



Outbound open innovation in bio-pharmaceutical out-licensing



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ABSTRACT

Our study investigates the outbound open innovation of firms engaged in technological venturing. Leveraging insights from the sociology theory and innovation literatures, we clarify whether social status helps entrepreneurial ventures overcome market imperfection and information asymmetry in out-licensing and illustrate the importance of specific aspects of social status building in this context. We also examine the effect of failure experiences on out-licensing. We take a dynamic view of desorptive capacity by studying an entrepreneurial venture's learning process, both internally, in terms of its own technology trajectory, and externally, through inter-organizational alliances. We apply a negative binomial model to our novel panel of 180 firms studied over an 18-year period with controls for stocks of clinical development activities, patenting and prior licensing activities. Empirical analysis enables us to observe the impact which the firms' technological and development status, reputation and desorptive capacity exert upon out-licensing volume. Prior outbound open innovation studies do not account for the heterogeneity of technology and R&D success and failure experiences observed in our study. We also demonstrate the contingency effect of external learning from alliances during the building-up of a firm's desorptive capacity, or the way in which the number of co-authoring partners in scientific publications negatively moderates the positive effect of the number of commercial alliances on the volume of its out-licensing deals. Our findings contribute to the understanding of external knowledge exploitation and complement important aspects of the literatures on outbound open innovation and desorptive capacity, offering empirically rich insights for bio-pharmaceutical firms into the drivers behind volumes of out-licensing deals.

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1. Introduction

The concept of open innovation (Chesbrough, 2003) has recently gained widespread research attention (e.g., Enkel et al., 2009; Giannopoulou et al., 2010; Groen and Linton, 2010; Huizingh, 2011). Earlier open innovation research focused on inbound processes, whereas outbound processes have received less attention (Mortara and Minshall, 2011). Outbound open innovation, such as out-licensing, is an inside-out process and includes opening up the innovation process to external knowledge exploitation (Mortara and Minshall, 2011). Through out-licensing a firm not only gains economic benefits from the commercialization of technological knowledge, but also achieves strategic nonmonetary benefits, including gaining access to external knowledge,

establishing industry standards, and acquiring freedom to operate based on cross-licensing agreements with other firms (Arora et al., 2001; Grindley and Teece, 1997).

We address recent calls in *Technovation* to use the concept of open innovation to develop new insights into the processes of knowledge creation and exploitation and integrate an open innovation perspective in an interdisciplinary manner (Huizingh, 2011; Van de Vrande and de Man, 2011), in our case drawing upon the literatures on social status in the market for technologies (Arora and Gambardella, 2010; Podolny, 1993) and on the desorptive capacity of firms (Helfat et al., 2007; Müller-Seitz, 2012). We address the gap whereby despite the importance of external knowledge exploitation for firms across different industries, outbound open innovation, such as out-licensing, has remained relatively neglected. In particular, it is not clear why some firms are able to achieve a higher number of out-licensing deals than others, in spite of the various challenges involved and the significant complexity and high attrition rate of this innovation activity (Bianchi et al., 2011a; Gambardella et al., 2007).

An illustrative example from our dataset on the development of a value capturing (revenue generating) out-licensing strategy is

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that of San Diego based Ligand Pharmaceuticals. Under CEO John Higgins, Ligand, a firm with less than 20 employees, has been pursuing a strategy that focuses on increasing licensing, milestone, and royalty fees from its partners. It intends to generate more opportunities to develop successful drugs by forging partnerships with large pharmaceutical companies. This strategy has proved to be a success in achieving a large number of drug out-licensing deals, often more than 20 each year. While building partnerships with pharmaceutical companies has contributed to the success of the firm in securing many out-licensing deals, we ask the question: are there any other factors that are at work in driving out-licensing deals? The answer to this question is important, since the capability levels of different firms in technology out-licensing tend to differ strongly, and these differences further underscore the lack of research on licensing capabilities which are “both relevant and understudied” (Fosfuri and Giarratana, 2010, p. 771).

2. Research context, questions and contributions

The context of our research is the bio-pharmaceutical industry, a fertile ground for the adoption of open innovation (Bianchi et al., 2011a) and a sector in which outbound open innovation such as out-licensing is of particular importance.

