and faster technological development than would be possible internally (Doz and Hamel, 1997). In addition, collaborative R&D arrangements have been rapidly growing since the 1980s in high-tech industries (Hagedoorn, 2002).

Although the notion is well accepted that alliances can be useful for collaborative innovation, there is scant empirical evidence to support it. This lack of evidence reflects the difficulty in evaluating innovation output resulting from alliances. Recent studies of alliances, especially technology-based alliances, have investigated

the association between alliances and innovation by looking at patents of individual firms as an indicator of innovation output (e.g. Ahuja, 2000; Stuart, 2000). However, output measured at the level of the individual firm is difficult to attribute to alliance-related activities because various exogenous factors influence the innovation output of individual firms. We attempt to remedy this situation by examining joint patents resulting from the collaborative efforts of alliances.

We argue that if firms engage formally in collaborative R&D, and if the output of the R&D is measurable by patent indicators, then patents which are co-assigned to both partners in an alliance should be good measures of innovative output resulting from the alliance. By definition, the co-assigned patent that we call the *joint patent* is assigned to and jointly owned by more than one inventor. To constitute a co-assigned patent, it is necessary that all the inventors involved make some contribution to the final invention. Here we focus our attention on inter-firm joint patents, tracking only patents owned jointly by two or more alliance partners.

According to Hicks and Narin (2001), co-assigned patents accounted for about 0.2% of US patents in the early 1980s, but the percentage rose to 1.4% in 1999. The

*Corresponding author. Tel.: +82 2 880 9080; fax: +82 2 878 3154.

E-mail addresses: cskim@ewha.ac.kr (C. Kim),
jsong@snu.ac.kr (J. Song).

percentage of co-assigned patents varies across sectors, with the two highest being 7% for biotechnology and 5.6% for pharmaceuticals. This salience of joint patents in these areas may be explained by the considerable scientific and technological interdependence among firms in pharmaceutical R&D. Modern pharmaceutical R&D is increasingly complex and demands an ever-widening range of skills. No single firm possesses all the knowledge, skills and techniques required (Powell et al., 1996). Accordingly, joint invention (and the collaboration that precedes it) often results from the need for complementary expertise.

This study is one of the early attempts to use joint patents as a measure of the innovation output of alliances. Hence, there are few studies which identify factors which predict the existence of joint patents. We therefore draw upon the literature on absorptive capacity and alliance learning, wherein it is argued that alliances provide a platform for learning and innovation. We focus on both the technological and relational aspects of alliance partners, and their effects on learning and innovation. Specifically, using patent citation data, we identify two key technology-related variables: path dependencies and pre-existing technology overlap between alliance partners. In addition, given many firms' aversion to sharing the ownership of proprietary technologies (Hagedoorn, 2003), we also introduce the variable of "repeated" alliance ties as a proxy for achieving a threshold level of trust, which is necessary to ease the appropriability risks of sharing proprietary technologies. Using a negative binomial regression model, we examine the impacts of these technological and relational variables on joint patenting in the context of the global pharmaceutical industry.

2. Theory and hypotheses

As a general rule, there are two ways of building R&D capabilities: through internal development or external acquisitions (Pisano, 1990). The extent to which firms can source external knowledge is determined, in part, by the nature of the knowledge to be sourced (Zander and Kogut, 1995) and by firm-specific capabilities (Cohen and Levinthal, 1990). State-of-the-art technologies are often developed from tacit knowledge that is built internally through experience (Cohen and Levinthal, 1990; Song, 2002) or "learning by doing" (Teece, 1982). Because this knowledge belongs to individuals within a firm and cannot be easily transferred across firms, organizational boundaries serve as "knowledge envelopes." Thus, valuable knowledge is much more likely to be diffused within an organization than outside it (Zucker et al., 1996). For example, Almeida et al. (2002) show that, in general, multinational firms transfer knowledge across countries more effectively than do firms within alliances or competitive markets because they not only have more internal mechanisms for knowledge transfer at their disposal, but can also use those mechanisms flexibly without worrying about misappropriation.

There are, however, several mechanisms that firms use to access external knowledge. Almeida (1996) highlights the advantages of co-location in technology-intensive regions. Similarly, Shan and Song (1997) show that foreign direct investments are used to source external knowledge that is embedded in foreign countries. Licensing agreements provide a formal means of acquiring external knowledge; they require firms which possess key knowledge to permit its transfer. Recently, Song et al. (2003) showed that engineer mobility is an important mechanism in inter-firm knowledge transfer, in a process that they call "learning by hiring."

Most importantly for our purposes, Mowery et al. (1996) point to the use of alliances in acquiring external knowledge. Verspagen and Duysters (2004) find that technology alliance networks indeed show small-world properties which are characterized by an efficient flow of information and knowledge. However, technology acquisition by alliance is not a substitute for, but a complement to internal development, as a new external technology brought into a firm builds upon existing internal technologies (Cohen and Levinthal, 1990). Researchers have identified an upsurge in R&D alliances since the 1980s (Hagedoorn, 1993, 2002). The most common reason given for the increasing popularity of collaborative R&D is that fewer firms are able to "go it alone" in technological development (Teece, 1992; Powell et al., 1996). In addition, alliances can speed up learning and innovation processes (Doz and Hamel, 1997). In these types of alliances, benefits can extend beyond the life of the alliance, as firms learn from their partners and increase their capabilities (Hamel, 1991; Mowery et al., 1996).

Inter-firm cooperation in the form of licensing, R&D contracts and joint ventures are of central importance especially to the pharmaceutical sector. For instance, 38% of new chemical entities approved by the FDA between 1963 and 1999 were based on licensing deals. In addition, the average number of biotechnology alliances formed per pharmaceutical company increased from 1.4 per year in 1988–1990 to 5.7 per year, per firm in 1997–1998 (Nicholson et al., 2002). In the context of the global pharmaceutical industry, we investigate the conditions under which alliances are more likely to produce joint patents. We develop hypotheses by focusing on both technological and relational aspects of alliances. When we develop hypotheses regarding technological aspects, we draw primarily on evolutionary economics (Nelson and Winter, 1982).

2.1. Path-dependent technologies and joint invention

Schumpeter (1961) argues that, in general, innovations arise from new combinations of existing technologies. This suggests that the creation of new technology does not occur in the absence of current technology. Evolutionary economics proposes that the search for new knowledge is often localized or path-dependent, i.e., it is influenced by a

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات