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Valuing patents and licenses from a business strategy perspective – Extending valuation considerations using the case of nanotechnology

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Abstract

Currently there is a debate in the field of nanotechnology about the evolving IP landscape and its impact on innovative progress based on technological discovery in the future. Nevertheless, nanotechnology patents will serve as an important securitization instrument for future financing and business strategic purposes. Valuation know-how of nanotechnology patents will therefore become critical in deal-making and in bringing about innovation. Like many innovative products today, nanotechnology enabled products also consist of a multitude of patented technological components from different stages in a value chain and belonging to a multitude of owners. Complex IP landscapes along entire value chains give rise to a tendency to over-value one's own patented technology from an ex-ante and individual company's perspective. Thus the sum of individually estimated values of patented technology can exceed the value that can be realized ex-post in a given value chain. We extend current valuation considerations of patented technology from a static perspective to include a dynamic view using nanotechnology as an example. Furthermore, in addition to single value chain stages as a level of analysis (level A) we also take into account the complex technology landscapes in entire value chains (level B) as well as patented technologies' potential value in different current or future value chains (level C). We derive conclusions with respect to valuation approaches for the discussed levels of analysis from a static and dynamic perspective.

Keywords: Patent valuation; Nanotechnology; Patent thicket; Network analysis; Simulation models; Business strategy; Value chain; Technology standards

1. Introduction

Today, many innovative products consist of a large number of technological components spread over different stages in a value chain. This growing complexity is aggravated by the likelihood that many patents covering these components belong to many different owners and can thus turn into IP roadblocks on the way to developing new products. IP as 'roadblocks' refers to the situation where many companies along a value chain hold intellectual property rights and claim their share of the revenues generated by the end product or products. The number of players sitting at the negotiation table becomes large and the negotiation costs can render a potential investment in the development of end products unattractive. "Tragedy of the anti-commons" is the well known label given to this pattern of royalty stacking [14]. However, it is a legitimate claim that investments in upstream inventions (i.e. nanoscale structures and intermediate products as well as in equipment for analyzing and building solutions at the nanoscale) can be recouped by participating in the final revenues generated by sale of end products.

To avoid the tragedy of the anti-commons there are two strategies left open to upstream companies with respect to reach-through rights, i.e. "patent claims that reach beyond the technological accomplishments of the patent holder" [15, p. 109]. Firstly, "reach-through remedies" are a modified "research exemption" [32]. According to this exemption within the realm of biomedical research, a downstream company would be allowed to use upstream

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or complementary technology without becoming subject to infringement liability. However, it would have to notify the IP holders. In case of an innovative success, the downstream company then has to negotiate the amount of royalties payable to the upstream inventors. Secondly, "reach-through claiming" is orientated towards achieving broad patent positioning that allows claiming many different potential future uses in subsequent inventions. Here, upstream companies will start negotiating over their piece of the cake if they discover that downstream inventors are about to bring promising new products to the market [15]. These negotiations are conducted within a legal framework founded upon a political opinion about the best way of distributing profits along the value chain in certain technological fields like biotechnology or nanotechnology.

In this paper we argue that complex IP landscapes all along value chains give rise to a tendency to over-value one's own patented technology from an ex-ante and individual company's perspective. Thus the sum of individually estimated values of patented technology can exceed the value that can be realized ex-post in a given value chain. In the context of radically new technologies, i.e. technologies that will serve as the foundation for completely new value chains with products which will become the foundation of entire new industries, this asymmetry can even be accentuated. In the following we have chosen nanotechnology as a prototypical example, firstly, because nanotechnology is believed to impact global economies pervasively; secondly, because research in the domain of nanotechnology has required – and will continue to require – huge financial investments; and, thirdly, because nanotechnology affects the operations and strategies of corporations all along value chains, from nanoscale structures to nano-enabled products. We will illustrate how this complex issue can be better addressed by valuing patented technology taking into account both the dynamic interaction between currently patented technology and future business strategy and the competitive situation within and across entire value chains.

The American "National Nanotechnology Initiative" (NNI) defines "nanotechnology" as "encompassing the science, engineering, and technology related to the understanding and control of matter at the length scale of approximately 1–100 nanometers. However, nanotechnology is not merely working with matter at the nanoscale, but also research and development of materials, devices, and systems that have novel properties and functions due to their nanoscale dimensions or components" [10, p. 7]; for an overview of definitions, see [10, p. 205].

Nanotechnology is a cross-sectional technology. It offers a broad array of applications in such diverse industries as agriculture, chemicals, aerospace, energy, sports equipment and healthcare. It is also interdisciplinary, combining research and engineering knowledge from several fields such as biology, physics, medicine, and computer science. NNI's summary of nanotechnology roots and status-quo emphasizes the topicality of nanotechnology: "Based on the ability to see, measure, and manipulate matter at the scale of atoms and molecules, nanotechnology was born, in many ways, with the advent of atomic force microscopy in the mid-1980s [37]. Today many industries such as semiconductors and chemicals already are creating products with enhanced performance based on components and materials with nanosized features" [10, p. 5]. Nanotechnology has attracted a lot of public interest due to spectacular visions of applications, scientific advances, and also because of concerns about nanomaterials, e.g. the toxicity of carbon nanotubes. Yet, nanotechnology is still in its early stages, with only a few 'tangible' applications and many more very promising application ideas. Ironic comment is sometimes passed on the debate about its potential impact on society and technology: "The answer is nano – what is the question?"

Most countries with a formal science and technology policy have implemented a national nanotechnology initiative: "by many estimates, the total investment by governments outside the United States surpasses $3 billion annually, with comparable investment by the private sector" [10, p. 5]. Until now, R&D in nanotechnology has been financed primarily by governments and large corporations. As products incorporating nanotechnology grow in number and in terms of the revenues they generate, there is more and more venture capital available for nanotechnology. However, compared to the funds invested in nanotechnology projects and companies by large multinationals and governments, venture capital-backed nanotechnology funds still represent the much smaller part. One main reason for the reluctance of many venture capitalists to invest in nanotechnology projects can be attributed to the small number of successful exits achieved so far by venture capitalists, i.e. going public (IPOs), mergers or acquisition targets [11]. Structured financing arrangements that align the interests of public institutions, business angels, banks, funds, and the like may be performing an important function in providing capital at an early stage in the life of a nanotechnology venture. The European Investment Fund (www.eif.com) serves as an example.

Besides the current embodiments of nanotechnology in existing products, and the wealth of knowledge accumulated, the main asset category created with all the money invested is patented technology. Nanotechnology patents are classified by the EPO (Y-class) [3,12] and the USPTO (class 977) [4]. At the moment there is a debate in the field of nanotechnology about the IP landscape that is in the process of evolving. Acknowledged as a potentially troubling issue in general [14,34], it is said to potentially slow down the innovative nanotechnology progress [13,20]. Patenting activity in the classified domains of nanotechnology indeed is soaring [4,12]. Industry analysts and researchers fear that too many early patents with extensively broad and overlapping claims have been awarded [20,22,23]. Patent thickets are claimed to exist for different nanomaterials and nanotechnology-related instruments. This could result in legal battles that slow down the commercialization of