Out-licensing can play a critical role in accessing the diverse sources of innovation in the new pharmaceutical R&D landscape (Allarakhia and Walsh, 2011). It also helps in bridging the widening gap between the amount of internally generated drugs for clinical trials by large-scale pharmaceutical firms (Paul et al., 2010), which have commercialization needs and world-class capabilities, and the generation of novel compounds by entrepreneurial bio-pharmaceutical firms, which focus on R&D-related activities along the value chain in the bio-pharmaceutical industry (Stuart et al., 2007). To explain the differences in the number of new out-licensing deals secured by bio-pharmaceutical firms, we use a longitudinal panel dataset for the out-licensing deals undertaken by 180 publicly quoted bio-pharmaceutical firms from Europe and North America over an 18-year period. Our empirical testing is based on a conceptual model for the out-licensing of new technology driven by market imperfections, information asymmetries, and desorptive capacity, controlling for classical issues such as firm size and technological and clinical R&D stocks.

This paper seeks to make three contributions to the literature on outbound open innovation. First, we seek to clarify the relationship between social status in the generation of public (scientific publishing) and private (patenting) knowledge about innovation on the one hand and the volume of outbound open innovation licensing undertaken by firms on the other. In doing so, we address two questions: (1) Does social status help entrepreneurial firms overcome market imperfection and information asymmetry with a view to the commercialization of technological knowledge? (2) If so, how much do specific aspects of social status building matter?

Our second contribution from this study is that of investigating the factors directly influencing firms' ability to actually license out knowledge. In this regard, we move one step beyond previous studies on desorptive capacity (namely, Bianchi et al., 2011a) in that we adopt a dynamic view of desorptive capacity by examining the learning process of an entrepreneurial venture, both externally, through its inter-organizational alliances, and internally, in terms of its own technology trajectory.

Our third contribution to the literature is on the relationship between failure experience and the performance outcomes of firms. The relationship between failure and performance in the organizational literature is paradoxical: failure both improves and impedes performance outcomes over time. On the positive side,

the literature reports a positive relationship between failure experience and organizational transformation (McNamara and Baden-Fuller, 1999) which improves firms' ability to adapt to environmental changes and improve organizational reliability (Carmeli and Schaubroeck, 2008). However, the literature also finds that failure experience can have negative consequences for performance in that greater experience of firm failure is associated with rising costs (Baum and Dahlin, 2007). Success is positively rewarded and failure is viewed negatively by peers (Edmondson, 2011). Therefore, it is not clear how failures in the R&D portfolio of an entrepreneurial firm affect the number of out-licensing deals it can achieve. Our research will bring more empirical clarity to this issue.

The rest of the article is organized as follows. Section 3 provides a short overview of the background to our research and theories pertaining to it, and in Section 4 we formulate our hypotheses. Section 5 describes our data, variables and methodology. Section 6 presents the results. Finally, Section 7 discusses the implications of our results, summarizes our findings and suggests avenues for future research.

3. Literature review: Outbound open innovation and out-licensing in the bio-pharmaceutical industry

In recent years open innovation has swept through a number of industries (Gassmann et al., 2010). Thus far, research on open innovation processes has focused on distinguishing between the ‘outside-in’ and the ‘inside-out’ processes of open innovation, along with their coexistence (Enkel et al., 2009).

Outbound open innovation, in particular technology out-licensing, remains a challenge for most firms. A recent survey on inventors in Europe identifies a worrying 40% attrition rate between the decision to out-license a technology and the actual conclusion of the deal (Gambardella et al., 2007). The difficulty in achieving out-licensing stems from the high complexity of this activity, which deserves detailed research attention.

Two streams of literature which are particularly rich in insights about outbound open innovation are theories on social status in the market for technologies (e.g., Arora and Gambardella, 2010) and work on desorptive capacity in outbound innovation (Helfat et al., 2007); these are discussed below.

3.1. The role of status

The characteristics of technology-intensive environments pose specific challenges to licensing exchange, and markets for knowledge are characterized by market imperfection and information asymmetries concerning the quality of the technology offered for license (Akerlof, 1970; Zeckhauser, 1996). Uncertainty about the value of technology hinders the development of a market for technology (Arora and Gambardella, 2010). Limited transparency and serious inefficiencies in the technology market impede the identification of potential partners, and both the process of negotiation and contracting with partners (Williamson, 1975). “Parties typically do not know who owns what, and who might be interested in trading” (Teece, 1998, p. 68). No licensee firm can be aware of all technological opportunities, let alone process all of the available information about new technological opportunities. Even if the licensee is aware of a certain technological opportunity, it faces a great deal of uncertainty regarding the value and applicability of the technology in question (Arora and Gambardella, 2010; Jensen and Thursby, 2001; Kani and Motohashi, 2012). Licensing a technology across firm boundaries is complicated due to cognitive, intangible, idiosyncratic and predominantly tacit nature of technological knowledge. These features complicate disclosure of this knowledge, in addition to valuation of

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