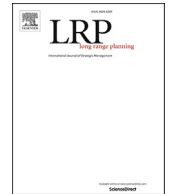




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The evolution of intellectual property strategy in innovation ecosystems: Uncovering complementary and substitute appropriability regimes

Marcus Holgersson ^{a,*}, Ove Granstrand ^b, Marcel Bogers ^c

^a Chalmers University of Technology, Department of Technology Management and Economics, SE-412 96 Gothenburg, Sweden

^b Chalmers University of Technology, Department of Mathematical Sciences, SE-412 96 Gothenburg, Sweden

^c University of Copenhagen, Department of Food and Resource Economics, Unit for Innovation, Entrepreneurship and Management, Rolighedsvej 25, 1958 Frederiksberg C, Denmark

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ABSTRACT

In this article, we attempt to extend and nuance the debate on intellectual property (IP) strategy, appropriation, and open innovation in dynamic and systemic innovation contexts. We present the case of four generations of mobile telecommunications systems (covering the period 1980–2015), and describe and analyze the co-evolution of strategic IP management and innovation ecosystems. Throughout this development, technologies and technological relationships were governed with different and shifting degrees of formality. Simultaneously, firms differentiated technology accessibility across actors and technologies to benefit from openness and appropriation of innovation. Our analysis shows that the discussion of competitiveness and appropriability needs to be expanded from the focal appropriability regime and complementary assets to the larger context of the innovation ecosystem and its cooperative and competitive actor relations, with dispersed complementary and substitute assets and technologies. Consequently, the shaping of complementary and substitute appropriability regimes is central when strategizing in dynamic and systemic innovation contexts. This holds important implications for the management of open innovation, innovation ecosystems, platforms, and cooptation.

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Introduction

An open approach to innovation has in both practice and research been increasingly accepted as a potential source of competitive advantage, enabling the use of external sources of innovation and external commercialization strategies (Granstrand, 1982; Granstrand and Sjölander, 1990; Chesbrough, 2003; Chesbrough et al., 2006; Dahlander and Gann, 2010; West and Bogers, 2014; Cassiman and Valentini, 2016). Every open innovation activity involves two or more actors, and a firm that engages in open innovation is part of a system of interconnected innovation actors, resources, activities, and institutions, connected by organizational and market relations. We here denote such a system an innovation ecosystem. With an increased awareness of the systemic nature of open innovation there have been several calls for research that brings increased understanding of the systems level of open innovation (Chesbrough and Bogers, 2014; West et al., 2014; Bogers et al., 2017).

* Corresponding author.

E-mail addresses: marhol@chalmers.se (M. Holgersson), ove.granstrand@chalmers.se (O. Granstrand), marcel@ifro.ku.dk (M. Bogers).

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One of several questions that deserves renewed attention when innovation takes place across systems of actors rather than in an integrated firm is the question of how firms appropriate or profit from innovation (Teece, 2006; Teece, forthcoming). Teece (1986) identified the role of appropriability regimes and complementary assets for explaining the distribution of profits from innovation in the 1980s. An important contribution was that when the appropriability regime is weak, i.e., when imitation is easy, it is important for innovators to establish positions in complementary assets in order to appropriate value from innovation. However, complementary *technologies* (as a subset of complementary assets) did not receive much explicit attention and the role of intellectual property (IP) strategy for the appropriability regime was not well developed at that time, as later described by Teece (2006). Today we know that IP strategy plays an important role for firms' competitiveness (Granstrand, 1999; Pisano, 2006; Teece, 2006; Pisano and Teece, 2007; Somaya, 2012), and that innovation often takes place in complex multi-technology systems with complementary innovations spread across actors (Granstrand et al., 1997; Hall and Ziedonis, 2001; Bessen, 2004; Teece, 2009; Somaya et al., 2011; Granstrand and Holgersson, 2013; Teece, forthcoming).

