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Systematic leverage of technological assets: A case study for automated tissue engineering

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ABSTRACT

The goal of this paper is to present a new decision-making model for identifying the appropriate exploitation strategy, taking the key internal and external factors that characterize the commercialization situation into account. A technology exploitation target system is established and the contribution of the different exploitation strategies, such as spin-offs, joint ventures and licensing, to the different targets is evaluated. The influence of the characteristics related to the market, the exploiting company and the technology is then discussed. The decision-making model is developed and applied to the case of "automated tissue engineering on demand", which has been accomplished by Fraunhofer.

Introduction

In the mid-20th century, the boards of many companies followed the philosophy that their own research and development units had to provide the majority of the necessary technologies for the development, production and marketing of their products (Escher, 2005; Huston and Sakkab, 2006). Therefore, they established large development and manufacturing capabilities. In some cases, certain technologies developed this way were only available to a single company or industrial sector (Escher, 2005). The need to exchange technologies was rare.

Product complexity necessitates many technologies

Due to increasing product complexity, the number of technologies per marketable product steadily increased (Escher, 2005). Emerging cost and performance pressure within the global competitive

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arena forced many companies to focus on those activities that distinguished them from other competitors (Meierbeck, 2010; Krüger, 1997; Mittag, 1985). Complementary technologies were increasingly acquired by suitable technology suppliers (Arora et al., 2002). The core competence approach had developed into the prevailing management philosophy. Outsourcing of activities became part of most restructuring programs.

As a consequence, internal development and manufacturing activities ultimately decreased. Procurement activities became an important component of business functions (Arnold, 1997; Gerwin and Höcherl, 1995; Zollenkop, 2006). This led to the establishment of the markets as we know them today – with technologies being exchanged between companies (Hentschel, 2007; Granstrand, 1998; Cheung and Reitsperger, 2005). Driven by globalization and technological specialization, the number of intellectual property rights increased and promoted the industrial transfer of knowledge (Mittag, 1985). The exchange of technologies facilitates property rights handling, in particular for companies that foster R&D investments (Mittag, 1985).

The so-called technological markets will gain importance as they offer better communication and networking possibilities (Birkenmeier, 2003; Grindley and Teece, 1997). Expansion of private and public exchange offices, as well as publicly financed programs supporting industrial technology transfer, demonstrate this (Mittag, 1985).

Increasing market fragmentation, however, calls for coordination, which in turn leads to rising transaction costs (Lay et al., 2009). Specialization therefore reduced R&D costs only partially. Technology development expenses are still rising, especially in high-wage countries such as Germany where research has a fundamental role.

Increasing R&D expenses and shorter lifecycles

Globalization increased the intensity of competition, which forced the companies to establish new products on the market even faster (Ford and Ryan, 1981). That means increasing innovation cycles on the one hand, while decreasing product life cycles on the other (Mittag, 1985; Escher, 2005; Hentschel, 2007; Mittelstaedt, 2009; Ford and Ryan, 1981). The resulting shorter product life cycles (Birkenmeier, 2003) also lead to a contraction of the technological life cycles. Therefore, there is less time to amortize technology development making it even harder to realize the high profitability required by financial investors (Wolfrum, 1991; Mittag, 1985; Birkenmeier, 2003; Hentschel, 2007; Brodbeck, 1999; Ford and Ryan, 1981) who demand an average of four to six percent organic growth per year (Huston and Sakkab, 2006).

The limited effect of property rights

Commercialization becomes even more important because of the limited effect of legislative and technological measures for technology protection (Ford and Ryan, 1981; Birkenmeier, 1998; Mittag, 1985). Full protection cannot be achieved simply through property rights; given time, the competition will copy the technology while incurring lower R&D expenses (Ford and Ryan, 1981; Birkenmeier, 1998; Rommel, 1999). Companies in emerging markets, in particular, can benefit from lower labor costs, displacing the inventor's products (Ford and Ryan, 1981). Individual technologies are launched more rapidly. Marketing technologies outside one's own company becomes key to ensuring the companies' success (Mittag, 1985).

Technologies are not fully exploited

Besides the difficulties of generating an attractive return for developed technologies, there are technologies that are not getting commercialized because of a lack of strategic relevance or inadequate performance evaluation (Ford and Ryan, 1981; Mittag, 1985; Wolfrum, 1991; Arora et al., 2002). Exploitation can be restricted by the company's finances or production capabilities (Ford and Ryan, 1981). A company also may not be able to capture all markets itself due to complex import and local content restrictions (Ford and Ryan, 1981).