Complex innovation settings require firms' IP strategies to include protection and/or sharing of their own technologies on the one hand and access to others' technologies on the other hand (Alexy et al., 2009; Somaya et al., 2011; Granstrand and Holgersson, 2013). In such settings IP strategy impacts appropriability both directly, through improved and protected sales and margins, and indirectly, for example through cross-licensing agreements, improved negotiation positions, standard-setting, blocking of others' R&D, and improved provision of complementary innovations (Arundel et al., 1995; Duguet and Kabla, 1998; Granstrand, 1999; Bekkers et al., 2002a; Baldwin and von Hippel, 2011; Holgersson and Wallin, 2017). Moreover, a specific firm's freedom to operate, i.e., the ability to do business without being excluded by the IP rights (IPRs) of others, is impacted by the firm's own IP strategy as well as other firms' IP strategies (Granstrand, 1999; Lemley and Shapiro, 2007; Bessen and Maskin, 2009; Somaya et al., 2011; Holgersson and Wallin, 2017; Jell et al., forthcoming).

In this paper, we want to shed light on the complexities that emerge when innovation takes place across actors in innovation ecosystems, implying an evolution of innovation and IP strategy across actors over time. We will present the case of mobile telecommunication systems in the period 1980–2015 to describe and analyze the co-evolution of strategic IP management and innovation ecosystems. Hereby, we extend and nuance the debate on IP strategy, appropriation, and open innovation in dynamic and systemic innovation contexts. The generational shifts in mobile telecommunication systems highlight the systemic and dynamic nature of such an open innovation context in which the role of IP strategy is not so much to provide short-term profits from single innovations as it is to ensure long-term competitive advantage within the innovation ecosystem—an advantage that is dependent on both internal and external innovations.

Our analysis leads to several contributions. First we identify the important roles of both collaborating and competing actors and both complementary and substitute technologies in innovation ecosystems. Second, we explicate the concept of appropriability, and relate it to the two distinct dimensions of technology governance and technology accessibility. Rather than focusing on the ease of imitation, this perspective acknowledges the fact that firms can use formal and/or informal technology governance to obtain high and/or low levels of technology accessibility in order to benefit from various forms of open and/or closed innovation in compliance with their business models (Chesbrough and Rosenbloom, 2002; Teece, 2010). Third, we illustrate how firms need to extend their focus from the focal appropriability regime to its complementary and substitute appropriability regimes, especially in systems technologies that are subject to standardization.

Theoretical background

The case of mobile telecommunications has been studied by one of the authors since the 1980s, and the use and development of theory have consequently evolved alongside the empirical studies over time. Transaction cost theory and its associated organization theory of the firm as developed by Williamson (1975) provided the main framework at the start of the longitudinal study. The growing use of various quasi-integrated organizational forms for conducting R&D and innovative activities, such as licensing and inter-firm collaborations, was identified early on and a typology of external technology acquisition and exploitation strategies was developed (Granstrand, 1982; Granstrand and Sjölander, 1990; Granstrand et al., 1992) based on contract theory (Grossman and Hart, 1986). Studies then showed that technology diversification and concomitant external technology acquisition and exploitation play pivotal roles for combining and recombining complementary technology resources into complementary multi-technology products, thereby generating recombinant growth (Granstrand and Oskarsson, 1994; Granstrand, 1998; Cantwell et al., 2004). Today such interorganizational innovation is often denoted “open innovation” —going back to Chesbrough (2003)—and it has received huge attention from both research and practice.

Open innovation research explains how firms can rely on external technologies to augment their internal innovation development or how they can tap into external partners to exploit internally developed technologies (Chesbrough and Bogers, 2014). This stream of research has paid much attention to how to leverage external sources of innovation with some key considerations being different mechanisms to obtain such innovation and how to integrate it into the organization (West and Bogers, 2014). At the same time, there are considerations about possible decreasing returns in terms of external search and appropriability (Laursen and Salter, 2006, 2014) and not only value-enhancing but also cost-increasing effects of open innovation (Faems et al., 2010). More generally, open innovation scholars have identified various mechanisms in relation to inbound knowledge flows and to some extent outbound knowledge flows, although these have largely been considered on the organization level with less attention to higher level attributes such as innovation systems (Chesbrough and Bogers, 2014; West et al., 2014). Recently, Bogers et al. (2017) proposed the innovation ecosystem as an important unit of analysis for future

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